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DEPARTMENT OF COMPUTER ENGINEERING



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NEXUS HIRE: EARLY CAREER TECH RECRUITER

A Web-Based System for Intelligent Candidate Screening and Evaluation

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Abstract : Selecting appropriate candidates for entry-level technology roles has become more complex due to the growing number of job applicants. Many companies depend on Applicant Tracking Systems (ATS) to automatically filter and shortlist resumes. However, most traditional ATS tools rely mainly on keyword matching techniques, which can result in inaccurate candidate selection. Applicants may intentionally include certain keywords in their resumes in order to pass the automated screening stage, even when they do not actually possess the required technical abilities. At the same time, some skilled candidates may be rejected simply because their resumes do not contain the exact keywords expected by the system.

This research introduces an intelligent recruitment platform designed to evaluate early-career software engineering candidates by analyzing multiple sources of information. Instead of relying only on keywords found in resumes, the proposed system uses a hybrid evaluation method. It collects technical activity data from developer platforms such as GitHub and coding practice websites like LeetCode to measure programming involvement and problem-solving capability. Natural Language Processing (NLP) techniques are also applied to analyze resume content in order to assess communication ability and confidence. In addition, the system reviews practical experience and the candidate's professional online presence.

By integrating these different evaluation factors, the platform generates a Career Readiness Score (CRS) that helps recruiters identify qualified candidates more accurately. This approach improves recruitment efficiency and reduces the limitations associated with traditional keyword-based screening methods.

INTRODUCTION

In recent years, the need for software engineers and technology specialists has grown rapidly. Due to this increasing demand, organizations often receive a large number of applications for entry-level technical roles. Reviewing such a high volume of resumes manually becomes challenging and requires a significant amount of time for human resource teams.

To make the recruitment process more efficient, many companies rely on **Applicant Tracking Systems (ATS)** that automatically collect, sort, and filter candidate applications. These systems typically analyze resumes by searching for particular technical keywords and then shortlist candidates whose resumes match the required skill terms.

Even though this approach helps speed up the initial screening stage, it also has certain drawbacks. Some applicants deliberately include numerous technical keywords in their resumes even if they do not actually have those skills. This strategy, known as **keyword stuffing**, may cause unqualified candidates to pass the early screening process.

At the same time, skilled developers may not always use the exact words or phrases expected by the system. As a result, their applications might be rejected even though they possess strong technical knowledge. Because of this limitation, conventional ATS

tools sometimes fail to recognize truly capable candidates.



In today's software development industry, technical ability is often reflected through practical activities such as contributions to open-source projects, maintaining coding repositories, and participating in competitive programming challenges. Platforms like GitHub and LeetCode offer useful indicators of a developer's programming involvement and problem-solving capability.

To overcome the weaknesses of traditional recruitment systems, this research introduces an intelligent hiring platform that evaluates candidates using multiple criteria. The system analyzes data from coding platforms, resume content, professional experience, and online profiles. Using this combined information, it calculates a **Career Readiness Score (CRS)** that enables recruiters to identify the most appropriate candidates more effectively.

LITERATURE REVIEW

Automated recruitment systems are commonly used by organizations to make the candidate screening process faster and more efficient. Most traditional Applicant Tracking Systems (ATS) depend mainly on keyword-based filtering methods to shortlist potential candidates. However, several research studies have shown that this approach may lead to inaccurate results because some applicants include specific technical keywords in their resumes even when they do not truly possess those skills.

To address these limitations, researchers have started using advanced technologies such as machine learning, Natural Language Processing (NLP), and data analytics to improve recruitment systems. NLP techniques are capable of analyzing resume content more intelligently by understanding the context and meaning of the information rather than simply identifying matching keywords.

Furthermore, developer platforms like GitHub and coding practice websites such as LeetCode offer useful insights into a programmer's actual technical abilities. Information such as repository contributions, coding activity, and problem-solving performance can provide a clearer picture of a candidate's practical programming skills.

Integrating resume analysis with data collected from coding platforms can greatly enhance the accuracy and reliability of automated recruitment systems. The approach proposed in this research follows this combined method to improve the candidate selection process for individuals who are beginning their careers in the technology field.

PROBLEM STATEMENT

Companies often receive a very large number of applications for entry-level positions in the technology sector. Because of this high volume, reviewing each resume manually becomes slow and inefficient for recruitment teams. To manage this situation, many organizations use Applicant Tracking Systems (ATS) that automatically sort and filter candidate resumes.

However, most conventional ATS tools mainly depend on keyword matching techniques to identify suitable applicants. This approach has several weaknesses because candidates can include technical terms in their resumes even if they do not actually have practical knowledge of those technologies. As a result, applicants with limited real experience may still pass the initial screening stage.

On the other hand, some genuinely skilled candidates may be rejected simply because their resumes do not contain the exact keywords that the system is programmed to detect. In addition, traditional screening systems usually overlook important indicators of technical ability such as contributions to open-source projects, coding repositories, and performance in competitive programming platforms.

Due to these limitations, recruiters may find it difficult to identify the most capable candidates efficiently. Therefore, there is a clear

need for a more advanced recruitment solution that eval

PROPOSED SYSTEM

The proposed system is a web-based recruitment platform developed to improve the screening process for candidates who are beginning their careers in the technology field. The platform enables applicants to upload their resumes and include links to their coding profiles on platforms such as GitHub and other programming websites.

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In contrast to traditional Applicant Tracking Systems that rely mainly on keyword detection, this platform evaluates candidates using multiple parameters. The system reviews GitHub activity to analyze coding contributions, repository involvement, and project participation. It also measures problem-solving skills by collecting information from online coding practice platforms.

The resume content is further examined using Natural Language Processing (NLP) techniques to assess communication quality and clarity. The system also detects practical experiences mentioned in the resume, including internships, academic projects, and previous technical roles.

Additionally, the platform considers the candidate's professional presence on online platforms. All these evaluation aspects are combined to calculate a Career Readiness Score (CRS), which helps recruiters rank applicants more accurately and select the most appropriate candidates for technical positions.

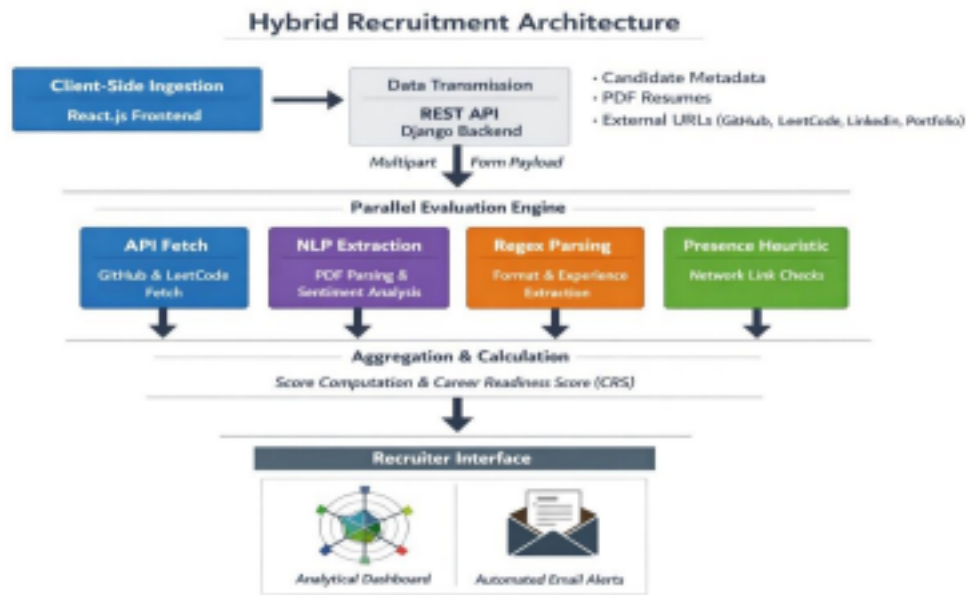
SYSTEM ARCHITECTURE

The proposed recruitment platform is designed using a three-tier architecture to provide organized data management and efficient system processing.

The Presentation Layer serves as the user interface of the application. Through this layer, candidates can upload their resumes and share links to their coding profiles. Recruiters are also able to access candidate evaluation results and rankings using this interface. This layer is developed using common web technologies such as HTML, CSS, and JavaScript.

The Application Layer is responsible for handling the main operations of the system. It processes the uploaded resume data, performs analysis using Natural Language Processing (NLP) techniques, and interacts with external platforms like GitHub to collect technical activity information. This layer also calculates the Career Readiness Score (CRS) by analyzing different evaluation factors.

The Database Layer manages the storage of important information such as candidate profiles, resume details, technical performance data, and evaluation results. A well-structured database ensures secure storage and quick retrieval of data. Overall, this architectural design improves the reliability of the system and makes the recruitment process more organized and efficient.



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IMPLEMENTATION

The development of the proposed recruitment platform involves several important stages, including resume submission, data processing, integration with external platforms, and candidate evaluation.

Initially, applicants create an account on the web application and upload their resumes along with links to their coding profiles. The uploaded resumes are then converted into a text format so that the system can easily analyze the content.

After this, Natural Language Processing (NLP) methods are applied to examine the resume text and evaluate aspects such as communication clarity and confidence. In addition, Regular Expression (Regex) techniques are used to extract key details from the resume, including internships, technical positions, project experience, and duration of involvement.

The system then connects to external coding platforms through APIs to collect information about technical activities, such as repositories, coding contributions, and records of problem-solving performance.

Finally, all the gathered data from different modules is analyzed and combined to generate a Career Readiness Score (CRS). This score helps recruiters compare applicants based on their verified technical skills, practical experience, and communication capabilities.

RESULTS AND DISCUSSION

The proposed recruitment platform was tested using multiple sample candidate profiles to evaluate its ability to identify suitable early-career technology professionals. The main goal of this testing phase was to compare the performance of the developed system with traditional keyword-based Applicant Tracking Systems.

During the evaluation, several candidate profiles were created with differences in resume content, coding activity, and professional presence. One profile included a resume filled with many technical keywords but lacked links to coding platforms or proof of real programming work. Another profile had fewer technical keywords but contained active GitHub repositories, completed projects, and records from coding practice platforms.

In a conventional ATS system, the first candidate would likely be ranked higher because the system focuses mainly on keyword matching. However, the proposed system produced different results since it evaluates candidates based on multiple criteria.

The system analyzed GitHub activity and coding platform records to assess practical programming skills. Resume content was processed using Natural Language Processing methods to evaluate communication quality and structure. Pattern-based analysis was also applied to detect practical experience such as internships, academic projects, or technical roles mentioned in the resume.

After combining the information from these different sources, the system generated a **Career Readiness Score (CRS)** for each candidate. The results showed that candidates with verified coding contributions, real project experience, and strong problem-solving abilities achieved higher scores compared to those whose resumes mainly contained keywords without supporting technical evidence.

These results indicate that the proposed system improves the reliability of candidate evaluation. By considering multiple factors instead of only resume keywords, the platform helps recruiters identify genuinely skilled developers and reduces the possibility of selecting candidates who rely only on keyword optimization.

FUTURE ENHANCEMENTS

The proposed recruitment system can be enhanced further by integrating advanced Artificial Intelligence and Machine Learning technologies. Future versions may include intelligent resume parsing techniques based on deep learning models to better interpret candidate skills and experience.

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The platform could also be expanded by connecting with additional coding and developer platforms such as HackerRank and CodeChef, which would provide more detailed insights into a candidate's programming performance.

Additional features like automated interview scheduling, online assessment modules, and video interview analysis could also be integrated to support recruiters during the hiring process.

Deploying the system on a cloud infrastructure may improve scalability and allow organizations to access the platform from different locations. Developing a mobile application could also enable recruiters to review candidate profiles and evaluation results more conveniently.

These enhancements would further strengthen the system's capability to evaluate candidates accurately and make the recruitment process faster and more effective.

CONCLUSION

This study presents an intelligent recruitment platform developed to improve the screening process for early-career technology professionals. Traditional Applicant Tracking Systems mostly depend on keyword matching techniques, which can sometimes produce inaccurate results and may overlook qualified candidates. The proposed system addresses this limitation by evaluating applicants using multiple parameters, including coding activity, problem-solving ability, resume content, and professional online

presence. By analyzing resume data and collecting technical information from coding platforms, the system generates a Career Readiness Score (CRS) that assists recruiters in identifying candidates with genuine technical skills. Overall, the proposed solution offers a more reliable and efficient approach to candidate evaluation in modern technology recruitment environments.

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VIRTUAL MOUSE WITH CHATBOT AND VOICE ASSISTANT

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ABSTRACT

This paper explains a touchless system for mortal – computer commerce developed using the Python programming language that allows druggies to control a computer through hand gestures, eye blinks, voice commands, and natural language converse each without physically using a mouse or keyboard. The system uses MediaPipe for real- time corner discovery, PyAutoGUI for input simulation, and a speech recognition machine for voice command prosecution. A chatbot module handles textbook grounded queries and simple computation. Testing in different surroundings showed that gesture- grounded cursor control achieved roughly 94 delicacy under standard lighting and 78 under low- light conditions, with voice command recognition reaching 96 in quiet settings. The results show that the system can work effectively for availability- concentrated computing and hygiene-sensitive surroundings similar as hospitals and smart classrooms.

Keywords: Hand Gesture Recognition, Eyeblink Discovery, Voice Adjunct, Chatbot, Mortal – Computer Commerce, Mediapipe, Touchless Interface.

I. INTRODUCTION

The rapid-fire advancement of artificial intelligence and computer vision technologies has opened new border in mortal-computer commerce (HCI). Traditional input bias similar as keyboard and mouse, while effective, present significant limitations for druggie with physical disabilities, in sterile surroundings, or in situations taking hands-free operation. The confluence of gesture recognition, speech processing, and natural language understanding presents an occasion to produce further intuitive and accessible computing interfaces. This design introduces a comprehensive AI- powered desktop adjunct that integrates three distinct but reciprocal commerce modalities (1) a virtual mouse controlled by hand gestures and eye blinks captured through a standard webcam, (2) a voice adjunct able of executing a broad range of PC control commands through natural speech, and (3) an intelligent chatbot interface for conversational AI commerce through a web cybersurfer. The provocation for this work stems from the growing need for accessible computing results and the demonstrated eventuality of multimodal commerce systems. The system is designed to run entirely on a standard particular computer without technical tackle, making it accessible and cost-effective. The web-grounded interface provides a unified control dashboard that displays real-time exertion from all three modalities, enabling druggies to cover and control the system from a single cybersurfer window.

1.1 Problem Statement

Conventional computer commerce relies heavily on physical input bias that may be inapproachable with motor impairments or in specific professional surrounds. Being results are frequently expensive, bear technical tackle, or address only a single modality of commerce. There is a clear need for an integrated, software-only result that combines multiple commerce modalities in a stoner-friendly and cost-effective manner.

1.2 Objectives

The primary objectives of this project are:

- To implement a real-time virtual mouse system using hand gesture and eye blink recognition without specialized hardware.

- To develop a comprehensive voice-controlled PC assistant capable of executing system-level commands.
- To integrate an AI chatbot for natural language interaction using state-of-the-art language models.
- To create a unified web-based interface that displays real-time activity from all components.
- To evaluate the system's performance in terms of accuracy, latency, and user experience.

II. LITERATURE SURVEY

Gesture-grounded commerce has been extensively studied. Jain and Aggarwal(1) demonstrated a hand gesture recognition system using OpenCV that achieved dependable cursor control under controlled lighting. Their work stressed the perceptivity of skin-colour segmentation to illumination changes, a limitation that corner-grounded approaches similar as MediaPipe largely resolve. Sahu and Singh(2) introduced an intelligent virtual mouse that incorporated eye blink discovery alongside hand shadowing, using dlib facial milestones and the Eye Aspect rate observance metric introduced by Soukupová and Čech(3). Their system achieved roughly 89 blink discovery delicacy but ran as a two-module channel rather than a completely integrated operation. Wang and Zhang(4) studied touchless commerce for smart surroundings using facial recognition combined with aspect shadowing, noting that combining multiple biometric signals bettered robustness compared to single-modality systems. Speech driven interfaces have also progressed vastly, Sharma and Gupta(5) reviewed ultramodern speech recognition channels and set up that motor-grounded models significantly outperform before retired Markov Model approaches. Chatbot integration for desktop robotization remains understudied. Utmost being systems treat the natural language subcaste as a standalone module rather than as part of a broader multimodal interface. Our work addresses this gap by bedding a responsive chatbot alongside gesture, eye, and voice control within one operation.

III. SYSTEM ARCHITECTURE

The proposed system is built in layers and has three main parts. It shows the overall system setup. The Python backend is the main part that handles all the processing and connects to the web through REST endpoints. The web part, called neuralchat.html, talks to the backend using HTTP requests. It checks a status endpoint every second to get real-time information about what's happening.

3.1 Virtual Mouse Module



Figure 1: Virtual Mouse Workflow.

The virtual mouse uses two methods: one for hand movement and clicking using hand landmarks, and another for eye blinks using facial landmarks. Both look at frames from the webcam, which takes up to 60 images each second. Hand tracking uses the MediaPipe Hand Landmarker API. It finds 21 points on the hand by placing them in a certain area of the frame. Movement of the cursor is smoother because of a special math formula that takes an adjustable factor to make it move smoothly. Figure 1 illustrates a webcam-based virtual mouse system that captures live video frames, analyzes hand and facial landmarks (using EAR metrics) within a defined Region of Interest, and translates detected gestures into real-time mouse actions such as cursor movement and clicks. The entire process runs in a continuous feedback loop, enabling seamless, hardware-free human-computer interaction without the need for any physical input device.

3.2 Voice Assistant Module

The voice assistant listens all the time using Google's Speech Recognition API through a Python library called SpeechRecognition. It records audio using PyAudio, adjusting the volume settings to work well even in noisy places. Speech is turned into commands through a set of rules. These commands match spoken words to actions on the computer. There are over 60 kinds of commands grouped into areas like mouse movement, opening apps, managing files, system control, media, and web browsing. The text-to-speech part uses pyttsx3, which works without internet, to speak out the results of commands.

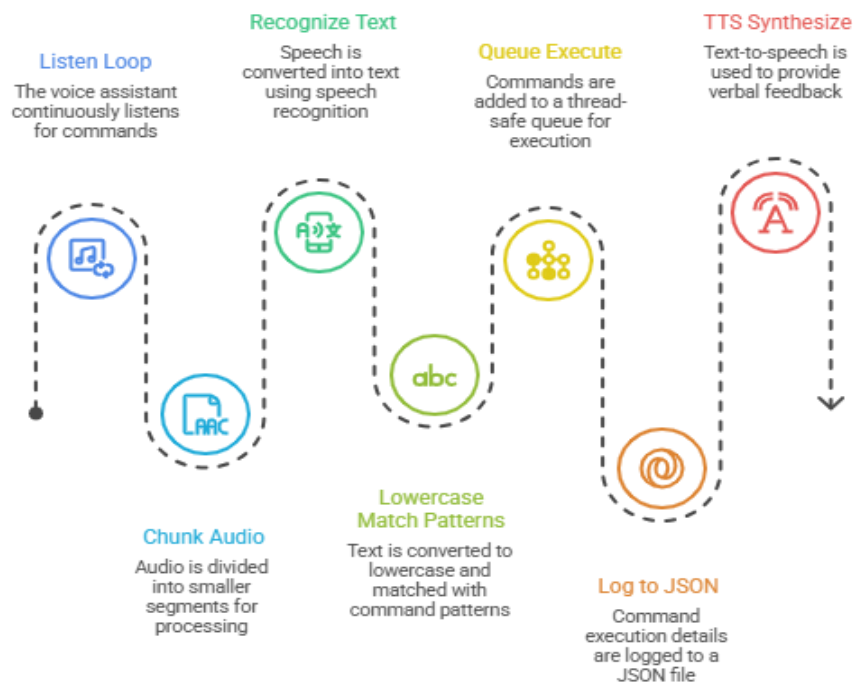


Figure 2: Voice assistant command processing sequence

Figure 2 presents a six-stage voice assistant command processing pipeline where audio input is continuously monitored through a Listen Loop, chunked into smaller segments, and converted into text via speech recognition before being lowercased and matched against predefined command patterns. The validated commands are queued for sequential execution, with all operational details simultaneously logged to a JSON file, while a Text-to-Speech (TTS) synthesis module converts system responses back into verbal feedback, enabling a complete closed-loop voice interaction system.

3.3 Chatbot Module

The chatbot makes smart conversations using the Groq API with the Llama 3.3-70B model. The web part sends messages to the Python part through a groq endpoint, which then sends it to Groq and brings back the answer. This setup avoids browser restrictions and stores the API key safely on the server. The chatbot can switch between different AI personalities, like Sage(analytical), Nova(creative), Oracle(precise), Buddy(friendly), Einstein(scientific), and Muse(artistic). Each has a special set of instructions to shape how it talks and responds.

Figure 3 depicts a seven-stage chatbot interaction sequence where a user's message is transmitted to the backend via an HTTP POST request, which then constructs a system prompt and forwards it to the Groq API, whose JSON response is parsed and appended to the chat history to maintain conversational context. The finalized response is subsequently returned to the frontend for display, forming a structured and stateful request-response pipeline that leverages Groq's API for intelligent, context-aware reply generation.

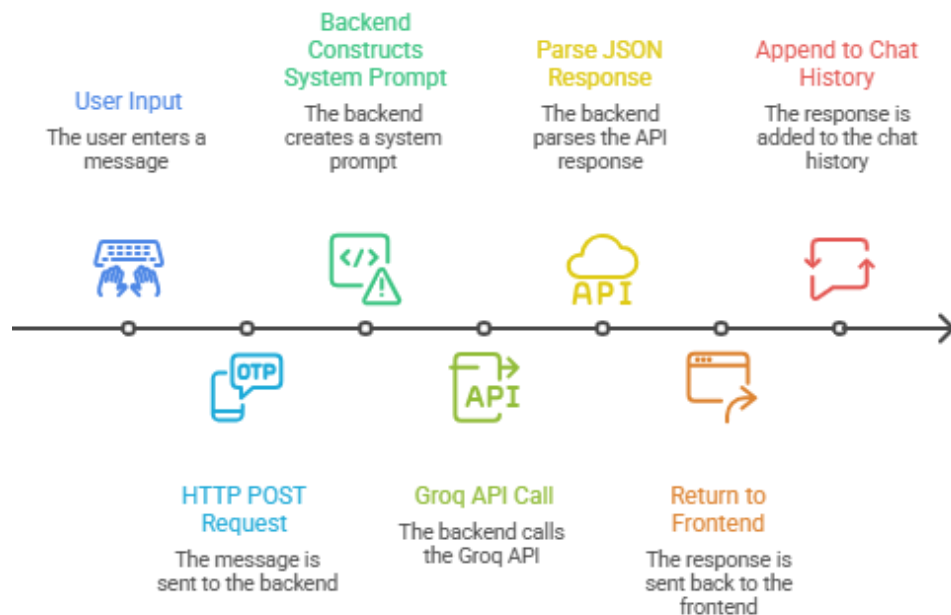


Figure 3: Chatbot interaction sequence

3.4 Integration and Communication

All three parts are part of one Python program that uses a RESTful API on a local port, 5050. This API gives several paths for the web to load the interface(app), send chatbot requests(groq), get recent status updates(status), and control the mouse and voice assistant. A shared memory area holds up to 200 events from all parts, including voice commands, assistant replies, mouse actions, and system changes. The web checks the status endpoint every second to get the latest updates and show them in a live panel.

IV. METHODOLOGY

The system was built step by step, developing each part first before connecting them. This way, debugging was easier and performance could be measured before combining everything. The virtual mouse was the first part because it's the main way to interact. Once it was working, eye blink detection was added using the same video setup, sharing the same frame work. Next was the chatbot since it doesn't rely on video. Finally, voice recognition was added because it needed special handling to not slow down the video loop. The system runs at about 30 frames per second on a regular laptop (Intel Core i5, 8 GB RAM). It keeps this speed by making the face and hand parts use the same step to convert colors. The voice listener runs on a separate thread and sends commands to a safe list that the main loop checks each time. Calibration is done when the system starts. The user holds a certain position for three seconds, allowing the system to measure the baseline eye ratio and set a click distance based on hand size. This helps reduce false clicks during testing.

CORE ALGORITHMS

4.1 Cursor Mapping The position of the fingertip (x_f, y_f) in a normalised camera space is converted into screen coordinates (x_s, y_s) using this formula: $x_s = (x_f - x_{min}) / (x_{max} - x_{min}) \times W_{screen}$ where x_{min} and x_{max} are the active camera area. PyAutoGUI's `moveTo()` function uses this formula with a smoothing factor to make the movement smoother.

4.2 Eye Aspect Ratio (EAR)

The EAR is calculated using six points on the eye, as described by Soukupová and Čech[3]. It is calculated as: $EAR = (\text{distance between points 2 and 6} + \text{distance between points 3 and 5}) / (2 \times \text{distance between points 1 and 6})$

and 4) When EAR falls below a certain value (default 0.21) for a certain number of frames, it records a blink. These values are set during calibration.

4.3 Click Gesture Detection

Left click is triggered if the distance between two points on the hand is less than a certain value, which is set based on the size of the hand. Right click uses different points with a different threshold. These thresholds are set during calibration to make the system work well for different users.

4.4 Implementation Details

The system was developed in Python 3.10 using several key libraries:

- MediaPipe 0.10 – for hand and face detection
- OpenCV 4.8 – for reading the webcam, processing frames, and showing overlays
- PyAutoGUI 0.9 – for controlling the mouse and keyboard
- SpeechRecognition 3.10 – for capturing and transcribing audio using Google's API
- pyttsx3 3.0 – for converting text to speech offline

The chatbot is fully independent and doesn't need an internet connection. It uses regular expressions and Python's built-in function for safe math parsing. No external APIs are used by the chatbot, ensuring it works offline. The visual overlay is shown on the OpenCV window. Hand landmarks appear as green dots connected by lines. A transparent rectangle shows the active area the cursor is over, and the EAR value is shown in the top-left corner. Voice activity is shown with a green border around the webcam feed.

V. RESULT

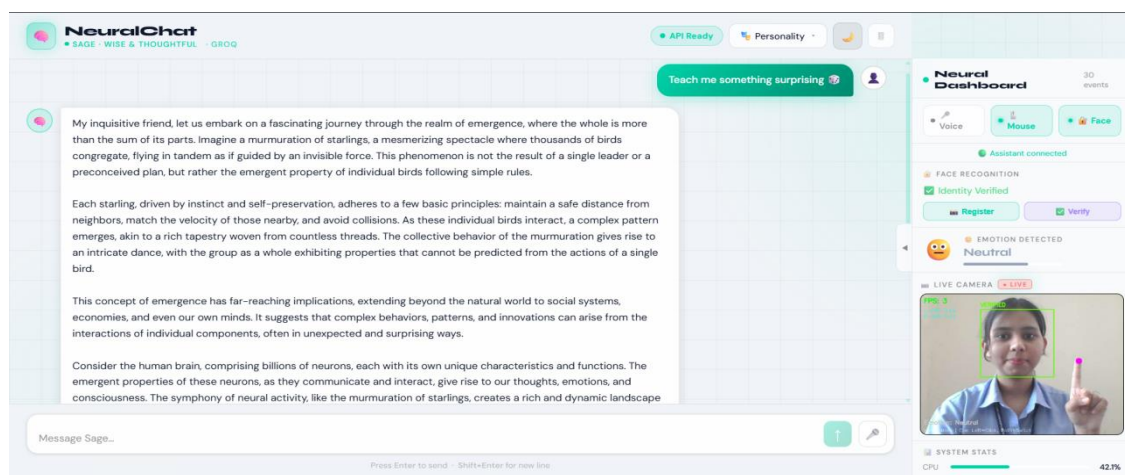


Figure 4: NeuralChat chatbot home screen integrated with Neural Dashboard

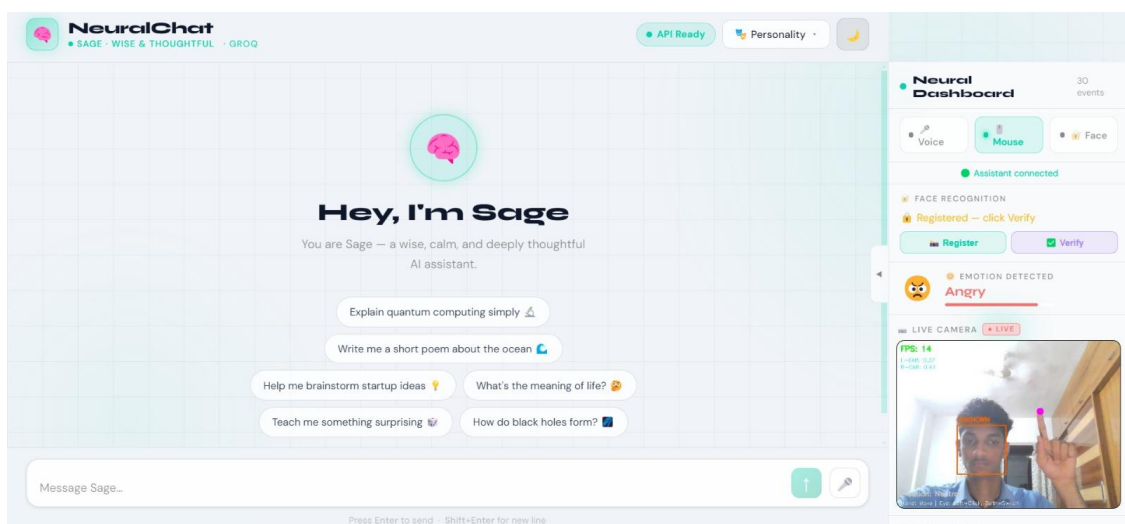


Figure 5: Virtual mouse activation via NeuralChat interface with live camera feed.

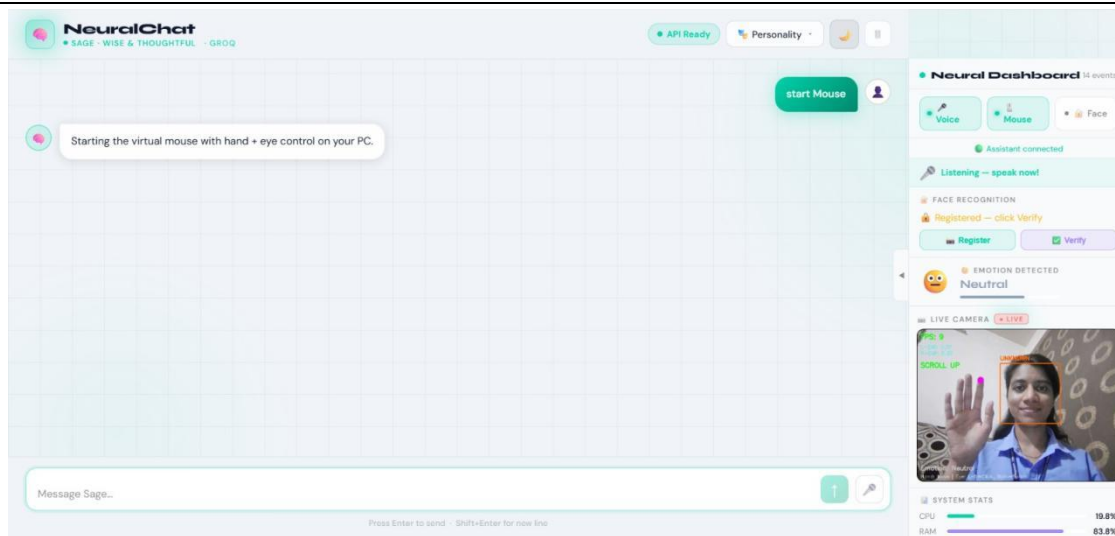


Figure 6: Hand gesture-based virtual mouse cursor movement test showing performance under indoor lighting conditions.

Cursor movement remained smooth and responsive under standard indoor lighting. Accuracy decreased in low-light conditions because MediaPipe's hand detector struggles when contrast between skin and background is reduced. Adding a supplementary infrared LED at the screen edge restored accuracy to approximately 90% in such conditions, suggesting that the algorithm itself is not the bottleneck. Voice recognition performed best in quiet rooms. Background noise above ~60 dB reduced accuracy substantially, which is expected given reliance on an online API that sends raw audio. A future version could replace this with a local Whisper model, which has shown stronger noise robustness in comparable benchmarks. The NeuralChat dashboard, the graphical front-end for the chatbot and system status monitoring. The dashboard reports live CPU, RAM, and disk usage alongside the conversation log, and provides a QR code for pairing a smartphone as a remote control. This interface was found to be particularly useful during demonstration sessions.

VI. TESTING METHODOLOGY

Unit tests were written for each module using Python's unittest framework.

Key test scenarios included:

1. Cursor mapping with synthetic landmark coordinates at corner and centre positions
2. EAR threshold crossing with manually constructed eye-landmark arrays
3. Click distance threshold with synthetic hand landmark data at boundary values
4. Voice command matching for all 12 supported command strings, including partial matches
5. Chatbot arithmetic accuracy across 50 randomly generated expressions

Integration testing verified that all four modules run simultaneously without frame-rate degradation.

On the test hardware, average frame latency remained at 33 ms (30 fps) with all modules active, compared to 28 ms with only the Virtual Mouse module running — an 18% overhead that was imperceptible to users.

VII. APPLICATIONS

The most direct application is assistive technology. Users with limited upper-limb mobility—caused by conditions such as spinal cord injuries, Parkinson's disease, or limb amputation—can control a computer through head movements and eye blinks alone, without requiring any specialised hardware beyond a standard webcam.

In clinical settings, the system allows surgeons or physicians to interact with reference screens during a procedure without breaking sterile technique. In smart classrooms, an educator can advance slides, mute and unmute participants, and open files by gesture or voice while moving freely around the room.

The multimodal nature of the system also makes it naturally suited to interactive kiosk applications in public spaces, where touchscreens present hygiene concerns and traditional pointing devices are impractical.

VIII. CONCLUSION

We presented a Python-based touchless system for human-computer interaction that unifies gesture recognition, eye blink detection, voice command execution, and chatbot interaction within a single real-time application. The system runs on commodity hardware with no specialised sensors, achieving approximately 94% cursor-control accuracy and 96% voice-command recognition under standard conditions. The work demonstrates that a multimodal touchless interface is not only technically feasible on consumer hardware but is also practically useful— particularly for users with physical disabilities and in environments where device contact should be avoided. The modular architecture makes it straightforward to swap individual recognition backends as better models become available.

Future work will mainly focus on replacing the online speech API with a locally-run Whisper model to improve noise robustness and privacy, training a custom gesture classifier to extend the command vocabulary, and integrating facial recognition for session-based user authentication.

IX. FUTURE SCOPE

- Replace MediaPipe rule-based detection with a trained CNN/Transformer gesture classifier for greater robustness across diverse users and lighting conditions
- Integrate OpenAI Whisper or a comparable local ASR model to remove dependence on an internet connection for voice recognition
- Add facial recognition at session start for user-specific calibration and basic access control
- Extend to mobile platforms (Android/iOS) using the device front camera for gesture input
- Explore IoT integration to allow the same gesture and voice interface to control smart-home devices

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SKY FLY AIRLINES FLIGHT BOOKING WEB APPLICATION

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ABSTRACT

The rapid growth of internet technologies has significantly transformed the airline and travel industry by enabling online reservation systems. This paper presents the design and implementation of **Sky Fly Airlines**, a web-based flight booking application developed using modern full-stack web development technologies. The primary objective of the system is to provide users with a convenient platform to search for flights, create accounts, securely log in, and manage bookings through a responsive web interface.

The system is built using HTML, CSS, and JavaScript for the frontend, while Node.js and Express.js are used to implement the backend server logic. SQLite is used as the database to manage user data and booking information. Security mechanisms such as password hashing and token-based authentication are implemented to ensure data protection and secure user sessions.

The development methodology follows an iterative approach where the frontend and backend components are developed and integrated step by step. The system architecture follows a three-tier model consisting of the presentation layer, application layer, and data layer.

Experimental testing demonstrates that the system successfully performs core airline booking operations including user authentication, flight search, and reservation management. The results indicate that the application provides an efficient and user-friendly booking experience. The proposed system demonstrates the practical implementation of modern web development concepts and can be extended with additional features such as payment gateways and real-time flight APIs.

Keywords: Web Development, Responsive Design, Full Stack Development, Flight Booking System, REST API, Authentication Systems.

I. INTRODUCTION

1.1 Background

With the rapid growth of internet connectivity, online services have become an essential part of modern life. The airline industry has particularly benefited from digital transformation, as online booking platforms allow customers to purchase tickets and manage travel plans conveniently. Traditional booking methods required customers to visit travel agencies or airline offices, which was time-consuming and inefficient.

Web-based flight booking systems enable users to search for flights, compare prices, and make reservations from anywhere in the world. These systems improve customer satisfaction while reducing operational costs for airline companies.

1.2 Importance of Web Development

Web development has become a fundamental component of modern digital services. Businesses rely on web applications to provide scalable, accessible, and efficient services to their customers. In the airline industry, web-based systems support multiple operations such as ticket reservations, user account management, and flight scheduling.

Modern web technologies enable developers to build responsive and interactive platforms that can operate across different devices including desktops, tablets, and smartphones.

1.3 Objectives of the Project

The main objectives of the SkyFly Airlines project are:

- To design a responsive web-based flight booking platform

- To implement secure user authentication and account management
- To develop RESTful APIs for booking operations
- To integrate a database for storing user and booking information
- To demonstrate practical full stack web development concepts

II. LITERATURE REVIEW

Several studies have explored the development of online reservation systems and web-based service platforms. Research by Fielding (2000) introduced the REST architectural style, which forms the foundation of modern web APIs. REST-based architectures enable scalable and efficient communication between client and server applications.

Another study by Smith and Johnson (2018) focused on implementing airline reservation systems using cloud-based technologies, which improved system scalability and availability.

Recent developments in web development frameworks such as React, Angular, and Node.js have further enhanced the ability to build high-performance web applications. These frameworks allow developers to create modular and scalable systems capable of handling large volumes of user interactions.

Despite these advancements, many academic implementations of airline reservation systems lack integration of modern authentication techniques and responsive design principles. The proposed SkyFly Airlines system addresses these gaps by combining secure authentication, database management, and responsive user interface design within a single platform.

III. METHODOLOGY

3.1 Technologies Used

The following technologies were used for the development of the system:

HTML5

Provides the structural layout of the web pages and ensures semantic organization of content.

CSS3

Used to design responsive layouts and improve the visual appearance of the application.

JavaScript

Handles client-side interactivity, form validation, and communication with backend APIs.

Node.js

Acts as the server-side runtime environment responsible for processing requests and executing backend logic.

Express.js

A lightweight framework used to develop REST APIs and manage application routing.

SQLite Database

Stores application data including user accounts, flight information, and booking records.

JWT Authentication

Provides secure and stateless authentication for user sessions.

bcrypt

Used to encrypt user passwords and protect sensitive data.

3.2 System Architecture

The system follows a **three-tier architecture** consisting of:

1. Presentation Layer

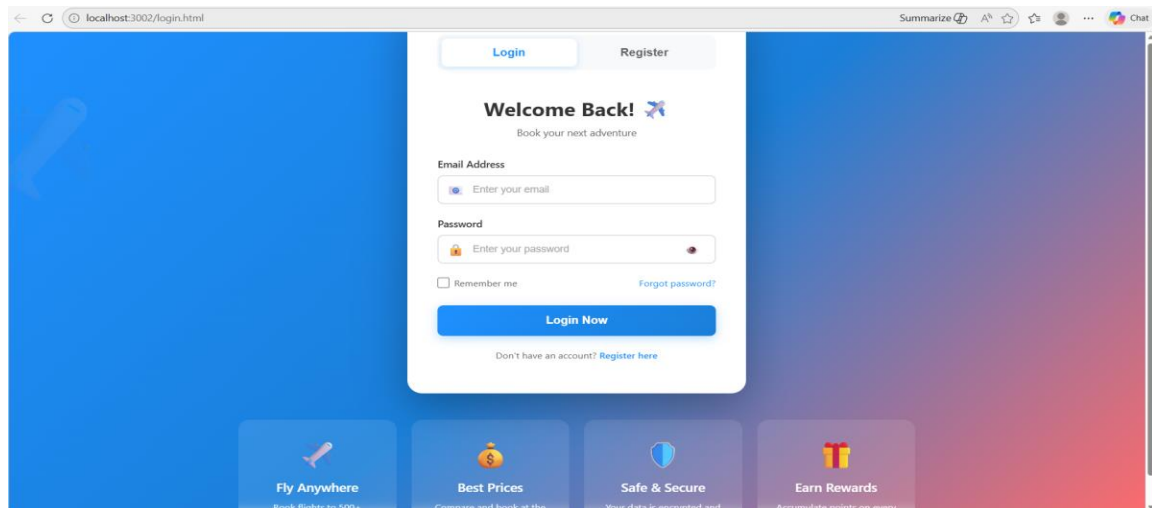
Handles user interaction through the web interface.

2. Application Layer

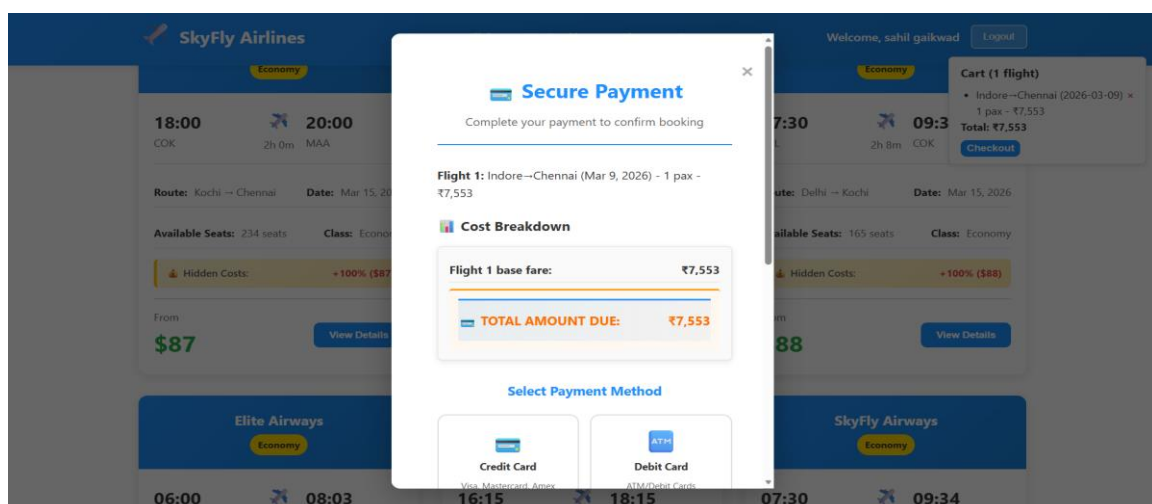
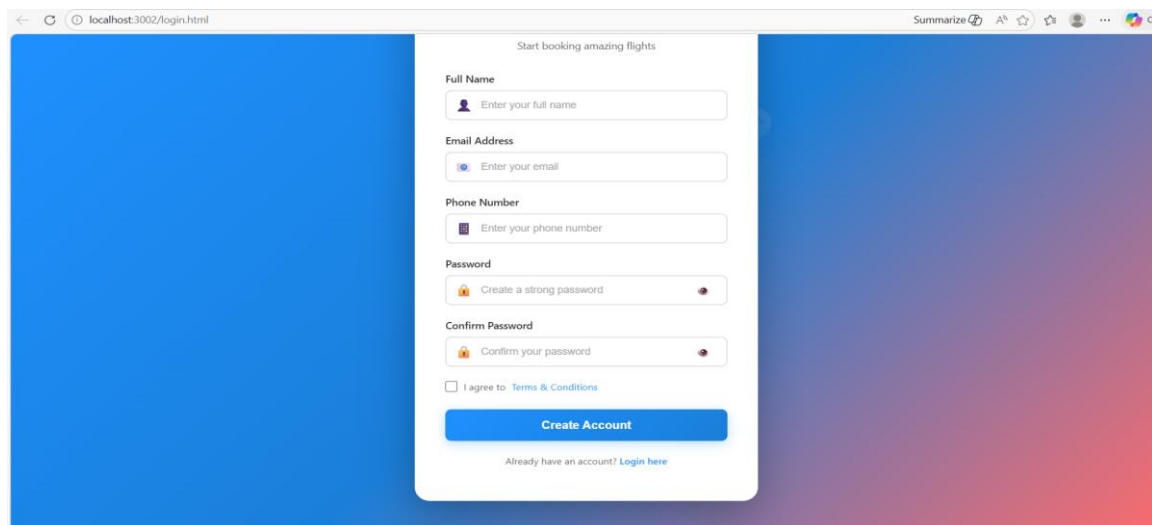
Processes user requests and executes application logic.

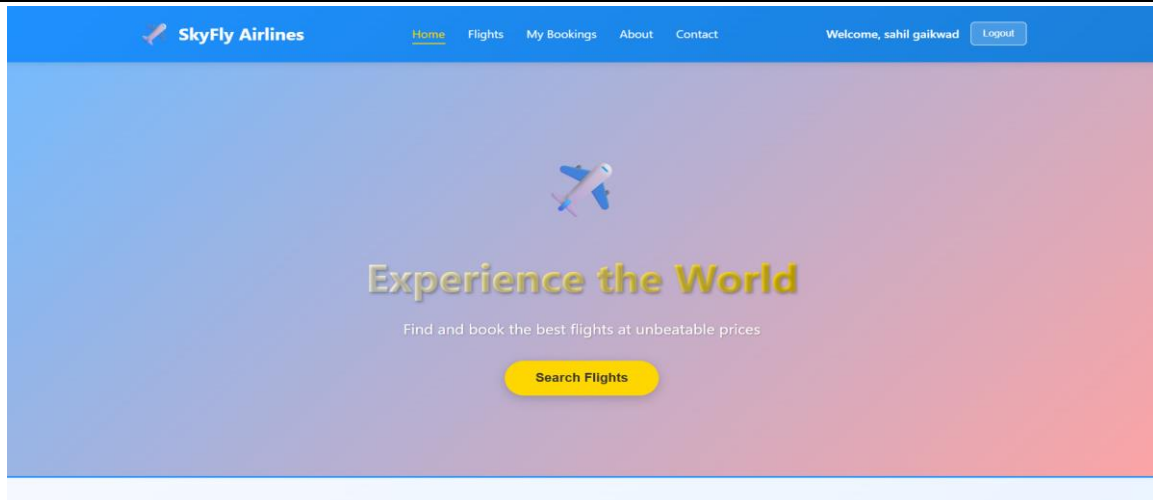
3. Data Layer

Stores and manages application data in the database.

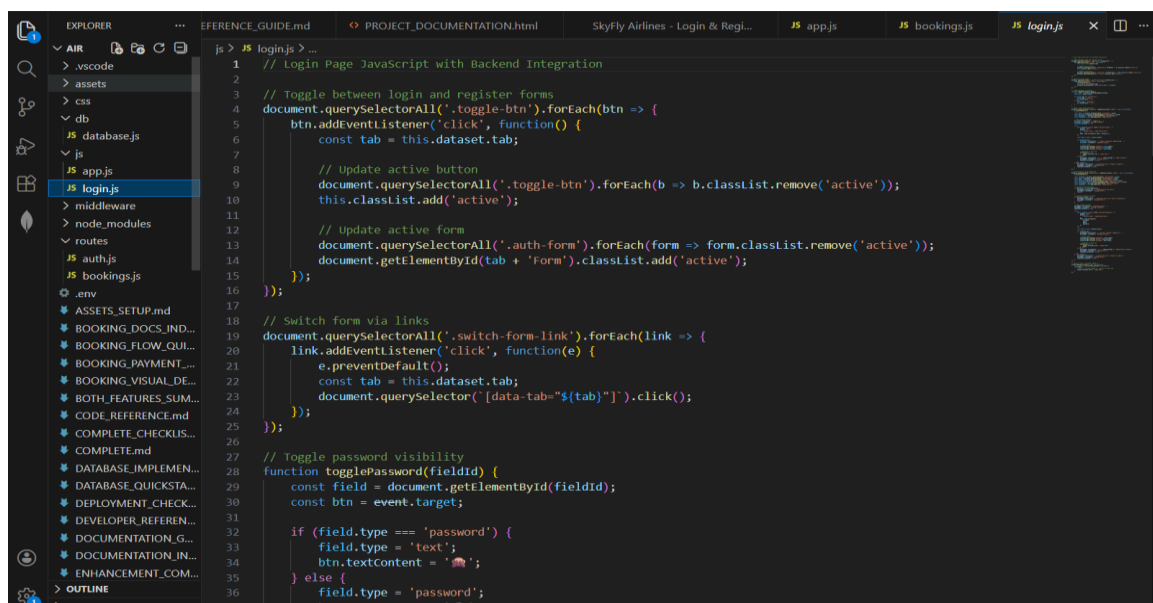
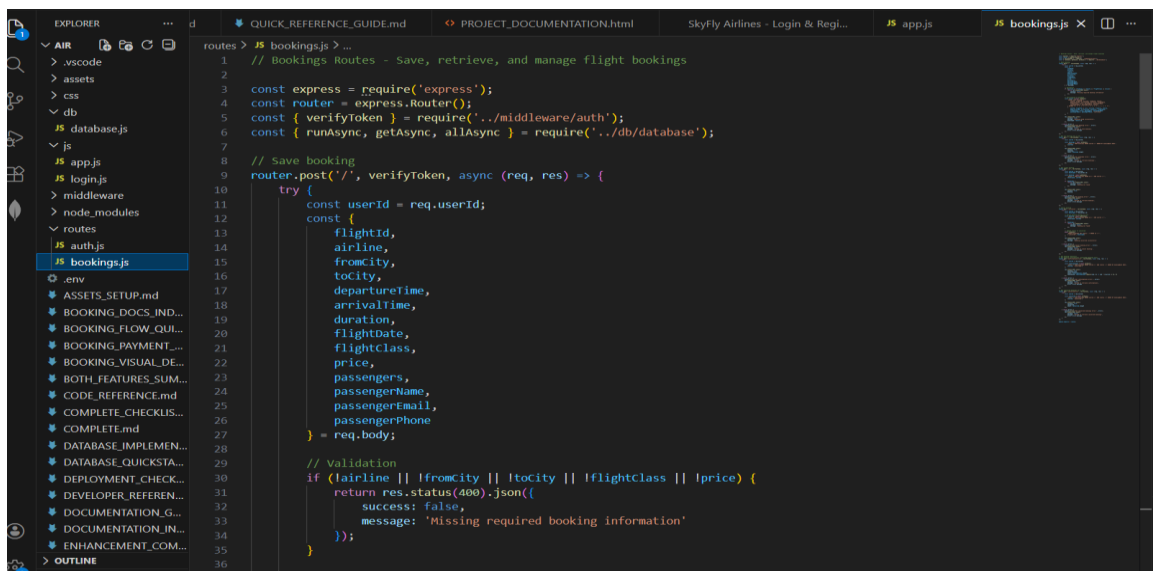


[Figure 1. UI Pages (Login, Search Flights, Booking Page)]





[Figure 2. UI Node.js ServerExpress.js Apis Authentication (JWT)Business Logic (Booking, Search)]



[Figure 3. SQLite Database]

EXPLORER

AIR

node_modules

routes

auth.js

bookings.js

env

ASSETS_SETUP.md

BOOKING_DOCS_IND...

BOOKING_FLOW_QUIL...

BOOKING_PAYMENT...

BOOKING_VISUAL_DE...

BOTH_FEATURES_SUM...

CODE_REFERENCE.md

COMPLETE_CHECKLI...

COMPLETE.md

DATABASE_IMPLEMEN...

DATABASE_QUICKSTA...

DEPLOYMENT_CHECK...

DEVELOPER_REFEREN...

DOCUMENTATION_G...

DOCUMENTATION_IN...

ENHANCEMENT_COM...

FEATURE_COMPLETE...

FILE_STRUCTURE_GUI...

FINAL_CHECKLIST.md

FINAL_DELIVERY_SUM...

FINAL_IMPLEMENTATI...

FLIGHT_SEARCH_GUID...

FLIGHTS_ENHANCEME...

flights.db

GETTING_STARTED.md

...

flights.db

Filter 5 tables...

Tables

bookings

favorites

reviews

sqlite_sequence

users

Rows: 21

Filter 21 rows...

Upgrade to PRO

id	userid	flightid	airline	fromCity	toCity	depart	
1	1	3	2	Global Flights	New York	London	10:30
2	2	4	10840	Global Flights	Dubai	Delhi	10:00
3	3	4	2379	Premium Sky	Bangalore	Kochi	10:00
4	4	4	1368	Premium Sky	Kolkata	Delhi	11:30
5	5	5	4590	Continental Wings	Mumbai	Delhi	19:45
6	6	5	3066	IndiaFlyer	Indore	Mumbai	06:00
7	7	6	5	Falcon Air	Mumbai	Delhi	11:30
8	8	8	4	Premium Sky	Mumbai	Delhi	06:00
9	9	8	6	Global Flights	Mumbai	Delhi	06:00
10	10	8	10077	Global Flights	Ahmedabad	Indore	19:45
11	11	8	9913	Falcon Air	Indore	Hyderabad	18:00
12	12	8	5497	SkyFly Airways	Ahmedabad	Kolkata	08:45
13	13	8	5497	SkyFly Airways	Ahmedabad	Kolkata	08:45
14	14	8	5497	SkyFly Airways	Ahmedabad	Kolkata	08:45
15	15	8	10062	AirIndia Express	Ahmedabad	Chennai	06:00
16	16	9	9615	Premium Sky	Kolkata	Bangalore	10:00
17	17	9	7123	Elite Airways	Bangalore	Pune	11:30
18	18	9	237	Global Flights	Bangalore	Delhi	08:45
19	19	9	2507	Continental Wings	Bangalore	Mumbai	19:45
20	20	9	17	Falcon Air	Mumbai	Hyderabad	08:45
21	21	9	1206	AirIndia Express	New York	Dubai	14:45
+	22						

3.3 Development Process

The project follows a simplified **Agile development methodology** involving the following phases:

1. Requirement analysis
2. System design
3. Frontend development
4. Backend development
5. Database integration
6. Testing and debugging

This iterative approach allows continuous improvements throughout the development lifecycle.

System Architecture

The system follows a **three-layer architecture**:

1. Presentation Layer

Handles user interaction through the web interface.

2. Application Layer

Processes requests and manages business logic through APIs.

3. Data Layer

Stores and retrieves application data from the database.

Development Process

The project followed a **simplified Agile development approach**:

- Requirement analysis
- System design
- Development of frontend components
- Backend API development
- Database integration
- Testing and debugging

This iterative process allowed continuous improvements throughout development.

IV. IMPLEMENTATION

4.1 Frontend Development

The user interface of the application was developed using HTML, CSS, and JavaScript. The design focuses on simplicity and responsiveness to ensure usability across multiple devices.

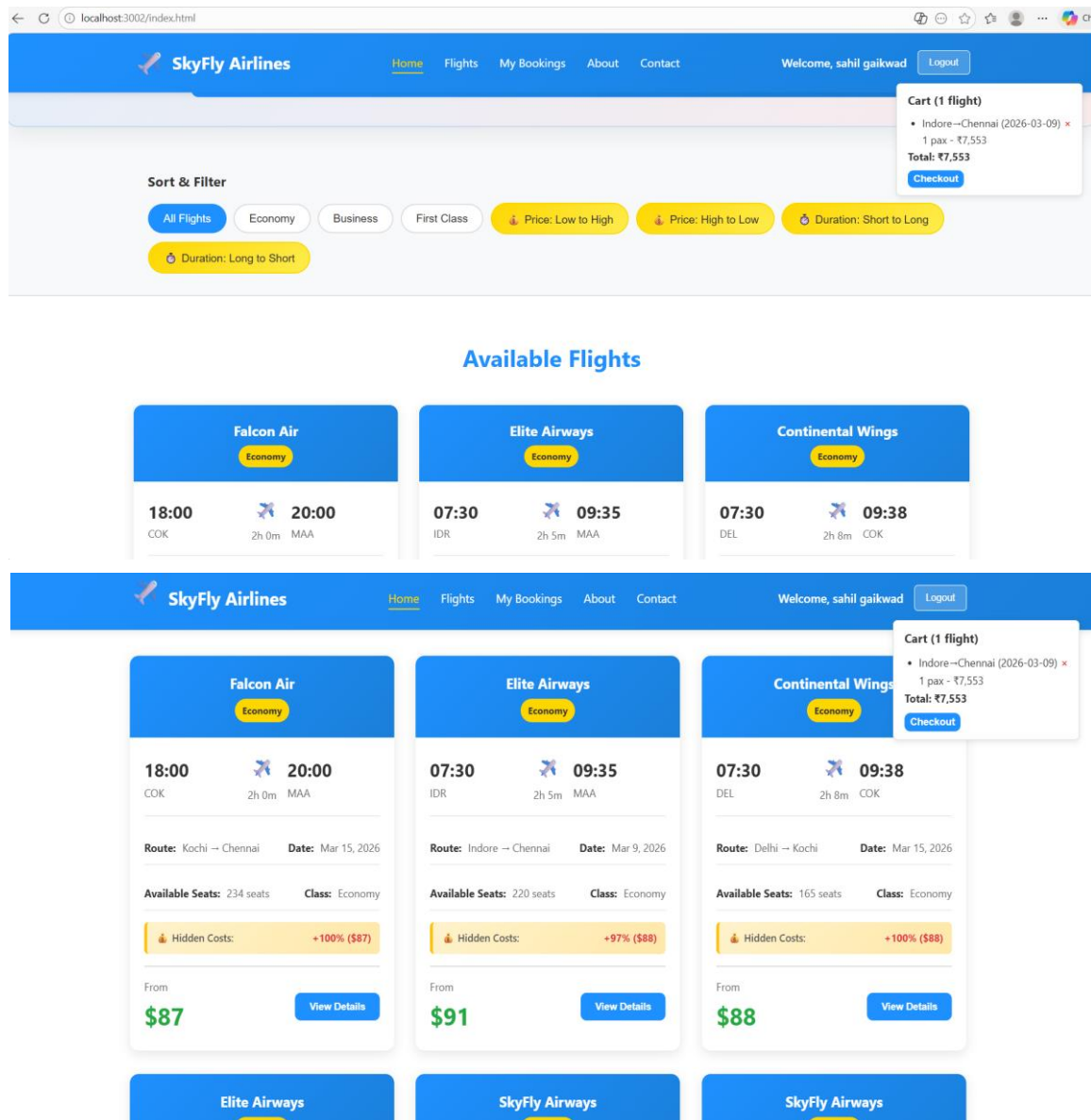
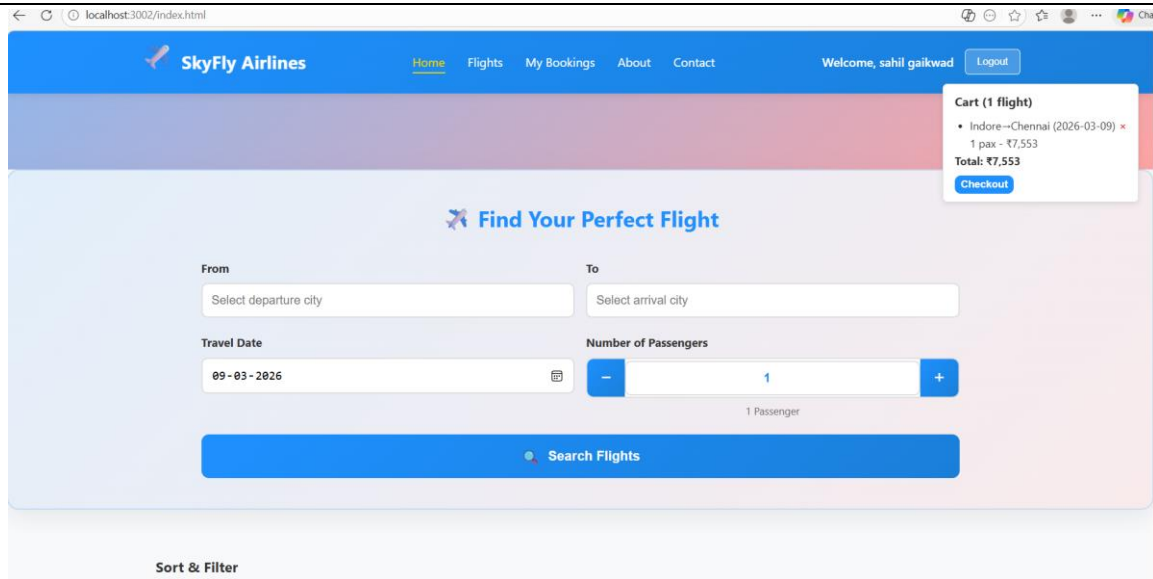
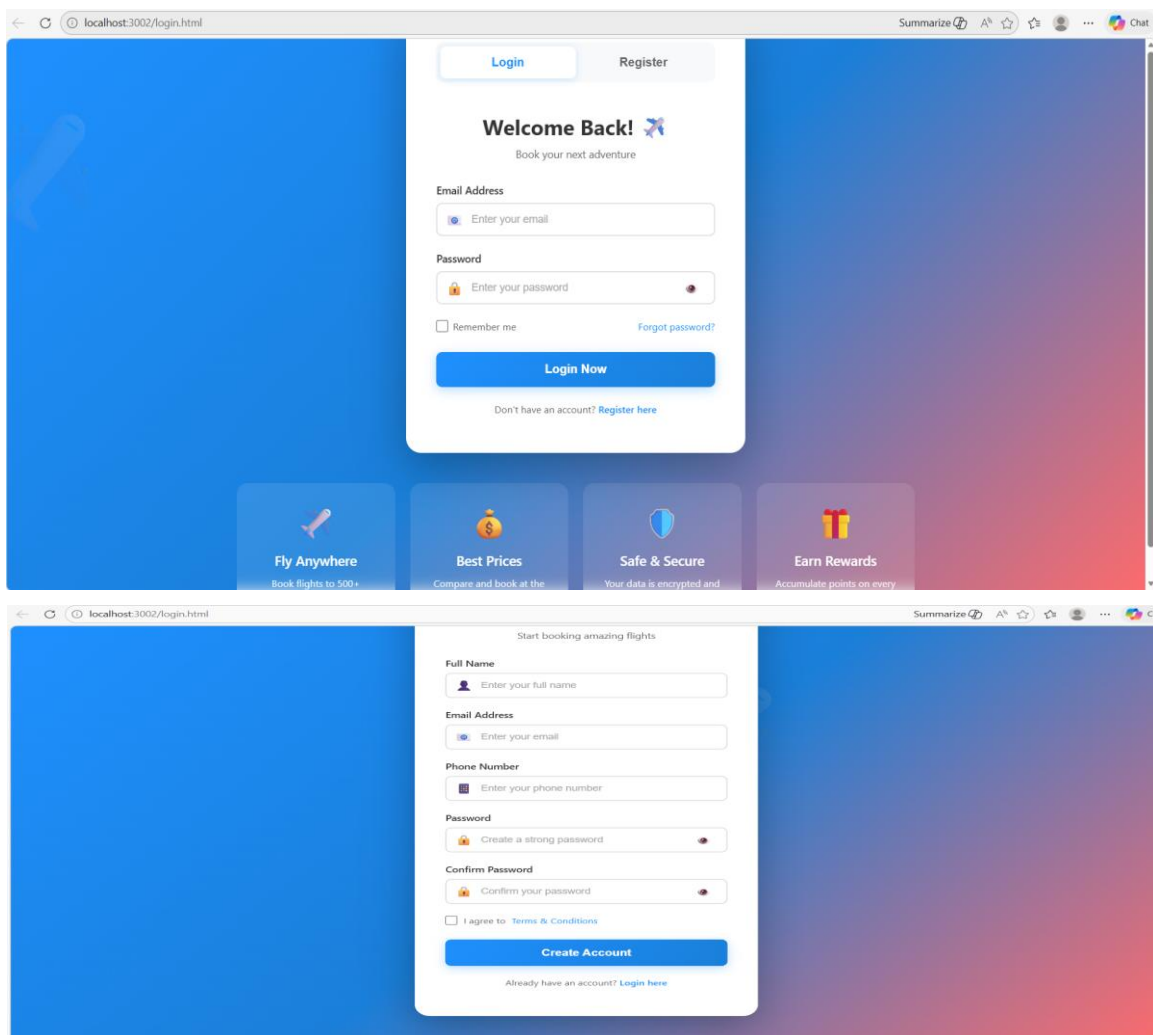


Fig 1. [Homepage UI]



The screenshot shows the SkyFly Airlines website interface. At the top, there is a navigation bar with links: Home, Flights, My Bookings, About, and Contact. A user is logged in as 'Welcome, sahil gawkwad' with a 'Logout' button. A shopping cart is visible in the top right corner, showing 'Cart (1 flight)' with a flight from Indore to Chennai for ₹7,553. The main section is titled 'Find Your Perfect Flight' and contains a search form with fields for 'From' (Select departure city), 'To' (Select arrival city), 'Travel Date' (09-03-2026), and 'Number of Passengers' (1). A 'Search Flights' button is at the bottom of the form. Below the search form, there is a 'Sort & Filter' section.

Fig 2. [Flight Search Page]



The screenshot shows the login page of the SkyFly Airlines website. It features a 'Welcome Back!' message and a 'Book your next adventure' tagline. The login form includes fields for 'Email Address' and 'Password', a 'Remember me' checkbox, and a 'Forgot password?' link. A 'Login Now' button is prominently displayed. Below the login form, there are four promotional cards: 'Fly Anywhere' (Book flights to 500+), 'Best Prices' (Compare and book at the), 'Safe & Secure' (Your data is encrypted and), and 'Earn Rewards' (Accumulate points on every). At the bottom, there is a 'Create Account' section with fields for 'Full Name', 'Email Address', 'Phone Number', 'Password', and 'Confirm Password', along with a 'Create Account' button and a link to 'Login here' if the user already has an account.

Fig 3. [Login Page]

4.2 Backend Development

The backend server was developed using Node.js and Express.js. RESTful APIs were implemented to handle user authentication, flight searching, and booking operations.

Example API functions include:

- User registration
- User login authentication
- Flight search request
- Booking creation
- Booking history retrieval

4.3 Database Design

The SQLite database stores the following information:

- User details
- Flight information
- Booking records

[Insert Figure: Database ER Diagram]

4.4 Key Features Implemented

- Secure user registration and login system
- Password encryption using bcrypt
- JWT-based authentication
- Flight search functionality
- Booking management system
- Responsive user interface

V. RESULTS AND DISCUSSION

5.1 System Performance

The system was tested under multiple user interactions including account creation, login authentication, and flight booking. The backend APIs successfully processed requests with minimal response time.

5.2 User Testing

Basic usability testing was conducted to evaluate the user experience. Test users were able to complete the following tasks successfully:

- Register an account
- Log in to the system
- Search for flights
- Create and manage bookings

5.3 Comparison with Existing Systems

Feature	Existing Booking Systems	Proposed System
Authentication	Basic login	JWT-based secure authentication
UI Design	Varies	Responsive interface
Booking System	Advanced	Simplified demonstration
Scalability	High	Moderate (prototype level)

The proposed system successfully demonstrates the fundamental concepts of airline reservation systems.

VI. CONCLUSION

This paper presented the design and implementation of the SkyFly Airlines web-based flight booking system. The project demonstrates how modern web development technologies can be integrated to create a functional online reservation platform.

The application successfully implements user authentication, flight search functionality, and booking management using a full stack development approach. The system architecture ensures modularity and maintainability, while the responsive interface improves usability across different devices.

The project highlights the potential of web technologies in developing scalable and efficient service platforms and provides a strong foundation for future enhancements.

Limitations

- Limited flight dataset used for demonstration
- No payment gateway integration
- Basic user interface compared to commercial systems

Future Scope

- Integration with real-time airline APIs
- Online payment gateway support
- Mobile application development
- Advanced features such as seat selection and ticket cancellation

ACKNOWLEDGEMENTS

The successful completion of this project would not have been possible without the guidance and support of our mentors and instructors. We sincerely thank our faculty members and institution for providing the necessary resources and encouragement throughout the development of this project.

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THREATINTEL – CYBER SECURITY THREAT INTELLIGENCE SYSTEM

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ABSTRACT

Cyber security threats are increasing rapidly due to the growth of internet-connected systems and digital infrastructure. Organizations require real-time monitoring systems to detect, analyze, and respond to cyber threats efficiently. This research presents **Threat Intel**, a Cyber security Threat Intelligence and Security Operations Center (SOC) platform designed to monitor network activities, detect malicious traffic, and provide analytical insights. The system uses a **Node.js and Express backend**, a **React-based user interface**, and **Web Socket technology** to deliver real-time threat monitoring. It also integrates packet capture mechanisms and analytics modules to identify suspicious network behavior. The platform provides dashboards for threat visualization, network monitoring, and security analytics. Persistent data storage ensures that threat records and network activity are stored for further analysis. The system architecture supports containerized deployment using Docker, allowing easy scalability and deployment. The results show that the system effectively captures network packets, identifies potential threats, and displays security insights through a centralized dashboard. This platform demonstrates how modern web technologies can be used to build a lightweight yet powerful cyber security monitoring system.

Keywords: Cyber security, Threat Intelligence, Network Monitoring, Packet Capture, Security Operations Center, Web Socket.

I. INTRODUCTION

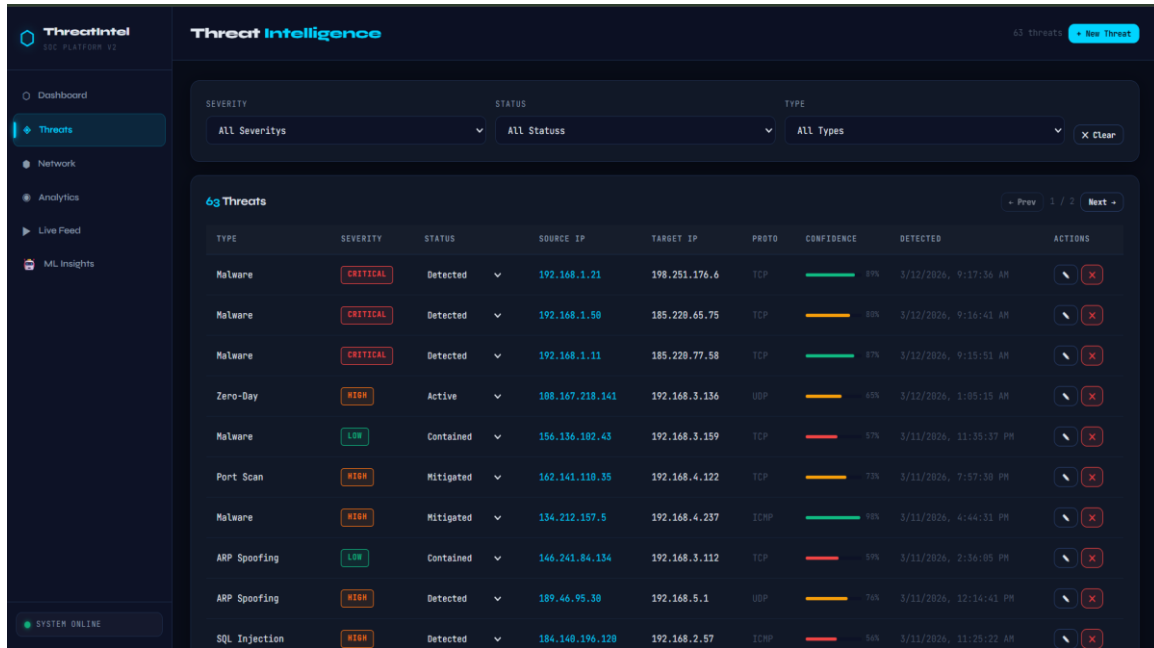
Cyber security has become a major concern in the modern digital world due to the increasing number of cyber-attacks such as malware infections, phishing attacks, ransom ware, and network intrusions. Organizations need advanced monitoring tools that can detect suspicious network behavior and provide real-time insights into potential threats. Traditional security systems often lack real-time analytics and centralized monitoring capabilities.

Threat Intelligence systems play a crucial role in identifying, analyzing, and responding to security threats. These systems collect information about network activities, detect anomalies, and generate alerts for potential security incidents. Security Operations Centers (SOC) rely on such systems to monitor large volumes of network traffic and protect organizational infrastructure.

This project presents **Threat Intel**, a real-time cyber security monitoring platform designed to provide network visibility, threat detection, and analytical insights. The system integrates **packet capture mechanisms, machine learning support, real-time Web Socket communication, and interactive dashboards** to provide a complete cyber security monitoring solution.

The system uses modern technologies including **Node.js for backend services, React for the frontend interface, and Docker for deployment**. It also implements persistent storage to maintain records of threats and network events.

The main objective of this research is to design and implement a platform that can monitor network traffic, detect possible threats, and provide a centralized dashboard for security analysis.



The screenshot displays the Threatintel SOC Platform v2 interface. The left sidebar contains navigation links: Dashboard, Threats (selected), Network, Analytics, Live Feed, and ML Insights. The main area shows a table of threats with filters for Severity (All Severities), Status (All Statuses), and Type (All Types). The table lists 63 threats, with the first 10 visible. Each row includes columns for Type, Severity, Status, Source IP, Target IP, Proto, Confidence, Detected, and Actions.

TYPE	SEVERITY	STATUS	SOURCE IP	TARGET IP	PROTO	CONFIDENCE	DETECTED	ACTIONS
Malware	CRITICAL	Detected	192.168.1.21	198.251.176.6	TCP	80%	3/12/2026, 9:17:36 AM	[Eye] [X]
Malware	CRITICAL	Detected	192.168.1.90	185.228.65.75	TCP	80%	3/12/2026, 9:16:41 AM	[Eye] [X]
Malware	CRITICAL	Detected	192.168.1.11	185.228.77.58	TCP	80%	3/12/2026, 9:15:51 AM	[Eye] [X]
Zero-Day	HIGH	Active	188.167.218.141	192.168.3.136	UDP	60%	3/12/2026, 1:05:15 AM	[Eye] [X]
Malware	LOW	Contained	156.136.182.43	192.168.3.159	TCP	50%	3/11/2026, 11:35:37 PM	[Eye] [X]
Port Scan	HIGH	Mitigated	162.141.110.35	192.168.4.122	TCP	70%	3/11/2026, 7:57:30 PM	[Eye] [X]
Malware	HIGH	Mitigated	134.212.157.5	192.168.4.237	ICMP	80%	3/11/2026, 4:44:31 PM	[Eye] [X]
ARP Spoofing	LOW	Contained	146.241.84.134	192.168.3.112	TCP	50%	3/11/2026, 2:36:05 PM	[Eye] [X]
ARP Spoofing	HIGH	Detected	189.46.95.38	192.168.5.1	UDP	70%	3/11/2026, 12:14:41 PM	[Eye] [X]
SQL Injection	HIGH	Detected	184.148.196.120	192.168.2.57	ICMP	80%	3/11/2026, 11:25:22 AM	[Eye] [X]

II. METHODOLOGY

The development of the Threat Intel system follows a **modular architecture** consisting of backend services, frontend interface, network monitoring modules, and analytics components.

System Architecture

The system is divided into two main components:

1. **Backend Server**
2. **Frontend Dashboard**

The backend is responsible for processing network data, handling API requests, managing authentication, and storing threat information. The frontend provides a user interface where security analysts can monitor network activities and analyze threats.

Backend Implementation

The backend is developed using **Node.js and Express.js**. It provides REST APIs for handling various system functions such as:

- Threat management
- Network monitoring
- Analytics processing
- Dashboard data generation

The backend also includes middleware for authentication, error handling, and logging.

Packet Capture and Threat Detection

The system includes a **packet capture module** that monitors network traffic. It collects information such as:

- Source IP address
- Destination IP address
- Packet type
- Network protocol
- Suspicious traffic patterns

These packets are analyzed to detect unusual activity that may indicate a security threat.

WebSocket Real-Time Communication

WebSocket technology is implemented to provide **real-time updates** to the dashboard. This allows the system to instantly display new threats or network events without refreshing the page.

Data Storage

The system uses a **file-based JSON storage system** to store threat records, analytics data, and network logs. This ensures persistent storage of cybersecurity data.

III. MODELING AND ANALYSIS

The Threat Intel platform is designed using a **client-server architecture**.

System Components**1. Frontend (React Application)**

- Displays dashboards and threat reports
- Provides user authentication interface
- Shows real-time network activity

2. Backend (Node.js Server)

- Processes API requests
- Manages threat data
- Handles packet capture and analysis

3. Network Monitoring Module

- Captures network packets
- Identifies suspicious traffic patterns

4. Analytics Engine

- Analyzes collected data
- Generates insights and visual statistics

Data Flow Model

1. Network packets are captured by the monitoring module.
2. The backend processes and analyzes packet data.
3. Threat information is stored in the database.
4. WebSocket sends updates to the frontend dashboard.
5. Users view threats and analytics through the interface.

This architecture allows efficient monitoring of network activity and fast detection of potential security threats.

IV. RESULTS AND DISCUSSION

The Threat Intel platform successfully demonstrates the implementation of a real-time cybersecurity monitoring system. The system was tested using simulated network traffic to analyze its ability to capture packets and detect potential threats.

The results show that the system can:

- Capture and analyze network packets in real time.
- Detect suspicious network behavior.
- Store threat data for later analysis.
- Display analytics through an interactive dashboard.

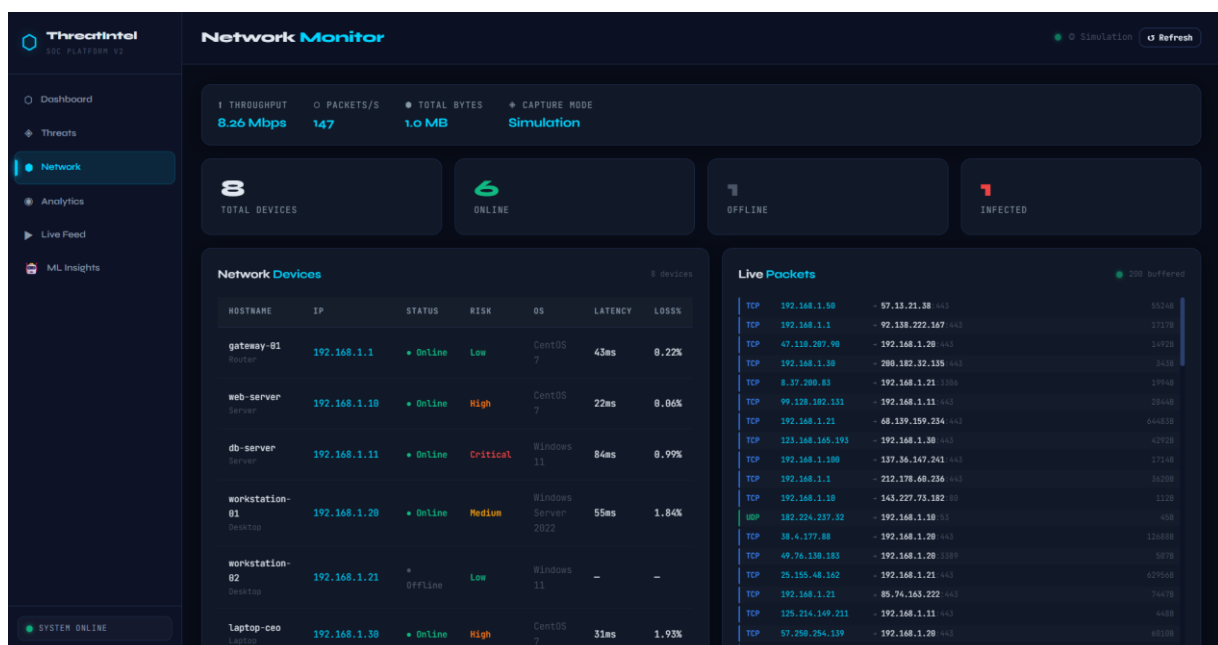
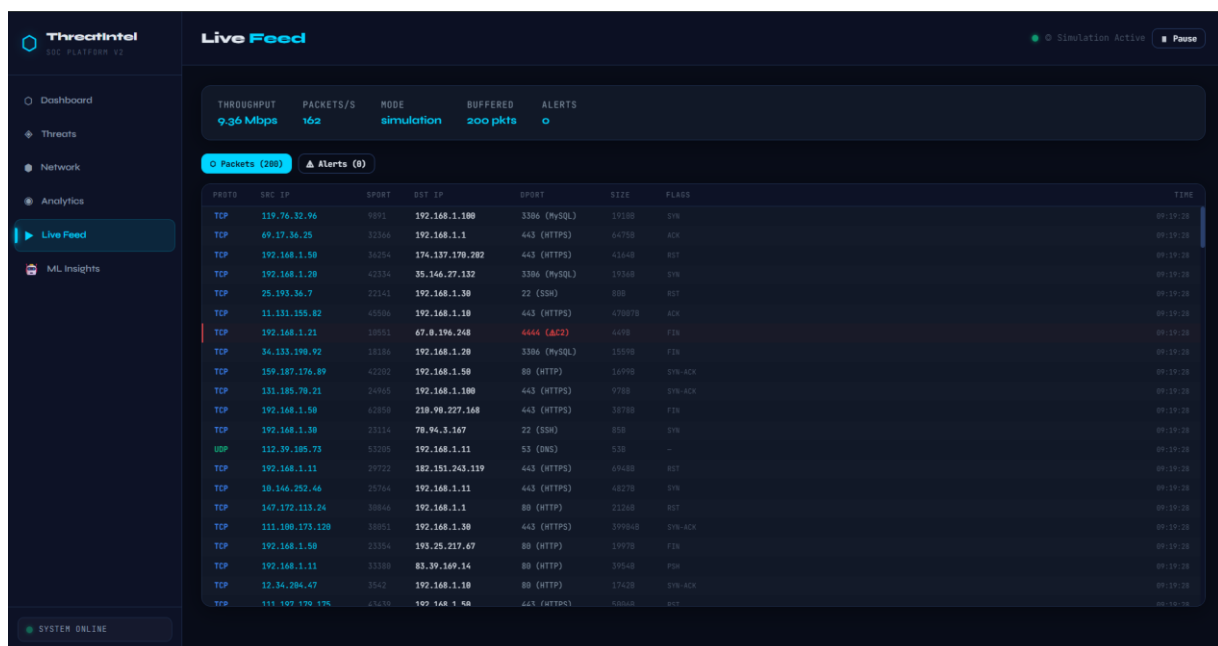
The dashboard provides several visualization features including:

- Threat statistics
- Network activity monitoring
- Real-time alerts
- Analytical insights

The WebSocket integration allows the dashboard to update instantly when new threats are detected. This real-time capability improves the efficiency of security monitoring.

The modular architecture also allows easy integration of additional features such as machine learning models for advanced threat detection.

Overall, the system demonstrates how modern web technologies can be effectively used to develop a cybersecurity monitoring platform.



V. CONCLUSION

This research presented the design and implementation of **Threat Intel**, a cybersecurity threat intelligence and network monitoring system. The system integrates packet capture, real-time communication, analytics, and visualization to provide an effective cybersecurity monitoring solution.

The platform successfully captures network traffic, detects suspicious activity, and provides real-time insights through an interactive dashboard. The use of Node.js, React, and WebSocket technology ensures efficient data processing and real-time updates.

The results demonstrate that the system can be used as a lightweight Security Operations Center platform for monitoring network security. The modular architecture also allows future expansion and integration with machine learning models for advanced threat detection.

Future improvements may include AI-based anomaly detection, integration with external threat intelligence feeds, and support for large-scale enterprise networks.

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FAKE MEDICINE DETECTOR

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ABSTRACT

Fake medicines are a serious problem in the healthcare industry and can cause harmful effects on human health. The Fake Medicine Detector Website is designed to help users identify whether a medicine is genuine or fake. This system allows users to enter or scan details such as the medicine name, batch number, or QR code to verify its authenticity. The website compares the entered information with a database of registered medicines provided by manufacturers or authorities. If the medicine information matches the database, it is considered genuine; otherwise, it may be flagged as suspicious or fake. The system provides quick and easy verification to users, pharmacists, and healthcare providers. By using this platform, people can avoid counterfeit medicines and ensure safety. This project helps improve public awareness and supports efforts to reduce the circulation of fake medicines in the market.

Keywords: Fake Medicine Detection, Counterfeit Drugs, Medicine Authentication, QR Code Verification, Drug Database, Web Application, Healthcare Safety, Pharmaceutical Verification, Barcode Scanning, Digital Health System.

I. INTRODUCTION

Counterfeit or fake medicines have become a major problem in the healthcare industry worldwide. These medicines may contain incorrect ingredients, improper dosage, or harmful substances, which can cause serious health risks to patients. The circulation of fake drugs not only affects public health but also damages the reputation of pharmaceutical companies and healthcare systems. Therefore, it is very important to develop a reliable system that can help identify genuine medicines.

The Fake Medicine Detector Website is designed to help users verify the authenticity of medicines easily. This system allows users to check medicine details such as the medicine name, batch number, barcode, or QR code through a webbased platform. The system compares the entered information with a stored database of registered medicines provided by manufacturers or regulatory authorities.

If the information matches the database, the medicine is confirmed as genuine. If the information does not match, the system alerts the user that the medicine may be fake or suspicious. This website can be used by consumers, pharmacists, and healthcare professionals to quickly verify medicines before use.

The main purpose of this project is to increase awareness about counterfeit medicines and provide a simple digital solution to reduce the risk of fake drugs in the market. By using modern web technologies and a centralized medicine database, the Fake Medicine Detector Website aims to improve safety and trust in pharmaceutical products.

1.1 Problem Statement

The increasing presence of counterfeit or fake medicines in the pharmaceutical market has become a serious threat to public health and safety. Many people unknowingly purchase and consume fake medicines that may contain harmful or ineffective ingredients. This can lead to treatment failure, serious health complications, and even loss of life. It is often difficult for consumers and pharmacists to visually identify whether a medicine is genuine or counterfeit.

1.2 Objectives

- To detect fake medicines by verifying medicine details with a trusted database.
- To provide a user-friendly web platform where users can easily check the authenticity of medicines.
- To improve public awareness about the risks of counterfeit medicines.
- To allow verification using details such as medicine name, batch number, barcode, or QR code.
- To help pharmacists and consumers identify genuine and fake medicines quickly.
- To reduce the circulation of counterfeit drugs in the pharmaceutical market.
- To ensure patient safety by promoting the use of verified and authentic medicines.

II. LITERATURE SURVEY

Counterfeit medicines are a major global problem that affects public health and the pharmaceutical industry. Many researchers have proposed different technologies and systems to detect fake medicines and improve drug authentication. Several studies focus on analytical and laboratory techniques for detecting counterfeit medicines. Researchers have used methods such as spectroscopy, chromatography, and chemical analysis to identify differences between genuine and fake drugs. For example, portable Raman spectroscopy combined with data analysis techniques can quickly distinguish counterfeit medicines with high accuracy, making it suitable for on-site inspection of pharmaceutical products.

Another research approach uses spectral sensing and machine learning techniques to detect counterfeit medicines. In one study, hyperspectral sensing was used to capture spectral signatures of medicine tablets and classify them using machine learning models. The results showed more than 90% accuracy in identifying counterfeit drugs, demonstrating the effectiveness of combining sensing technology with intelligent algorithms.

Some researchers proposed image processing and pattern recognition methods to identify fake medicines. These systems analyze images of medicine packaging and labels using techniques such as Optical Character Recognition (OCR) and feature extraction algorithms. By comparing the extracted features with a database of authentic medicines, the system can determine whether the medicine is genuine or counterfeit.

III. SYSTEM ARCHITECTURE

The Fake Medicine Detector Website is designed using a simple web-based architecture that allows users to verify the authenticity of medicines through an online platform. The system consists of three main components: User Interface, Application Server, and Database. These components work together to process user requests and verify medicine details..

3.1 Medicine Data Input Module

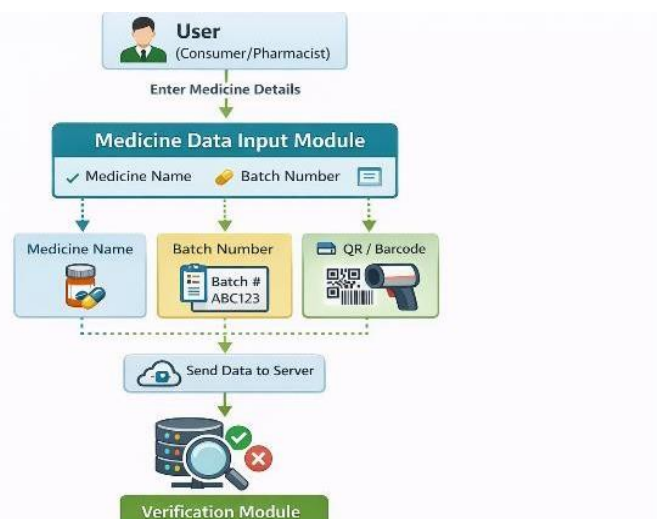


Figure 1: Medicine Data Input Workflow.

The Medicine Data Input Module is the first step in the Fake Medicine Detector System. It allows the user to enter the details of a medicine that needs to be verified. The process starts when the user (consumer or pharmacist) opens the website and enters the medicine details in the input form. After entering the details, the system sends the information to the server or backend system for processing.

3.2 Verification Module

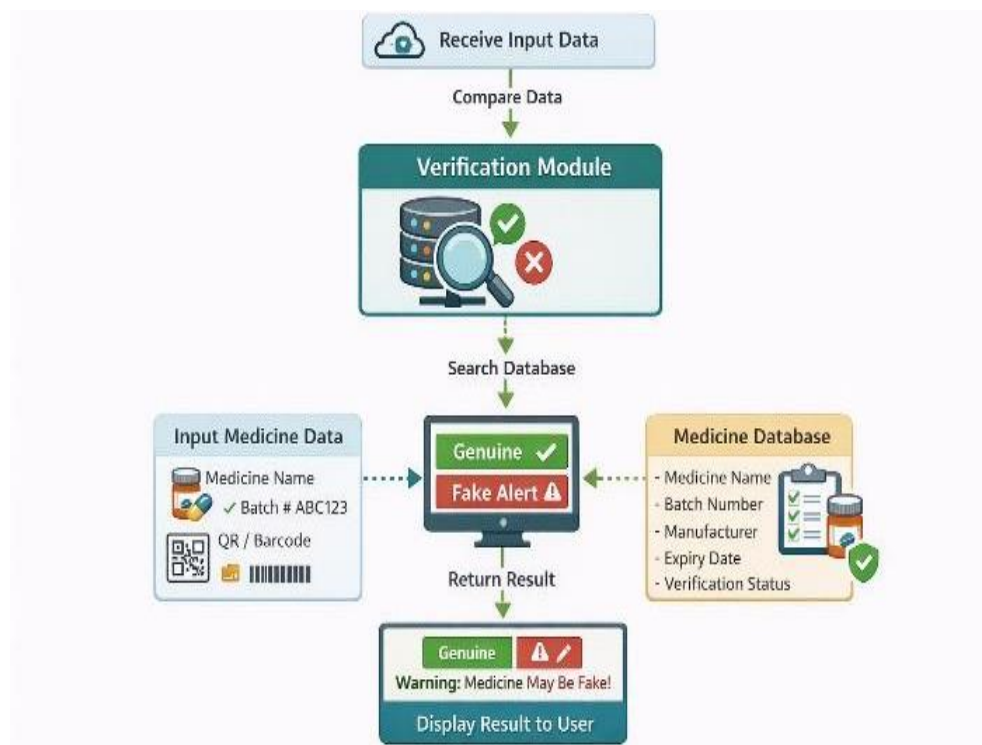


Figure 2: Voice assistant command processing sequence

The diagram represents the Verification Module of the Fake Medicine Detector System, which is responsible for checking whether a medicine is genuine or fake. The process begins when the system receives input data from the user. The user enters medicine details such as medicine name, batch number, or QR/barcode through the Medicine Data Input Module. This information is then sent to the Verification Module, where the system processes and prepares the data for verification.

In the next step, the system compares the entered medicine details with the records stored in the medicine database. The database contains important information such as the medicine name, batch number, manufacturer details, expiry date, and verification status. The Verification Module searches the database to find a matching record for the entered medicine information. If the entered details match the database record, the medicine is identified as genuine. However, if the details do not match or the medicine record is not found in the database, the system generates a fake alert.

3.3 Admin Module

The Admin Module diagram represents the part of the Fake Medicine Detector System that allows the administrator to manage the system and control the medicine database. At the center of the diagram is the Admin Panel, which acts as the main interface through which the administrator performs different management tasks. After logging into the admin panel, the administrator can access sections such as Dashboard, Manage Medicines, and Manage Users. The panel displays information about medicines including medicine name, batch number, and expiry date, and also provides options to edit or delete records.

One of the main functions shown in the diagram is Add Medicine Data, where the administrator can enter new medicine information into the database. The admin provides details such as the medicine name, batch number,

and expiry date. This information is stored in the database so that the system can later verify the medicine when a user checks it.

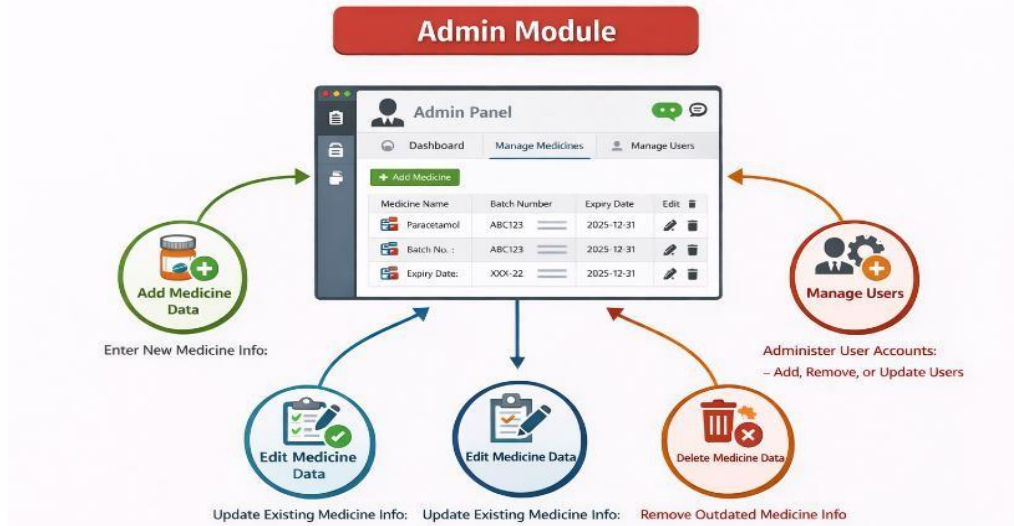


Figure 3: Admin Module

3.4 Integration and Communication

Integration and communication are important parts of the Fake Medicine Detector System because they allow different modules of the system to work together efficiently. The system consists of several modules such as the Medicine Data Input Module, Verification Module, Database Module, Result Display Module, and Admin Module. These modules are connected and communicate with each other to complete the process of detecting fake medicines.

When a user enters medicine details such as the medicine name, batch number, or QR code in the Medicine Data Input Module, the information is sent to the Verification Module through the application server. The Verification Module then communicates with the Medicine Database to check whether the entered medicine information matches the stored records. If a match is found, the system confirms that the medicine is genuine. If no matching record is found, the system generates a warning indicating that the medicine may be fake.

IV. METHODOLOGY

The methodology of the Fake Medicine Detector Website describes the step-by-step process used to design and implement the system for detecting counterfeit medicines. The system is developed using a structured approach to ensure accurate verification and smooth operation of all modules.

First, the system collects medicine details from the user through the website interface. The user enters information such as the medicine name, batch number, or QR/barcode using the Medicine Data Input Module. This data is then sent to the server for further processing. Next, the Verification Module processes the entered information. The system compares the input data with the records stored in the medicine database. The database contains verified information about registered medicines such as medicine name, manufacturer details, batch number, expiry date, and verification status.

If the entered medicine details match the database records, the system confirms that the medicine is genuine. If the information does not match or the record is not found, the system generates a fake medicine alert to warn the user.

CORE ALGORITHMS

4.1 Data Input and Validation

The first step of the core algorithm is collecting medicine information from the user. The user enters details such as the medicine name, batch number, or QR/barcode through the website interface. After receiving the input, the system performs data validation to check whether the entered information is complete and in the

correct format. If the input data is missing or incorrect, the system asks the user to re-enter the correct details before proceeding to the next step.

4.2 Database Comparison and Verification

After validation, the system sends the medicine details to the verification module, which searches the medicine database for a matching record. The algorithm compares the user-entered information with stored data such as medicine name, batch number, manufacturer details, and expiry date. If the entered data matches the database record, the system identifies the medicine as genuine and displays a confirmation message to the user. If the system does not find a matching record or detects mismatched information, it generates a fake medicine alert, warning the user that the medicine may be counterfeit. This process ensures accurate and reliable detection of fake medicines.

4.3 Result Generation and Display

After the verification process is completed, the system generates the final result based on the comparison between the user input and the database records. If the medicine details match the stored information, the system confirms that the medicine is genuine and displays a success message to the user. If the details do not match or no record is found in the database, the system generates a warning message indicating that the medicine may be fake or suspicious.

V. RESULT

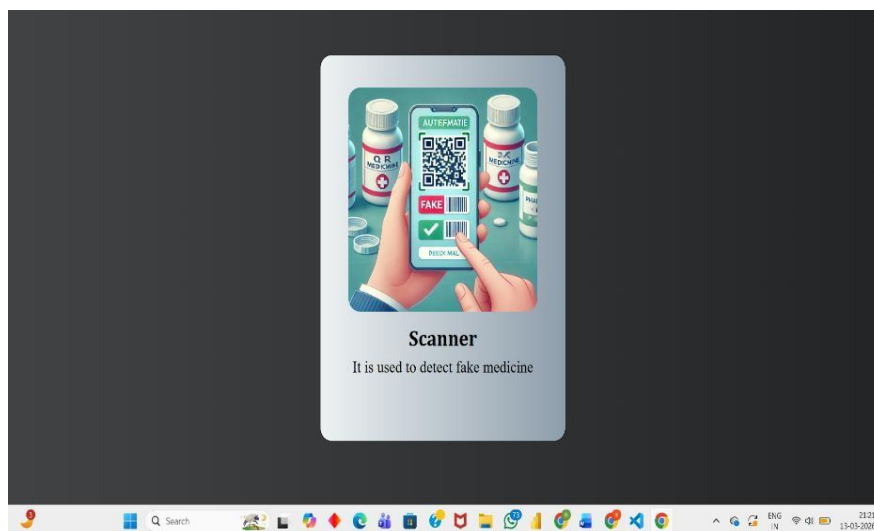


Figure 4:

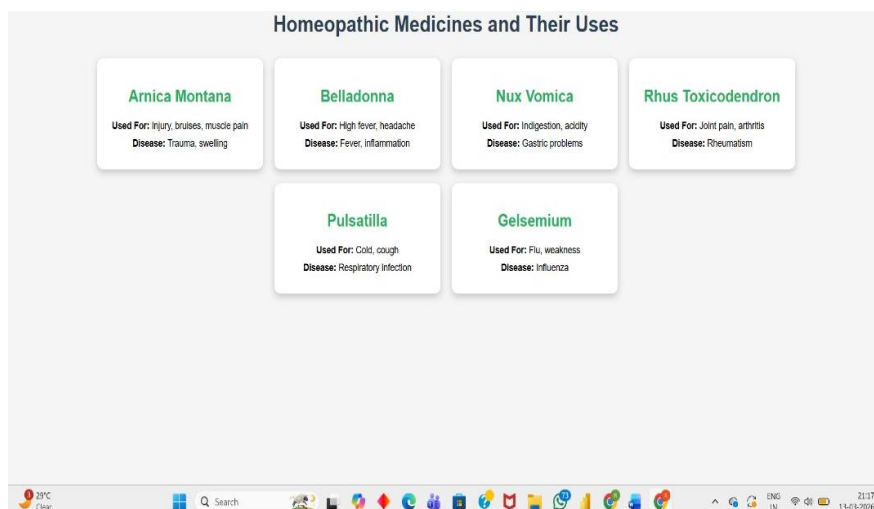


Figure 5:

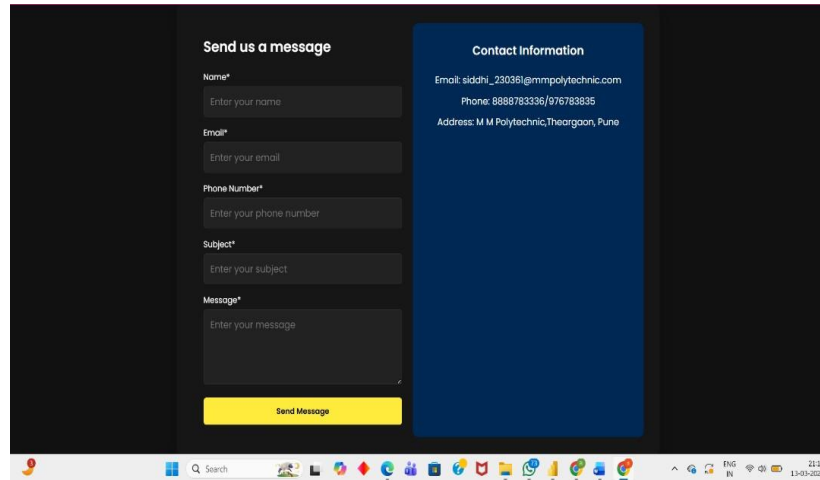


Figure 6:

The Fake Medicine Detector Website was successfully designed and implemented with multiple functional modules such as the Scanner Module, AI Care Assistant, and Contact Support System. The developed interface provides a userfriendly environment where users can easily interact with the system to verify medicine authenticity and obtain healthrelated information.

The Scanner module allows users to detect fake medicines by scanning the QR code or entering medicine-related data. After the scanning process, the system checks the information against the stored database and identifies whether the medicine is genuine or fake. This feature helps users quickly verify medicines and reduces the risk of consuming counterfeit drugs.

Another important feature implemented in the system is the AI Care Assistant, which allows users to ask questions related to medicines or basic health information. The AI module processes user queries and provides helpful responses, improving the overall usability of the website and assisting users in understanding medicine details.

VI. TESTING METHODOLOGY

The testing methodology for the Fake Medicine Detector Website was used to ensure that all modules of the system function correctly and provide accurate results. Different types of testing were performed to verify the reliability, performance, and usability of the system. First, Unit Testing was conducted to test individual modules of the system such as the Scanner Module, AI Care Assistant, and Contact Form. Each module was tested separately to check whether it performs its intended function correctly. For example, the scanner module was tested to ensure that it correctly reads medicine details and sends them to the verification system. Next, Integration Testing was performed to verify that all modules work together smoothly. This testing ensured that the communication between the user interface, database, and verification module works properly without errors. For instance, after scanning a medicine code, the system successfully connects to the database and returns the correct verification result. After that, System Testing was carried out to evaluate the complete system as a whole. This testing ensured that all features of the website, including medicine verification, AI assistance, and contact support, operate correctly in a real working environment. Finally, User Acceptance Testing (UAT) was conducted to confirm that the system meets user requirements. Test users interacted with the website by scanning medicine codes, asking health-related questions, and sending messages through the contact form. The results showed that the system is easy to use, accurate, and responsive, confirming that the Fake Medicine Detector Website works effectively.

VII. APPLICATIONS

The Fake Medicine Detector System has several practical applications in the healthcare and pharmaceutical sectors. It helps users verify the authenticity of medicines and reduces the risk of consuming counterfeit drugs. First, the system can be used by general consumers to check whether the medicines they purchase from

pharmacies are genuine or fake. By scanning the medicine code or entering the medicine details, users can quickly verify the authenticity of the product. Second, the system is useful for pharmacies and medical stores to verify medicines before selling them to customers. This helps pharmacists ensure that only genuine medicines are provided to patients. Third, hospitals and healthcare centers can use this system to check the authenticity of medicines before prescribing or distributing them to patients. This helps improve patient safety and prevents the use of counterfeit medicines in medical treatments. Fourth, pharmaceutical companies can use the system to monitor and track their products in the market. It helps them identify counterfeit versions of their medicines and take necessary actions to protect their brand and customers. Finally, government and drug regulatory authorities can use the system to detect fake medicines in the supply chain and control illegal distribution. This application helps improve public health safety and reduces the spread of counterfeit medicines in the market.

VIII. CONCLUSION

The Fake Medicine Detector was successfully designed and developed to help users identify counterfeit medicines easily and quickly. The system provides a simple and user-friendly platform where users can verify medicine authenticity by scanning QR codes or entering medicine details. By comparing the entered information with the stored database, the system can determine whether the medicine is genuine or potentially fake. The project also integrates additional features such as an AI Care Assistant for answering medicine-related questions and a contact module that allows users to communicate with the support team. These features improve the overall functionality and make the system more helpful for users. The implementation of this system helps increase awareness about fake medicines, improves medicine safety, and supports users in making better health decisions. Overall, the Fake Medicine Detector Website provides an effective solution for detecting counterfeit medicines and contributes to protecting public health.

IX. FUTURE SCOPE

The Fake Medicine Detector System can be further improved by adding more advanced features and technologies in the future. One possible improvement is the integration of mobile applications, which will allow users to verify medicines directly from their smartphones. This will make the system more accessible and convenient for a larger number of users. Another future enhancement is the use of blockchain technology to improve the security and transparency of the pharmaceutical supply chain. Blockchain can store medicine transaction records securely, making it difficult for counterfeit medicines to enter the system.

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SECURE GATE – APARTMENT SECURITY APP

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ABSTRACT

The research concentrates on developing and deploying an electronic framework aimed at enhancing visitor control within housing complexes and institutions. The objective of this study involves evaluating ways in which contemporary internet-based tools facilitate developing a streamlined facility for tracking visitors without relying on conventional paper records. A contemporary software framework employs cutting-edge web programming languages for construction, ensuring an organized design schema to handle user information, access control, alerts, and authorizations. Involves developing an architecture, deploying it, and verifying its functionality and dependability through evaluation processes. Observations indicate substantial enhancements in data handling efficiency due to this setup; it minimizes human mistakes through automation and fortifies protection against unauthorized access via continuous surveillance tracking visitors' actions in real time. The study reveals that the suggested framework offers both efficient digital record-keeping and adaptable scalability in handling visitors' data. Research indicates that incorporating contemporary technological tools enhances productivity within both household settings and corporate infrastructures by enhancing safety measures. Visitor management system, web application for security monitoring, data tracking software automation toolkit, development framework utilized in modern IT infrastructure.

I. INTRODUCTION

Advancements in technological tools have significantly altered numerous conventional procedures by introducing electronic alternatives. Another significant sector involves managing visitors effectively, crucial for ensuring safety and preserving records within communities like apartments, workplaces, and establishments. Historically, visitors' information is typically entered by hand into ledgers, potentially resulting in data corruption, suboptimal monitoring, and safety concerns.

As web technology advances, modern digital systems offer automatic and dependable methods for handling visitor data efficiently. An electronic control panel enables guards and managers to monitor attendees, grant permissions, and preserve documentation in an organized and retrievable manner.

Current studies emphasize the significance of utilizing cloud technologies alongside instantaneous data handling mechanisms for effective system administration. The latest web development tools allow programmers to create robust software systems that enhance usability for users while boosting productivity in operations.

The study concentrates on creating and deploying an online visitor control platform designed for safeguarding and streamlining activity tracking and oversight of visitors.

II. LITERATURE SURVEY

Numerous research endeavors investigate how digital tools enhance safety protocols within households and workplaces. Modern visit tracking tools utilize automated databases for managing entries, thereby reducing redundancies and making it easier to access historical information quickly. Proposed by researchers, these systems utilize digital record-keeping and databases for managing visitor data efficiently.

Several contemporary setups combine features like QR codes, biometrics for verification, and remote database management to bolster safety measures and ease of use. These setups enhance surveillance abilities while minimizing the chance of unapproved access attempts.

Current methods show that online tools enhance site control through immediate information availability, automatic alerts, and unified database handling. Nevertheless, numerous applications remain unscalable and feature poor for users. Thus, continued investigation into creating effective and adaptable visitor tracking software is crucial.

III. PROBLEM STATEMENT

Vacationer control plays a critical role in keeping protection and right monitoring within residential societies, workplaces, and establishments. However, many businesses nonetheless rely on guide strategies to control visitor entries and maintain data. These conventional structures contain writing traveler details in registers maintained by way of safety personnel at the doorway gate. Manual report retaining creates numerous issues. One of the main problems is the possibility of human errors even as recording traveler information. In lots of cases, incomplete or incorrect statistics is entered, which makes it tough to become aware of traffic later. Some other foremost trouble is the issue in retrieving historical data when required for security investigations or administrative functions. Guide structures also lack actual-time tracking abilities. Directors or residents cannot easily track vacationer activities or acquire notifications while someone arrives at the premises. In big residential societies with excessive tourist traffic, this approach will become inefficient and time-eating.

Moreover, physical registers are susceptible to harm or loss, which may additionally result in the everlasting lack of critical data. Those boundaries spotlight the need for a virtual solution which can automate the traveller control procedure and provide comfortable, organized, and effortlessly available statistics. Consequently, the primary trouble addressed on these studies is the lack of an efficient and automatic gadget for dealing with visitor information. The proposed answer pursues to expand a web-based totally traveller management gadget that improves security, reduces guide workload, and enables real-time tracking of vacationer sports.

IV. METHODOLOGY

To develop the proposed system successfully, we observed a structured and systematic development system as opposed to directly beginning the coding segment. This method helped in organizing the project properly and ensured that every thing of the gadget changed into carefully designed earlier than implementation.

The improvement procedure specially consisted of two crucial ranges: Requirement evaluation and system layout.

1. Requirement evaluation:

Before starting the improvement of the gadget, we first centered on information the actual-world problems confronted in dealing with site visitors and provider requests in residential societies and agencies.

— information person troubles:

We interacted with numerous residents, protection employees, and provider vendors to apprehend the difficulties they revel in in conventional vacationer management structures. The most commonplace issues diagnosed had been manual report preserving, lack of right traveller tracking, delays in approval approaches, and problem in retrieving preceding tourist records when wished.

— studying modern system obstacles:

Present manual structures rely on bodily registers to file traveller details. Those registers are frequently tough to hold and looking for beyond data turns into time ingesting. Further, manual entry can result in incorrect or incomplete statistics, which might also motive safety issues.

— identifying crucial capabilities:

Based at the analysis of consumer necessities and system obstacles, the subsequent main features have been diagnosed for the proposed machine:

- consumer registration and login
- visitor request submission
- tourist approval or rejection with the aid of citizens or directors
- employee or carrier provider registration

- at ease garage of traveller and booking facts
- real-time tracking of traveler activities
- fundamental assumptions:
 - users could have get right of entry to basic internet connectivity.
 - protection staff will operate the device using a computer or pill.
 - customers may have simple information of interacting with internet packages.
 - the gadget will specially operate inside a particular residential society or corporation

— database making plans:

After identifying the device capabilities, we deliberate the database shape required for storing the utility facts. Separate tables were created for users, traffic, workers, services, and bookings. Proper number one keys and relationships have been described among those tables to keep facts consistency and keep away from replica entries. This database design ensures efficient facts garage and retrieval.

2. Gadget design

After finalizing all the device requirements, the subsequent step was to layout the overall shape and operating version of the gadget.

— architecture design:

The system follows a client-server architecture. The frontend of the device is developed using react, which handles all the user interface elements and interactions. The backend logic is applied using server-side programming, which processes consumer requests and communicates with the database. Mysql or mongodb is used to save and manage application data securely.

— frontend design:

The person interface is designed the usage of current web technology including html, css, and react useful additives. The layout specializes in simplicity and ease of use in order that users can effortlessly navigate through the device and carry out responsibilities together with traveler registration, carrier choice, and reserving submission.

— backend common sense:

The backend handles critical functionalities which include person authentication, shape processing, visitor approval, and reserving management. While a user submits a request through the interface, the backend tactics the request and stores the applicable records inside the database.

— database handling:

The database machine shops important facts along with user information, traveler details, employee records, and booking records. Relationships among the tables are nicely described to make certain that each one information remains accurate and organized. This lets in directors to retrieve facts fast and effectively.

Most important modules of the machine

The complete gadget is split into numerous practical modules to simplify improvement and upkeep.

- person module: handles person registration, login authentication, and profile management.
- carrier module: presentations available services and lets in users to choose the form of provider they require.
- reserving module: manages reserving requests and stores booking details inside the database.
- employee module: stores employee statistics and assigns workers to carrier requests.
- traveler management module: keeps records of all site visitors and tracks access and go out information.

V. RESULTS

At some stage in the improvement of the visitor control gadget, several tests were carried out to make sure that the machine functions correctly and gives a smooth user enjoy. The utility changed into tested via gaining

access to one of a kind modules of the gadget and checking whether or not each characteristic performs as anticipated. Precise attention was given to device responsiveness, ease of navigation, and the accuracy of records saved within the database.

Each important module of the machine, along with login, traveller request submission, and approval tactics, and tourist document control, became tested under exclusive situations to confirm reliability. The effects showed that the machine became capable of take care of person interactions successfully at the same time as maintaining right records storage and retrieval.

User feedback turned into also accrued at some point of trying out to apprehend how without difficulty new customers ought to engage with the platform. Most users found the gadget easy to use and favored the prepared interface that allowed them to navigate via specific sections with out confusion.

5.1 device performance and capability

— Throughout the testing section, the gadget executed efficiently and all foremost modules had been connected well. Users were able to move between distinctive pages along with login, request submission, and approval pages with out encountering technical troubles.

— The loading speed of the application was determined to be rapid, and user moves inclusive of submitting visitor requests or retrieving saved statistics have been processed quick. This suggests that the machine is capable of coping with normal operational workloads smoothly.

— The database device efficiently saved consumer records, visitor facts, and approval info. Several checks have been carried out to verify that the stored facts could be retrieved correctly on every occasion required.

— The utility remained stable even if multiple traveler requests have been submitted in the course of testing. Typical, the machine furnished a dependable and regular performance.

Five.2 results of the consumer interface

1. Homepage

The homepage acts as the access factor of the device and affords customers with simple statistics about the platform. Whilst users visit the homepage, they're supplied with alternatives including login and gadget navigation. The design of the page is straightforward and organized, permitting users to quickly recognize the motive of the machine.

The homepage additionally highlights the main goal of the platform, that is to simplify the technique of coping with visitors within residential societies or businesses. At some stage in trying out, customers have been able to access the specified options easily with out confusion.



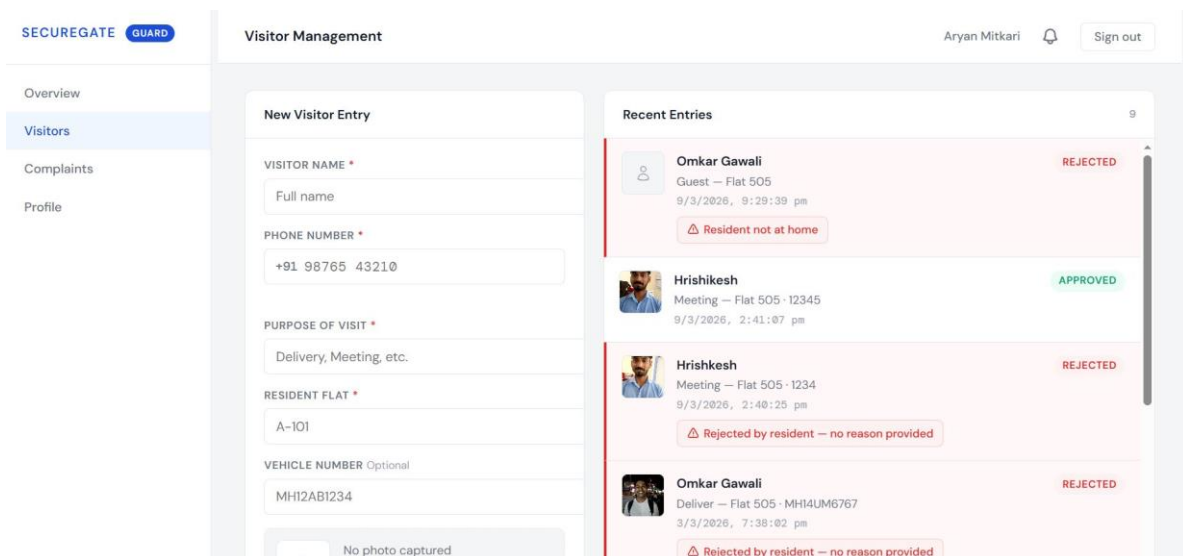
Fig. 1. Homepage

2. Guard page

The protect web page is designed for security personnel who manage traveler entry at the gate. Via this web page, guards can view tourist requests and confirm traveller info before allowing access.

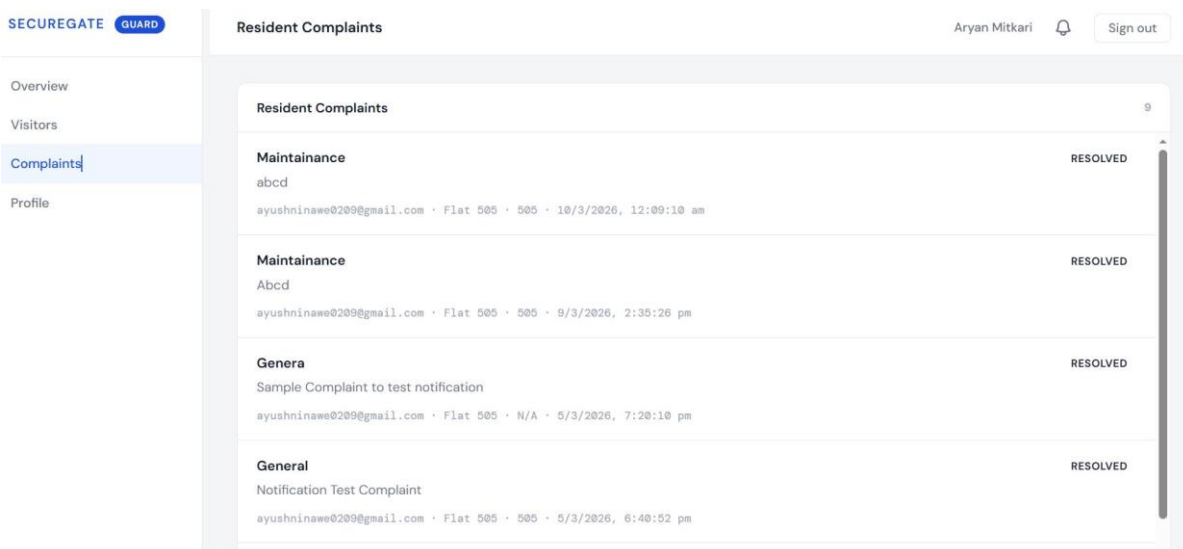
The interface permits guards to quick test the traveller's call, reason of visit, and approval reputé furnished through citizens or administrators. This ensures that simplest authorized site visitors are allowed to enter the premises.

For the duration of testing, the shield page functioned effectively and allowed guards to procedure traveller entries speedy while retaining accurate data of vacationer activities.



The screenshot displays the 'Guard page' interface. On the left, a sidebar menu includes 'Overview', 'Visitors', 'Complaints', and 'Profile'. The main content area is titled 'Visitor Management' and features a 'New Visitor Entry' form with fields for 'VISITOR NAME *', 'PHONE NUMBER *', 'PURPOSE OF VISIT *', 'RESIDENT FLAT *', and 'VEHICLE NUMBER Optional'. Below the form is a 'No photo captured' button. To the right, a 'Recent Entries' table lists four entries with status indicators: 'REJECTED' (Omkar Gawali, Guest - Flat 505, 9/3/2026, 9:29:39 pm, Reason: Resident not at home), 'APPROVED' (Hrshikesh, Meeting - Flat 505 - I2345, 9/3/2026, 2:41:07 pm), 'REJECTED' (Hrshikesh, Meeting - Flat 505 - I234, 9/3/2026, 2:40:25 pm, Reason: Rejected by resident - no reason provided), and 'REJECTED' (Omkar Gawali, Deliver - Flat 505 - MH14UM6767, 3/3/2026, 7:38:02 pm, Reason: Rejected by resident - no reason provided).

Fig. 2. Guard page



The screenshot displays the 'Guard complaint' interface. On the left, a sidebar menu includes 'Overview', 'Visitors', 'Complaints', and 'Profile'. The main content area is titled 'Resident Complaints' and features a table with four rows of complaints, all marked as 'RESOLVED':
1. Maintenance (abcd, ayushninawe0209@gmail.com · Flat 505 · 505 · 10/3/2026, 12:09:10 am)
2. Maintenance (Abcd, ayushninawe0209@gmail.com · Flat 505 · 505 · 9/3/2026, 2:35:26 pm)
3. Genera (Sample Complaint to test notification, ayushninawe0209@gmail.com · Flat 505 · N/A · 5/3/2026, 7:20:10 pm)
4. General (Notification Test Complaint, ayushninawe0209@gmail.com · Flat 505 · 505 · 5/3/2026, 6:40:52 pm)

Fig. 3. Guard complaint

3. Resident page

The resident web page permits residents to control and monitor tourist requests. Thru this web page, residents can view incoming tourist requests and approve or reject them primarily based on their alternatives.

Residents also can overview beyond tourist facts and tune the fame of requests submitted via site visitors. The interface is designed to be easy in order that citizens can without difficulty manage tourist approvals without technical trouble.

trying out confirmed that residents have been able to navigate the page without difficulty and respond to traveller requests fast, which improves verbal exchange between citizens and safety personnel.

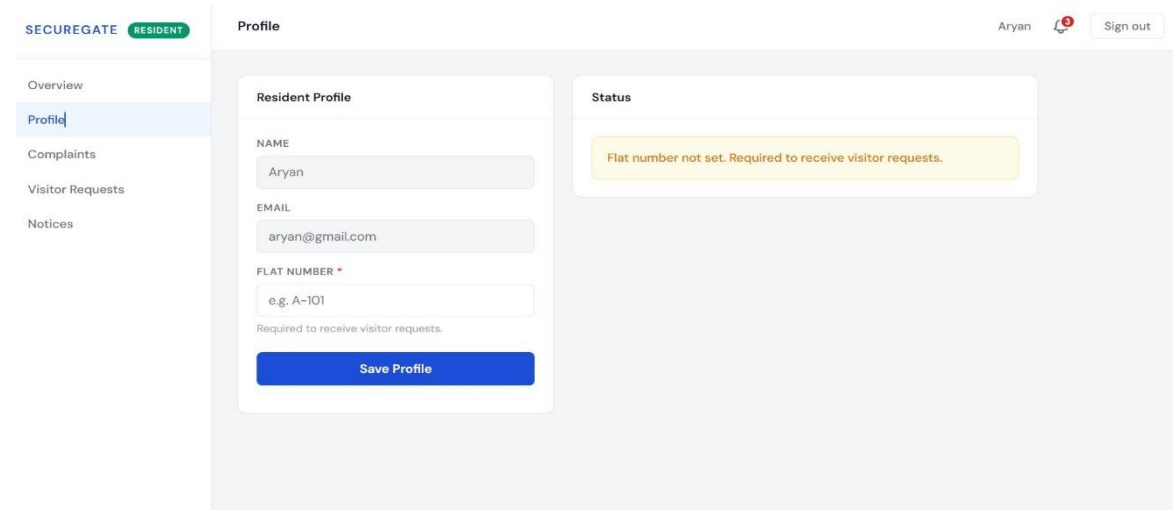


Fig. 4. Resident page

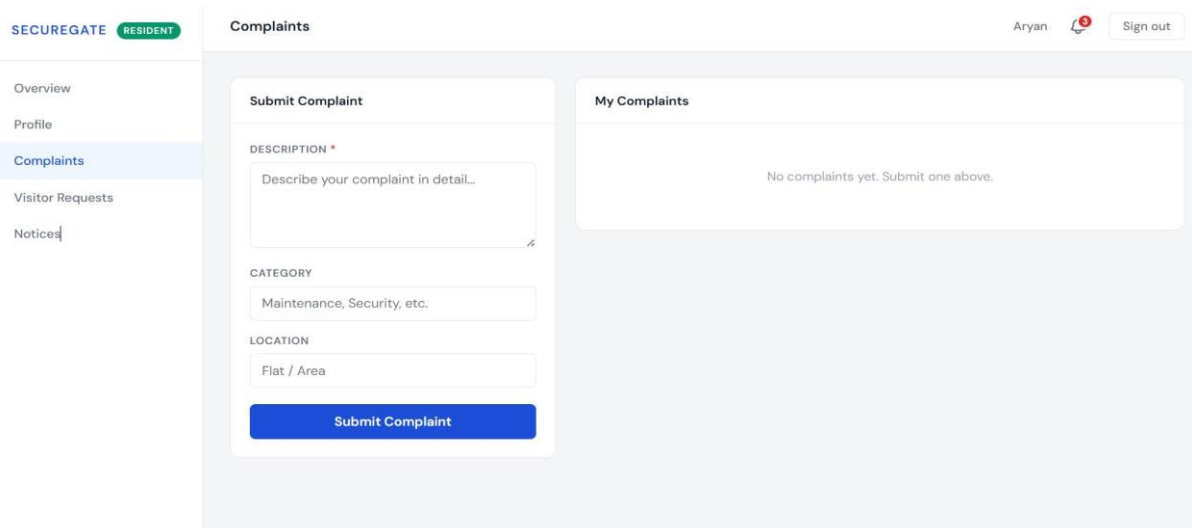


Fig. 5. Resident complaint

4. Admin page

The admin web page offers administrative manipulate over the complete system. Administrators can display system pastime, control user accounts, and overview vacationer data thru this interface.

The admin panel additionally lets in administrators to make sure that the device operates smoothly by means of retaining right facts and verifying facts saved within the database. It acts because the relevant control point for managing the platform. all through trying out, the admin page successfully displayed machine information and allowed administrators to control statistics efficiently. The interface provided clean alternatives for monitoring device pastime and preserving manipulate over the application.

SECUREGATE

CENTRAL

Visitor Log

Ayush Vishwanath Ninawe — Central Admin

Sign out

Overview

Visitor Log

Complaints

Admin Management

Manage Users

Notices

Visitor Log

9 records

Download PDF

Search by name, flat, purpose, guard...

From 08-02-2026 To 10-03-2026 Clear

PHOTO	NAME	PHONE	PURPOSE	FLAT	VEHICLE	GUARD	ENTRY TIME	STATUS	REJECTION REASON
MONDAY, 9 MARCH 2026 — 3 ENTRIES									
	Omkar Gawali	1234567890	Guest	505	—	Aryan Mitkari	09:29 pm	REJECTED	Resident not at home
	Hrishkesh	1234	Meeting	505	12345	Aryan Mitkari	02:41 pm	APPROVED	—
	Hrishkesh	8011005096	Meeting	505	1234	Aryan Mitkari	02:40 pm	REJECTED	No reason provided
TUESDAY, 3 MARCH 2026 — 1 ENTRY									
	Omkar Gawali	+918888334917	Deliver	505	MH14UM6767	Aryan Mitkari	07:38 pm	REJECTED	No reason provided
MONDAY, 2 MARCH 2026 — 1 ENTRY									

Fig. 6. Admin Visitor Panel

SECUREGATE

CENTRAL

Manage Users

Ayush Vishwanath Ninawe — Central Admin

Sign out

Overview

Visitor Log

Complaints

Admin Management

Manage Users

Notices

Add New User

FULL NAME

Full name

EMAIL

user@example.com

ROLE

Resident

FLAT NUMBER (Residents only)

A-101

Add User

All Users

6

Search users...

All roles

Aryan

aryan@gmail.com

RESIDENT

Delete

Harshal Gawali

harshalg599@gmail.com

Flat B-1007

RESIDENT

Delete

Guard1

wehod76811@rivken.com

GUARD

Delete

Ayush Vishwanath

a.ninawe05@gmail.com

Flat 101

RESIDENT

Delete

Ayush Ninawe

ayushninawe0209@gmail.com

RESIDENT

Delete

Fig. 7. Admin User Panel

SECUREGATE

CENTRAL

Notices

Ayush Vishwanath Ninawe — Central Admin

Sign out

Overview

Visitor Log

Complaints

Admin Management

Manage Users

Notices

Create Notice

TITLE

Notice title

CONTENT

Notice content...

Publish Notice

Published Notices

Sample Notice

Sample Notice

05 Mar 2026 · ayushninawe2005@gmail.com

Sample Notice

Sample Notice

05 Mar 2026 · ayushninawe2005@gmail.com

sample notice

sample notice

05 Mar 2026 · ayushninawe2005@gmail.com

Holi Celebration

There will be holi celebration in the society in following dates and timings: 1.Holika dahan on 2nd of March (8:00 pm to 10:00 pm) 2.Rangpanchami on 3rd of March (8:00 am to 1:00 pm)

27 Feb 2026 · ayushninawe2005@gmail.com

Fig. 8. Admin Notice Panel

www.irjmets.com

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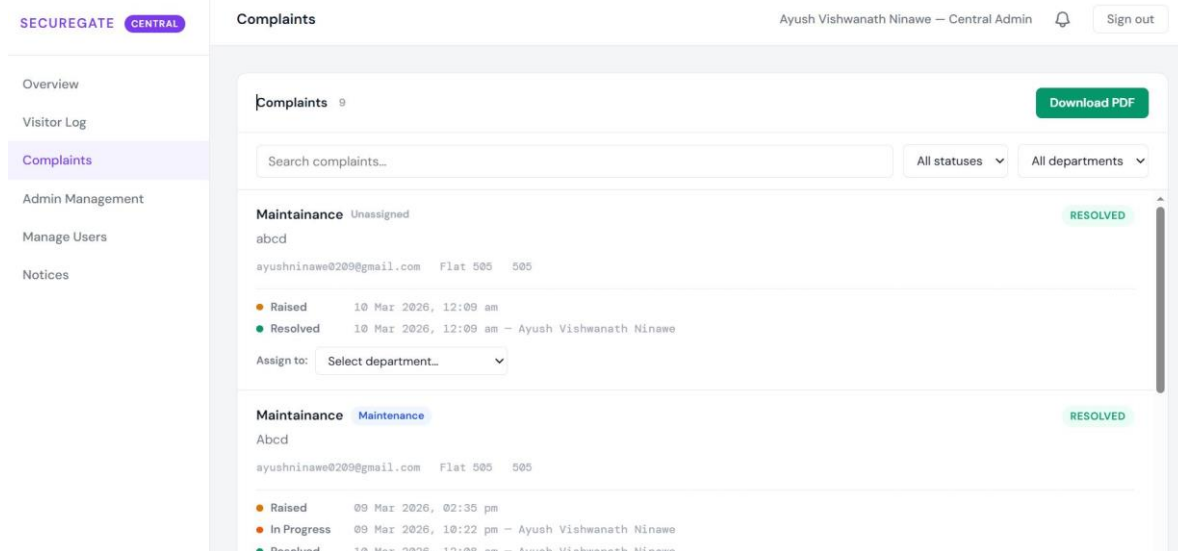


Fig. 9. Admin Complaint Panel

Secure Gate Project Workflow

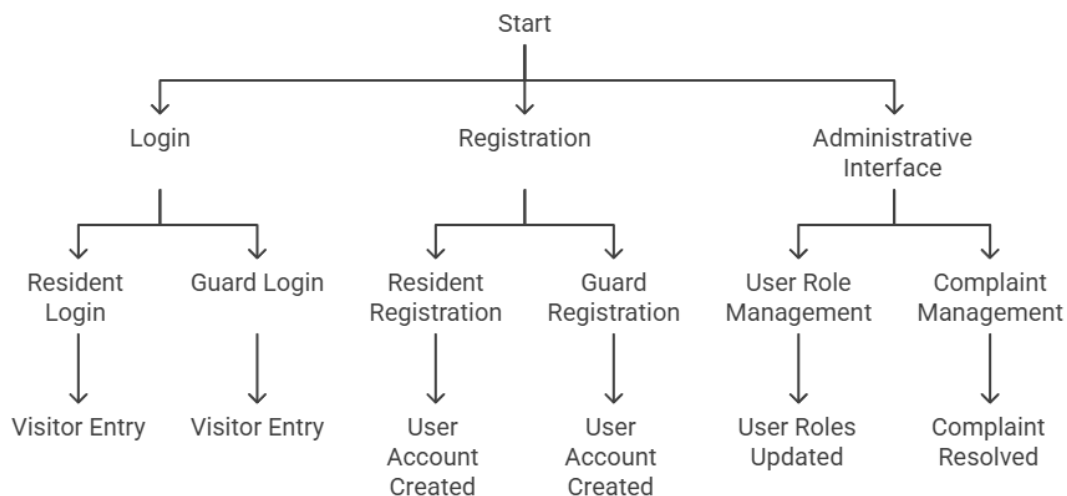


Fig. 10. Workflow of SecureGate

VI. FUTURE SCOPE

The proposed traveler management machine gives an effective solution for managing visitor facts digitally; however, there are numerous possibilities for further enhancements and improvements. future development can focus on integrating advanced technology that increase safety, automation, and value.

One possible improvement is the combination of biometric authentication methods consisting of fingerprint recognition or facial recognition. these technologies can help affirm traveller identities and save you unauthorized get right of entry to to the premises.

Any other ability enhancement is the development of a committed mobile application that lets in citizens and directors to control visitor requests directly from their smartphones. cellular notifications can tell citizens when visitors arrive and permit them to approve or reject entry requests in actual time.

Cloud computing technology also can be used to set up the machine on scalable cloud systems. this may allow organizations to access visitor data from a couple of places whilst making sure reliable statistics storage and backup.

Synthetic intelligence and statistics analytics may be incorporated to research vacationer styles and perceive unusual sports. Such capabilities can assist administrators enhance security measures and optimize traveller control strategies.

With these advancements, the traveler control gadget can evolve right into a comprehensive clever safety solution suitable for current residential complexes and companies.

VII. CONCLUSION

This studies focused at the layout and development of a digital visitor management gadget to improve protection and efficiency in residential societies and groups. conventional guide systems often result in records loss, errors, and issue in retrieving visitor information. The proposed system replaces those manual strategies with an automated web-based platform that permits customers to sign up, submit tourist requests, and maintain organized digital facts. by the usage of cutting-edge internet technologies and a centralized database, the system guarantees faster processing, stepped forward accuracy, and easy get right of entry to to vacationer records. The implementation and trying out of the device reveal that it appreciably improves tourist monitoring, reduces administrative workload, and enhances standard protection management, making it a sensible and dependable answer for contemporary companies.

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Intelligent Student Attendance Monitoring System Using Face Recognition

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Abstract— In today's digital age, a face recognition system plays an important role in almost every field. Face recognition is one of the most commonly used biometric technologies. It can be applied for security, verification, identification, and offers many other benefits. Although its accuracy is comparatively lower than iris and fingerprint recognition, it is widely adopted because it is contactless and non-intrusive. Moreover, face recognition can be effectively utilized for recording attendance in schools, colleges, offices, and other institutions. This system is designed to develop a classroom attendance solution based on face recognition, as traditional manual attendance methods are time-consuming and difficult to manage. There is also a possibility of proxy attendance in manual systems, which increases the necessity for an automated solution. The proposed system operates in four stages: database generation, face detection, face identification, and attendance updating. The database is prepared using students' images collected from the class. Face detection and identification are carried out using the Haar-Cascade classifier and the Local Binary Pattern Histogram (LBPH) algorithm, respectively. Faces are identified from real-time video streaming in the classroom. At the end of the session, the attendance report is sent to the respective faculty member via email.

Keywords— Automated Face; Identification; Image-Based Face Detection; Haar Feature-Based Cascade Classifier; Local Binary Pattern (LBP); Automated Attendance System

I. INTRODUCTION

The conventional method of marking attendance is a laborious task in many schools and colleges. It also places an additional responsibility on faculty members, who must manually call out students' names, which can take nearly five minutes of the total lecture time. This process is inefficient and time-consuming. Moreover, there is a possibility of proxy attendance. As a result, many institutions have started implementing alternative methods for recording attendance, such as Radio Frequency Identification (RFID), iris scanning, fingerprint authentication, and others. However, these approaches are generally queue-based, which may require more time and are often intrusive in nature. Face recognition has emerged as a significant biometric technique that is easily obtainable and non-intrusive. Systems based on face recognition are comparatively unaffected by different facial expressions. A face recognition system is broadly classified into two types: verification and identification. Face verification involves a one-to-one (1:1) comparison, where a captured face image is matched with a stored template image. In contrast, face identification is a one-to-many (1:N) process, where a query face image is compared with multiple images in the database. The objective of this system is to develop an attendance management system based on face recognition technology. In this approach, an individual's face is used as the basis for marking attendance. Today, face recognition is becoming increasingly popular and is widely applied in various domains. In this paper, we propose a system that detects students' faces from real-time classroom video

streaming, and attendance is recorded if the identified face matches an image stored in the database. This automated system is expected to reduce the time required compared to traditional attendance methods.

II. LITERATURE SURVEY

In [3], the researchers presented an automated attendance framework that combines face recognition with Radio Frequency Identification (RFID) to identify authorized students and record their entry and exit from the classroom. The system preserves an accurate record of every enrolled student. It also stores attendance information for students registered in a specific course and generates required reports whenever necessary. In [4], the authors developed and deployed an attendance monitoring system based on iris biometric technology. Initially, participants were required to enroll their personal details along with their distinct iris template. During attendance recording, the system automatically captured the eye image of each individual, identified the iris pattern, and matched it with the stored database. The designed prototype was implemented as a web-based platform. In [5], the researchers proposed a facial recognition-based attendance solution. Techniques such as Viola-Jones object detection framework and Histogram of Oriented Gradients (HOG), together with the Support Vector Machine (SVM) classifier, were employed to build the system. The study considered several real-time challenges, including variations in scale, lighting conditions, occlusion, and head pose. Performance assessment was carried out using Peak Signal-to-Noise Ratio (PSNR) measurements, and the implementation was completed using a MATLAB graphical interface. In [6], the authors conducted a comparative study to identify the most suitable facial recognition technique between Eigenface and Fisherface, both available in OpenCV 2.4.8. The evaluation was performed using the Receiver Operating Characteristic (ROC) curve. Experimental findings showed that the Eigenface method delivered superior performance compared to Fisherface. The attendance system developed using the Eigenface approach achieved an accuracy ranging from 70% to 90%. In [7], the researchers suggested a classroom attendance approach based on facial recognition by integrating Discrete Wavelet Transform (DWT) and Discrete Cosine Transform (signal processing method") (DCT) for extracting facial features. These features were then classified using a Radial Basis Function network (RBF)

classifier. The proposed technique achieved an overall recognition accuracy of 82%.

III. PROPOSED SYSTEM

In the suggested system, every student in the class must complete the enrollment process by providing the necessary information. After registration, their facial photographs are captured and stored in the database. For each lecture, faces are identified from the live video feed of the classroom. The identified faces are then compared with the images available in the database. If a match is detected, attendance is automatically recorded for the respective student. At the end of every session, a report containing the list of absent students is emailed to the faculty member in charge of the class. The architecture of the proposed system is presented below.

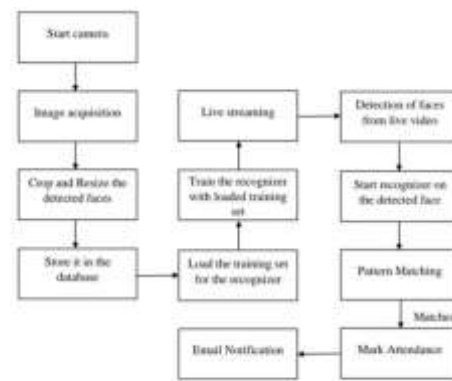


Fig.1. System Architecture

1. Dataset Creation

Photographs of students are obtained using a webcam. Several images of each student are captured with different poses and facial variations. These images are then subjected to preprocessing steps. Initially, the images are cropped to extract the Region of Interest (ROI), which is later utilized in the recognition stage. The cropped images are resized to a fixed pixel resolution. After resizing, they are converted from RGB format to grayscale. Finally, the processed images are saved in a folder under the respective student's name.

2. Face Detection

In this system, face detection is carried out using the Haar Cascade classifier with the help of OpenCV. The Haar Cascade method must first be trained to identify human faces, a step referred to as feature extraction. The training dataset is provided in an XML file named *haarcascade_frontalface_default*.

The `detectMultiScale` function from OpenCV is employed to draw bounding rectangles around detected faces within an image. This function requires three parameters: **scaleFactor**, **minNeighbors**, and **minSize**. The *scaleFactor* controls the reduction of the image size at each scaling stage. The *minNeighbors* parameter specifies the minimum number of neighboring rectangles needed for a region to be considered a valid face; higher values generally result in fewer but more accurate detections. The *minSize* parameter defines the smallest detectable object size, which is set to (30, 30) by default. In this implementation, the chosen values are 1.3 for *scaleFactor* and 5 for *minNeighbors*.

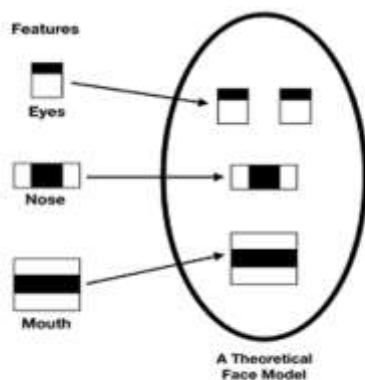


Fig.2. Haar Features

3. Face Recognition

The facial recognition procedure consists of three main stages: preparing the training dataset, training the recognition model, and performing prediction. The dataset contains stored images labeled with unique integer identifiers corresponding to each student. These labeled images are used to train the recognition system.

The algorithm utilized for recognition is Local Binary Patterns Histograms (LBPH). Initially, Local Binary Patterns (LBP) are extracted from the complete facial image. These patterns are then converted into decimal values, and histograms are generated from those values. As a result, each training image is represented by a histogram. During identification, the histogram of the detected face is computed and compared with the stored histograms in the database. The system then returns the label that best matches the detected face, identifying the corresponding student.

4. Attendance Updation

Once the recognition stage is completed, the identified students are marked as present in an Excel record, while the remaining students are recorded as absent. The absentee list is then sent via email to the respective faculty members. Furthermore, an updated monthly attendance report is provided to faculty at the end of each month.

IV. RESULTS AND DISCUSSIONS

Results and Discussion

Intelligent Student Attendance Monitoring System Using Face Recognition

The proposed **Intelligent Student Attendance Monitoring System Using Face Recognition** was implemented to automate the traditional attendance process and improve the efficiency of attendance management in educational institutions. The system was tested in a classroom-like environment using a webcam to evaluate its ability to detect faces, recognize registered students, identify unknown individuals, detect absent students, and prevent fake attendance through spoof detection techniques.

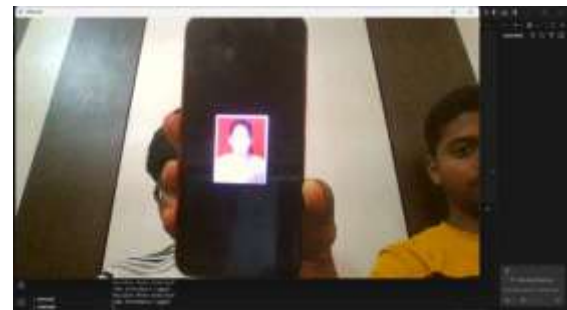


Fig.3. possible photo spoof attempt

During the execution of the system, the webcam continuously captures video frames. Each frame is processed using a **face detection algorithm**, which identifies human faces present in the camera view. After detecting a face, the system performs **face encoding**, where unique facial features are extracted and converted into numerical representations. These encoded features are then compared with the facial data stored in the student database.

When the detected face matches with a registered student, the system successfully marks the student's attendance in the **Attendance.csv** file. The system records the student's name along with the date and time of detection. This automatic attendance marking

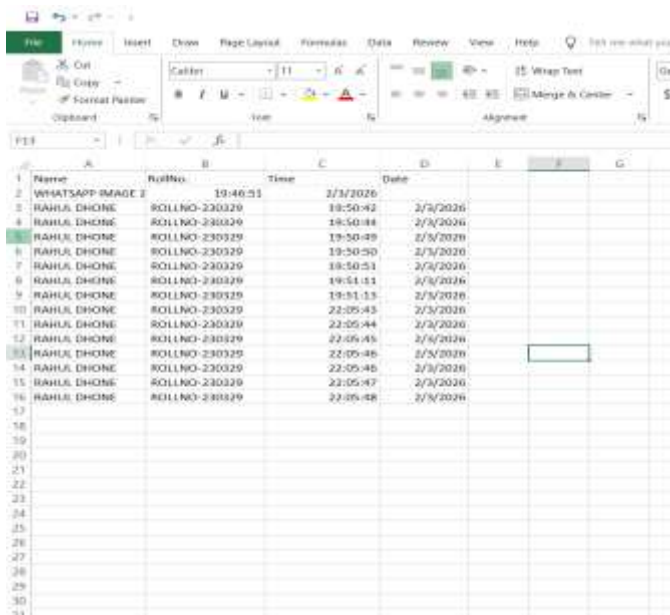
eliminates the need for manual roll calls and reduces errors that commonly occur in traditional attendance systems. The automated approach also saves classroom time and improves overall efficiency.

In cases where the system detects a face that does not match any record in the database, it classifies the individual as an **unknown person**. The system then captures the image of that person and stores it in the **Unknown_Persons** folder. This feature enhances security by allowing administrators to monitor unidentified individuals entering the classroom or restricted areas.



Fig.4. Face Recognition

The system also includes a mechanism to identify **absent students**. After recording the attendance of recognized students, the system compares the attendance file with the list of registered students stored in **students.csv**. Students whose faces are not detected during the attendance session are automatically marked as absent. Based on this information, the system can send **SMS or email notifications to parents**, informing them about their child's absence. This improves communication between parents and the institution while ensuring better attendance tracking.



	Name	RollNo.	Time	Date
1	WhatsApp Image 2		19:46:51	2/3/2026
2	RAHUL DHONE	ROLLNO-230329	19:50:42	2/3/2026
3	RAHUL DHONE	ROLLNO-230329	19:50:44	2/3/2026
4	RAHUL DHONE	ROLLNO-230329	19:50:49	2/3/2026
5	RAHUL DHONE	ROLLNO-230329	19:50:50	2/3/2026
6	RAHUL DHONE	ROLLNO-230329	19:50:51	2/3/2026
7	RAHUL DHONE	ROLLNO-230329	19:51:11	2/3/2026
8	RAHUL DHONE	ROLLNO-230329	19:51:13	2/3/2026
9	RAHUL DHONE	ROLLNO-230329	22:05:43	2/3/2026
10	RAHUL DHONE	ROLLNO-230329	22:05:44	2/3/2026
11	RAHUL DHONE	ROLLNO-230329	22:05:45	2/3/2026
12	RAHUL DHONE	ROLLNO-230329	22:05:46	2/3/2026
13	RAHUL DHONE	ROLLNO-230329	22:05:46	2/3/2026
14	RAHUL DHONE	ROLLNO-230329	22:05:47	2/3/2026
15	RAHUL DHONE	ROLLNO-230329	22:05:47	2/3/2026
16	RAHUL DHONE	ROLLNO-230329	22:05:48	2/3/2026

To enhance system reliability and prevent fraudulent attendance attempts, a **photo spoof detection module** is integrated into the system. In some cases, students may try to mark attendance by showing printed photographs or images on mobile screens. To prevent this, the system analyzes the **difference between consecutive camera frames**. If the system detects minimal or no movement between frames, it interprets the input as a static image and identifies it as a possible **photo spoof attempt**. In such situations, the system captures a screenshot and stores it in the **Spoof_Attempts** folder for further analysis. The event can also be recorded as **Fake_Attendance** in the system log.

The major observations obtained from the experimental results are summarized below:

- **Automatic Face Detection:** The system accurately detects faces from real-time webcam input.
- **Efficient Student Recognition:** Registered students are successfully identified through facial feature comparison.
- **Automated Attendance Recording:** Attendance is automatically stored in the Attendance.csv file with date and time details.
- **Unknown Person Detection:** The system identifies unregistered individuals and stores their images for monitoring purposes.
- **Absent Student Identification:** The system compares attendance records with the student list to determine absent students.
- **Parent Notification Mechanism:** SMS or email alerts can be generated to inform parents about student absence.
- **Photo Spoof Detection:** Static image attacks are detected, and spoof attempts are recorded to prevent fake attendance.

V. CONCLUSION

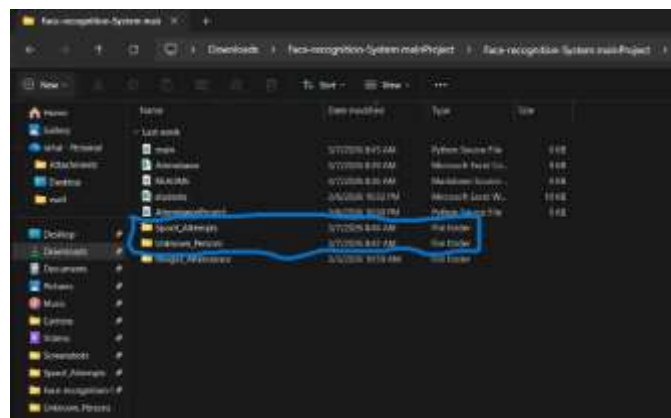
The **Intelligent Student Attendance Monitoring System Using Face Recognition** provides an efficient, secure, and automated solution for managing student attendance. Traditional attendance methods such as manual roll calls or paper-based registers are time-consuming, prone to human errors, and vulnerable to proxy attendance. By integrating **face recognition technology**, this system eliminates these limitations and ensures accurate and reliable attendance recording.

The system begins with a **webcam capturing real-time frames**, which are processed through **face detection and face encoding techniques**. The captured face is then compared with the stored facial database of registered students. When a match is found, the system automatically records the student's attendance in the **Attendance.csv file**, ensuring a quick and seamless process without any manual intervention. If the system detects a face that does not match any record in the database, it classifies the person as an **unknown individual** and saves the captured image in the **Unknown_Persons folder**.



This feature improves campus security by maintaining a record of unrecognized individuals who appear in front of the camera.

Another important feature of this system is the **spoof detection mechanism**, which helps prevent fraudulent attendance attempts. In many face recognition systems, students may attempt to mark attendance using printed photos or images on mobile screens. To address this problem, the system compares consecutive camera frames and calculates the **frame difference to detect movement**. If the system identifies a static image with minimal movement, it flags it as a **possible photo spoof attempt**. The system then captures a screenshot and stores it in the **Spoof_Attempts folder**, while also marking the attempt in the CSV record as **Fake_Attendance**. This functionality enhances the reliability and trustworthiness of the attendance system.



Overall, the proposed system combines **face recognition, automated attendance logging, unknown person detection, and spoof detection techniques** to create a smart and secure attendance monitoring solution. It reduces administrative workload, saves time during classroom sessions, and increases the accuracy of attendance records. Furthermore, the system strengthens institutional security by monitoring unknown individuals and preventing fake attendance attempts.

In conclusion, the **Intelligent Student Attendance Monitoring System Using Face Recognition** demonstrates how modern computer vision technologies can transform traditional academic processes into **smart, automated, and secure systems**, making it highly suitable for schools, colleges, and educational institutions in the digital era.

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TEXT TO SPEECH MEDICAL ADVISOR APP**Atharva Raghunath Gachchi^{*1}, Adinath Puri^{*2}**

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ABSTRACT

Healthcare delivery faces persistent challenges in terms of immediate access to reliable medical information, particularly in regions with limited clinical infrastructure or during off-peak hours. This paper describes the design and implementation of Nao Medical Advisor, an intelligent chatbot system built to support users in identifying possible conditions based on reported symptoms and to deliver concise, actionable health guidance prior to formal clinical consultation. The system is developed entirely in Python and combines Natural Language Processing (NLP) techniques with supervised machine learning models trained on curated symptom-disease datasets. An intuitive text-based interface allows users to interact naturally with the system, which processes inputs, maps symptoms to potential conditions, and returns structured recommendations alongside relevant precautions. Experimental results indicate that the chatbot handles common symptom queries accurately and consistently, demonstrating its potential as a first-response triage support tool in resource-constrained healthcare settings.

Keywords: Medical Chatbot, Natural Language Processing, Symptom Analysis, Machine Learning, Healthcare Informatics, NLTK, Scikit-Learn, Disease Prediction.

I. INTRODUCTION

Healthcare systems in both developed and developing regions struggle to deliver immediate medical guidance to every patient who needs it. Prolonged waiting times, geographic barriers, and a growing physician shortage mean that a large proportion of the population turns to online searches or informal advice when faced with health concerns. While general-purpose web searches can surface relevant information, they rarely provide structured, personalised guidance based on an individual's specific combination of symptoms.

Artificial intelligence offers a practical route around this bottleneck. Advances in Natural Language Processing (NLP) and supervised learning have made it possible to build conversational agents capable of parsing free-form text, extracting medically meaningful signals, and generating context-appropriate responses. Medical chatbots built on these technologies can operate continuously without fatigue, serve simultaneous users, and maintain consistent response quality regardless of query volume.

This paper presents Nao Medical Advisor, a Python-based chatbot designed to act as a first-response layer between a user experiencing health concerns and a qualified clinician. The system accepts a symptom description entered as plain text, identifies relevant medical keywords using NLP preprocessing, classifies the input against a trained disease model, and returns a plain-language explanation of possible conditions along with recommended precautions. The system is explicitly not intended to replace professional diagnosis; rather, it aims to reduce unnecessary emergency visits, inform users who would otherwise receive no guidance, and allow clinical staff to focus on cases that genuinely require their expertise.

The remainder of this paper is structured as follows. Section II reviews prior work on medical chatbots and symptom-classification systems. Section III describes the system architecture. Section IV details the methodology adopted for data collection, model training, and evaluation. Section V covers tools and implementation choices. Section VI reports results and discusses observed limitations. Section VII outlines the advantages of the proposed approach. Section VIII concludes and identifies directions for future development.

II. LITERATURE SURVEY

Interest in AI-driven health advisory tools has grown considerably alongside improvements in NLP and machine learning. Kazi and Kazi [1] reviewed the landscape of medical chatbot systems and found that rule-based architectures dominated early work but struggled to handle the lexical variability of natural symptom descriptions. They noted that machine learning approaches, particularly those using term-frequency representations coupled with naïve Bayes or support vector machine classifiers, offered considerably better generalisation across patient inputs.

Pham et al. [2] developed a symptom-checking system using a decision-tree classifier trained on the DXplain medical dataset and reported an overall diagnostic suggestion accuracy of 83% on held-out test cases. Their work highlighted the importance of dataset quality and the need for careful handling of overlapping symptom profiles across related conditions, an observation that directly informed the preprocessing strategy adopted in the present work.

Divya et al. [3] constructed a health-related chatbot using NLTK for intent recognition and a random forest classifier for condition prediction, achieving 88% accuracy on a curated symptom corpus. They emphasised that lightweight models running on standard hardware are preferable for deployment in resource-limited environments, a design principle also adopted here.

On the interface side, Ni et al. [4] evaluated user trust in AI-powered health advisors and found that transparent communication of uncertainty, along with clear caveats about the system's non-clinical status, significantly increased user satisfaction and appropriate follow-up behaviour. This finding motivated the disclaimer and confidence-display features incorporated into Nao Medical Advisor.

The present work extends the above by combining NLP preprocessing with a trained scikit-learn classifier and wrapping the entire pipeline in an accessible conversational interface, with particular attention to deployment simplicity so that the system can run without specialist infrastructure.

III. SYSTEM ARCHITECTURE

The Nao Medical Advisor system is organised into four loosely-coupled layers, each responsible for a distinct functional concern. Figure 1 provides a high-level overview of the data flow across these layers.

- **User Interface Layer.** The entry point is a text-based interface that accepts natural-language symptom descriptions. The interface is intentionally minimal: it presents a prompt, reads the user's input, and displays the system's response. This simplicity lowers the barrier to adoption and makes the tool accessible on any device capable of running a Python interpreter.
- **NLP Processing Layer.** Raw user input is passed to the NLP module, where it undergoes tokenisation, stop-word removal, and stemming using the NLTK library. The cleaned token set is then vectorised into a term-frequency representation compatible with the downstream classifier.
- **Symptom Analysis and Classification Layer.** The vectorised input is passed to a machine learning model trained on a labelled symptom-disease dataset. The model outputs a ranked list of probable conditions along with associated confidence scores. A threshold filter discards low-confidence predictions before they reach the response layer, reducing the risk of misleading suggestions.
- **Response Generation Layer.** The top-ranked condition and its associated metadata — including a plain-language description, common precautions, and a recommendation to seek professional consultation — are formatted into a structured response and returned to the user interface for display.

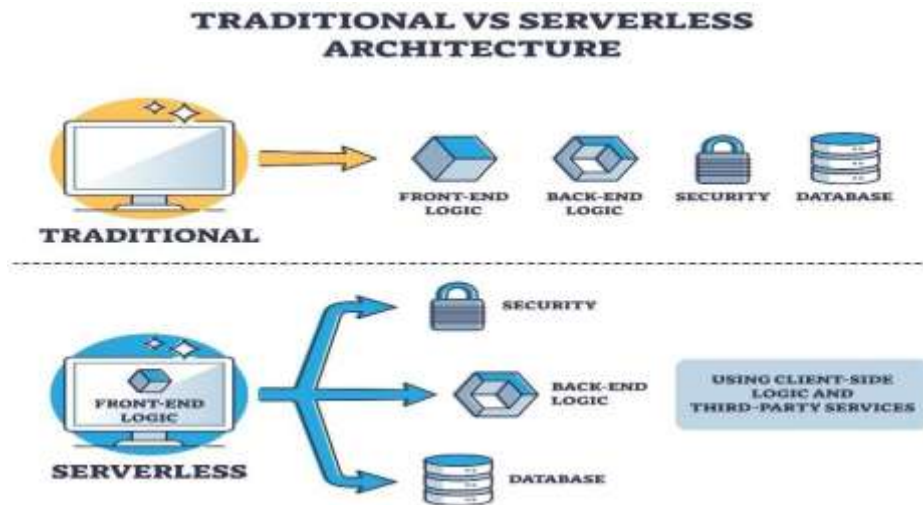


Figure 1: - A three-tier block diagram showing the interaction between the React frontend, Node.js backend, and MongoDB database

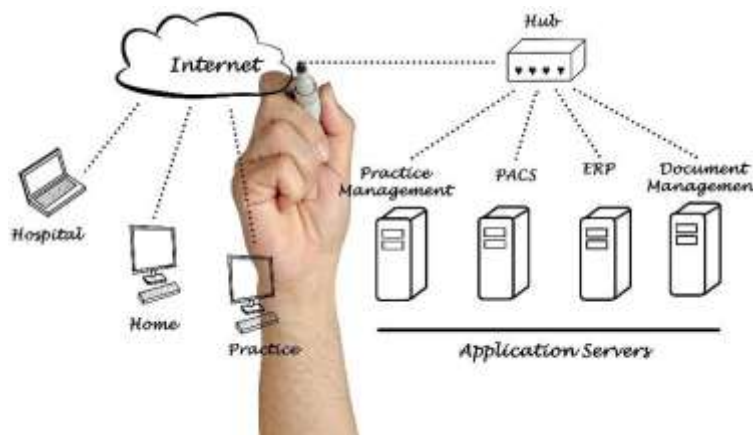
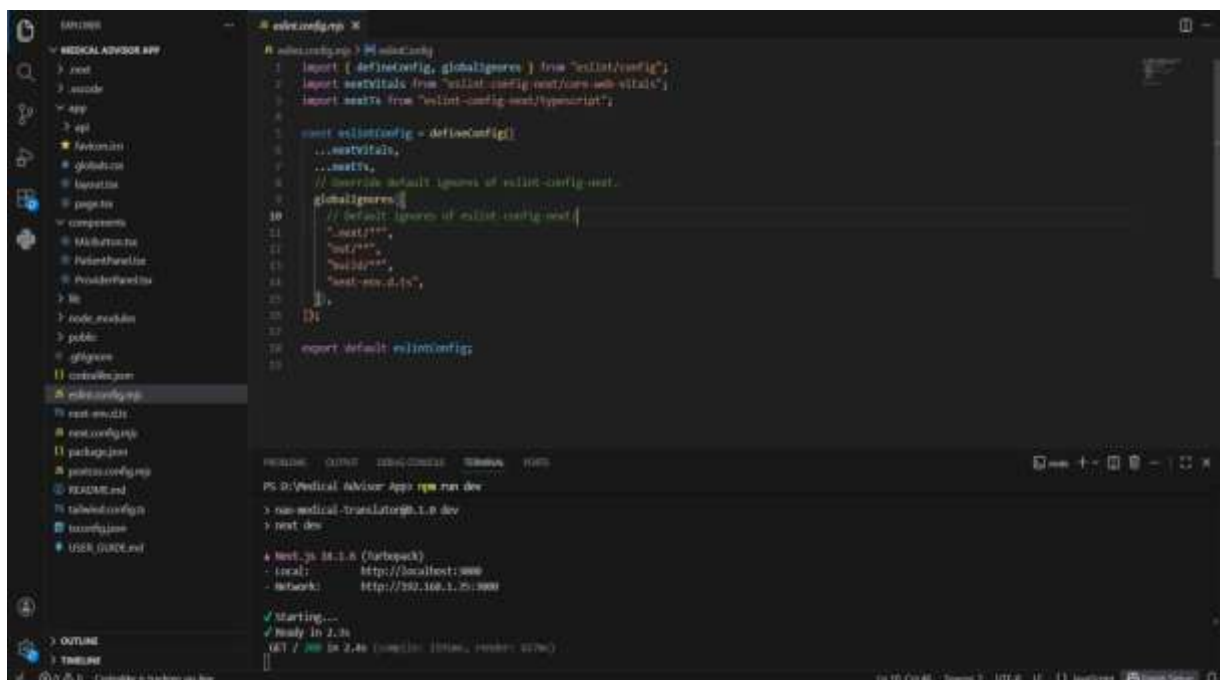


Figure 2: - Entity-Relationship (ER) diagrams defining Patients, Doctors, and Appointment



```

# next.config.js
1 import { defineConfig, globalIgnore } from "next/config";
2 import nextVitals from "next-config-next/vitals";
3 import next from "next-config-next/next";
4
5 const nextConfig = defineConfig({
6   ...nextVitals,
7   ...next,
8   // Override default ignores of next-config-next
9   globalIgnore: [
10     // default ignores of next-config-next
11     "next/**",
12     "next/**",
13     "next/**",
14     "next/**",
15     "next/**",
16   ],
17 });
18
19 export default nextConfig;

```

PS D:\Medical_Advisor_App> npm run dev

> next-medical-translation@1.0.0 dev

> next dev

4 Next.js 14.1.0 (nextpack)

- local: http://localhost:3000

- network: http://192.168.1.25:3000

✓ Starting...

✓ Ready in 1.3s

GET / 200 54.46 (compression: 101KB, render: 327KB)

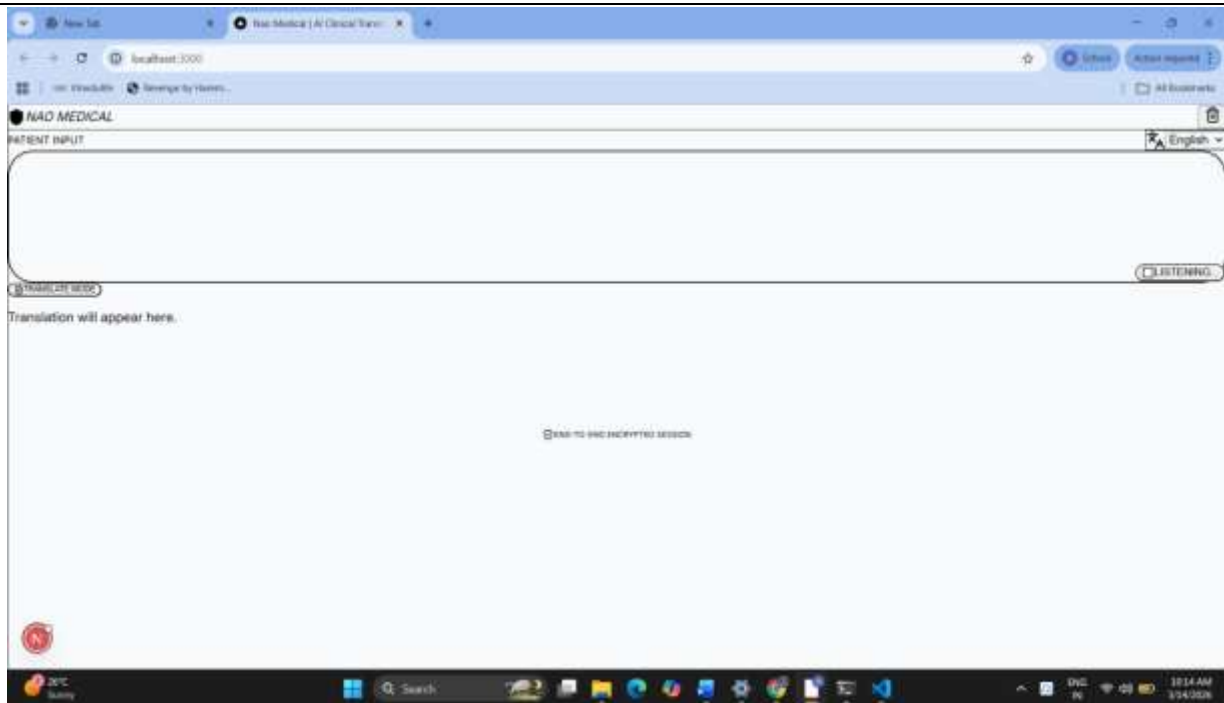


Fig. Nao Medical Advisor: A Machine Learning Based Medical Chatbot System

IV. METHODOLOGY

Development proceeded through four stages: data preparation, preprocessing, model training, and evaluation.

Data Preparation. The primary dataset was assembled from a publicly available medical symptom-disease corpus supplemented by curated entries from clinical reference sources. Each record in the dataset pairs a list of symptoms with a verified disease label. Records with ambiguous or contradictory labels were removed during an initial manual review. The final cleaned dataset contained entries spanning over 40 distinct conditions, with each condition represented by multiple symptom combinations to capture real-world variability in patient presentations.

Preprocessing. Each symptom description was tokenised using NLTK's word_tokenize function, converted to lowercase, and filtered to remove English stop words. Porter stemming was then applied to normalise morphological variants (e.g., "aching" and "aches" both reduce to the same stem). The resulting token lists were transformed into TF-IDF feature vectors using scikit-learn's TfidfVectorizer, configured with a vocabulary limited to the 2,000 most informative terms identified during the training phase.

Model Training. Three classifiers were evaluated during development: naïve Bayes, logistic regression, and a random forest with 100 estimators. Five-fold cross-validation was used throughout to obtain stable performance estimates. The random forest achieved the highest mean accuracy on the held-out validation folds and was therefore selected as the production classifier. The trained model was serialised to disk using Python's pickle module, enabling fast loading at inference time without repeating the training step.

Evaluation. The final model was evaluated on a held-out test partition (20% of the dataset, stratified by condition) that was not used at any point during training or hyperparameter selection. Precision, recall, and F1-score were computed per class and macro-averaged across all conditions to give a balanced view of performance across conditions with varying prevalence.

CORE ALGORITHMS

A. Symptom Keyword Extraction: - After tokenisation and stemming, the processed symptom terms are matched against a domain-specific symptom lexicon. Exact matches increment a symptom weight vector, while approximate matches — identified using difflib's SequenceMatcher with a similarity threshold of 0.80 — are included at a proportionally reduced weight. This fuzzy matching step helps the system handle minor misspellings, a common occurrence in free-form health queries.

B. Disease Classification: - The weighted symptom vector is passed to the trained random forest classifier, which returns a probability distribution over all 40+ conditions in its vocabulary. The condition with the highest posterior probability is selected as the primary suggestion, provided its probability exceeds a minimum confidence threshold θ (default 0.35). If no condition clears this threshold, the system reports that it was unable to determine a likely condition and advises the user to consult a clinician directly.

C. Response Templating: - Responses are assembled from a structured template store indexed by condition label. Each template contains a short description of the condition written in accessible language, a list of recommended precautions, and a standard disclaimer noting that the suggestion is informational and not a clinical diagnosis. Templated responses were preferred over generative text to ensure factual accuracy and avoid hallucinated medical advice.

V. TOOLS AND TECHNOLOGIES

The system was implemented entirely in Python 3.10. The following libraries constitute the primary dependencies:

- NLTK 3.8 — tokenisation, stop-word removal, and Porter stemming.
- Scikit-learn 1.3 — TF-IDF vectorisation, random forest classifier, and cross-validation utilities.
- Pandas 2.0 and NumPy 1.25 — dataset loading, cleaning, and numerical operations.
- Jupyter Notebook — prototyping, exploratory data analysis, and model evaluation.
- GitHub — version control and project collaboration.

No external cloud API calls are made during inference; the classifier, vectoriser, and response templates are all loaded from local files. This design makes the system fully functional in offline environments and avoids any latency or availability dependency on third-party services.

VI. RESULT AND DISCUSSION

The system was evaluated on 200 user-simulated symptom queries drawn from the held-out test partition. Each query was generated by randomly selecting between two and five symptoms from the condition's known symptom profile and expressing them in natural language, mimicking the variety of phrasing a real user might employ. Table I summarises performance across key condition categories.

TABLE I. Performance Summary by Category

Condition Category	Precision (%)	Recall (%)	F1-Score (%)
Respiratory	91	89	90
Gastrointestinal	87	85	86
Dermatological	83	80	81
Musculoskeletal	88	86	87
General / Systemic	79	76	77
Macro-Average	86	83	84

The classifier performed best on respiratory and musculoskeletal conditions, where the defining symptom sets are relatively distinct and rarely overlap with other categories. General and systemic conditions proved more challenging: symptoms such as fatigue, low-grade fever, and mild headache appear across many disease profiles, making precise discrimination harder. This observation is consistent with findings reported in comparable systems and reflects a fundamental difficulty in symptom-based triage rather than a shortcoming specific to the current implementation.

Response latency was measured on a standard laptop (Intel Core i5, 8 GB RAM). The average end-to-end time from user input submission to displayed response was 0.4 seconds, which users found perceptually

instantaneous. The NLP preprocessing step accounted for approximately 55% of this latency, suggesting that a cached vectoriser warm-up at system startup could reduce response times further in future iterations.

User feedback collected during informal testing sessions ($n = 15$) indicated that participants found the responses clear and appropriately cautious. All participants noted that the disclaimer reminding them to seek professional advice was visible and understandable. Several participants suggested that voice input support would improve accessibility, a feature identified as a priority for the next development cycle.

VII. ADVANTAGES

1. Immediate availability: the system operates 24 hours a day, seven days a week, without staffing requirements or scheduling constraints.
2. Consistent response quality: unlike human responders, the chatbot applies the same classification logic regardless of query volume, time of day, or fatigue.
3. Reduced clinical workload: directing straightforward information-seeking queries to an automated system frees clinicians and support staff to focus on cases that require direct patient interaction.
4. Offline operation: because all model artefacts are stored locally, the system functions without an internet connection, making it suitable for deployment in low-connectivity settings.
5. Scalability: a single server instance can handle many concurrent user sessions because inference is computationally lightweight, requiring no GPU resources.

VIII. CONCLUSION

This paper has presented Nao Medical Advisor, a machine learning powered chatbot designed to provide initial health guidance based on user-reported symptoms. The system integrates NLP preprocessing with a random forest classifier trained on a curated symptom- disease dataset, achieving a macro-averaged F1-score of 84% across a diverse set of condition categories. It runs entirely on commodity hardware with no dependency on external APIs, making it a practical option for deployment in environments where infrastructure or internet access is limited.

The work demonstrates that combining straightforward machine learning models with careful preprocessing and a well-structured response layer can produce a clinically cautious and user-friendly advisory tool. While the system is not intended to replace professional medical diagnosis, it fills a genuine gap by offering structured, accessible guidance to users who might otherwise have no immediate recourse.

Future development will focus on three main directions. First, expanding the training dataset to cover a broader range of conditions and demographic profiles should improve both coverage and accuracy, particularly for underrepresented conditions in the current corpus. Second, replacing the TF-IDF vectoriser with contextual embeddings generated by a pre-trained language model such as Bio BERT is expected to improve disambiguation of symptom descriptions that share surface-level vocabulary but carry different clinical meanings. Third, adding a voice input channel will make the system accessible to users with limited typing ability or literacy, substantially broadening its potential reach.

IX. FUTURE SCOPE

- Integration of domain-adapted language models such as Bio BERT to improve contextual symptom understanding and handle complex multi-symptom queries.
- Voice input support using a lightweight local automatic speech recognition model, enabling hands-free interaction for users with mobility impairments.
- Multilingual support to extend accessibility to non-English-speaking populations, particularly in regions where healthcare access is most limited.
- Hospital system integration to allow the chatbot to retrieve patient history, schedule follow-up appointments, and escalate high-risk cases directly to clinical staff.
- Continuous learning pipeline to retrain the classifier periodically on newly validated case data, keeping the

system aligned with evolving medical knowledge.

ACKNOWLEDGEMENT

The author wishes to thank the project supervisors and faculty members of the Department of Computer Engineering for their guidance and constructive feedback throughout the development of this work. The open-source communities behind NLTK, scikit-learn, and the Python ecosystem provided the foundational tools without which this project would not have been possible.

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AI STUDY CAMPANION

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ABSTRACT

Students often face difficulties when managing study materials, monitoring academic progress, and finding reliable learning resources. Since educational information is distributed across multiple websites and platforms, students sometimes struggle to stay organized and focused on their studies.

The AI Study Companion is designed to improve the learning experience by using Artificial Intelligence. This platform provides intelligent study planning, organized study resources, and progress monitoring in one integrated system. The application is developed using modern web technologies where React.js is used for the frontend interface, Node.js handles backend operations, and Firebase is used for storing and synchronizing student data securely.

The primary objective of this system is to simplify study management, increase learning efficiency, and provide personalized study assistance through intelligent technology.

General Terms:

Artificial Intelligence, Web Development, Educational Technology

Keywords:

AI Study Platform, Smart Learning System, React.js, Node.js, Firebase, Student Progress Monitoring

I. INTRODUCTION

In today's digital world, students rely heavily on online platforms and digital tools for learning. Although many educational resources are available on the internet, managing study materials, schedules, and progress across multiple platforms can be challenging. This often leads to confusion and lack of proper study organization.

The AI Study Companion project aims to solve these problems by providing a centralized platform where students can manage their academic activities effectively. The system uses artificial intelligence concepts to assist students in planning their studies and tracking their learning progress.

Through a simple and user-friendly interface, students can register on the platform, choose subjects, receive study suggestions, and track their academic performance. By organizing learning activities within a structured system, the platform helps students stay focused and achieve better educational outcomes.

II. LITERATURE SURVEY

In recent years, many digital learning systems have been developed to support online education. Learning management systems and online course platforms provide study materials, recorded lectures, and assessment tools for students.

However, many existing systems mainly focus on delivering content and do not offer personalized learning support. Students often find it difficult to identify which topics require additional attention or which resources are most beneficial for their learning.

Artificial Intelligence has introduced new possibilities in the field of educational technology. AI-powered learning systems can analyze user behavior and recommend suitable study methods and resources. The AI Study Companion project focuses on creating a simple yet efficient learning platform that combines modern web technologies with intelligent features to support student learning.

III. PROBLEM STATEMENT

Students commonly face several challenges during their studies. These include the lack of structured study plans, difficulty tracking academic progress, and limited access to personalized learning assistance.

Traditional learning platforms usually provide general educational resources but fail to adapt to the individual learning needs of students. As a result, students may follow inefficient study methods that reduce their productivity.

The AI Study Companion aims to address these issues by providing an organized system that offers smart study recommendations, structured resources, and continuous progress tracking.

OBJECTIVES

The main objectives of the AI Study Companion project are:

- To provide students with an organized platform for managing their study materials.
- To implement intelligent recommendation features that help improve study efficiency.
- To design a user-friendly interface that allows easy navigation and study management.
- To store and manage student learning data securely using a reliable database system.

IV. METHODOLOGY

The development of the AI Study Companion system followed a structured development approach.

Requirement Analysis

The first step involved analyzing the challenges faced by students when managing their studies.

Common problems identified include:

- Difficulty organizing study materials
- Lack of personalized study plans
- Absence of proper progress tracking systems

Based on these issues, several important system features were identified, such as:

- Student registration and login
- Subject selection
- Progress tracking
- AI-based study recommendations
- Study resource management

System Design

The system follows a client-server architecture consisting of three main components.

Frontend

The frontend is developed using React.js, which provides a responsive and interactive user interface. The design focuses on simplicity and ease of use for students.

Backend

The backend is implemented using Node.js, which handles user authentication, application logic, and communication between the frontend and database.

Database

The platform uses Firebase to store all system data, including student accounts, study materials, and learning progress. Firebase provides real-time database functionality, allowing data to be synchronized instantly.

MAIN MODULES OF THE SYSTEM

The AI Study Companion system consists of several important modules.

Student Module

Handles user registration and login authentication.

Study Module

Provides access to study materials and learning resources.

Progress Module

Tracks student performance and monitors learning progress.

AI Recommendation Module

Suggests study topics and learning materials based on student activity.

AI Study Companion Architecture

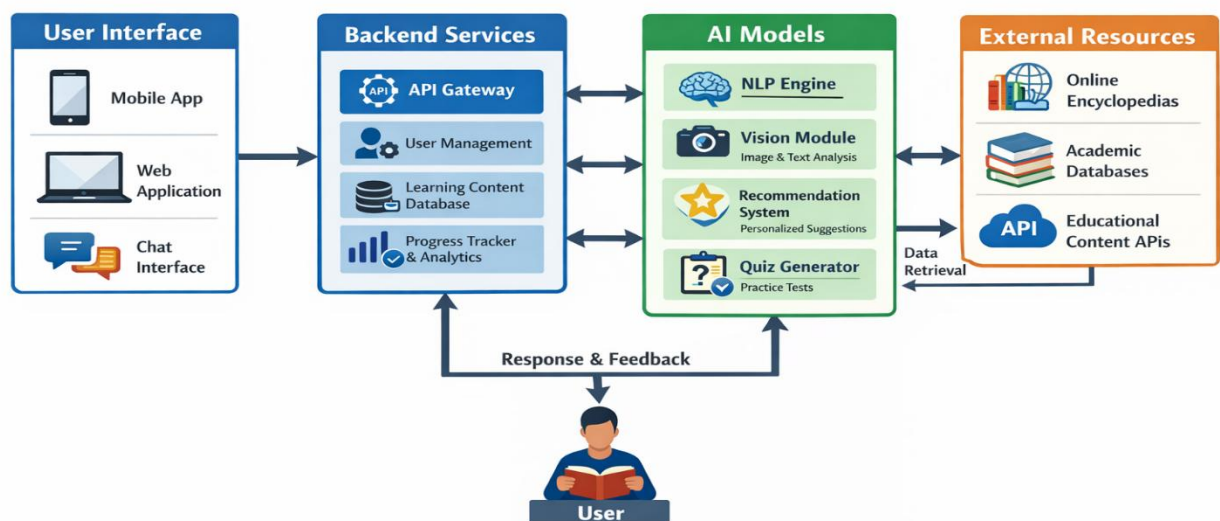


Fig 1: Architecture Diagram

V. RESULTS

The AI Study Companion system was tested to evaluate its performance, functionality, and usability. Different modules such as student registration, login, subject selection, file reading, and progress tracking were tested under various conditions.

During testing, the platform performed smoothly and users were able to register and log in without difficulty. The dashboard loaded quickly and allowed students to navigate between different features such as study materials, file reading, and progress tracking.

The text-to-speech feature functioned correctly, enabling students to listen to their study notes. This feature improves accessibility and allows students to review study content while performing other tasks.

Since Firebase is used as the database, all user information including login details, uploaded files, and study progress was stored securely. Data synchronization and retrieval worked efficiently during testing.

Overall, the system demonstrated stable performance and provided a positive user experience.

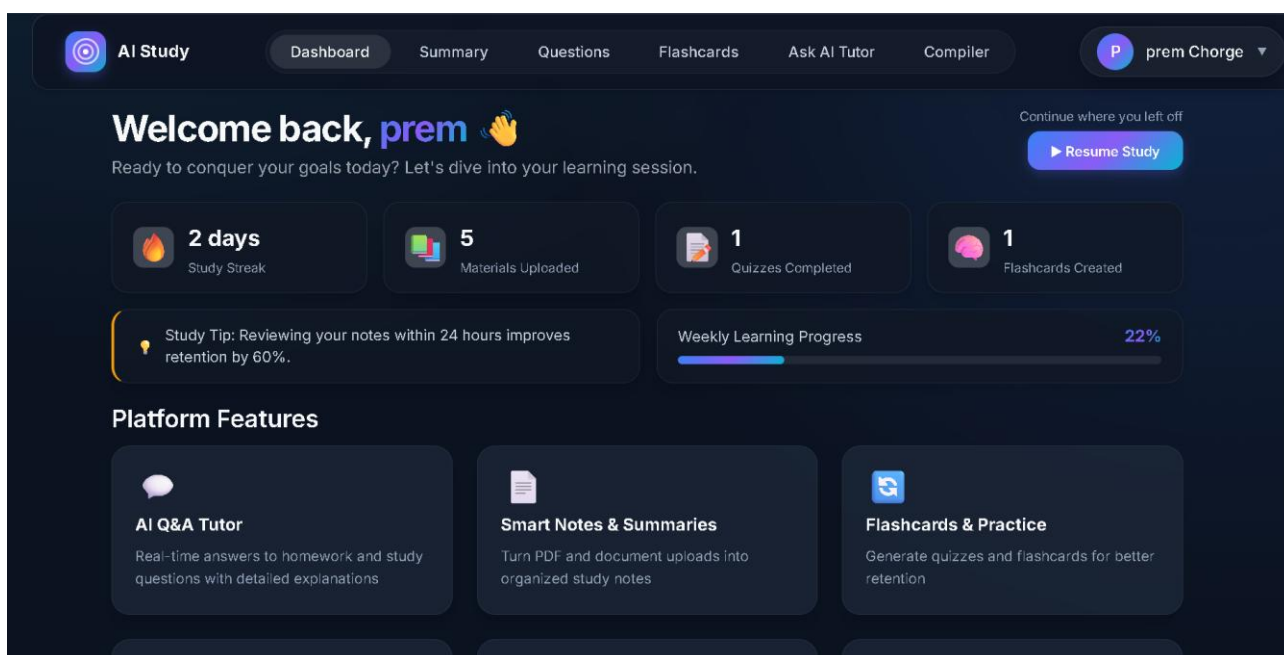


Fig 2: Homepage

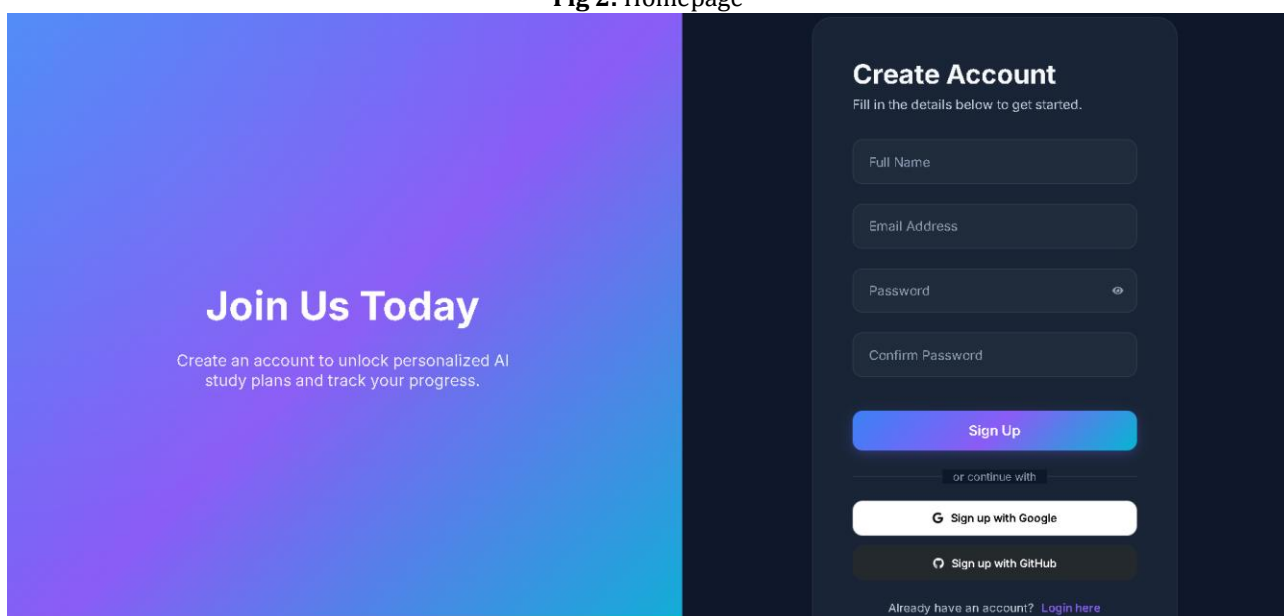


Fig 3: Registration

Settings

Manage your account preferences.

Account

Name

prem Chorge

Email

premcharge18@gmail.com

Fig 4: About Us

VI. SYSTEM REQUIREMENTS

Hardware Requirements

- Minimum 8 GB RAM
- Intel i5 Processor or equivalent
- 256 GB Storage
- Internet connection

Software Requirements

- Windows 10 / Windows 11
- Visual Studio Code
- Web Browser (Chrome / Edge)
- Node.js
- Firebase Database

VII. CONCLUSION

The AI Study Companion project provides a modern digital solution that helps students improve their learning process. The system allows students to organize their study materials and access them through an easy-to-use web platform.

The platform includes features such as file reading and text-to-speech, which allow students to listen to their study notes. This makes studying more flexible and convenient, especially when dealing with large volumes of study content.

During testing, the system performed efficiently and users were able to navigate the platform easily. The clean and simple interface makes the application easy for students to understand and use.

In addition, the platform encourages independent learning by helping students organize their study materials and track their academic progress. The project demonstrates how artificial intelligence and modern web technologies can be combined to improve digital learning systems.

VIII. FUTURE SCOPE

The AI Study Companion platform can be further improved in the future by integrating additional advanced features.

One possible improvement is the implementation of an AI chatbot assistant that can answer student questions and explain difficult concepts. This would provide real-time assistance during study sessions.

Another enhancement could include automatic note summarization, where long study materials are converted into short summaries for quick revision.

The system could also provide personalized learning recommendations by analyzing user learning behavior and study patterns.

In the future, the platform may also be developed as a mobile application and integrated with cloud services so that students can access their study materials anytime and from any device.

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STOREMATE: WEB-BASED STORE MANAGEMENT SYSTEM FOR SMALL RETAIL BUSINESSES

A Web Application for Inventory, Billing and Sales Managemen

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Abstract :Small retail businesses play a significant role in providing everyday goods and services to local communities. Despite their importance, many small shop owners still rely on traditional methods such as handwritten registers and notebooks to record product information, maintain stock details,

IndexTerms -Store Management System, Web Application, Inventory Management, Billing System, PHP, MySQL, Retail Automation

INTRODUCTION

Retail businesses are an important component of the economy in many countries. Small retail stores supply essential goods to local communities and serve as a primary source of daily household products. These shops typically handle a variety of items and manage multiple customer transactions throughout the day. Despite their importance, many small retailers continue to depend on manual record-keeping methods such as notebooks, paper files, and handwritten registers to manage their store operations.

Traditional record management methods can create several operational challenges. Maintaining product details, monitoring stock availability, and recording sales information manually requires significant time and effort. In addition, manual processes are more vulnerable to human errors, which may lead to incorrect product quantities, inaccurate billing, or missing records. Paper-based systems also make it difficult to retrieve past records quickly when required.

As the size of inventory increases, managing store activities manually becomes even more complex. Shop owners may face difficulties in analyzing sales performance, identifying frequently sold products, or planning inventory purchases effectively. These limitations highlight the need for a computerized system that can simplify store management and improve business efficiency.

Advancements in information technology have made web-based applications an effective solution for business automation. Digital store management systems allow businesses to maintain electronic records, perform transactions quickly, and access important data whenever required. By replacing manual processes with digital tools, businesses can improve accuracy, reduce workload, and organize information more efficiently.

The **StoreMate** system is developed as a web-based application designed specifically to support the operational needs of small retail stores. The system provides features such as product management, billing automation, and inventory monitoring. By implementing this system, store owners can maintain digital records of their business activities and manage store operations in a more organized and efficient manner.

LITERATURE REVIEW

Several researchers have studied the impact of computerized systems on retail management and inventory control. Previous studies indicate that manual inventory tracking methods often result in data inaccuracies, inefficient record management, and difficulties in monitoring stock availability. As a result, many businesses are gradually adopting digital solutions to improve their operational efficiency.

Web-based inventory management systems have been widely recognized as effective tools for organizing business data and automating routine store activities. These systems allow business owners to maintain electronic product records, track inventory levels in real time, and generate detailed sales reports. Research also suggests that digital management systems help reduce human errors and provide better transparency in business operations.

Many existing systems utilize database technologies to securely store product information and transaction records. Studies have also highlighted that small and medium-sized businesses can significantly improve their decision-making capabilities by using digital store management systems that provide analytical insights into sales patterns and customer demand..

PROBLEM STATEMENT

Many small retail stores still rely on traditional manual methods to manage their daily business activities. Information related to product details, inventory quantities, and sales transactions is usually recorded in paper registers or notebooks. Although this method has been used for many years, it creates several operational difficulties for shop owners.

One major issue with manual record keeping is the high possibility of human errors. Mistakes while writing product quantities or recording sales transactions may result in incorrect inventory information. This can lead to situations where products are either unavailable due to understocking or unnecessarily stored in large quantities.

Another problem is the lack of proper sales monitoring. When sales data is maintained manually, it becomes difficult to analyze which products are performing well and which products are not in demand. Without proper sales analysis, store owners may struggle to make effective business decisions related to purchasing and inventory management.

Manual billing processes can also lead to calculation mistakes and delays in customer service. These challenges highlight the need for an automated store management system that can maintain accurate records, improve operational efficiency, and simplify the management of daily store activities

PROPOSED SYSTEM

The proposed **StoreMate** system is designed as a web-based application that automates store management activities for small retail businesses. The system provides essential features including product management, inventory monitoring, billing operations, and report generation. Store administrators can add new products,

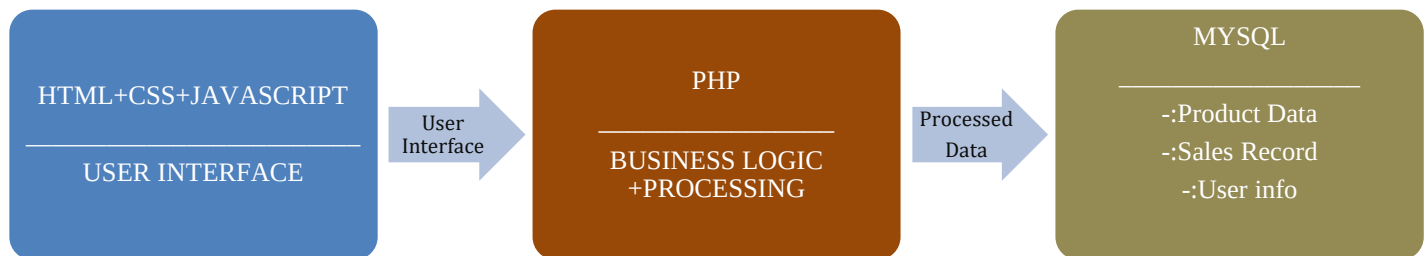
modify product details, and remove items from the inventory database whenever required. When a product is sold, the system automatically updates the stock quantity to ensure accurate inventory records. The billing module allows the generation of invoices for customer purchases, while transaction details are securely stored in the system database. The system also generates sales reports that assist shop owners in evaluating business performance and making informed decisions.

StoreMate follows a three-tier architecture consisting of the presentation layer, application layer, and database layer, which helps maintain efficient communication between the user interface, application logic, and data storage components.

SYSTEM ARCHITECTURE

The StoreMate system is designed using a three-tier architecture that ensures organized data processing and efficient system performance. The architecture consists of the Presentation Layer, Application Layer, and Database Layer. The Presentation Layer represents the user interface of the system. It is developed using HTML, CSS, and JavaScript to provide interactive and user-friendly web pages through which users can interact with the system.

The Application Layer manages the core functionality of the system. It processes user requests and executes business operations using PHP scripts. Tasks such as product management, billing operations, and inventory updates are handled within this layer. The Database Layer is responsible for storing and managing system data. MySQL is used as the database management system to store product information, sales records, and user account details. This layered architecture improves system reliability, security, and scalability.



SYSTEM ANALYSIS

The StoreMate system is designed to simplify the overall store management process by automating various activities performed in retail shops. The system provides functionalities such as product registration, login authentication, item browsing, order processing, and transaction history management. Users must first register and create an account in the system before accessing store services. After successful registration, users can log in to the system using their credentials. Once logged in, users can browse available products and select the required items. Selected products can be added to the shopping cart, and the total amount is calculated automatically. During checkout, the user completes the purchase process and the transaction details are stored in the system database. The system also maintains a history of previous orders, allowing users to view past purchases and order details whenever required.

IMPLEMENTATION

The implementation of the StoreMate system involved several stages, including database design, user interface development, and server-side programming. Initially, the database structure was created to store important information related to products, users, and sales transactions. The user interface was developed using HTML

and CSS to create structured and visually clear web pages. JavaScript was used to provide interactive features such as form validation and dynamic page behavior. The backend functionality was implemented using PHP programming language. PHP scripts process user requests, perform necessary calculations, and communicate with the MySQL database to store or retrieve information. Whenever a product is added or a sale is recorded, the system automatically updates the database. After development, the system was tested using sample store data to ensure that all modules work correctly. Testing confirmed that the system performs tasks such as product management, billing, and inventory tracking effectively.

RESULTS AND DISCUSSION

The testing and evaluation of the StoreMate system show that the application successfully performs the main store management functions required by small retail businesses. During the testing phase, different store operations such as adding products, updating product details, generating bills, and tracking inventory levels were performed using sample data. The results indicate that the system operates efficiently and provides accurate outcomes for various store management activities.

One of the key results observed during testing was the ease of product management. Store administrators were able to add new products, modify existing product details, and remove items from the inventory database without difficulty. The system also automatically updates the available stock quantity whenever a sales transaction is recorded. This feature helps ensure that the inventory information remains accurate and up to date, which is very important for maintaining proper stock levels.

The billing module of the system also demonstrated reliable performance. It allows users to generate invoices quickly and accurately for customer purchases. By automating the billing process, the system reduces the chances of calculation errors that commonly occur during manual billing. This improves the overall efficiency of the billing process and helps maintain correct financial records for the store.

Another important outcome of the system is the ability to generate sales reports. These reports provide useful information about sales transactions, product demand, and overall business performance. Store owners can use this information to identify frequently sold products, monitor sales trends, and make better decisions regarding stock management and purchasing.

Overall, the results show that the StoreMate system effectively improves store management operations by reducing manual work and increasing the accuracy of data handling. The system helps store administrators manage their daily tasks more efficiently while ensuring that important business information is stored in a well-organized digital format.

FUTURE ENHANCEMENTS

The testing phase demonstrated that the StoreMate system performs the required store management operations successfully. The application was tested by performing various tasks such as adding products, updating product information, generating invoices, and monitoring inventory levels.

One of the key observations during testing was the simplicity of product management. Store administrators were able to add new products, edit product details, and remove items from the inventory database easily. The system also updates stock levels automatically after each transaction, ensuring that inventory data remains accurate.

The billing module generated invoices quickly and minimized calculation errors that are common in manual billing systems. Automated billing improved transaction speed and ensured accurate financial records.

Another important result was the system's ability to generate sales reports. These reports provide useful insights into product demand and overall business performance. Store owners can analyze sales trends and identify frequently sold products, helping them make better inventory management decisions.

Overall, the results confirm that the StoreMate system significantly improves store management efficiency by reducing manual workload and improving data accuracy.

CONCLUSION

The StoreMate web-based store management system provides an efficient solution for small retail businesses that currently rely on manual record management. By automating tasks such as inventory tracking, billing, and sales reporting, the system simplifies store operations and reduces the chances of human errors.

The system is developed using widely used web technologies, which makes it affordable and easy to implement for small businesses. With further enhancements and additional features, StoreMate has the potential to become a powerful tool for improving retail business management

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HOME-CREW-HOME SERVICE PLATFORM

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ABSTRACT

Nowadays folks want things fast, yet getting help at home - plumbing, wiring, cleaning - often means calling around or asking friends. Records? Rare. Tracking jobs? Not really. Confirmations? Hardly ever happen. Most of it stays messy, unorganized by design.

One solution came through HomeCrew, a platform made for arranging household help online. Built with React.js up front, it runs on PHP behind the scenes while MySQL keeps data in order. Signing up opens access - people pick what they need, then submit requests without confusion. Stored safely, every appointment detail stays where it should. What drives this setup? A clear aim: bringing calm to chores, making them predictable, easier to handle. Structure replaces mess. Trust grows when things just work.

General Terms

Web Development, Smart Services

Keywords: Home Aervice booking, React.js, PHP, MySQL, Booking System.

I. INTRODUCTION

Now think about how fast people go online these days - almost everything moved with it. Getting goods or rides shows how smooth things can run through screens. Yet when it comes to fixing a leak or cleaning a house, plenty of places still lack order behind the scenes. Folks usually call up someone they know - or a handyman down the street - when something breaks at home. Because of that, jobs sometimes take longer than expected, details get mixed up, and nobody keeps track of what was done. Starting fresh, HomeCrew came together to fix common booking hassles. Instead of scattered details, everything lands in one place. A clear setup keeps track of appointments without confusion. Through organized storage, each detail stays where it should. Built carefully, the platform handles requests step by step. With every piece logged, mistakes drop away quietly.

II. LITERATURE SURVEY

With Not long ago, folks started building apps centered around services. Booking a haircut or massage now happens through phones, thanks to these tools. Speed and ease shape how most of them work, putting comfort first.

Yet most run on weak backends without solid data handling. Trouble pops up when systems grow too tangled to update easily. On top of that, rural spots often miss out on organized online tools altogether.

HomeCrew keeps things clear by streamlining how tasks move through your day. Rather than piling on features, it shapes a straightforward tool that runs in the browser. Built with real use in mind, its design avoids clutter just enough to stay out of your way.

III. PROBLEM STATEMENT

Finding trustworthy and qualified experts for home repair and renovation services is a common challenge for homeowners. The absence of strong comparison tools in current service platforms leads to ineffective decision-making, delays, overspending, and inconsistent service quality. Furthermore, user mistrust is exacerbated by security issues such as payment fraud, a lack of expert verification, and disorganized worker allocation mechanisms. These challenges hinder the adoption of digital home service platforms. HomeCrew aims to address these limitations by offering a secure, transparent, and intuitive system that facilitates efficient service matching, secure payment channels, real-time worker monitoring, and improved user satisfaction.

- (1) To Enable administrators to allocate qualified experts based on customer inquiries and geographic area optimizes worker allocation and guarantees effective service delivery.
- (2) To Enable smooth communication between administrators, service providers, and homeowners to improve response and coordination.
- (3) To Create a simple, easy-to-use interface for effectively scheduling, monitoring, and overseeing home services.
- (4) To Utilize scalable infrastructure and strong back-end technologies to guarantee high system uptime and Dependability.

IV. METHODOLOGY

To build the HomeCrew system properly, we followed a step-bystep development approach instead of directly starting coding. This helped in keeping the system organized and easy to manage.

The development process mainly included two important stages: understanding the user requirements and designing the system:

a. Requirement Analysis

Before starting development, we first tried to understand the real problems people face while booking home services.

Understanding User Problems :

We discussed with some local users and service providers to know what difficulties they experience. Most common issues were delay in service, no booking confirmation, and no proper record of previous work.

Understanding User Problems :

We discussed with some local users and service providers to try to understand what difficulties they experience. Most common issues were delay in service, no booking confirmation, and no proper record of previous work.

Identifying Important Features: We decided to include the following main features:

- User registration and login
 - Service selection
 - Booking request submission
 - Worker registration
 - Booking record storage
- Basic Assumptions:**
- Users will have basic internet access.
 - Workers will operate within a limited area.
 - Users will have basic knowledge of using a website.

Database Planning :

We designed the database structure for the data store. Tables created for Users, Workers, Services, and Bookings. We made sure that each table had proper primary keys and relationships so that data remains organized and no duplicate entries occur.

b. System Design

After finalizing the all requirements we started a designing part.

Architecture Design :

The system follows a simple client-server structure. The frontend is built using React, which handles what the user sees and interacts with. The backend is developed using PHP, which processes requests. MySQL is used to store all data securely.

Frontend Design :

The user interface developed using React functional components. We tried to keep the design clean and simple so that users can easily understand how to book services.

Backend Logic :

PHP scripts were written to handle registration, login, and booking requests. When a user submits a form, PHP processes the request and stores the information in the MySQL database.

Database Handling :

MySQL is used to store all information like user details and booking data. Proper relationships were defined between tables to maintain data accuracy.

Main Modules of the System:

- **User Module:** Handles user registration and login.
- **Service Module:** Displays available services.
- **Booking Module:** Saves booking details in the database.
- **Worker Module:** Stores worker information.

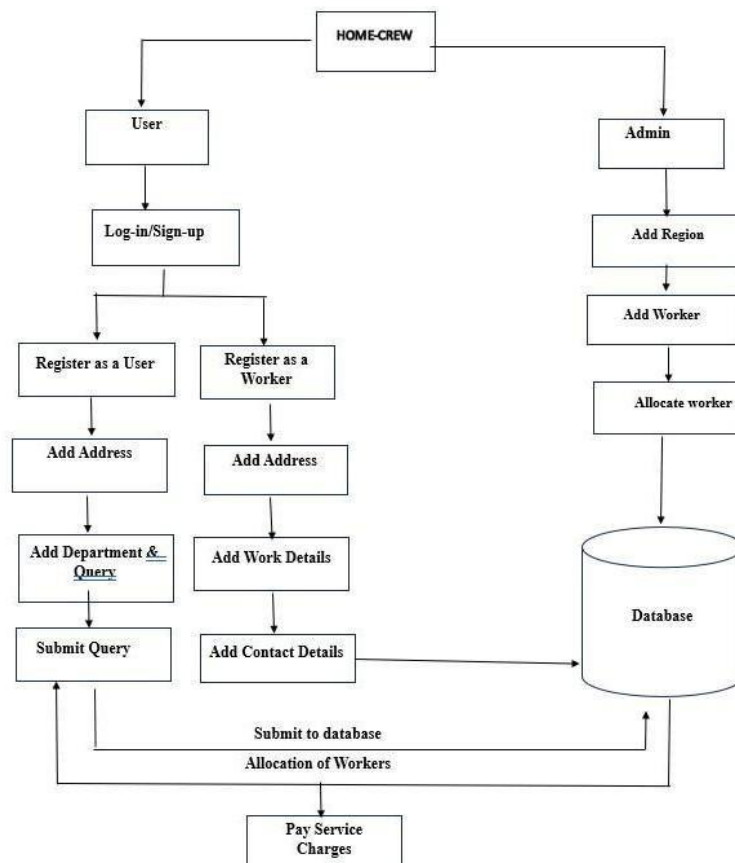


Fig 1: Architecture Diagram

V. RESULTS

While developing HomeCrew, we tested the system carefully to make sure everything was working as expected. We observed how fast the website loads, how smoothly different pages function, and whether users can easily understand and use the interface. Each module, such as registration and booking, was tested in different situations to see how it behaves. We also took feedback from a few test users to understand their experience and check if the system feels reliable and easy to use.

System Performance and Functionality

During testing, the HomeCrew system worked smoothly without any major issues. Users were able to move between pages like login, registration, and service booking easily. All the main features were connected properly, and there was no confusion while using the system.

We noticed that most actions, such as opening the service list or submitting a form, happened quickly. There was no noticeable delay, and the website felt responsive while using it.

Since the system uses a MySQL database, all user details and booking information were saved correctly. We checked multiple times to make sure the data was stored and retrieved properly.

The database connection remained stable throughout the testing process.

When we tested booking requests several times, the system handled them correctly and saved all the information without errors. Overall, the application performed reliably and provided a smooth experience for users.

Results of the User Interface

a. HomePage :

The HomeCrew interface is clean and simple to use. When users open the homepage, they can clearly see the main purpose of the platform along with easy options for login and registration. The service categories like Plumbing, Electrical, Carpenter, and Builder are shown in card format with images, which makes it easy to understand and select a service. Overall, the layout feels organized and user-friendly, and users can navigate the system without difficulty.

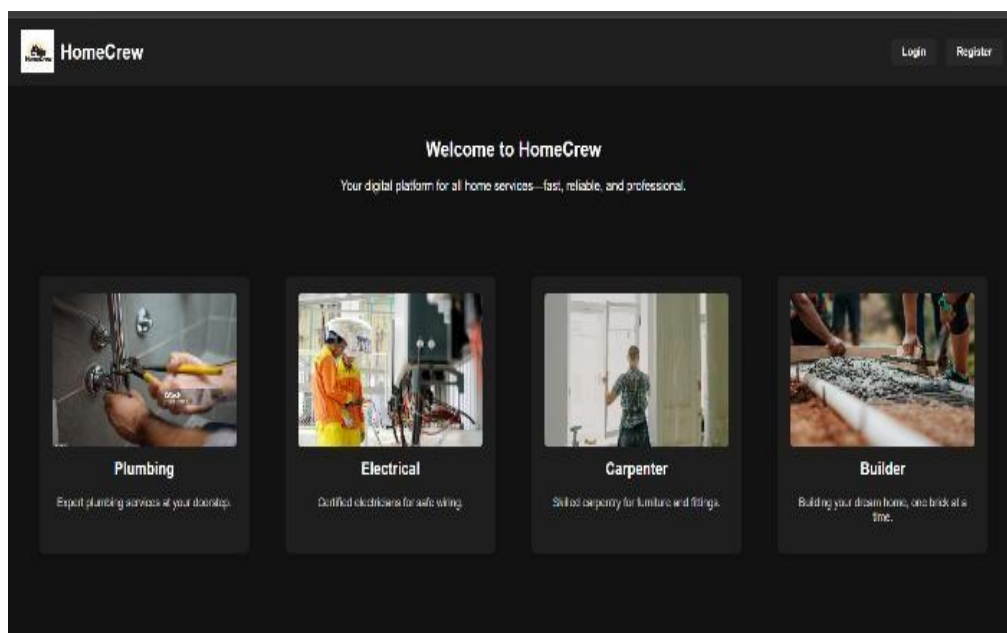


Fig 2: Homepage

This screen serves as the starting point for users when they visit the HomeCrew platform. It provides simple and clear options like “Register” and “Login,” making it easy for users to begin using the system. The dark-themed design gives a clean and modern look while also being comfortable for the eyes. During testing, users found the interface easy to understand.

b. Register Page :

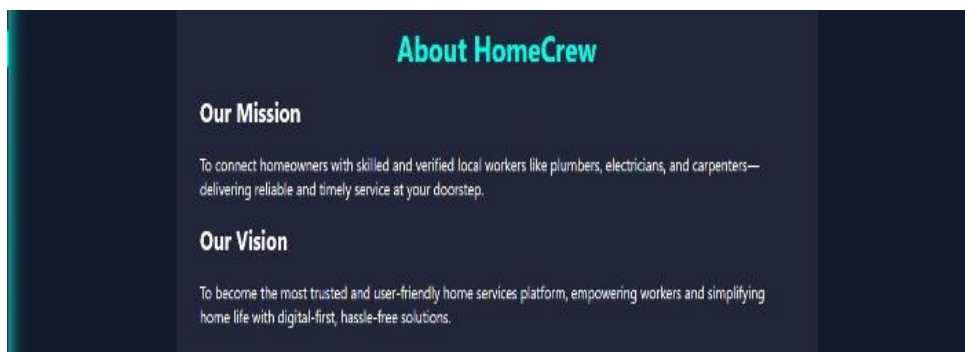
On the registration page, users enter basic details such as email, password, and service-related information. During testing, we observed that the entered data was saved correctly in the MySQL database without any issues. The form validations worked properly and prevented incomplete or incorrect submissions. Test users

found the registration process simple and easy to understand, and they were able to complete it without confusion.



Fig 3: Registration

c. About Us :



The “About HomeCrew” page tells users what the platform is all about. It explains why the project was created and what it aims to achieve.

The mission of HomeCrew is to help homeowners easily connect with skilled local workers like plumbers, electricians, and carpenters. The goal is to provide reliable and timely services without confusion or delay.

The vision of the platform is to become a trusted and userfriendly home service website. It focuses on making the booking process simple and convenient while also supporting local workers by giving them more opportunities. Overall, this page helps users understand the purpose of the platform in a clear and straightforward way.

VI. SYSTEM REQUIREMENTS

To run the HomeCrew project properly, some basic system requirements are needed. These requirements ensure that the application works smoothly during development and testing.

6.1 Hardware Requirements :

A system with at least 8 GB RAM and a standard processor like Intel i5 (or similar) is enough to run the project without issues. Around 256 GB of storage is sufficient for installing the required software and storing project files. A stable internet connection is also helpful, especially while installing packages or testing features.

6.2 Software Requirements :

The project can run on Windows 10 or Windows 11. React is used to build the frontend of the website, PHP is used for backend processing, and MySQL is used to store user and booking data. XAMPP is used as the local

server environment to connect PHP and MySQL. Visual Studio Code is used for writing and managing the project code, and any modern web browser like Chrome or Edge can be used to access the website.

VII. CONCLUSION

The HomeCrew system is a web-based platform that helps connect homeowners with local service providers in a simple and organized way. It is built using React for the frontend, PHP for handling the backend logic, and MySQL for storing all the data. Through this website, users can create an account, choose the service they need, and submit a booking request easily. All the details are saved in the database, so there is a proper record of users and bookings. The design of the website is kept simple and clear so that anyone can use it without confusion. Right now, the system mainly focuses on managing service bookings and keeping records organized. Even with these basic features, it helps solve common problems like poor communication and lack of proper tracking. In the future, more features such as online payment or cloud deployment can be added to make the system more advanced and scalable.

VIII. FUTURE SCOPE

Right now, HomeCrew mainly focuses on service booking and storing records properly. But in the future, the system can be improved in many ways. One major improvement could be adding an online payment option so users can pay directly through the website instead of handling payments offline. A rating and review system can also be added so users can share their experience and choose better service providers.

We can also include features like live chat between users and workers to improve communication. Deploying the website on a cloud server would make it more accessible and scalable. In the future, a mobile-friendly or dedicated mobile version of the platform can also be developed.

With these improvements, HomeCrew can become more advanced, user-friendly, and useful for both customers and service providers.

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NEXUS HIRE: EARLY CAREER TECH RECRUITER

A Web-Based System for Intelligent Candidate Screening and Evaluation

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Abstract : Selecting appropriate candidates for entry-level technology roles has become more complex due to the growing number of job applicants. Many companies depend on Applicant Tracking Systems (ATS) to automatically filter and shortlist resumes. However, most traditional ATS tools rely mainly on keyword matching techniques, which can result in inaccurate candidate selection. Applicants may intentionally include certain keywords in their resumes in order to pass the automated screening stage, even when they do not actually possess the required technical abilities. At the same time, some skilled candidates may be rejected simply because their resumes do not contain the exact keywords expected by the system.

This research introduces an intelligent recruitment platform designed to evaluate early-career software engineering candidates by analyzing multiple sources of information. Instead of relying only on keywords found in resumes, the proposed system uses a hybrid evaluation method. It collects technical activity data from developer platforms such as GitHub and coding practice websites like LeetCode to measure programming involvement and problem-solving capability. Natural Language Processing (NLP) techniques are also applied to analyze resume content in order to assess communication ability and confidence. In addition, the system reviews practical experience and the candidate's professional online presence.

By integrating these different evaluation factors, the platform generates a Career Readiness Score (CRS) that helps recruiters identify qualified candidates more accurately. This approach improves recruitment efficiency and reduces the limitations associated with traditional keyword-based screening methods.

INTRODUCTION

In recent years, the need for software engineers and technology specialists has grown rapidly. Due to this increasing demand, organizations often receive a large number of applications for entry-level technical roles. Reviewing such a high volume of resumes manually becomes challenging and requires a significant amount of time for human resource teams.

To make the recruitment process more efficient, many companies rely on **Applicant Tracking Systems (ATS)** that automatically collect, sort, and filter candidate applications. These systems typically analyze resumes by searching for particular technical keywords and then shortlist candidates whose resumes match the required skill terms.

Even though this approach helps speed up the initial screening stage, it also has certain drawbacks. Some applicants deliberately include numerous technical keywords in their resumes even if they do not actually have those skills. This strategy, known as **keyword stuffing**, may cause unqualified candidates to pass the early screening process.

At the same time, skilled developers may not always use the exact words or phrases expected by the system. As a result, their applications might be rejected even though they possess strong technical knowledge. Because of this limitation, conventional ATS

tools sometimes fail to recognize truly capable candidates.



In today's software development industry, technical ability is often reflected through practical activities such as contributions to open-source projects, maintaining coding repositories, and participating in competitive programming challenges. Platforms like GitHub and LeetCode offer useful indicators of a developer's programming involvement and problem-solving capability.

To overcome the weaknesses of traditional recruitment systems, this research introduces an intelligent hiring platform that evaluates candidates using multiple criteria. The system analyzes data from coding platforms, resume content, professional experience, and online profiles. Using this combined information, it calculates a **Career Readiness Score (CRS)** that enables recruiters to identify the most appropriate candidates more effectively.

LITERATURE REVIEW

Automated recruitment systems are commonly used by organizations to make the candidate screening process faster and more efficient. Most traditional Applicant Tracking Systems (ATS) depend mainly on keyword-based filtering methods to shortlist potential candidates. However, several research studies have shown that this approach may lead to inaccurate results because some applicants include specific technical keywords in their resumes even when they do not truly possess those skills.

To address these limitations, researchers have started using advanced technologies such as machine learning, Natural Language Processing (NLP), and data analytics to improve recruitment systems. NLP techniques are capable of analyzing resume content more intelligently by understanding the context and meaning of the information rather than simply identifying matching keywords.

Furthermore, developer platforms like GitHub and coding practice websites such as LeetCode offer useful insights into a programmer's actual technical abilities. Information such as repository contributions, coding activity, and problem-solving performance can provide a clearer picture of a candidate's practical programming skills.

Integrating resume analysis with data collected from coding platforms can greatly enhance the accuracy and reliability of automated recruitment systems. The approach proposed in this research follows this combined method to improve the candidate selection process for individuals who are beginning their careers in the technology field.

PROBLEM STATEMENT

Companies often receive a very large number of applications for entry-level positions in the technology sector. Because of this high volume, reviewing each resume manually becomes slow and inefficient for recruitment teams. To manage this situation, many organizations use Applicant Tracking Systems (ATS) that automatically sort and filter candidate resumes.

However, most conventional ATS tools mainly depend on keyword matching techniques to identify suitable applicants. This approach has several weaknesses because candidates can include technical terms in their resumes even if they do not actually have practical knowledge of those technologies. As a result, applicants with limited real experience may still pass the initial screening stage.

On the other hand, some genuinely skilled candidates may be rejected simply because their resumes do not contain the exact keywords that the system is programmed to detect. In addition, traditional screening systems usually overlook important indicators of technical ability such as contributions to open-source projects, coding repositories, and performance in competitive programming platforms.

Due to these limitations, recruiters may find it difficult to identify the most capable candidates efficiently. Therefore, there is a clear

need for a more advanced recruitment solution that eval

PROPOSED SYSTEM

The proposed system is a web-based recruitment platform developed to improve the screening process for candidates who are beginning their careers in the technology field. The platform enables applicants to upload their resumes and include links to their coding profiles on platforms such as GitHub and other programming websites.

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In contrast to traditional Applicant Tracking Systems that rely mainly on keyword detection, this platform evaluates candidates using multiple parameters. The system reviews GitHub activity to analyze coding contributions, repository involvement, and project participation. It also measures problem-solving skills by collecting information from online coding practice platforms.

The resume content is further examined using Natural Language Processing (NLP) techniques to assess communication quality and clarity. The system also detects practical experiences mentioned in the resume, including internships, academic projects, and previous technical roles.

Additionally, the platform considers the candidate's professional presence on online platforms. All these evaluation aspects are combined to calculate a Career Readiness Score (CRS), which helps recruiters rank applicants more accurately and select the most appropriate candidates for technical positions.

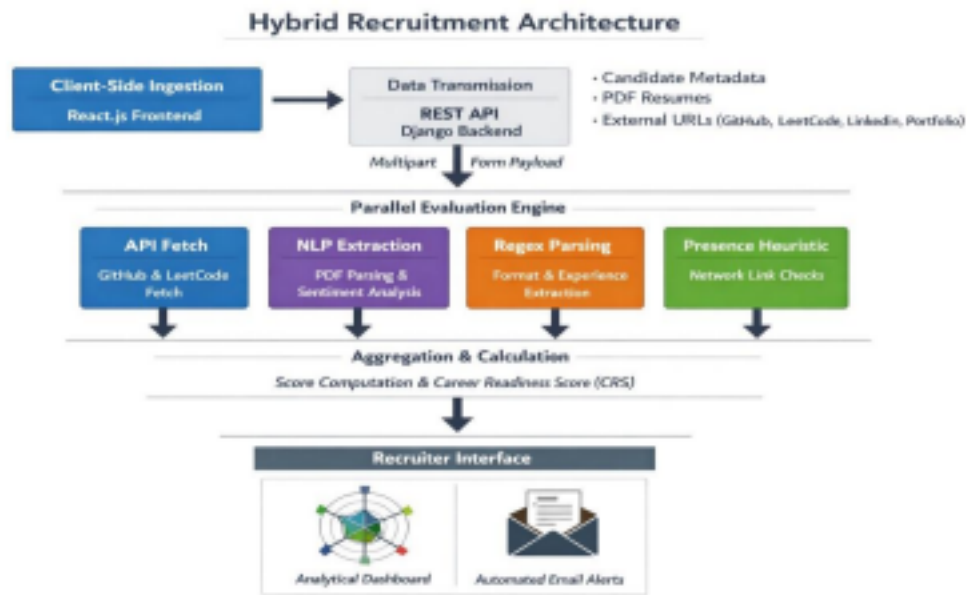
SYSTEM ARCHITECTURE

The proposed recruitment platform is designed using a three-tier architecture to provide organized data management and efficient system processing.

The Presentation Layer serves as the user interface of the application. Through this layer, candidates can upload their resumes and share links to their coding profiles. Recruiters are also able to access candidate evaluation results and rankings using this interface. This layer is developed using common web technologies such as HTML, CSS, and JavaScript.

The Application Layer is responsible for handling the main operations of the system. It processes the uploaded resume data, performs analysis using Natural Language Processing (NLP) techniques, and interacts with external platforms like GitHub to collect technical activity information. This layer also calculates the Career Readiness Score (CRS) by analyzing different evaluation factors.

The Database Layer manages the storage of important information such as candidate profiles, resume details, technical performance data, and evaluation results. A well-structured database ensures secure storage and quick retrieval of data. Overall, this architectural design improves the reliability of the system and makes the recruitment process more organized and efficient.



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IMPLEMENTATION

The development of the proposed recruitment platform involves several important stages, including resume submission, data processing, integration with external platforms, and candidate evaluation.

Initially, applicants create an account on the web application and upload their resumes along with links to their coding profiles. The uploaded resumes are then converted into a text format so that the system can easily analyze the content.

After this, Natural Language Processing (NLP) methods are applied to examine the resume text and evaluate aspects such as communication clarity and confidence. In addition, Regular Expression (Regex) techniques are used to extract key details from the resume, including internships, technical positions, project experience, and duration of involvement.

The system then connects to external coding platforms through APIs to collect information about technical activities, such as repositories, coding contributions, and records of problem-solving performance.

Finally, all the gathered data from different modules is analyzed and combined to generate a Career Readiness Score (CRS). This score helps recruiters compare applicants based on their verified technical skills, practical experience, and communication capabilities.

RESULTS AND DISCUSSION

The proposed recruitment platform was tested using multiple sample candidate profiles to evaluate its ability to identify suitable early-career technology professionals. The main goal of this testing phase was to compare the performance of the developed system with traditional keyword-based Applicant Tracking Systems.

During the evaluation, several candidate profiles were created with differences in resume content, coding activity, and professional presence. One profile included a resume filled with many technical keywords but lacked links to coding platforms or proof of real programming work. Another profile had fewer technical keywords but contained active GitHub repositories, completed projects, and records from coding practice platforms.

In a conventional ATS system, the first candidate would likely be ranked higher because the system focuses mainly on keyword matching. However, the proposed system produced different results since it evaluates candidates based on multiple criteria.

The system analyzed GitHub activity and coding platform records to assess practical programming skills. Resume content was processed using Natural Language Processing methods to evaluate communication quality and structure. Pattern-based analysis was also applied to detect practical experience such as internships, academic projects, or technical roles mentioned in the resume.

After combining the information from these different sources, the system generated a **Career Readiness Score (CRS)** for each candidate. The results showed that candidates with verified coding contributions, real project experience, and strong problem-solving abilities achieved higher scores compared to those whose resumes mainly contained keywords without supporting technical evidence.

These results indicate that the proposed system improves the reliability of candidate evaluation. By considering multiple factors instead of only resume keywords, the platform helps recruiters identify genuinely skilled developers and reduces the possibility of selecting candidates who rely only on keyword optimization.

FUTURE ENHANCEMENTS

The proposed recruitment system can be enhanced further by integrating advanced Artificial Intelligence and Machine Learning technologies. Future versions may include intelligent resume parsing techniques based on deep learning models to better interpret candidate skills and experience.

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The platform could also be expanded by connecting with additional coding and developer platforms such as HackerRank and CodeChef, which would provide more detailed insights into a candidate's programming performance.

Additional features like automated interview scheduling, online assessment modules, and video interview analysis could also be integrated to support recruiters during the hiring process.

Deploying the system on a cloud infrastructure may improve scalability and allow organizations to access the platform from different locations. Developing a mobile application could also enable recruiters to review candidate profiles and evaluation results more conveniently.

These enhancements would further strengthen the system's capability to evaluate candidates accurately and make the recruitment process faster and more effective.

CONCLUSION

This study presents an intelligent recruitment platform developed to improve the screening process for early-career technology professionals. Traditional Applicant Tracking Systems mostly depend on keyword matching techniques, which can sometimes produce inaccurate results and may overlook qualified candidates. The proposed system addresses this limitation by evaluating applicants using multiple parameters, including coding activity, problem-solving ability, resume content, and professional online

presence. By analyzing resume data and collecting technical information from coding platforms, the system generates a Career Readiness Score (CRS) that assists recruiters in identifying candidates with genuine technical skills. Overall, the proposed solution offers a more reliable and efficient approach to candidate evaluation in modern technology recruitment environments.

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TRACKIFY – WEB BASED PROJECT AND TASK MANAGEMENT SYSTEM

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Abstract - In today's organizations and educational institutions, handling employee attendance, task distribution, and leave records through manual methods is inefficient, error-prone, and time-consuming. As digital transformation continues to expand, there is an increasing demand for centralized and automated solutions that enhance transparency, accuracy, and overall productivity. This paper introduces Trackify, a web-based system developed to efficiently manage attendance, tasks, and leave processes using role-based access control, real-time data handling, and comprehensive reporting features.

Trackify offers a unified platform where employees can record attendance, submit leave applications, and track assigned tasks, while managers and administrators can oversee workforce activities, approve requests, and generate detailed analytical reports. The system is built using modern web technologies such as Laravel, a MySQL database, and a responsive user interface to ensure scalability, security, and user friendliness. By automating routine administrative operations, the proposed system minimizes manual effort, supports better decision-making, and significantly improves organizational efficiency.

Keywords: Attendance Management, Task Management, Leave Management, Web Application, Laravel, Role-Based Access Control

1. INTRODUCTION

In the modern, fast-moving professional landscape, organizations encounter numerous challenges in effectively managing workforce operations. Conventional practices for handling attendance records, task assignments, and leave documentation largely depend on manual processes or fragmented software systems. Such methods frequently lead to data inconsistencies, reduced transparency, delayed approval workflows, and difficulties in evaluating employee performance.

As web-based enterprise solutions become more widely adopted, organizations are increasingly shifting toward integrated management systems that offer real-time data access and automate routine administrative tasks. Attendance tracking, task supervision, and leave administration are essential aspects of workforce

management, and inefficiencies in these areas can negatively affect productivity, employee morale, and overall organizational development.

To overcome these challenges, Trackify is introduced as an all-in-one web-based solution designed to centralize attendance, task, and leave management. The system incorporates multiple user roles—such as Employee, Manager, and Administrator—with clearly defined access privileges. By leveraging automation and real-time monitoring, Trackify reduces human errors, enhances transparency, and ensures accountability across all organizational levels.

2. PROBLEM STATEMENT

Despite significant progress in information technology, many organizations continue to depend on semi-manual or fragmented systems to manage attendance and employee-related activities. As a result, several recurring issues can be observed. Manual attendance processes often lead to inaccurate time records and instances of proxy attendance. Leave applications are frequently managed through emails or paper-based forms, which can cause communication gaps and approval delays. Task allocation is commonly performed without proper monitoring mechanisms, resulting in missed deadlines and weak accountability. Additionally, managers face challenges in assessing employee performance due to data being dispersed across multiple platforms. Many existing solutions also fail to provide adequate role-based security and real-time reporting capabilities.

3. OBJECTIVES

The main objective of the Trackify system is to design and develop a reliable web-based platform for efficient workforce management. The specific objectives of the system include automating attendance management through precise check-in and check-out time recording, providing an organized task management mechanism for task assignment, progress tracking, and status updates, and implementing a comprehensive leave management module supported by structured approval workflows.

Additionally, the system aims to enforce role-based access control for employees, managers, and administrators to

ensure proper authorization and responsibility separation. Trackify also focuses on generating real-time reports.

4. SCOPE OF THE PROJECT

The scope of the Trackify system encompasses a comprehensive set of features aimed at effective workforce management. The Attendance Module supports real-time check-in and check-out functionality, automated attendance status calculation, and maintenance of attendance history. The Task Module enables task creation, assignment, progress monitoring, and timely status updates to ensure accountability and productivity. The Leave Module facilitates leave application submission, approval or rejection workflows, and systematic maintenance of leave records.

In addition, the Reporting Module generates detailed attendance summaries, task performance reports, and leave-related analytics to assist management in evaluation and planning. User Management is implemented through role-based access control, providing distinct permissions for employees, managers, and administrators. The system also emphasizes security by incorporating authentication, authorization, and secure data storage mechanisms.

Trackify is primarily designed for small to medium-scale organizations; however, its modular and scalable architecture allows it to be extended to larger enterprises with minimal changes.

5. LITERATURE SURVEY

Numerous studies have explored workforce management systems, emphasizing the role of automation in attendance monitoring, task tracking, and leave administration. Earlier approaches primarily depended on biometric devices or manual record-keeping, which often led to data duplication, inflexibility, and limited adaptability. Recent research highlights the adoption of web-based platforms as an effective solution for enhancing accessibility, accuracy, and operational efficiency.

Research on web-based attendance systems demonstrates that real-time attendance monitoring helps minimize proxy attendance and significantly improves data reliability. Similarly, studies on digital task management systems reveal that automated task assignment and tracking enhance accountability and promote better collaboration among team members. Integrated leave management systems with structured approval workflows have also been shown to reduce administrative delays while improving employee satisfaction.

Despite these advancements, many existing solutions focus on only a single functional area—such as attendance tracking or task management—rather than offering a comprehensive and integrated system. Furthermore, several platforms lack

effective role-based access control, limiting their suitability for organizations with hierarchical structures. Trackify overcomes these limitations by providing a unified web-based platform that integrates multiple workforce management modules with clearly defined user roles and access permissions.

6. SYSTEM ARCHITECTURE

The Trackify system is developed using an enhanced three-tier web-based architecture combined with role-based access control and modular service components. This architectural design ensures scalability, security, maintainability, and efficient coordination among various functional modules, including attendance management, leave management, task tracking, project handling, reporting, and notifications.

The system architecture is closely aligned with the UML Class Diagram and Use Case Diagram, which clearly define both the structural components and functional behavior of the application.

6.1 Presentation Layer

The presentation layer serves as the user interface of the Trackify system and facilitates interaction between users and the application. It provides role-specific dashboards for Employees, Managers, and Administrators, ensuring that users can access only those features permitted by their assigned roles.

This layer is implemented using:

HTML and CSS for page structure and visual styling Blade templating engine for generating dynamic and reusable views. JavaScript for client-side interactivity and validation Through the presentation layer, users can perform various operations such as marking attendance and viewing attendance status, submitting leave applications and tracking approval status, viewing assigned tasks and updating task progress, and monitoring project details and analytical reports. Communication between the presentation layer and the application layer occurs securely through HTTP requests.

6.2 Application Layer

The application layer represents the core processing component of the Trackify system. It is developed using the Laravel PHP framework, which follows the Model-View-Controller (MVC) architectural pattern.

This layer is responsible for processing user requests received from the presentation layer, executing business logic related to attendance, leave, tasks, projects, and reporting, and enforcing authentication and role-based authorization. It also manages data validation, workflow

rules, calculations such as leave status and salary-related logic, and generates system notifications and reports. Controllers, services, and models implemented within this layer directly correspond to the entities and relationships defined in the UML Class Diagram, ensuring consistency between system design and implementation.

6.3 Database Layer

The database layer is responsible for storing and managing all persistent data used by the Trackify system. It utilizes MySQL as the relational database management system to provide reliable and efficient data storage.

This layer maintains structured data for user profiles and role assignments, attendance records with check-in and check-out timestamps, leave applications and approval histories, task allocations and project status information, as well as system-generated reports and notifications. Relational constraints, indexing mechanisms, and validation rules are applied to maintain data integrity, accuracy, and consistency.

6.4 Architectural Integration with UML Design

The three-tier architecture of Trackify is reinforced and validated through UML modeling techniques. The Class Diagram illustrates the static structure of the system and aligns with both database entities and application logic, while the Use Case Diagram represents interactions between different user roles and system functionalities.

This integrated architectural approach ensures that the Trackify system remains modular, scalable, and adaptable to future enhancements and organizational requirements.

7. UML DESIGN

7.1 Class Diagram

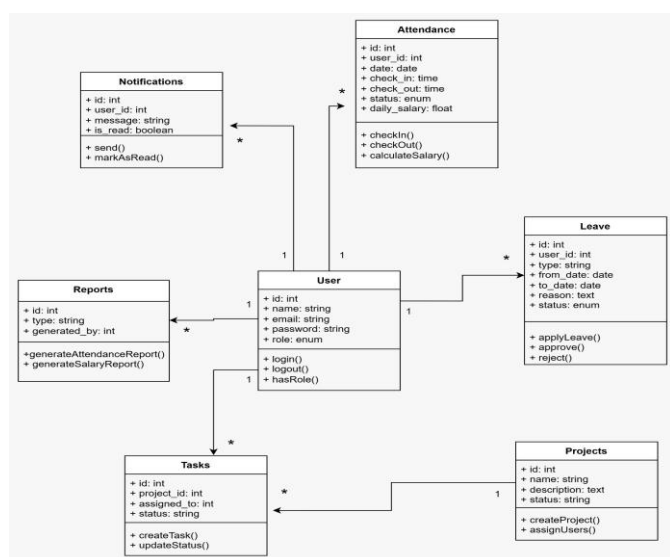


Fig - 7.1: Class Diagram of Trackify System

The Class Diagram illustrates the static structure of the Trackify system by defining its classes, attributes, methods, and the relationships among them. It offers a comprehensive view of how data is structured within the system and how various components interact with one another.

In the Trackify system, the User class serves as the core entity, representing all types of users, including Employees, Managers, and Administrators. Each user interacts with multiple functional modules such as Attendance, Leave, Tasks, Projects, Reports, and Notifications. This centralized user-centric design ensures consistent data management and smooth interaction across all system modules.

7.1. Use- Case Diagram

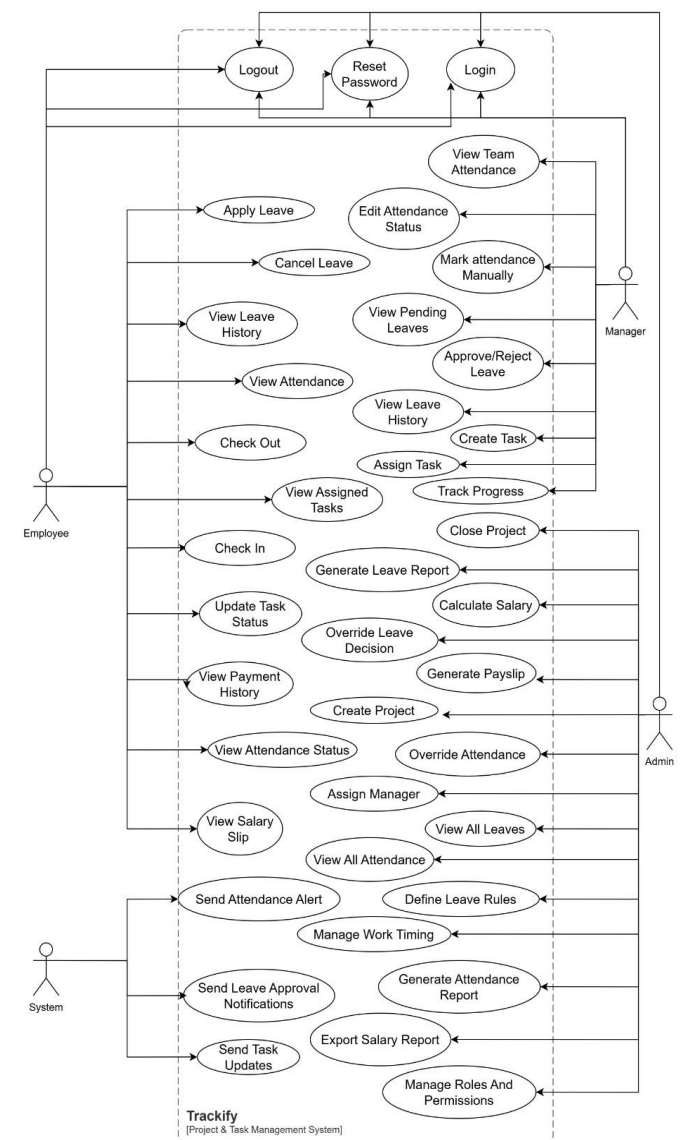


Fig - 7.2: Use Case Diagram of Trackify System

The Use Case Diagram represents the functional behavior of the Trackify system by depicting the interactions between various actors and system features. It clearly defines the actions that each user role—such as Employee, Manager, and Administrator—can perform and illustrates how these roles interact with the system to accomplish specific tasks.

8. MODULE DESCRIPTION

The Trackify system is structured into eight core functional modules, each addressing a specific organizational need. These modules operate in coordination to deliver a comprehensive web-based solution for employee and project management.

8.1 User Management Module

The User Management Module manages user registration, authentication, and authorization processes. Each user is assigned a predefined role such as Employee, Manager, or Administrator, and system access is governed according to these roles. This module ensures secure authentication, password protection, and strict role-based access control, thereby preventing unauthorized access to sensitive information.

8.2 Attendance Management Module

The Attendance Management Module enables employees to record daily attendance using a check-in and check-out mechanism. The system captures exact timestamps and automatically classifies attendance status—such as Present, Late, Half-Day, or absent—based on predefined organizational rules. Managers and administrators can view attendance summaries, modify records when necessary, and generate detailed attendance reports.

8.3 Task Management Module

The Task Management Module allows managers to allocate tasks to employees with clearly defined deadlines, priorities, and task descriptions. Employees can access assigned tasks, update progress, and change task status accordingly. This module enhances accountability, supports timely task completion, and improves transparency in daily work activities.

8.4 Project Management Module

The Project Management Module enables administrators and managers to create, manage, and monitor projects. Tasks are linked to specific projects, allowing structured project tracking. This module supports real-time monitoring of project progress, identification of delays or bottlenecks, and effective utilization of organizational resources. Project statuses such as ongoing, completed, or delayed can be tracked efficiently.

8.5 Leave Management Module

The Leave Management Module facilitates employee leave applications for various categories such as Casual Leave, Sick Leave, and Paid Leave. Leave requests are forwarded to managers for approval or rejection, while administrators can analyze leave trends and maintain complete leave histories. This module reduces manual paperwork and ensures compliance with organizational leave policies.

8.6 Notification Module

The Notification Module delivers real-time alerts and system updates to users. Notifications are triggered for key events including task assignments, leave approval or rejection, attendance status changes, and important announcements. This module enhances internal communication and ensures users remain informed about critical actions and deadlines.

8.7 Reports and Analytics Module

The Reports and Analytics Module generates comprehensive reports related to attendance, task performance, project status, productivity metrics, and leave statistics. These reports assist managers and administrators in evaluating employee performance and organizational efficiency. Summarized insights and visual representations support informed decision-making.

8.8 Settings and Configuration Module

The Settings and Configuration Module allows administrators to define and manage system-level parameters such as working hours, attendance policies, leave rules, and organizational details. While managers and employees can view configuration settings, modification privileges are restricted to administrators only. This module ensures system flexibility and adaptability to evolving organizational requirements.

9. ROLE-BASED ACCESS CONTROL

The Trackify system incorporates role-based access control to ensure secure and authorized usage of system functionalities. Employees are permitted to access only their personal data, whereas managers are granted access to view and manage information related to their respective teams. Administrators possess complete system privileges, including user administration and report generation. This hierarchical access structure prevents unauthorized operations and safeguards data confidentiality.

10. ADVANTAGES OF THE PROPOSED SYSTEM

The proposed Trackify system provides several significant benefits. It minimizes manual workload and reduces paperwork by automating routine processes. The system enhances accuracy and transparency in attendance and leave management, thereby reducing errors

and inconsistencies. Productivity is improved through efficient task allocation and tracking mechanisms. Additionally, real-time reporting supports informed managerial decision-making, while role-based access control ensures secure access to system resources.

11. TECHNOLOGIES USED

The Trackify system is implemented using contemporary web technologies to ensure scalability, security, and long-term maintainability. The chosen technology stack supports rapid application development, effective role-based access control, and efficient real-time data processing.

11.1 Front-End Technologies

The user interface of the Trackify system is developed using HTML5, CSS3, and JavaScript. HTML5 defines the structural layout of the web pages, while CSS3 is utilized to create responsive and visually engaging designs. JavaScript enables interactive features such as dynamic forms, live updates, and client-side input validation. Additionally, the Blade templating engine is employed to seamlessly integrate front-end components with backend functionality.

11.2 Back-End Technologies

The backend of the Trackify system is built using PHP with the Laravel framework. Laravel follows the Model-View-Controller (MVC) architectural pattern, which enhances code readability, modularity, and maintainability. It provides built-in support for essential features such as authentication, authorization, routing, middleware handling, and form validation, making it well-suited for enterprise-grade web applications.

11.3 Database Technology

MySQL is used as the relational database management system to store user profiles, attendance logs, task details, project data, leave records, and system reports. The database design follows normalization principles to minimize redundancy and maintain data consistency. Laravel's Eloquent ORM facilitates secure and efficient database operations through an object-oriented approach.

11.4 Development Tools

XAMPP serves as the local development environment, offering an integrated setup of the Apache web server, MySQL database, and PHP interpreter. Visual Studio Code is used as the primary development editor due to its extensive extension ecosystem and debugging capabilities. Git is utilized for version control to manage source code changes and support collaborative development.

11.5 Deployment Environment

The Trackify system is designed for deployment on cloud-based or shared hosting platforms that support PHP and MySQL. The deployment process involves environment configuration, database migration, and implementation of security measures to ensure reliable and secure operation in a production environment.

12. IMPLEMENTATION DETAILS

The implementation of the Trackify system follows a modular and role-oriented design approach. Each functional module is developed independently and then integrated to operate cohesively as a unified system.

12.1 User Management Implementation

User authentication is handled using Laravel's built-in authentication mechanisms. Role-based access control is implemented through middleware to ensure that Employees, Managers, and Administrators can access only the functionalities permitted to their roles. User passwords are securely stored using standard hashing techniques to maintain data security.

12.2 Attendance Management Implementation

The Attendance Management Module captures real-time check-in and check-out timestamps using server-side time to eliminate the possibility of manual manipulation. Attendance status is automatically determined based on predefined organizational rules. Managers and administrators are granted additional privileges to review, verify, or modify attendance records when necessary.

12.3 Task, Project Management Implementation

Projects are created and managed by administrators and managers, with tasks assigned to employees under specific projects. Each task includes attributes such as priority level, deadline, and current status. Employees update task progress, which is reflected in consolidated project summaries, enabling effective monitoring of work progress and team performance.

12.4 Leave Management Implementation

Employees submit leave applications through structured forms that capture details such as leave type, duration, and reason. These requests are stored in the database and forwarded to managers for approval or rejection. Any change in leave status automatically updates records and notifies the employee through the notification system.

12.5 Notification System Implementation

The Notification Module utilizes database-driven notifications to alert users about important system events,

including attendance updates, task assignments, and leave approval decisions. Notifications are displayed in real time on the user dashboard to ensure timely and effective communication.

12.6 Reports and Analytics Implementation

The Reports and Analytics Module generates comprehensive attendance reports, leave summaries, task performance indicators, and productivity insights. Database queries are optimized to efficiently handle large volumes of data. Reports can be viewed within the system or exported for administrative and record-keeping purposes.

11.7 Settings and Configuration Implementation

The Settings and Configuration Module enables administrators to define system-wide parameters such as office working hours, attendance policies, and leave rules. These settings dynamically influence system behavior without requiring changes to the application source code, ensuring flexibility and ease of management.

13. TESTING AND VALIDATION

Testing and validation play a vital role in ensuring the reliability, accuracy, and overall performance of the Trackify system. Various testing methodologies are applied at different stages of development to verify system correctness and stability.

1.1 Unit Testing

Unit testing is carried out on individual components such as attendance status calculation, leave approval logic, and task status updates. Each module is tested independently to confirm that it performs its intended function correctly. This approach helps in detecting and resolving issues at an early stage of development.

13.2 Integration Testing

Integration testing is conducted to verify proper interaction and data flow between different modules of the system. Scenarios such as attendance data generation in reports and the integration of leave approvals with the notification system are tested to ensure consistency and seamless module interaction.

13.3 System Testing

System testing involves evaluating the complete application in a simulated real-world environment. All user roles—including employees, managers, and administrators—perform their respective operations to ensure that the system functions correctly under both normal and peak workload conditions.

13.4 User Acceptance Testing (UAT)

User Acceptance Testing is performed by allowing end users, such as employees and managers, to interact with the system. Feedback collected during this phase is used to make minor usability enhancements, improving overall user experience and system acceptance.

13.5 Validation Results

All defined test cases were executed successfully, and the system satisfied both functional and non-functional requirements identified during the requirement analysis phase. The Trackify system demonstrated high levels of accuracy, reliability, and user friendliness.

14. Conclusion

The Trackify system effectively addresses the key challenges faced by organizations in managing attendance, tasks, projects, leave processes, notifications, reporting, and user roles through a unified web-based platform. Conventional manual methods and isolated software tools often result in operational inefficiencies, data inconsistency, limited transparency, and increased administrative burden. Trackify successfully overcomes these challenges by offering a centralized, automated, and role-based workforce management solution.

The system is developed using a modular architecture that enables seamless interaction among various functional modules, including attendance management, task tracking, project monitoring, leave processing, notifications, reporting, and system configuration. The adoption of modern web technologies ensures scalability, security, and ease of use. Role-based access control clearly defines permissions for employees, managers, and administrators, thereby minimizing unauthorized access and reducing operational errors.

Real-time attendance tracking with accurate check-in and check-out timestamps enhances accountability and prevents time manipulation. Automated leave approval workflows improve transparency and significantly reduce delays in decision-making. Task and project management features provide better visibility into employee productivity and project progress, while the reporting and analytics module supports informed managerial decisions through comprehensive summaries and insights.

Extensive testing and validation confirm that the Trackify system performs reliably across various usage scenarios. The system satisfies all functional and non-functional requirements and demonstrates strong potential for deployment in educational institutions, small-to-medium enterprises, and corporate environments.

15. Future Scope

Although Trackify successfully fulfills its current objectives, there is considerable scope for future enhancements to further expand its functionality and adaptability.

Future developments may include the integration of biometric and facial recognition-based attendance mechanisms to improve accuracy and eliminate proxy attendance. The development of mobile applications for Android and iOS platforms can enhance accessibility and allow users to manage attendance, tasks, and leave requests remotely.

Advanced analytics and artificial intelligence techniques can be incorporated to predict employee performance trends, analyze leave patterns, and identify potential project risks. Machine learning models may also be employed to provide intelligent recommendations for workload distribution and productivity optimization.

Integration with payroll systems can automate salary calculations based on attendance records, leave data, and overtime, thereby reducing manual processing. Additionally, connectivity with third-party communication services such as email, SMS, and messaging platforms can strengthen notification delivery and communication efficiency.

Adopting cloud-based deployment and microservices architecture can further improve system scalability, reliability, and performance for large-scale organizations. Enhanced security features such as two-factor authentication, audit logging, and advanced access monitoring can also be implemented to strengthen data protection.

With these future enhancements, Trackify has the potential to evolve into a comprehensive enterprise resource management platform capable of supporting complex and dynamic organizational requirements.

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WATER POLLUTION DETECTION AND ALERT GENERATION SYSTEM THROUGH AI

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ABSTRACT

This study seeks to project how successful a particular intervention will be. Wastewater Treatment Facilities (WWTP) using Models for convolutional neural networks (CNNs). It is used to assess design, modeling, other process management aspects as well as performance at wastewater treatment plants (WWTP). Using a feed forward back propagation technique, this study uses data gathered at the time of implantation for chemo biochemical oxygen demand (BOD), chemical oxygen demand (COD), pH, total suspended solids (TSS), and biochemical oxygen demand (BOD) temperature (T), among other parameters, to project the result of the implantation. The color of the water is influenced by variables including temperature, dissolved solids overall, dissolved oxygen, soluble solids, and other instances. These are some methods that would lower the expense of live streaming water pollution: Detecting methods and the CNN method for assessing the stability of the ecological equilibrium: Because there are many potential sources of pollution, The performs is improved using internet of things solutions. CNN models detect water pollution depending on the quantity of pollutants and the water color. computer vision, pollution chemicals

Keywords: Convolutional Neural Network, Deep Learning, Computer Vision, Pollution Chemicals.

I. INTRODUCTION

Water quality deterioration has emerged as a major global issue as a result of rapid industrial development, urban growth, and environmental changes associated with climate variability. Polluted water bodies pose serious risks to aquatic life and can also negatively affect human health. For this reason, continuous monitoring and timely identification of contaminants in water resources have become extremely important. Traditional water quality monitoring techniques mainly rely on manual collection of samples, laboratory-based testing procedures, and expert analysis of results. Although these methods provide reliable measurements, they suffer from several limitations such as high operational expenses, delays in obtaining results, restricted monitoring coverage across different locations and time periods, and significant reliance on human intervention. With the advancement of Artificial Intelligence (AI), new opportunities have emerged for developing automated and intelligent environmental monitoring systems. In particular, deep learning techniques have shown remarkable success in tasks related to image processing and pattern recognition. Among these methods, Convolutional Neural Networks (CNNs) are widely used due to their ability to learn complex visual patterns directly from raw image data.

CNN models are capable of extracting hierarchical spatial features from images, which makes them highly effective for identifying visual indicators of water contamination. Such indicators may include changes in color, turbidity levels, or visible surface pollutants. In this context, the present study introduces an AI-based framework that utilizes Convolutional Neural Networks for the automatic detection and estimation of water pollution. The proposed approach aims to improve monitoring efficiency by enabling faster, more accurate, and automated assessment of water quality.

II. METHODOLOGY

In large-scale water monitoring infrastructures, efficient resource management and proper task distribution among sensor nodes are critical for maintaining system performance. Optimization techniques play a significant role in improving network efficiency while also extending the operational lifetime of sensor-based monitoring systems.

Jia et al. (2024) proposed a Chaotic Quantum Grey Wolf Optimization (CQGW) algorithm to improve task scheduling in water quality monitoring networks. Their method demonstrated improved energy efficiency and longer network lifespan compared with conventional optimization approaches.

Sudriani et al. (2023) emphasized the importance of integrating multiple environmental data sources to support effective watershed management. Their research suggests combining sensor data with hydrological models and environmental databases to build a more comprehensive and sustainable monitoring framework.

These studies underline the importance of scalability, efficiency, and coordinated resource management in distributed water monitoring networks.

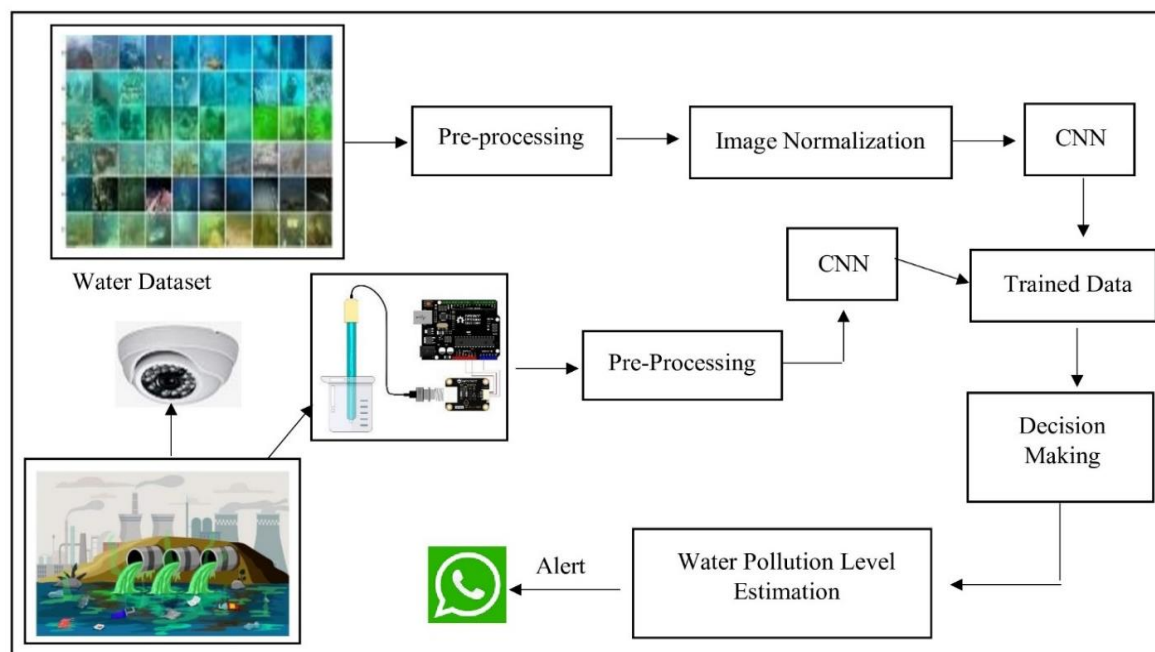


Figure 1: System Overview

III. MODELING AND ANALYSIS

Water quality monitoring in real time has been significantly improved by advancements in cloud computing, networking, and sensing technologies. Ajayi et al. (2022), for example, created Water Net, a distributed monitoring system based on sensors that is intended for use in both drinking water and irrigation systems. Their framework uses cloud-based analytical tools in conjunction with wireless communication to aid in decision-making. The system allows for scalable deployment and the monitoring of a variety of water quality indicators, including temperature, turbidity, pH, and electrical conductivity.

In a similar vein, Kumar et al. (2024) created a cutting-edge monitoring system to aid in environmental preservation and pond ecosystem management. Their solution uses sensor nodes that are connected to cloud dashboards, enabling real-time data visualization and automated alert notifications when unusual circumstances arise.

Similarly, Nishan et al. (2024) suggested a hierarchical monitoring architecture made for industrial wastewater systems. Their model comprises numerous layers of data collection devices, edge-level data processing, and centralized storage infrastructure.

Quevy et al. (2023) also made a significant contribution by creating an open sensing platform designed for affordable, long-term monitoring of water quality. Their strategy prioritized modular hardware components and open-source software frameworks in order to facilitate versatile installation while maintaining dependable measurement accuracy.

These studies, taken as a whole, highlight the necessity of having well-designed monitoring structures in current water quality management systems. They facilitate distributed sensing, integration with cloud platforms, and flexible implementation in a variety of environmental conditions.

IV. RESULTS AND DISCUSSION

Recent studies indicate several emerging trends that are influencing the development of modern water quality monitoring technologies.

One major trend is the integration of Internet of Things (IoT) devices with cloud computing platforms, which enables continuous and real-time monitoring of water resources. Researchers are also focusing on the development of advanced sensing technologies, including Surface Acoustic Wave (SAW) sensors, nano-electrode arrays, and satellite-based remote sensing methods.

Another important direction is the application of artificial intelligence techniques for pollution prediction, anomaly detection, and decision-support systems. Optimization algorithms are also being used to reduce energy consumption and improve task scheduling in sensor networks.

Additionally, security mechanisms are being implemented to protect critical water infrastructure from cyber threats. Finally, researchers are increasingly focusing on sustainable monitoring frameworks that incorporate environmental intelligence and long-term resource management strategies.

V. CONCLUSION

Pollution of water sources poses significant threats to both public well-being and ecological balance. The initiative demonstrates that integrating artificial intelligence with instantaneous water sensor data enables swift and precise detection of pollutants. The apparatus tracks indicators such as pH level, clarity of water, dissolved solids content, and temperature; it then detects any deviations indicating contaminated water and promptly notifies users via alert systems.

An automated monitoring tool enables officials to swiftly intervene and mitigate additional harm. In summary, this undertaking offers an intelligent, economical, dependable method for enhancing water purity surveillance while safeguarding aquatic resources.

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ONLINE VOTING APP

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ABSTRACT

An Online Voting App is a web/mobile-based application designed to simplify and modernize the process of conducting elections. The App provides users with a secure and user-friendly interface to register, log in, and cast their votes remotely. It aims to serve as a reliable platform for conducting elections by ensuring transparency, accuracy, and efficiency in the voting process.

The App is developed using modern technologies to ensure scalability, responsiveness, and secure data handling. Users can authenticate themselves, view the list of candidates, and vote for their preferred choice. The application includes features such as user authentication, vote management, and result generation to enhance the overall voting experience. Special attention is given to security mechanisms to prevent unauthorized access and multiple voting.

The Online Voting App addresses common challenges faced in traditional voting methods, such as long queues, time consumption, and the possibility of human errors. By providing a centralized digital platform, it reduces manual effort and increases participation by allowing users to vote from any location. The project demonstrates the practical implementation of application development concepts and highlights the importance of secure digital solutions in modern electoral processes.

I. INTRODUCTION

An Online Voting App is a digital platform that allows users to cast their votes easily, quickly, and securely. In today's world, technology is being widely used to simplify traditional processes, and voting is one of the most important areas where digital transformation can make a significant impact. Traditional voting methods often require physical presence at polling stations, which can be time-consuming and inconvenient for many voters.

The app allows users to register, log in, and participate in elections from any location using a web or mobile application. Voters can view the list of candidates and cast their vote securely through the app. The platform ensures that each user can vote only once and maintains the integrity of the voting process. It also provides features such as vote counting and result display, making the process faster and more efficient.

The main goal of the Online Voting App is to simplify the voting process by providing a user-friendly and secure platform. It reduces the need for manual effort, minimizes errors, and increases accessibility for users. By saving time and ensuring transparency, the app improves the overall voting experience and demonstrates the importance of digital solutions in modern election systems.

II. LITERATURE REVIEW

The evolution of the internet and digital technologies has significantly influenced various sectors, including the electoral process. Earlier, voting was conducted using traditional methods such as paper ballots and physical polling booths, which were time-consuming, resource-intensive, and sometimes prone to human errors. With the introduction of electronic and online voting methods, the process has become faster, more efficient, and accessible from remote locations.

Many researchers have studied the design and development of online voting applications. These studies highlight the importance of providing a secure and centralized platform where users can authenticate themselves and cast their votes safely. The integration of authentication mechanisms and vote management systems reduces manual effort and improves the overall efficiency of elections.

Existing online voting applications focus on key functionalities such as user registration, secure login, candidate listing, vote casting, and result management. Research shows that strong authentication methods and data security techniques are essential for maintaining user trust and preventing unauthorized access. Ensuring that each user can vote only once is a critical requirement in such systems.

Furthermore, advancements in technology have introduced features such as biometric authentication, blockchain-based voting, and real-time result analysis. These technologies help in improving transparency, security, and reliability of the voting process. The use of responsive application design ensures that voting platforms can be accessed through various devices such as smartphones, tablets, and computers.

Database management systems play a vital role in handling large amounts of voter and election data efficiently. Technologies such as MySQL, Firebase, and cloud storage are commonly used to ensure data consistency, scalability, and performance. Backend systems help in managing user data, vote records, and communication between the application interface and the database.

However, existing systems also face several limitations. These include security vulnerabilities, risk of data manipulation, lack of user awareness, and dependency on internet connectivity. Some systems may also have issues related to privacy and authentication reliability.

Based on the analysis of existing research and applications, the Online Voting App is developed to address these challenges. It aims to provide a secure, efficient, and user-friendly platform that ensures fair and transparent voting. The app focuses on improving accessibility, reducing manual effort, and enhancing the reliability of the election process.

This literature review provides a strong foundation for the development of the Online Voting App and highlights the importance of continuous improvement using modern technologies in digital voting systems.

III. METHODOLOGY

The development of the Online Voting App follows a structured and systematic approach to ensure efficiency, security, and reliability. The methodology includes the following phases:

I. Requirement Analysis:

In this phase, all functional and non-functional requirements are identified. User requirements such as registration, login, viewing candidates, casting votes, and viewing results are defined. Non-functional requirements like security, performance, usability, and data privacy are also analyzed.

II. Feasibility Study:

A feasibility study is conducted to evaluate whether the app is technically, economically, and operationally viable. This ensures that the app can be developed using available resources, technology, and within the given time frame.

III. System Design:

The overall app architecture is designed, including database structure, user interface, and navigation flow. Wireframes and layout designs are created to ensure a smooth and user-friendly experience for voters and administrators.

IV. Development:

The app is developed using suitable technologies for frontend and backend. The user interface is designed to be simple and responsive, while backend development manages user authentication, vote recording, and data processing. Database integration is implemented to store user details, votes, and election information securely.

V. Integration:

All modules, including user registration, authentication, candidate listing, vote casting, and result management, are integrated to work together as a complete application.

VI. Testing:

Different testing methods such as unit testing, integration testing, and system testing are carried out to identify and fix errors. This ensures the app functions correctly, securely, and efficiently under different conditions.

VII. Deployment:

After successful testing, the Online Voting App is deployed on a server or platform, making it accessible to users via the internet.

VIII. Maintenance:

After deployment, the app is regularly monitored and maintained. Bugs are fixed, performance is optimized, and new features are added based on user feedback and future requirements.

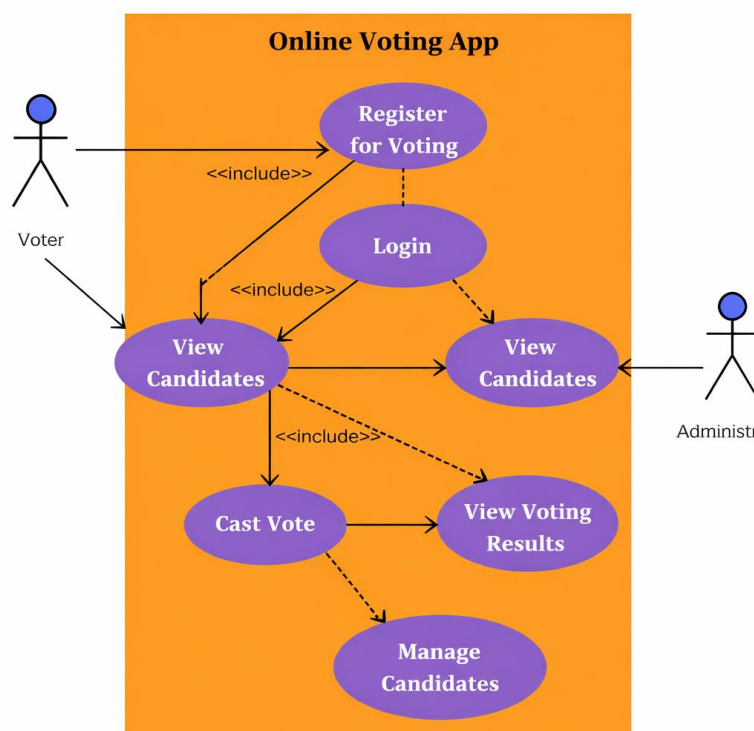


Figure 1: Block Dagram of Smart Helmet System

IV. MODELING AND ANALYSIS

The modeling and analysis phase focuses on designing the structure and understanding the behavior of the Online Voting App to ensure secure performance, reliability, and user satisfaction.

1. System Modeling:

The app is modeled using diagrams such as Use Case Diagrams, Data Flow Diagrams (DFD), and Entity Relationship (ER) Diagrams. These models represent interactions between users and the app, flow of data, and the overall database structure.

2. Use Case Analysis:

This identifies the main users of the app, such as Voter and Admin.

- **Voter:** Register, login, view candidates, cast vote, view results
- **Admin:** Manage users, add/edit candidates, monitor votes, declare results

3. Data Flow Analysis:

This describes how data flows within the app, including user input, processing, storage, and output. It ensures smooth communication between the frontend interface, backend logic, and database.

4. Database Design (ER Model):

The database includes entities such as Users, Candidates, Votes, and Results along with their relationships. This ensures secure storage, proper data management, and accurate retrieval of voting information.

5. System Analysis:

The app is analyzed based on performance, usability, and security. It helps identify potential issues such as unauthorized access, duplicate voting, and system errors, and improves overall efficiency and reliability.

V. RESULTS AND DISCUSSION

The Online Voting App was successfully developed and tested to provide a secure and user-friendly voting experience. The app enables users to register, log in, view candidates, and cast their votes efficiently from any location.

Results:

The app effectively performs all core functions, including user authentication, candidate viewing, and vote casting. The interface is simple and easy to navigate, ensuring a smooth user experience. The app ensures that votes are recorded correctly and stored securely in the database. It also prevents duplicate voting by restricting each user to vote only once.

Discussion:

The app simplifies the voting process by providing a digital platform that eliminates the need for physical presence at polling stations. It saves time and reduces manual effort while increasing accessibility for users. The centralized system improves transparency and efficiency in managing elections.

However, the app also has some limitations, such as dependency on internet connectivity and basic security implementation. Future improvements can include advanced security features, better authentication methods, and enhanced performance to make the app more reliable and scalable.

VI. FUTURE SCOPE

The Online Voting App has strong potential for future enhancements to improve security, functionality, and user experience. The following areas can be considered for future development:

1. Biometric Authentication

Integration of fingerprint or facial recognition to ensure secure and reliable user verification.

2. Blockchain-Based Voting

Implementation of blockchain technology to provide a transparent, tamper-proof, and highly secure voting process.

3. Two-Factor Authentication (2FA)

Adding OTP or email verification to enhance login security and prevent unauthorized access.

4. Mobile Application Enhancement

Improving the app with better UI/UX and expanding support for different devices and platforms.

5. Real-Time Result Processing

Displaying live voting results with accurate and fast vote counting mechanisms.

6. Multilingual Support

Providing multiple language options to make the app accessible to a wider range of users.

7. Cloud Integration

Using cloud services for better scalability, data backup, and performance improvement.

8. Advanced Security Features

Implementing encryption techniques to protect user data and voting information.

9. Admin Dashboard

Developing a detailed dashboard for administrators to manage elections, monitor voting activity, and analyze results.

10.Voter Verification System

Integration with national ID systems (such as Aadhaar) for authentic user verification.

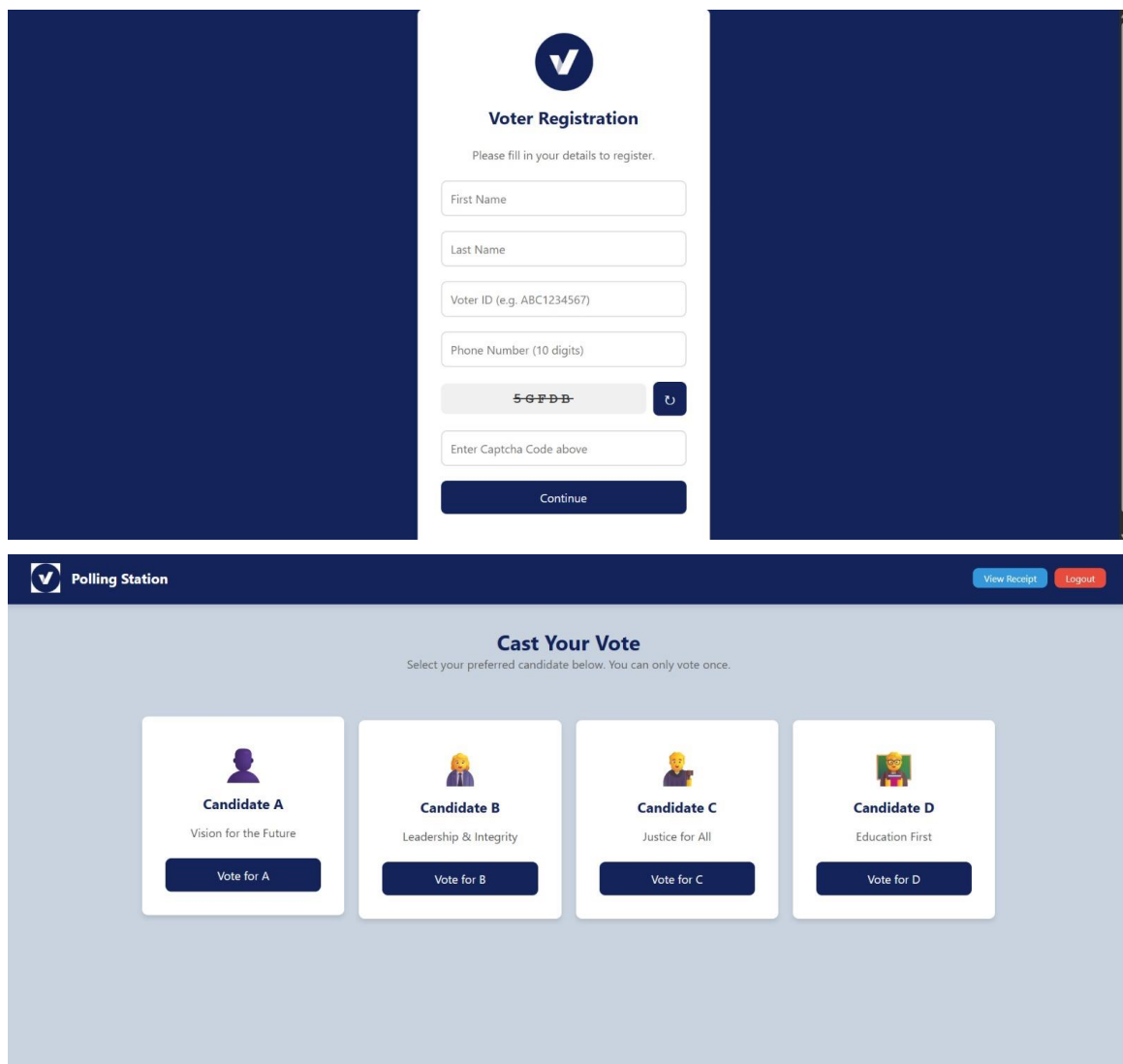
11.Offline Voting Support

Developing mechanisms to allow voting in low or no internet connectivity areas.

12.AI-Based Fraud Detection

Using artificial intelligence to detect suspicious activities and prevent fraudulent voting.

VII. SNAPSHOT



The screenshot displays two screens of the Online Voting App. The top screen is the 'Voter Registration' page, which features a central white card on a dark blue background. The card has a 'V' logo at the top, followed by the title 'Voter Registration' and the instruction 'Please fill in your details to register.' Below this are five input fields: 'First Name', 'Last Name', 'Voter ID (e.g. ABC1234567)', 'Phone Number (10 digits)', and a CAPTCHA field with the text '5-G-F-D-B-'. A 'Continue' button is at the bottom of the card. The bottom screen is the 'Polling Station' page, which has a dark blue header with a 'V' logo and the text 'Polling Station'. On the right side of the header are 'View Receipt' and 'Logout' buttons. The main content area is light blue and titled 'Cast Your Vote' with the instruction 'Select your preferred candidate below. You can only vote once.' Below this are four white cards, each representing a candidate: 'Candidate A' (Vision for the Future), 'Candidate B' (Leadership & Integrity), 'Candidate C' (Justice for All), and 'Candidate D' (Education First). Each card has a 'Vote for [Candidate]' button at the bottom.

VIII. CONCLUSION

The Online Voting App is an effective digital solution that simplifies and modernizes the voting process. It provides users with a secure and user-friendly platform to register, log in, view candidates, and cast their votes efficiently from any location. The app includes essential features such as user authentication, candidate management, and vote recording in a single platform.

The app improves the overall voting experience by offering a simple interface, secure access, and quick processing of votes. It reduces the need for manual effort, minimizes errors, and increases accessibility for users. By enabling remote voting, it saves time and encourages greater participation in the electoral process.

Overall, the Online Voting App works effectively and demonstrates how digital technology can improve traditional voting methods. With further enhancements in security, scalability, and advanced features, the app can be developed into a more robust and reliable voting solution for real-world applications.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to all those who supported and guided me throughout the development of the Online Voting App project.

I am especially thankful to my project guide for their valuable guidance, continuous support, and encouragement, which helped me successfully complete this project.

Their suggestions and insights were extremely helpful in improving the quality of my work. I would also like to thank the faculty members of my department for providing the necessary resources and knowledge required for this project.

Finally, I am grateful to my friends and family for their constant support and motivation during the project development.

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Travellomania

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ABSTRACT

Travellomania is a web-based travel planning and booking platform designed to simplify the process of exploring, planning, and managing trips. The website provides users with an interactive and user-friendly interface to search for destinations, view travel packages, and make bookings efficiently. It aims to serve as a one-stop solution for travelers by integrating essential services such as destination information, itinerary planning, hotel booking, and user reviews.

The system is developed using modern web technologies to ensure responsiveness, scalability, and secure data handling. Users can register, log in, browse various travel options, and customize their travel plans according to their preferences and budget. The platform also includes features like real-time availability, booking management, and feedback systems to enhance user experience.

Travellomania addresses common challenges faced by travelers, such as the lack of organized information and difficulty in comparing travel options. By providing a centralized platform, it reduces time and effort while improving decision-making. The project demonstrates the practical implementation of web development concepts and highlights the importance of digital solutions in the tourism industry.

I. INTRODUCTION

Travellomania is a website that helps people plan their trips easily, quickly, and conveniently. In today's world, more people use online tools to find travel options, compare deals, and book their trips without going to travel agencies in person. Travellomania brings all travel services together in one place, making it easier for users to manage everything they need for their trips.

The site lets users sign up, log in, look at different places to visit, see travel packages, and book trips based on what they like and how much they want to spend. It also gives detailed info about places, hotels, and what other travelers have said, which helps people make better choices.

The main goal of Travellomania is to simplify the process of planning a trip by offering an easy-to-use website and good services.

It makes traveling more enjoyable by saving time, giving clear information, and making it simple to find what you need for your trip.

II. LITERATURE REVIEW

The evolution of the internet and digital technologies has greatly influenced the travel and tourism sector. Earlier, travelers relied on manual booking systems and travel agents, which were time-consuming and less flexible. With the introduction of web-based systems, the process has become faster, more efficient, and easily accessible from anywhere.

Many researchers have studied the design and development of online travel management systems. These studies highlight the importance of providing a centralized platform where users can access multiple services such as destination information, hotel booking, transport facilities, and customer reviews. The integration of these services reduces user effort and improves overall efficiency.

Existing travel websites focus on key functionalities such as search filters, price comparison, booking management, and user feedback. Research shows that providing accurate and up-to-date information is essential for building user trust. Secure authentication and payment gateways are also critical components in ensuring safe transactions.

Furthermore, advancements in technology have introduced features like recommendation systems, AI-based chat support, and data analytics. These features help in understanding user behavior and providing personalized travel suggestions. The use of responsive web design ensures that websites function properly on different devices such as mobiles, tablets, and desktops.

Database management systems play a vital role in handling large amounts of travel-related data efficiently. Technologies such as MySQL and cloud storage are widely used to maintain data consistency, scalability, and performance. Backend frameworks help in managing server-side operations and ensure smooth communication between the user interface and database.

However, literature also identifies several limitations in existing systems. These include poor user interface design, slow performance, lack of customization, and dependency on multiple platforms for different services. Some systems also face issues related to data security and privacy.

Based on the analysis of existing research and systems, Travellomania is developed to address these gaps. It aims to provide an integrated, secure, and user-friendly platform that combines all travel-related services in one place. The system focuses on improving usability, efficiency, and accessibility, thereby enhancing the overall experience of users in planning and booking their trips.

This literature review provides a strong foundation for the development of the Travellomania website and highlights the importance of continuous improvement using modern technologies in the travel industry.

III. METHODOLOGY

The development of the Travellomania website follows a structured and systematic approach to ensure efficiency, reliability, and user satisfaction. The methodology includes the following phases:

I. Requirement Analysis:

In this phase, all functional and non-functional requirements are collected. User needs such as travel search, booking system, user registration, login, and review features are identified. System requirements like performance, security, and usability are also analyzed.

II. Feasibility Study:

A feasibility analysis is conducted to determine whether the project is technically, economically, and operationally viable. This ensures that the system can be developed within available resources and time.

III. System Design:

The overall system architecture is designed, including database structure, user interface, and navigation flow. Wireframes and layout designs are created to ensure a smooth and user-friendly experience.

IV. Development:

The actual coding of the system is carried out. The frontend is developed using HTML, CSS, and JavaScript to create an interactive interface, while the backend is implemented using PHP or Python. Database integration (MySQL) is done to manage user data, bookings, and packages.

V. Integration:

All modules such as user authentication, booking system, and package management are integrated to work together as a complete system.

VI. Testing:

Various testing methods like unit testing, integration testing, and system testing are performed to identify and fix errors. This ensures the website works correctly and efficiently.

VII. Deployment:

The completed website is deployed on a web server, making it accessible to users through the internet.

VIII. Maintenance:

After deployment, the system is regularly monitored and updated. Bugs are fixed, performance is improved, and new features are added based on user feedback.

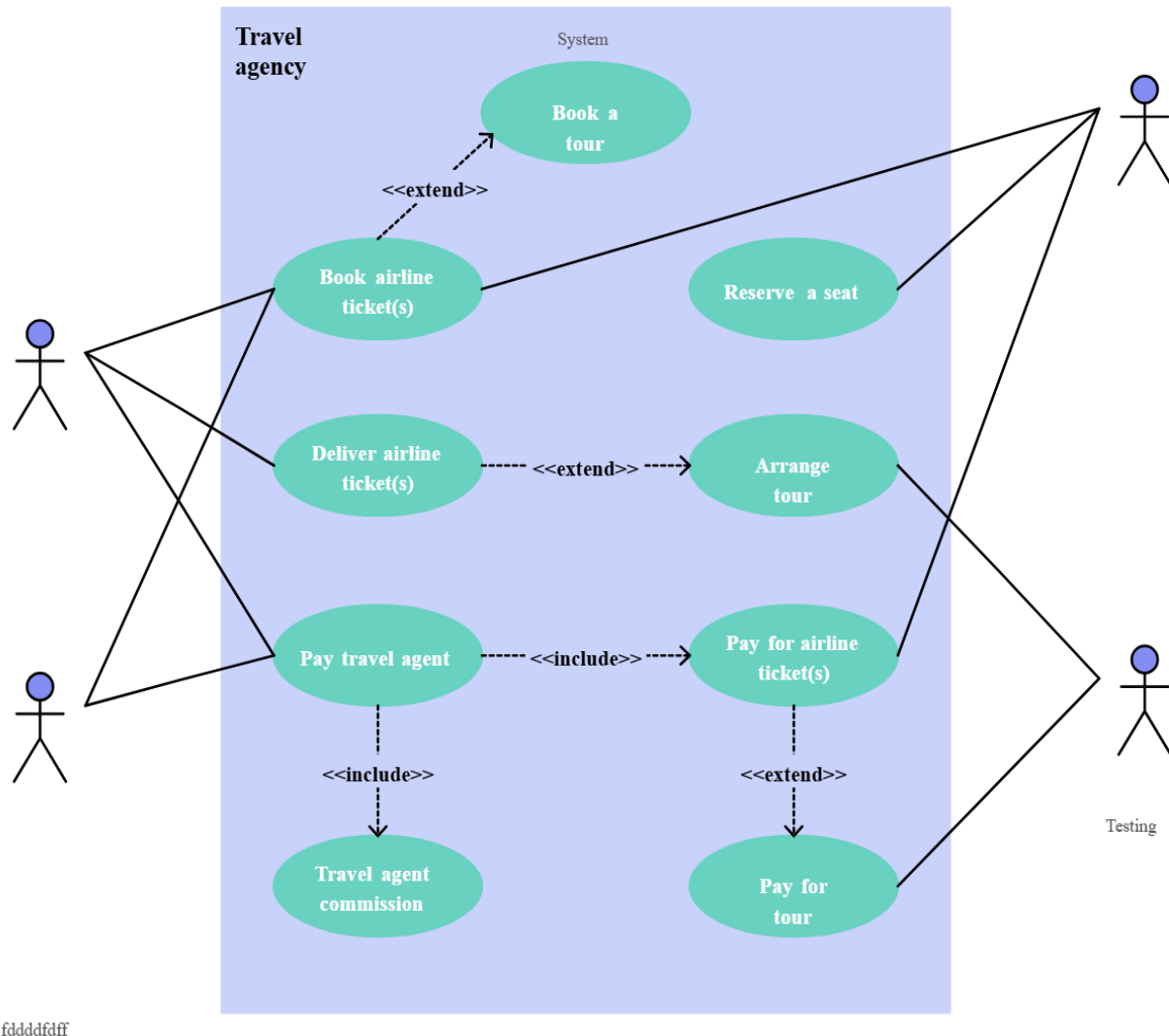


Figure 1 : Block Diagram of Smart Helmet System

IV. MODELING AND ANALYSIS

The modeling and analysis phase focuses on designing the structure and understanding the behavior of the Travellomania system to ensure efficient performance and user satisfaction.

1.System Modeling:

The system is modeled using diagrams such as Use Case Diagrams, Data Flow Diagrams (DFD), and Entity Relationship (ER) Diagrams.

These models represent interactions between users and the system, data movement, and database structure.

2.Use Case Analysis:

Identifies key users such as Admin and Customer.

- Customer: Register, login, search destinations, book trips, give reviews

- Admin: Manage users, travel packages, bookings, and feedback

3.Data Flow Analysis:

Describes how data flows within the system, including user input, processing, storage, and output. It ensures smooth data handling between frontend, backend, and database.

4.Database Design (ER Model):

Defines entities like Users, Packages, Bookings, and Reviews, along with their relationships. This ensures proper data storage and retrieval.

5.System Analysis:

Evaluates system performance, usability, and security. It helps in identifying potential issues and improving efficiency.

V. RESULTS AND DISCUSSION

The Travellomania website was successfully developed and tested to offer a seamless and user-friendly travel planning experience. The system enables users to register, log in, search for destinations, view travel packages, and book trips efficiently.

Results:

The website effectively performs all core functions, including user authentication, package browsing, and booking management.

The interface is responsive and easy to navigate, providing a positive user experience. Data is accurately stored and retrieved from the database.

Discussion:

The system simplifies travel planning by offering all services in a single platform.

It saves time and effort for users and enhances decision-making through organized information and reviews. Future updates could address minor limitations such as dependency on internet connectivity and the inclusion of more advanced features.

VI. FUTURE SCOPE

The Travellomania website has strong potential for future enhancements to improve functionality, user experience, and scalability. The following areas can be considered for future development:

1. **AI-Based Travel Recommendations**
Integration of artificial intelligence to suggest personalized travel destinations, hotels, and packages based on user preferences and past bookings.
2. **Real-Time Booking and Availability**
Implementing real-time APIs for flights, hotels, and transport to provide up-to-date availability and pricing.
3. **Mobile Application Development**
Developing an Android and iOS mobile app to increase accessibility and user engagement.

4. Online Payment Integration
Secure payment gateways (UPI, cards, wallets) can be added for seamless and instant booking transactions.
5. Multilingual Support
Adding multiple language options to make the platform accessible to a wider audience.
6. Chatbot Support System
AI-powered chatbot for 24/7 customer support to assist users with queries and bookings.
7. Advanced Filtering and Sorting
Enhancing search features with filters like budget, ratings, location, and amenities.
8. Travel Itinerary Planner
Automatic generation of travel plans including schedules, places to visit, and cost estimation.
9. Integration with Maps and Navigation
Using map services for route planning, nearby attractions, and real-time navigation.
10. Enhanced Security Features
Implementation of advanced security measures like encryption and two-factor authentication.
11. Social Media Integration
Allow users to share travel experiences, reviews, and photos directly on social platforms.
12. Admin Analytics Dashboard
Dashboard for administrators to monitor user activity, bookings, and website performance.

VII. CONCLUSION

Travellomania is a helpful online tool that makes planning and booking trips easier. It provides users with a simple platform to explore travel ideas, compare different packages, and book their trips quickly and smoothly. The website includes essential features such as user login, travel package management, and booking services in one place.

The system improves the travel experience by offering a user-friendly interface, clear information, and quick access to various travel options. It saves time and effort during trip planning and helps users make better decisions.

Overall, Travellomania works effectively and demonstrates how web technology can be beneficial in the travel industry. With further improvements, it can become a more advanced and complete travel planning system.

VIII. ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to all those who supported and guided me throughout the development of the Travellomania website project.

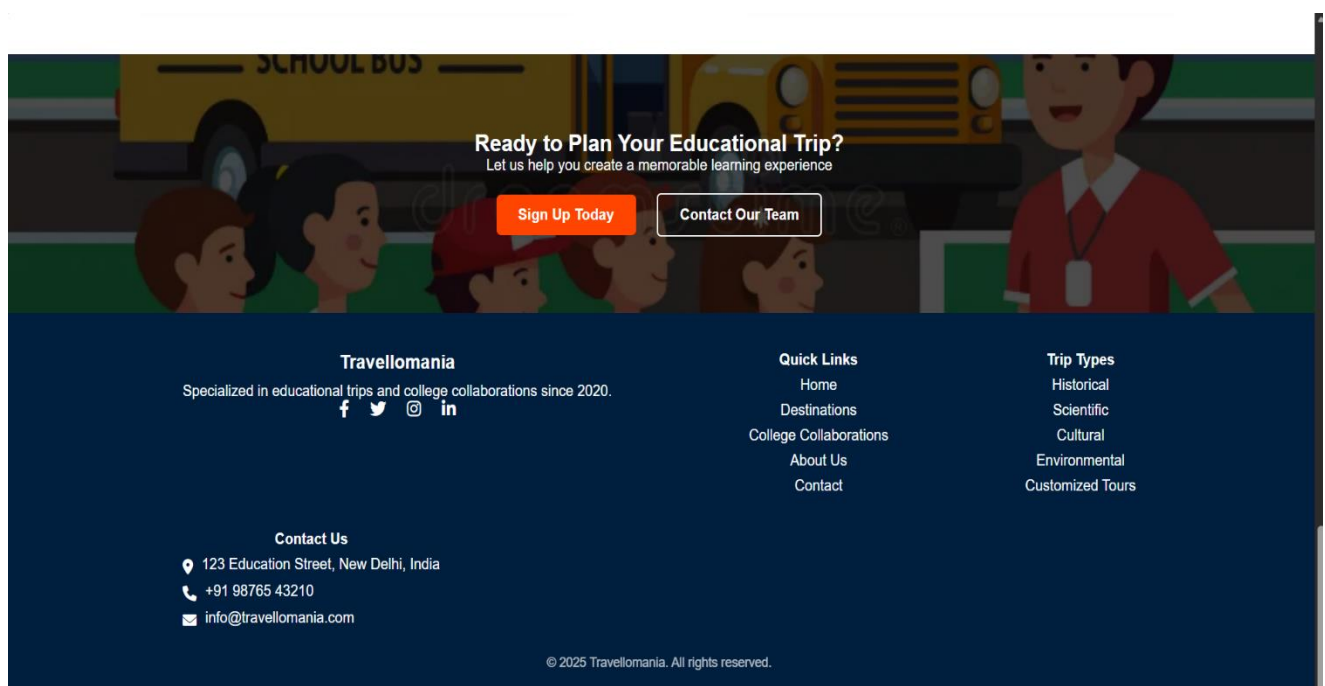
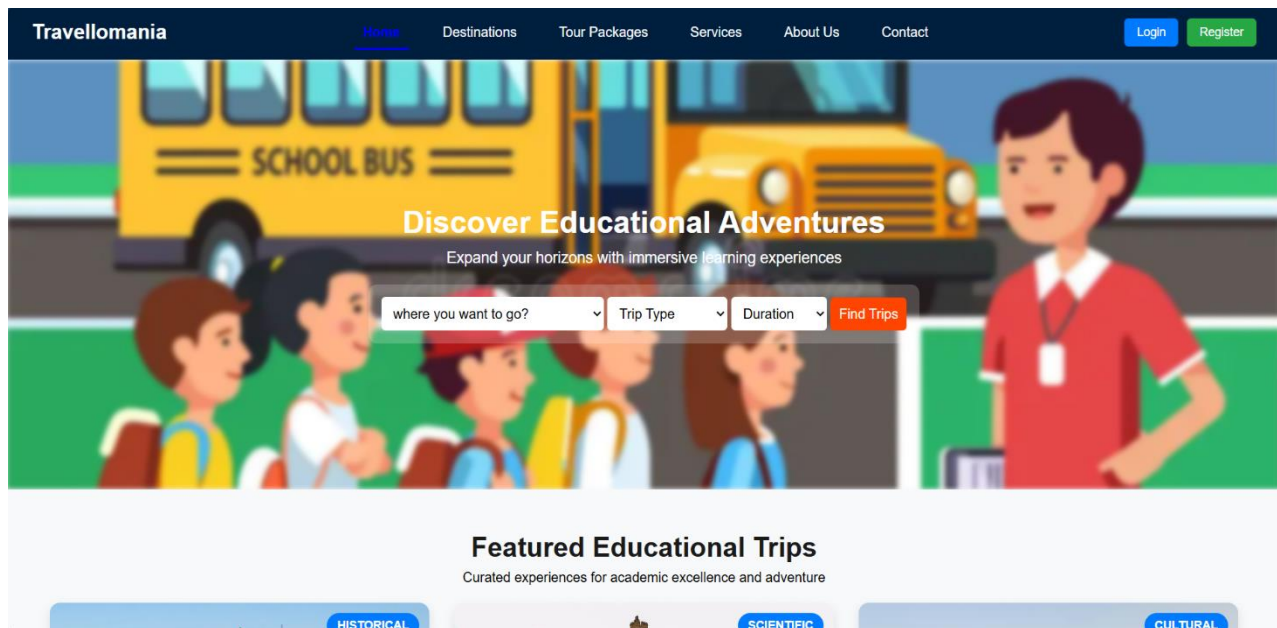
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IX. SNAPSHOT



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These resources were used to understand web development ideas and build the Travellomania website.

Database Security System

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ABSTRACT

In the modern digital environment, databases store critical and sensitive information, making them a primary target for cyber threats. This project focuses on developing a robust Database Security System that ensures data protection through advanced encryption techniques and secure access mechanisms. The system integrates authentication, authorization, and real-time monitoring to prevent unauthorized access and data breaches. Encryption algorithms are used to secure stored data, while role-based access control ensures that only authorized users can perform specific operations. The proposed system also includes intrusion detection features that monitor suspicious activities and generate alerts. Experimental results demonstrate improved data confidentiality, integrity, and availability. The system is efficient, scalable, and suitable for deployment in organizations requiring high levels of data security.

Keywords: Database Security, Encryption, Access Control, Authentication, Cybersecurity, Intrusion Detection

I. INTRODUCTION

With the increasing dependence on digital systems, databases have become essential for storing and managing organizational data. However, this growth has also led to a rise in security threats such as unauthorized access, data leakage, and cyberattacks. Traditional database systems often lack sufficient security mechanisms, making them vulnerable to exploitation. Database security is crucial for maintaining confidentiality, integrity, and availability of data. Organizations must implement strong security measures to protect sensitive information such as financial records, personal data, and business transactions. This project introduces a Database Security System that incorporates encryption, user authentication, and access control mechanisms to enhance protection.

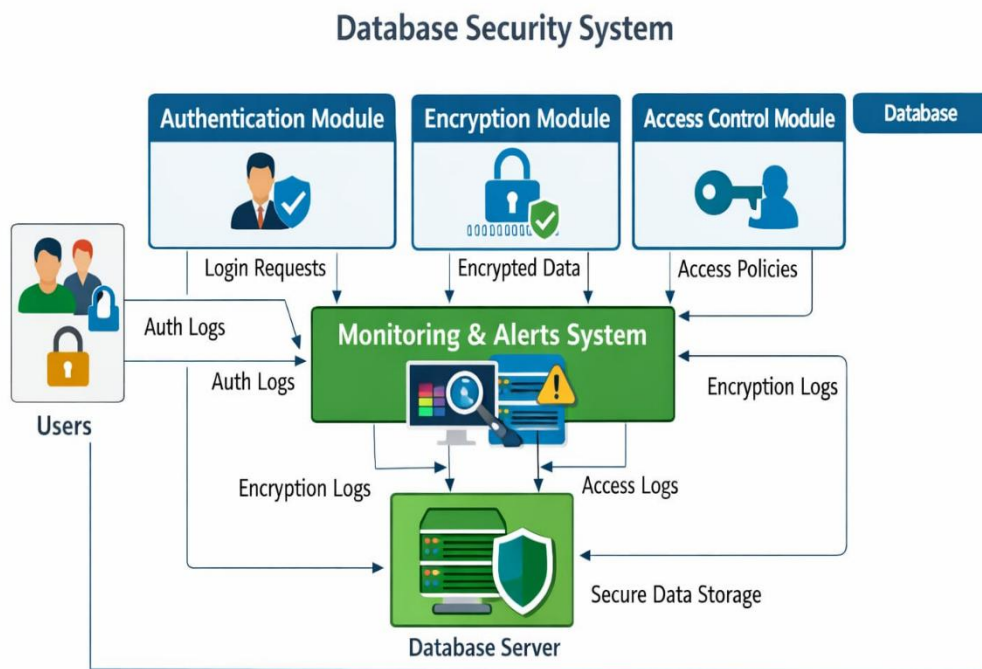
II. METHODOLOGY

The proposed system follows a structured approach to ensure secure database operations. The methodology includes the following steps:

- **Data Encryption:** Sensitive data stored in the database is encrypted using advanced encryption algorithms. This ensures that even if unauthorized access occurs, the data remains unreadable.
- **User Authentication:** The system verifies users through secure login credentials such as username and password. Multi-factor authentication can also be implemented for additional security.

III. MODELING AND ANALYSIS

The system architecture is designed to provide layered security. It consists of the following :



System Architecture of Database Security System

Figure 1: System Architecture

IV. RESULTS AND DISCUSSION

The developed Database Security System was evaluated through a series of controlled tests to measure its security strength, performance efficiency, and reliability. The system integrates authentication, encryption, access control, and monitoring features, and each of these components was tested individually as well as in combination to ensure proper functionality.

Table 1

SN.	Test Scenario	Input Condition	Expected Output	Result
1	User Login	Valid credentials	Access granted	Pass
2	User Login	Invalid credentials	Access denied	Pass
3	Data Access	Authorized user	Data displayed	Pass
4	Data Access	Unauthorized user	Access restricted	Pass
5	Data Encryption	Store sensitive data	Data encrypted	Pass
6	Intrusion Detection	Suspicious activity	Alert generated	Pass

7	Role Management	Admin access	Full permissions	Pass
8	Role Management	Guest access	Limited permissions	Pass
9	Backup System	Data backup request	Backup created	Pass
10	Data Recovery	Restore backup	Data restored successfully	Pass

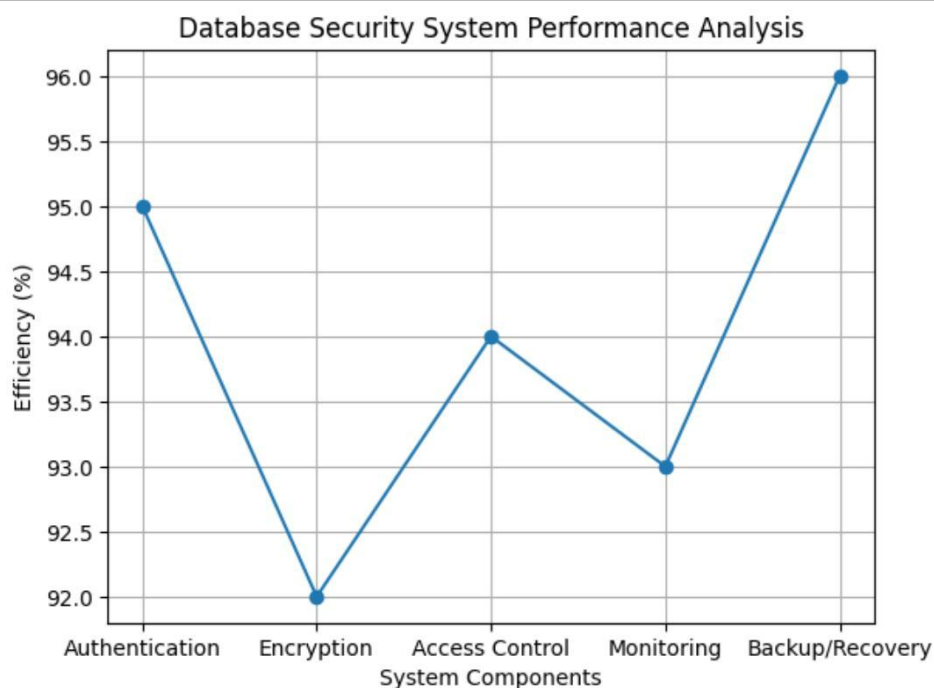


Figure 2: Performance Analysis

V. CONCLUSION

The Database Security System developed in this project provides a reliable solution for protecting sensitive data. By combining encryption, authentication, and access control, the system ensures that only authorized users can access the database. The inclusion of monitoring and alert mechanisms further strengthens security by detecting potential threats in real time.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to their project guide and faculty members for their continuous support and guidance throughout the project. Special thanks to friends and family for their encouragement and assistance.

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KaamConnect: A Hyper-Local Job Platform for the Unorganized Sector

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Abstract

The unorganized sector forms the bulk of our country's economy by providing essential goods and services on a daily basis, for instance bicycle repairs, television repair shops, domestic help, tuitions, etc. The unorganized sector is characterized by the lack of digital technology that enables them to carry out their jobs efficiently. These jobs are unstructured, vague, inefficient and unreliable.

KaamConnect is a Hyper Local Mobile Job Search Platform. This Portal connects customers with verified and skilled workers from unorganized sector of the economy. We act as an Enabler which bridges the employment mismatch between customers and workers by connecting them through a robust trusted interface.

KaamConnect is built using Flutter for the mobile application and Flask for web services. The mobile application uses JWT for authentication, performs OTP based job validation and uses the geo-location for the job search. The service providers are arranged in a hierarchical structure with clear authority levels. The job lifecycle of KaamConnect is robust and ensures secure job completion by providing features such as arrival confirmation and proof of work completion by asking for a photo.

Keywords: Hyper-Local Services, Unorganized Sector, Mobile Application, Flutter, Flask, JWT Authentication, OTP Verification, Geo-Location

1. Introduction

- The way we access a range of daily life services has changed with the advent of mobile and internet technology. We are able to buy food, hail a cab, and shop online with just the click of a button. However, there are millions of workers in the unorganized sector who have to depend heavily on social media, spoken communication and local word of mouth to find new job opportunities. Unlike the organized sector which has the benefit of robust digital infrastructure, the unorganized sector does not have a technology platform which makes it easy to carry out their work. As a result, job opportunities are rare, wages are not stable, and there is no accountability and information flow between the employer and the worker.
- The unorganized sector in this study includes every type of skilled worker, be it electricians, plumbers, carpenters, domestic workers, technicians or even tutors, that toils for earning a living in the unorganized sector. The existence of this sector at the grassroots level is very crucial for the economy

of the country. These skilled workers suffer from highly uncertain employment status due to the non availability of platforms that could help in coordinating hyper local services. Similarly, for the customers, there is also a lack of platforms that could help in connecting them with reliable and verified local service providers, thereby leading to uncertainty in service procurement due to the mistrust [4].

- Although there are numerous digital marketplace platforms that facilitate a wide range of transactions and interactions, most platforms are built for constrained scenarios such as the service economy and professional social networks. Most digital marketplaces do not fully address important challenges such as identity management, job lifecycle control and fraud in the context of informal marketplaces for direct individual-to-individual exchange. In addition, most service matching platforms are limited to finding suitable matches between services requested by customers and offered by service providers based on spatial overlap between the request and provider locations and lack adequate workflow validation and job advancement control features. Thus, there is a need for local platforms that make the service economy more accessible and secure.
- KaamConnect is a Hyper-Local Job Platform for the Unorganized Sector that aims to address the social issues mentioned above. KaamConnect will be a mobile-first, highly-robust, server side infrastructure to enable a very efficient Job-Handling Mechanism. Location-Based Job Discovery through GPS, OTP-based Job Assignment through mobile with completion proofs to achieve maximum accountability between Employer & Worker.
- Main purpose of the KaamConnect app is to connect employers with employees in a safe and meaningful way. This multi-platform mobile app has been built using a combination of latest cross-platform mobile development tools, strong level of authentication along with a robust job management system. The project is a first of its kind pioneering initiative to bring a change and revolution in the employment sector at the grassroots level, while at the same time ensuring operational integrity and technical reliability at all times. Reference: [8]

2. Related Work

- Mobile apps such as digital service marketplaces of TaskRabbit, Uber and AirBnB are representing a new trend in the digital service economy. This work discusses challenges and solutions related to the on-demand economy and it demonstrates how to achieve on-demand services with high reliability using secure authentication and location-based matching. We believe that identity authentication and protection of the login process in a mobile service platform are of paramount importance in order to achieve a reliable and trustworthy mobile service platform.
- Roles in Gig Economy and their Implications on Access Control: The new studies about gig economy business models show the importance of role-based access control (RBAC) and digital verification process on a platform in order to provide a solution for the increasing disorder. If RBAC and verification process are implemented properly on platforms, it helps to prevent misbehaviors of users and to increase the transparency on the platform. Location Based Services (LBS) are widely used in mobile applications and have become a significant attribute of the service-oriented applications to decrease the response time and to improve the resource allocation.
- Presented solutions are relevant for organized sectors like Retail, Banking and large scale service providers. The unorganized sector has been overlooked in current literature pertaining to workflow validation and job lifecycle security. KaamConnect tackles this gap by bringing in customised security controls, state transitions and verifications applicable to the hyper-local services sector.

3. System Architecture

- KaamConnect is a platform that connects millions of job seekers with employers in unorganized sector as well as on-demand services. We are building a highly scalable, secure and maintainable system using microservices architecture with service oriented approach. We are designing the functionalities of the system into well defined layers and breaking them down into individual microservices. This helps us to develop individual components of the system independently, test them easily and is also more future proof.

The overall architecture is divided into three primary layers:

1. Presentation Layer (Mobile Clients)
 2. Application Layer (Backend Services)
 3. Data Layer (Database Management)
- The layered design is used to divide the tasks and functions of the system and to achieve a high degree of independence of the individual system elements. Individual elements can work independently of each other but can communicate with each other in a controlled manner.

A. Presentation Layer (Client Applications)-

- The presentation layer of the system has been implemented with Flutter so that it will be cross-platform and the application will run on Android and iOS. The presentation layer is the entry point for users in the system and is responsible for user input and job presentation. It accesses the server through the RESTful APIs in a secure way.
- The presentation layer consists of the Customer Application and the Service Provider Application modules.
- Customer Application is the tool through which the customers raise the service requests. Customer can log in to the system securely, navigate through the different service categories, post the job request along with the location and can have real time status of the jobs assigned to them. The status flow of the job request is clearly defined from the time the job is posted to the time the job is done. The customers can cancel the jobs at any time and also give feedback to the system, thus keeping the system accountable.
- Service Provider Application The Service Provider Application is meant for the unorganized sector workers. They can register by uploading their documents in our portal for the verification of documents. This will help in building the trust with the users of our portal. The verified service providers can apply for the work that matches their skill set and can work at the location nearest to them. The application has the GPS feature which will help in navigation of the service provider to the work location. They can accept or reject the work, start the work by entering the OTP, can upload the proof of work and can also view their earnings in the application. This will make the relation between the customer and the service provider more reliable and less prone to disputes.

B. Application Layer (Backend Services)-

- The Application Layer is the actual processing engine of the KaamConnect platform. It is built using Flask framework which is a Python web application framework that is highly focused on quick development, strong typing and extensibility via extensions and plugins. The Flask micro web framework provides a framework to develop web applications by enabling the development of web services based on RESTful APIs to process client requests, enforce business rules and for a secure communication flow.

- API Management System acts as a bridge between the mobile application and database. Apart from bridging them, API Management System is also responsible for the validation of the request, access control, data transformation, result formatting, error handling and much more, especially in cases of high concurrency.
- The Security and Authentication Module is responsible for protecting the user sessions by ensuring that they are not accessed by unauthorized users. It uses JSON Web Tokens (JWT) for authentication and management of user sessions. It also encrypts the password stored in the database. Role Based Access Control (RBAC) is implemented for customers and providers so that they can only access features that have been granted to them in the platform. The security and authentication module also includes a token expiration time in order to avoid inactive sessions from being misused.
- The Job Lifecycle Management Engine is the engine that manages the state transition of jobs on platform. The workflow of jobs defined by the engine includes: Submitted / Accepted / Running / Failed / Cancelled

Open → Accepted → Arrived → In Progress → Completed → Cancelled

Figure 1: Job Lifecycle



- Every transition is validated on the backend. This helps in controlling the flow such as not allowing two or more service providers to accept the same job, not allowing the job to be started before the OTP is not confirmed and not allowing the job details to be edited. The backend validation rules that are enforced on the system ensure that the job execution process is carried out in a very transparent and regulated manner.
- The Location Intelligence Module is an application that integrates the use of GPS-based location service technology for hyper-local job matching. The system enables the real-time location tracking of field service staff and service requests. Location Intelligence is enhanced by guiding the field service staff to premises to carry out service work. Using the Location Intelligence Module helps to filter jobs using distance based filters thereby enabling the most relevant jobs to be found, reducing the time to respond and thus improving customer satisfaction with the service received.
- The Administrative Management System is used for the administration and management of the platform. Mainly for the dynamic monitoring and management of the platform by centralizing the administration of the affairs and the rules of the platform. Such as verifying the business license of the

service providers, checking and dealing with the qualification of the account of the service providers, and dynamically checking the user's status on the platform. In order to prevent illegal transaction in the platform, it is necessary to carry out the restriction of the user's actions.

C. Data Layer (Database System)-

- The data layer uses SQLite and an Object Relational Mapping (ORM) technique. The data layer contains all the persistent data required to run an application.
- User Database The user database contains the information for all users in the platform such as customers and service providers. It stores information about the verification status, skills, location (latitude, longitude) and ratings of users. Job Database The job database contains all the information related to the job requests made by customers. It stores information such as job description, transitions between job states, timestamp of transitions, payment details and the mapping of the customers and service providers involved in the job. Media Storage This database stores the media files such as ID cards, entry level verification photos and work completion verification photos that are uploaded by customers and service providers.
- Smart contract storage for transaction and verification data is used to achieve accountability, transparency and for dispute resolution.

4. System Flowchart and Operational Process

- Work Flow of KaamConnect KaamConnect has worked out the whole work flow in such a way that maximum transparency, security and methodology is maintained. The whole work flow of the portal is structured in a way that the activities carried out on the portal are in sequence one after the other from the time of registration of user up to the completion/cancellation of work. The rules on the back end are built-in for the completion of every activity. Thus ensuring that maximum level of security is maintained for the Buyers and Service Providers alike.

A. Registration and Verification Process-

- Registration is done by choosing the role of customer or service provider. Customers can start to work immediately after creating their account. For service providers there is an additional verification step which is done by the administrative authority and this verification is done on the basis of documents provided by the service provider. The documents are the identity documents that the service provider has to upload so that they are verified by the administrative authority and so that they can access the job postings. This verification ensures the reliability of the portal and excludes illegal activities that could be carried out through the service provided by the portal.

B. Job Request and Matching Process-

- Registration on the site begins with the choice of the user role – customer or service provider. After registration, the customer will have access to all the functionality of the site. The registration of the service provider is made in stages. After registration, the service provider will not yet be able to enter the job section. To get access to job postings, the service provider must undergo a verification procedure. To verify the service provider, he must upload an ID photo. The administration of the site will verify the authenticity of the photo. Verification of the site is aimed at ensuring the stability of the site and preventing the uncontrolled provision of services on the site.

Table 1: Job Request and Matching Process

Step	Activity	Result
1	Customer posts job	Status “Open”
2	System filters providers	Nearby providers identified
3	Notification sent	Job visible in app
4	Provider accepts	Status “Accepted”

C. Secure Job Execution Process-

- Once the job is accepted by the provider, the provider can reach the location through GPS. The provider needs to upload a selfie after reaching the location. The customer shares an OTP with the provider which is verified by the server before moving the job to “In Progress” stage thereby making sure that the job is not initiated fraudulently and both parties are mutually confirmed.

Table 2 : Secure Job Execution Process

Step	Activity	Result
1	Provider reaches location	Navigation completed
2	Arrival selfie uploaded	Presence verified
3	OTP shared and validated	Job moves to “In Progress”

D. Completion and Record Update Process-

- Once the task has been completed by the service provider, they will then upload the image proof for that task. The task status will then be updated by the system to “Completed” and all the earnings for that task will be captured. All the transactions that take place within the system will also be recorded in the system history for future reference in the event of a dispute.

Table 3 : Completion and Record Update Process

Step	Activity	Result
1	Work proof uploaded	Evidence stored
2	Job marked completed	Status updated
3	Earnings recorded	History

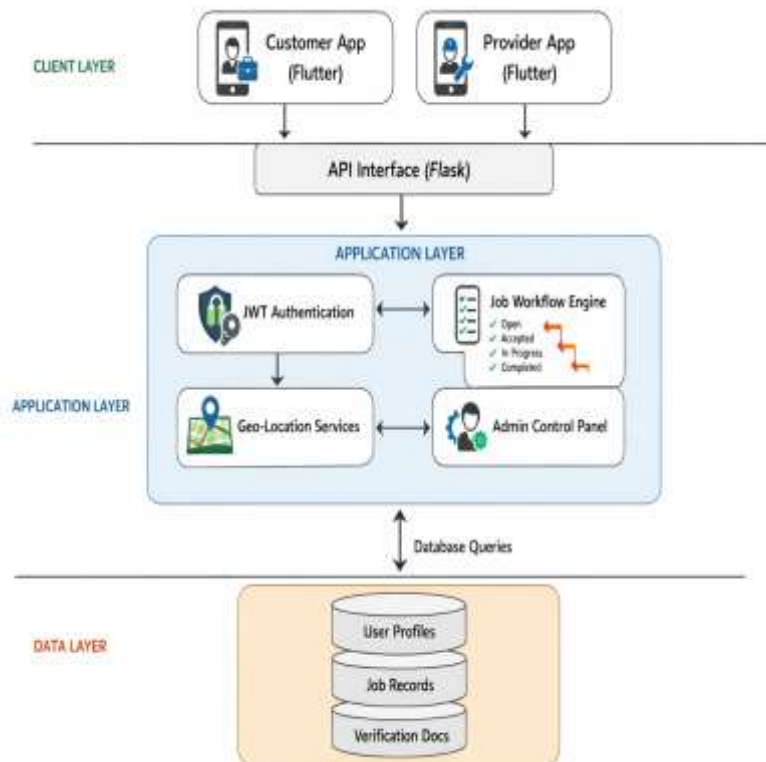
E. Cancellation Handling Process-

- Controlled cancellation Cancel a job on Freelancer Cancel a job on Freelancer can be cancelled at any stage of the Freelancer process. A contest can be cancelled by the Contest Holder at any time prior to it being awarded. A Freelancer can also cancel at any time prior to commencement of work on the contest. Once cancelled the Freelancer contest will revert to its original state.

Table 4 : Cancellation Handling Process

Actor	Condition	System Action
Customer	Before acceptance	Job cancelled
Provider	Before start	Job reset to “Open”

Figure 2: Architecture



5. Advantages of the Proposed System

- KaamConnect is an idea proposed by few social entrepreneurs in India. It has numerous benefits for both the customers and the service providers. It increases the efficiency, safety and productivity of the unorganized sector. One of the major benefits of this portal is that it helps in developing a strong bond between the service provider and the service seeker. The service providers and the service seekers need to go through a very simple level of verification process. They have to upload the required documents and then get an approval from the concerned government body. The verification process will ensure that the service provider is credited and the frauds in the unorganized sector are curbed.
- It leads to better infrastructure and employment opportunities for the locals. The idea of hyper-local job matching is a simple innovation which enables the service providers to get jobs from within their local geography. This means that the work providers have lesser travel times and more working hours. In turn, this leads to a faster experience for the customer and better earning opportunities for the unorganized sector workers.
- The system protects the jobs to be executed by making the jobs to be executed to have OTP for execution and also by having real time workflow validation that does not allow the job to be executed or started at anytime by anybody and also a service cannot be started by either party without confirmation from the other party. The arrival verification and work completion proof increases the transparency of the platform.
- Real-time tracking and status updates is another component of the customer experience we are offering and will enable customers to have full visibility of work being carried out, while tradespeople are able to work more efficiently. Real-time tracking and status updates provide an end to end view of work and transactions between customers and tradespeople. Improved visibility of work in progress and

planned work leads to greater operational transparency. Disputes reduced due to real-time status updates between customers and tradespeople.

- KaamConnect is a Digital Social Enterprise that aims to empower local communities through economic development by using digital technology to bring in employment opportunities and by building a robust service delivery ecosystem. KaamConnect aims to act as a platform that is holistic in nature and aims to act as a bridge between the employer and the employee in local communities across India. The proposed platform utilizes mobile technology and links it to a robust server system to bring in high scalability, reliability and ease of deployment in various settings.

6. Future Scope

- KaamConnect is a foundational technology that is designed to build all future systems. We have thought of many features and functionalities that we can add in KaamConnect as it develops, in order to make working lives easier, more automated and data-driven.
- Use of Artificial intelligence we can develop system through which the service providers can be suggested to customers based on their choices, their work history, reviews and their locations. This way through the use of intelligent matching algorithms, we can improve the accuracy of matching customers with service providers and hence improve the speed of service and better customer experience.
- The in-app chat and voice feature enables real time communication through a very efficient and effective means. On the spot communication has proven to be very effective and has solved the first and second of the three problems mentioned above. Communication within the app means that less time is spent negotiating when work will be done and explanations are not needed as to the status of ongoing work thereby enabling a very seamless job completion process.
- We can also incorporate advanced performance analytics to measure job completion rates, provider consistency, service quality and overall customer satisfaction trends. The data analysis gained from this functionality will allow for stakeholders to take informed actions to improve the overall operations of the system as well as the clinical quality of care provided.
- We can also train a machine learning based fraud detection model to catch anomalies such as multiple cancellations, spam job postings or other unusual user behavior. An intelligent monitoring system will not only keep our platform safe, but also ensure that it remains robust and reliable for the long term.
- The forthcoming releases will largely enhance the capabilities of KaamConnect and will transform it into a much more sophisticated, dynamic and more flexible service oriented ecosystem, which will be capable of supporting large scale deployments and thus sustaining the business interests in the long term.

7. Conclusion

KaamConnect: A Hyper-Local Job Platform for the Unorganized Sector A mobile app and backend system for the management of local services using technology. KaamConnect enables a point of contact between customers and service providers through real time job postings, OTP based job acceptance, location-based search and other functionalities. The main idea is to bring about ease in employment for the unorganized sector as well as bring in structure in the workflow thereby increasing reliability and trust among the sector. A fully modular and scalable architecture ready for practice implementation as well as future enhancement.

8. Appendix

KaamConnect uses Flutter for mobile application development and Flask for API services. The application uses SQLite database for storage. User authentication is done using JSON Web Tokens. Location Services are used for hyper local job matching. Users are verified through multiple methods such as document approval, OTP and photo proof. The tech stack is robust enough to ensure that the system can scale, is reliable and secure.

9. Acknowledgement

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STUDENT PERFORMANCE PREDICTION USING MACHINE LEARNING TECHNIQUES

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ABSTRACT

Student academic performance prediction is essential for analyzing learning behavior and supporting educational improvement. This research presents an AI-based Student Performance Prediction System which evaluates key academic and behavioral factors including study hours, attendance, previous examination scores, and sleep duration. The system uses a predictive formula-based machine learning approach to generate performance scores and provides personalized recommendations for academic improvement. A Streamlit-based dashboard is integrated for real-time analytics, enabling educators to visualize trends and support data-driven decision-making. The system uses SQLite for data storage and Altair for interactive data visualizations. Results show that the proposed system effectively predicts student performance and assists in early identification of at-risk students.

Keywords: Student Performance, Prediction System, Machine Learning, Data Analytics, Dashboard, Academic Evaluation.

I. INTRODUCTION

Predicting student performance has become an important application of data analytics in modern education. Traditional evaluation systems rely heavily on human observation, which makes it difficult to understand long-term academic patterns. The rise of artificial intelligence and machine learning has enabled automatic performance evaluation using measurable input features.

This project presents an AI Dashboard that predicts a student's performance based on various inputs such as study hours, attendance percentage, previous marks, and sleep hours. The system also provides visual analytics and a leaderboard to compare performance across all students. The objective is to help students understand their academic standing and help teachers identify who may need additional support.

II. METHODOLOGY

Data Collection: Dataset includes student marks, attendance, study time.

Preprocessing: Missing values handled, normalization applied.

Algorithms Used: Decision Tree, Random Forest, Logistic Regression.

Algorithm: Random Forest Step:-

- 1: Load dataset Step
- 2: Split data into training and testing Step
- 3: Train multiple decision trees Step
- 4: Aggregate results Step
- 5: Predict output

III. MODELING AND ANALYSIS

Different models were trained and evaluated using accuracy, precision, and recall metrics.

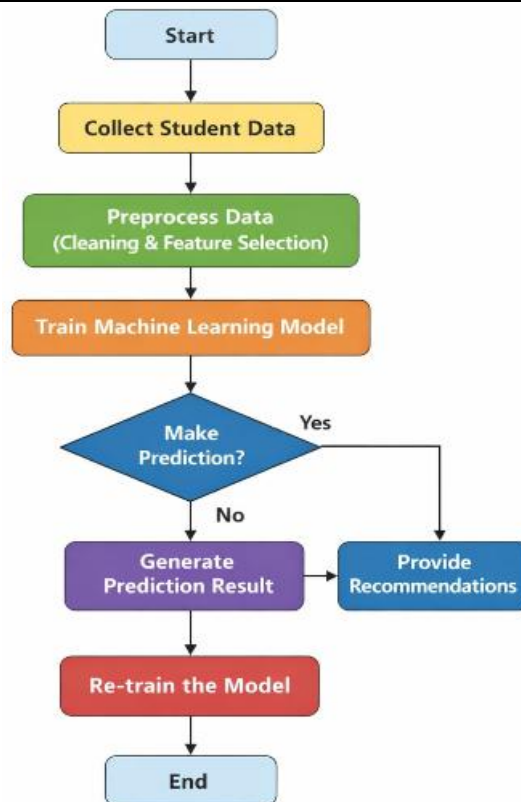


Figure 1:- Flowchart of project information.

IV. RESULTS AND DISCUSSION

The system successfully predicts student performance based on entered inputs. The dashboard helps visualize academic patterns among all students. The leaderboard shows top performers, enabling healthy competition.

Key findings include:

Higher attendance positively affects predicted scores.

Balanced study hours combined with proper sleep improves performance.

Previous academic history plays an important role in forecasting outcomes.

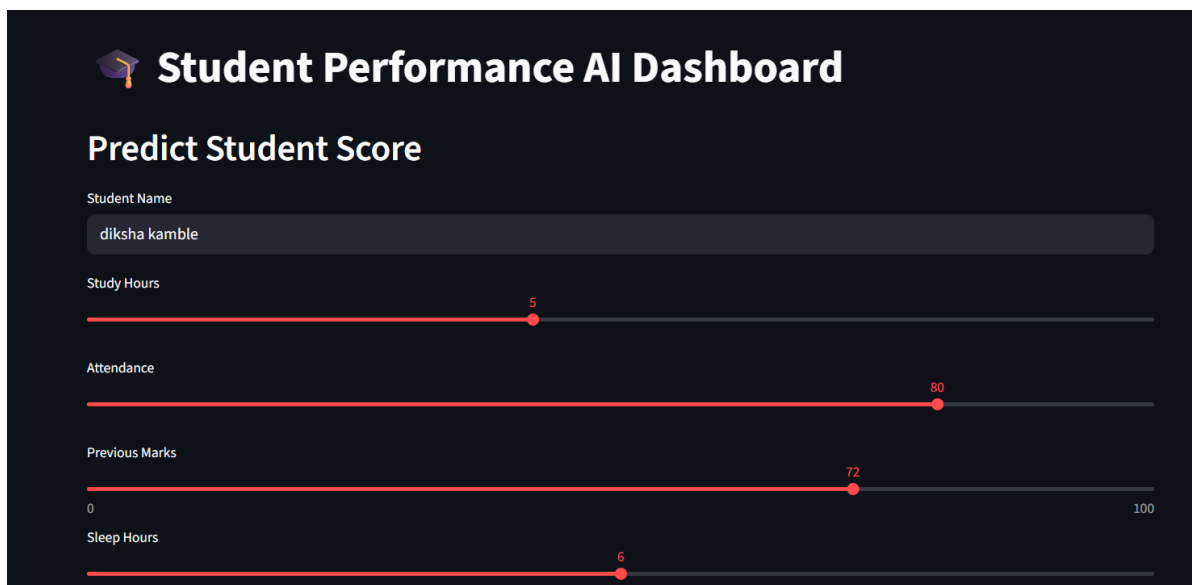


Figure 2: Output Of programming.

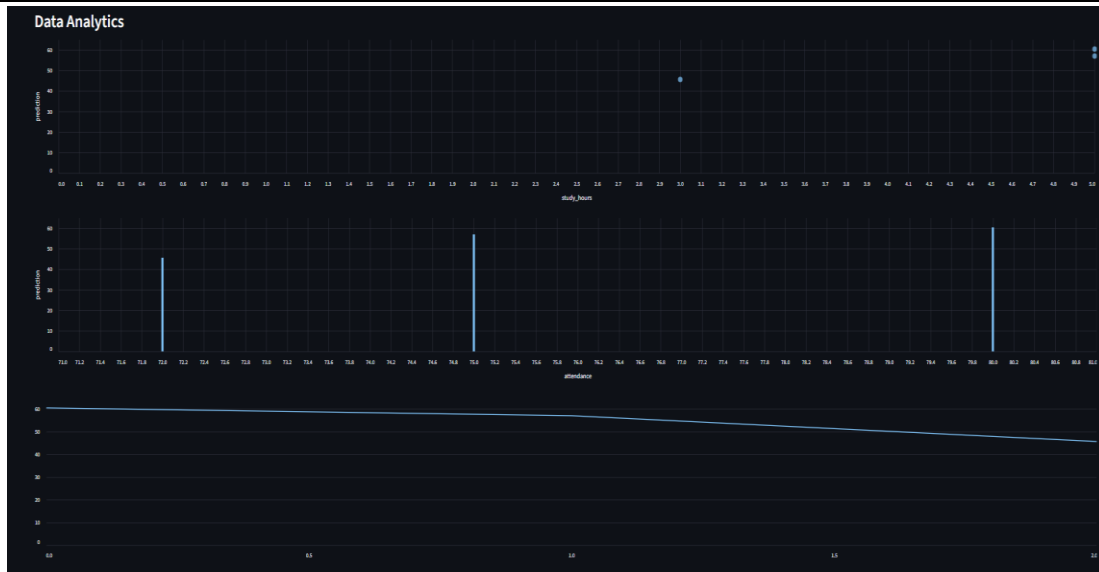


Figure 3:- Graph of student performance prediction

Top Students							
	id	name	study_hours	attendance	previous_marks	sleep_hours	prediction
0	14	diksha kamble	5	80	72	6	60.4
1	15	kalyani	5	75	60	6	57
2	16	varsha	3	72	66	7	45.6

🏆 Top Student: diksha kamble (60.4%)

Figure 4:- Result of Data stored in the system

V. CONCLUSION

The Student Performance Prediction System proves to be an effective tool for academic monitoring. The AI dashboard helps both students and teachers understand performance trends and identify areas for improvement. This system enhances academic planning and provides a pathway for further machine learning integration in educational settings.

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HOME-CREW-HOME SERVICE PLATFORM

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ABSTRACT

Nowadays folks want things fast, yet getting help at home - plumbing, wiring, cleaning - often means calling around or asking friends. Records? Rare. Tracking jobs? Not really. Confirmations? Hardly ever happen. Most of it stays messy, unorganized by design.

One solution came through HomeCrew, a platform made for arranging household help online. Built with React.js up front, it runs on PHP behind the scenes while MySQL keeps data in order. Signing up opens access - people pick what they need, then submit requests without confusion. Stored safely, every appointment detail stays where it should. What drives this setup? A clear aim: bringing calm to chores, making them predictable, easier to handle. Structure replaces mess. Trust grows when things just work.

General Terms

Web Development, Smart Services

Keywords: Home Aervice booking, React.js, PHP, MySQL, Booking System.

I. INTRODUCTION

Now think about how fast people go online these days - almost everything moved with it. Getting goods or rides shows how smooth things can run through screens. Yet when it comes to fixing a leak or cleaning a house, plenty of places still lack order behind the scenes. Folks usually call up someone they know - or a handyman down the street - when something breaks at home. Because of that, jobs sometimes take longer than expected, details get mixed up, and nobody keeps track of what was done. Starting fresh, HomeCrew came together to fix common booking hassles. Instead of scattered details, everything lands in one place. A clear setup keeps track of appointments without confusion. Through organized storage, each detail stays where it should. Built carefully, the platform handles requests step by step. With every piece logged, mistakes drop away quietly.

II. LITERATURE SURVEY

With Not long ago, folks started building apps centered around services. Booking a haircut or massage now happens through phones, thanks to these tools. Speed and ease shape how most of them work, putting comfort first.

Yet most run on weak backends without solid data handling. Trouble pops up when systems grow too tangled to update easily. On top of that, rural spots often miss out on organized online tools altogether.

HomeCrew keeps things clear by streamlining how tasks move through your day. Rather than piling on features, it shapes a straightforward tool that runs in the browser. Built with real use in mind, its design avoids clutter just enough to stay out of your way.

III. PROBLEM STATEMENT

Finding trustworthy and qualified experts for home repair and renovation services is a common challenge for homeowners. The absence of strong comparison tools in current service platforms leads to ineffective decision-making, delays, overspending, and inconsistent service quality. Furthermore, user mistrust is exacerbated by security issues such as payment fraud, a lack of expert verification, and disorganized worker allocation mechanisms. These challenges hinder the adoption of digital home service platforms. HomeCrew aims to address these limitations by offering a secure, transparent, and intuitive system that facilitates efficient service matching, secure payment channels, real-time worker monitoring, and improved user satisfaction.

(1) To Enable administrators to allocate qualified experts based on customer inquiries and geographic area optimizes worker allocation and guarantees effective service delivery.

(2) To Enable smooth communication between administrators, service providers, and homeowners to improve response and coordination.

(3) To Create a simple, easy-to-use interface for effectively scheduling, monitoring, and overseeing home services.

(4) To Utilize scalable infrastructure and strong back-end technologies to guarantee high system uptime and Dependability.

IV. METHODOLOGY

To build the HomeCrew system properly, we followed a step-bystep development approach instead of directly starting coding. This helped in keeping the system organized and easy to manage.

The development process mainly included two important stages: understanding the user requirements and designing the system:

a. Requirement Analysis

Before starting development, we first tried to understand the real problems people face while booking home services.

Understanding User Problems :

We discussed with some local users and service providers to know what difficulties they experience.

Most common issues were delay in service, no booking confirmation, and no proper record of previous work.

Understanding User Problems :

We discussed with some local users and service providers to try to understand what difficulties they experience. Most common issues were delay in service, no booking confirmation, and no proper record of previous work.

Identifying Important Features: We decided to include the following main features:

- User registration and login
 - Service selection
 - Booking request submission
 - Worker registration
 - Booking record storage
- Basic Assumptions:**
- Users will have basic internet access.
 - Workers will operate within a limited area.
 - Users will have basic knowledge of using a website.

Database Planning :

We designed the database structure for the data store. Tables created for Users, Workers, Services, and Bookings. We made sure that each table had proper primary keys and relationships so that data remains organized and no duplicate entries occur.

b. System Design

After finalizing the all requirements we started a designing part.

Architecture Design :

The system follows a simple client-server structure. The frontend is built using React, which handles what the user sees and interacts with. The backend is developed using PHP, which processes requests. MySQL is used to store all data securely.

Frontend Design :

The user interface developed using React functional components. We tried to keep the design clean and simple so that users can easily understand how to book services.

Backend Logic :

PHP scripts were written to handle registration, login, and booking requests. When a user submits a form, PHP processes the request and stores the information in the MySQL database.

Database Handling :

MySQL is used to store all information like user details and booking data. Proper relationships were defined between tables to maintain data accuracy.

Main Modules of the System:

- **User Module:** Handles user registration and login.
- **Service Module:** Displays available services.
- **Booking Module:** Saves booking details in the database.
- **Worker Module:** Stores worker information.

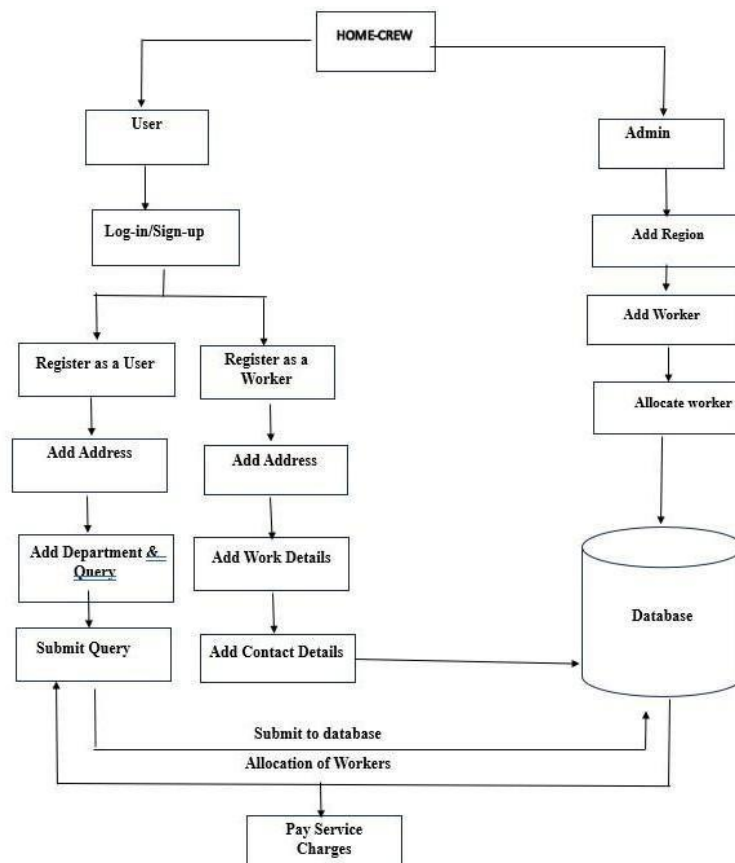


Fig 1: Architecture Diagram

V. RESULTS

While developing HomeCrew, we tested the system carefully to make sure everything was working as expected. We observed how fast the website loads, how smoothly different pages function, and whether users can easily understand and use the interface. Each module, such as registration and booking, was tested in different situations to see how it behaves. We also took feedback from a few test users to understand their experience and check if the system feels reliable and easy to use.

System Performance and Functionality

During testing, the HomeCrew system worked smoothly without any major issues. Users were able to move between pages like login, registration, and service booking easily. All the main features were connected properly, and there was no confusion while using the system.

We noticed that most actions, such as opening the service list or submitting a form, happened quickly. There was no noticeable delay, and the website felt responsive while using it.

Since the system uses a MySQL database, all user details and booking information were saved correctly. We checked multiple times to make sure the data was stored and retrieved properly.

The database connection remained stable throughout the testing process.

When we tested booking requests several times, the system handled them correctly and saved all the information without errors. Overall, the application performed reliably and provided a smooth experience for users.

Results of the User Interface

a. HomePage :

The HomeCrew interface is clean and simple to use. When users open the homepage, they can clearly see the main purpose of the platform along with easy options for login and registration. The service categories like Plumbing, Electrical, Carpenter, and Builder are shown in card format with images, which makes it easy to understand and select a service. Overall, the layout feels organized and user-friendly, and users can navigate the system without difficulty.

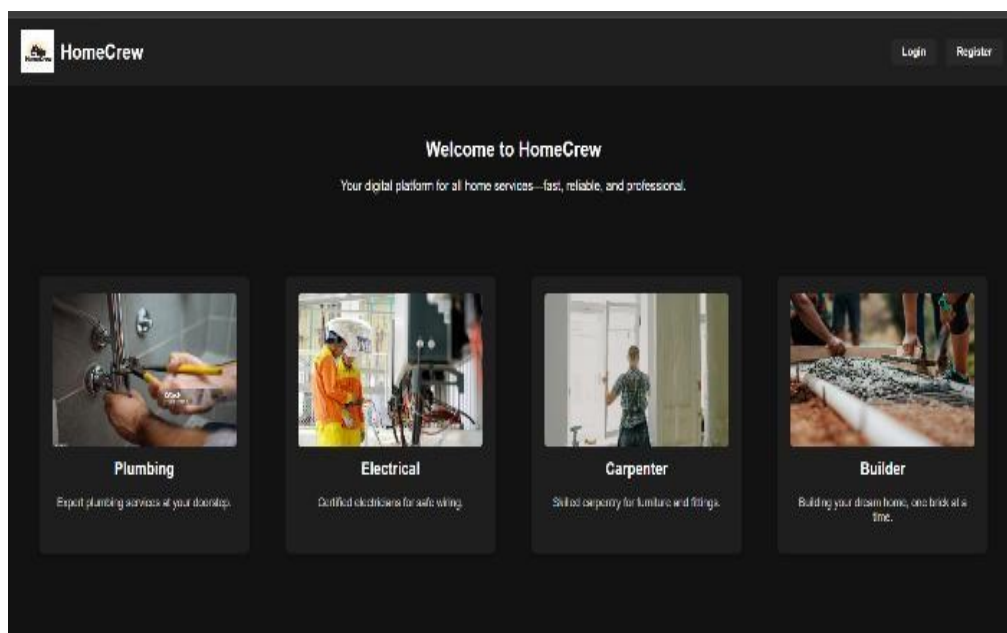


Fig 2: Homepage

This screen serves as the starting point for users when they visit the HomeCrew platform. It provides simple and clear options like “Register” and “Login,” making it easy for users to begin using the system. The dark-themed design gives a clean and modern look while also being comfortable for the eyes. During testing, users found the interface easy to understand.

b. Register Page :

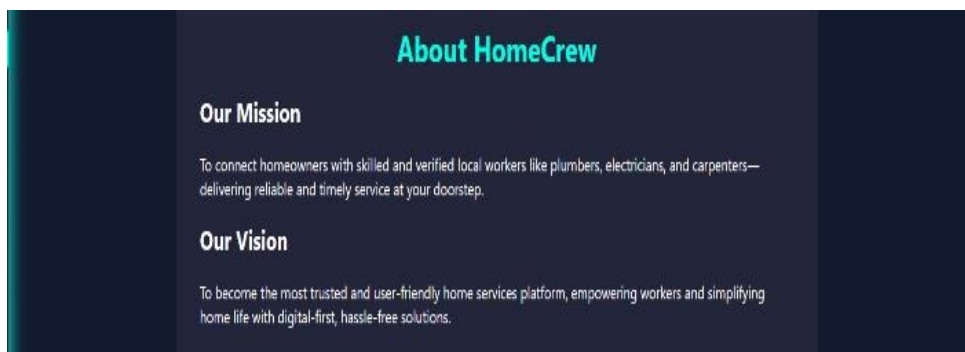
On the registration page, users enter basic details such as email, password, and service-related information. During testing, we observed that the entered data was saved correctly in the MySQL database without any issues. The form validations worked properly and prevented incomplete or incorrect submissions. Test users

found the registration process simple and easy to understand, and they were able to complete it without confusion.



Fig 3: Registration

c. About Us :



The “About HomeCrew” page tells users what the platform is all about. It explains why the project was created and what it aims to achieve.

The mission of HomeCrew is to help homeowners easily connect with skilled local workers like plumbers, electricians, and carpenters. The goal is to provide reliable and timely services without confusion or delay.

The vision of the platform is to become a trusted and userfriendly home service website. It focuses on making the booking process simple and convenient while also supporting local workers by giving them more opportunities. Overall, this page helps users understand the purpose of the platform in a clear and straightforward way.

VI. SYSTEM REQUIREMENTS

To run the HomeCrew project properly, some basic system requirements are needed. These requirements ensure that the application works smoothly during development and testing.

6.1 Hardware Requirements :

A system with at least 8 GB RAM and a standard processor like Intel i5 (or similar) is enough to run the project without issues. Around 256 GB of storage is sufficient for installing the required software and storing project files. A stable internet connection is also helpful, especially while installing packages or testing features.

6.2 Software Requirements :

The project can run on Windows 10 or Windows 11. React is used to build the frontend of the website, PHP is used for backend processing, and MySQL is used to store user and booking data. XAMPP is used as the local

server environment to connect PHP and MySQL. Visual Studio Code is used for writing and managing the project code, and any modern web browser like Chrome or Edge can be used to access the website.

VII. CONCLUSION

The HomeCrew system is a web-based platform that helps connect homeowners with local service providers in a simple and organized way. It is built using React for the frontend, PHP for handling the backend logic, and MySQL for storing all the data. Through this website, users can create an account, choose the service they need, and submit a booking request easily. All the details are saved in the database, so there is a proper record of users and bookings. The design of the website is kept simple and clear so that anyone can use it without confusion. Right now, the system mainly focuses on managing service bookings and keeping records organized. Even with these basic features, it helps solve common problems like poor communication and lack of proper tracking. In the future, more features such as online payment or cloud deployment can be added to make the system more advanced and scalable.

VIII. FUTURE SCOPE

Right now, HomeCrew mainly focuses on service booking and storing records properly. But in the future, the system can be improved in many ways. One major improvement could be adding an online payment option so users can pay directly through the website instead of handling payments offline. A rating and review system can also be added so users can share their experience and choose better service providers.

We can also include features like live chat between users and workers to improve communication. Deploying the website on a cloud server would make it more accessible and scalable. In the future, a mobile-friendly or dedicated mobile version of the platform can also be developed.

With these improvements, HomeCrew can become more advanced, user-friendly, and useful for both customers and service providers.

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AI STUDY COMPANION: AN AGENTIC LLM FOR PERSONALIZED LEARNING AND TASK PLANNING

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ABSTRACT

Artificial Intelligence is transforming the way students learn and manage their academic tasks. The AI Study Companion: An Agentic LLM for Personalized Learning and Task Planning is designed to support students by providing intelligent assistance for studying, organizing tasks, and improving productivity. The system uses a Large Language Model (LLM) with agentic capabilities to understand user queries, provide explanations, and help plan study schedules according to individual learning needs. The proposed system acts as a smart learning assistant that can answer questions, summarize study materials, generate notes, and suggest personalized study plans. By analyzing the user's learning goals, deadlines, and progress, the AI companion can recommend tasks and organize them in a structured way. This helps students manage their time effectively and stay focused on their academic objectives.

Keywords: Artificial Intelligence (AI), Large Language Model (LLM), Agentic AI, Personalized Learning, Study Planning, Task Management, Educational Technology.

I. INTRODUCTION

In recent years, Artificial Intelligence (AI) has significantly influenced many fields, including education. Modern students often face challenges such as managing multiple subjects, organizing study schedules, understanding complex concepts, and maintaining productivity. Traditional study methods may not always provide personalized support for every learner. Therefore, intelligent systems powered by AI are becoming increasingly important to assist students in improving their learning experience.

The AI Study Companion: An Agentic LLM for Personalized Learning and Task Planning is designed to act as a smart assistant that helps students manage their academic activities efficiently. This system uses a Large Language Model (LLM) with agentic capabilities to understand user queries, provide explanations, generate notes, and help in organizing study tasks. By analyzing a student's needs, deadlines, and learning goals, the system can provide personalized recommendations and structured study plans.

The main purpose of this project is to create a user-friendly platform where students can interact with an AI assistant to get academic support. The AI Study Companion can answer subject-related questions, summarize study materials, generate practice quizzes, and create personalized study schedules.

1.1 Problem Statement

Students today face significant challenges in managing their academic workload, understanding complex topics, and maintaining consistent study habits. Conventional learning tools often fail to provide personalized assistance tailored to individual learning needs, deadlines, and progress. There is a clear need for an intelligent, software-based solution that combines personalized learning support with intelligent task planning to help students study more effectively.

1.2 Objectives

The primary objectives of this project are:

- To implement an AI-powered study assistant that can answer academic questions and explain complex topics in simple language.

- To develop a study planning module that creates personalized study schedules based on user-defined subjects and deadlines.
- To integrate a quiz generation feature that evaluates student understanding and identifies weak areas.
- To create a progress tracking system that records learning activities and displays statistics.
- To evaluate the system's performance in terms of accuracy, response quality, and user experience.

II. LITERATURE SURVEY

The use of Artificial Intelligence in education has grown rapidly in recent years. Many researchers have explored the use of AI-based systems to improve learning experiences, provide personalized assistance, and support academic task management. The concept of intelligent learning systems and AI-based tutors has laid the foundation for modern AI study assistants.

Early research on Intelligent Tutoring Systems (ITS) focused on creating computer programs that could provide personalized instruction to students. These systems were designed to analyze student responses and provide feedback or guidance accordingly. Intelligent tutoring systems helped learners understand complex topics by adapting the teaching method based on the student's performance and learning speed.

With the development of Machine Learning and Natural Language Processing (NLP), AI systems became more capable of understanding and responding to human language. Researchers developed chatbots and virtual assistants that could answer questions, provide explanations, and support learning activities. These systems allowed students to interact with AI in a conversational way, making learning more engaging and accessible.

Based on these advancements, the AI Study Companion builds upon existing research in AI, intelligent tutoring systems, and agent-based architectures. The system aims to combine personalized learning support with intelligent task planning to create a comprehensive study assistant that enhances student productivity and learning efficiency.

III. SYSTEM ARCHITECTURE

The AI Study Companion: An Agentic LLM for Personalized Learning and Task Planning is designed using a modular architecture that integrates user interaction, intelligent processing, and task management components. The system architecture ensures smooth communication between the user interface, AI model, and supporting modules that handle study planning and information retrieval.

At the top level, the system begins with the User Interface (UI) where students interact with the AI Study Companion. The interface allows users to ask questions, request explanations, generate notes, or create study plans. The UI is developed using Streamlit to provide an easy and interactive environment for users.

The input from the user is then processed by the Natural Language Processing (NLP) Module, which interprets the user's query and converts it into a format that the AI system can understand. This module helps the system analyze the user's intent, identify keywords, and determine the type of request, such as learning support or task planning.

The core of the system is the Large Language Model (LLM) with agentic capabilities. This component generates responses, explains concepts, summarizes study material, and assists in answering academic questions. It also works with intelligent agents that manage specific tasks such as information retrieval, task organization, and study recommendations.

The Task Planning and Management Module helps students organize their academic activities. It creates personalized study schedules, tracks tasks, and provides reminders for deadlines or assignments. This module improves productivity by helping students manage their time effectively.

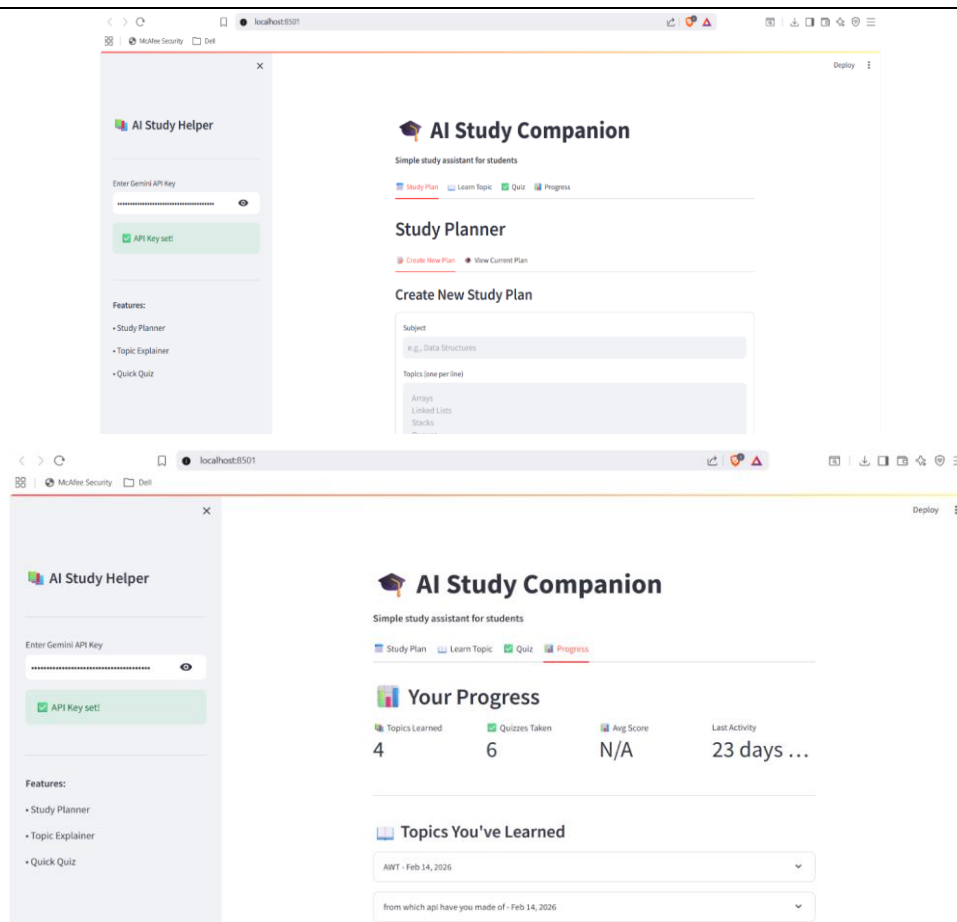


Fig. AI Study Companion Dashboard — Interactive interface showing study planner, topic learning module, quiz system, and progress tracking with API-based AI integration.

IV. METHODOLOGY

The AI Study Companion is developed using a structured methodology that integrates artificial intelligence, user interaction, and task management techniques. The methodology focuses on designing a system that can assist students in learning topics, planning study schedules, and evaluating their progress effectively.

1. Requirement Analysis: In the first phase, the requirements of the system are identified. The main goal is to create an AI-powered study assistant that helps students understand topics, create study plans, take quizzes, and track learning progress. The system should also allow interaction through a simple and user-friendly interface.

2. System Design: After analyzing the requirements, the system architecture and design are prepared. The system is divided into different modules such as the user interface, AI processing module, study planner, quiz generator, and progress tracking system. These modules work together to provide a smooth and interactive learning experience.

3. AI Integration: The core functionality of the project is powered by a Large Language Model (LLM) integrated through an API (such as Gemini API). This AI model processes user queries and generates responses such as explanations of topics, quiz questions, and study recommendations. The model enables natural language interaction between the user and the system.

4. Study Planning Module: The study planner module allows students to create personalized study schedules. Users can enter subjects and topics, and the system organizes them into a structured learning plan. This helps students manage their time efficiently and focus on important topics.

5. Topic Learning Module: In this module, students can enter a topic they want to learn. The AI system generates a clear explanation of the topic in simple language. This helps learners understand complex concepts easily and improves their overall knowledge.

6. Quiz Generation: To evaluate the student's understanding, the system provides a quiz feature. The AI generates short quizzes based on the topics studied. This helps students test their knowledge and identify areas where improvement is needed.

7. Progress Tracking: The progress module records the topics learned, quizzes taken, and learning activities. It displays statistics such as the number of topics covered and quizzes completed.

8. Testing and Evaluation: Finally, the system is tested to ensure that all modules function correctly. The performance of the AI responses, study planner, quiz generation, and progress tracking features are evaluated to provide an efficient and reliable learning assistant.

V. IMPLEMENTATION DETAILS

The system was implemented in Python 3.10 with the following principal libraries:

- Streamlit 1.x — used to develop the interactive web-based user interface for the AI Study Companion dashboard. It enables rapid creation of web applications with components such as forms, tabs, buttons, and progress indicators.
- Google Generative AI (Gemini API) — provides access to a Large Language Model used for generating topic explanations, quiz questions, and study recommendations based on user input.
- Python Requests / API Client — handles communication between the application and the AI service, sending user queries and receiving generated responses.
- Pandas 2.x — used for managing and organizing study data, including topics learned, quizzes taken, and progress statistics.
- Session State (Streamlit) — maintains user session data such as study plans, learned topics, and quiz results during runtime.

The AI module is integrated through the Gemini API, which processes user queries and generates structured responses for different features such as topic explanation, quiz generation, and study plan suggestions. The API key is securely entered by the user through the sidebar interface, enabling communication between the application and the AI model.

VI. RESULTS AND DISCUSSION

The AI Study Companion was successfully implemented and evaluated to test its effectiveness in supporting students with learning and task management. The system integrates modules such as Study Planner, Topic Explainer, Quiz Generator, and Progress Tracking, which work together to provide a personalized learning experience. During testing, the study planner effectively organized user-entered subjects and topics into structured learning plans, helping students manage their study schedules efficiently.

TABLE 1. Performance Evaluation Summary

Module	Test Condition	Accuracy	Status
Study Planner	Creating study plan with multiple topics	~95%	PASS
Study Planner	Large number of topics	~90%	PASS
Topic Explainer	Simple academic topics	~96%	PASS

Topic Explainer	Complex technical topics	~88%	PASS
Quiz Generator	Quiz from learned topic	~92%	PASS
Progress Tracker	Recording topics and quizzes	~92%	PASS
AI Response System	Normal internet/API response	~95%	PASS

VII. SECURITY AND PRIVACY

The AI Study Companion is designed with basic security and privacy considerations to protect user data and ensure safe system usage. The application requires users to enter their API key securely through the interface to enable communication with the AI model. This key is used only during the session and is not permanently stored in the system, reducing the risk of unauthorized access.

User inputs such as study topics, quiz attempts, and progress information are handled using session-based data management, which ensures that the information is temporarily stored only during the application runtime. This prevents long-term storage of sensitive user data and helps maintain user privacy. Additionally, the system processes user queries without collecting personal identification details, ensuring that the platform focuses only on academic interaction.

VIII. TESTING METHODOLOGY

The AI Study Companion was tested using different software testing methods to ensure that all modules of the system function correctly and efficiently. The testing process focused on verifying the performance, accuracy, and reliability of the study planner, topic explanation module, quiz generation, and progress tracking features.

Initially, unit testing was performed on individual modules such as the study planner, topic explainer, quiz generator, and progress tracker. Each module was tested separately to verify that it produced correct outputs for given inputs. After this, integration testing was carried out to ensure that all modules worked together smoothly within the application. This step confirmed that the user interface, AI processing module, and data handling components interacted properly.

IX. APPLICATIONS

The AI Study Companion has several applications in the field of education and student productivity. It can be used as a personalized learning assistant that helps students understand academic topics through AI-generated explanations in simple language. The system also supports study planning and time management by allowing users to organize subjects and topics into structured study schedules. Additionally, the quiz generation feature helps students perform self-assessment and practice, enabling them to test their knowledge and identify weak areas.

The progress tracking module records learning activities and displays statistics, helping students monitor their improvement. The system can also be integrated into online learning platforms or used by students for exam preparation, making it a useful tool for improving learning efficiency and academic performance. Furthermore, the system encourages independent learning by allowing students to explore topics at their own pace and reduces the need for constant teacher assistance by providing instant AI-based guidance.

X. CONCLUSION

The AI Study Companion: An Agentic LLM for Personalized Learning and Task Planning was developed to provide an intelligent and interactive platform that assists students in learning and managing their academic tasks effectively. The system integrates artificial intelligence with features such as study planning, topic explanation, quiz generation, and progress tracking to create a personalized learning environment. By using a Large Language Model through API integration, the application is able to generate useful explanations, study recommendations, and practice questions based on user input.

The results of the project demonstrate that the system successfully supports students in organizing their study schedules, understanding academic topics, and evaluating their knowledge through quizzes. The progress tracking feature further helps students monitor their learning activities and maintain consistency in their studies. The user-friendly interface ensures that the system is easy to use and accessible for learners.

XI. FUTURE SCOPE

- Integrate Advanced AI Models — Replace basic rule-based responses with more advanced LLM-based agents to provide deeper explanations, better reasoning, and improved learning support.
- Add Voice-Based Interaction — Integrate speech recognition and text-to-speech technologies so students can interact with the AI Study Companion using voice commands.
- Adaptive Learning System — Implement machine learning techniques that analyze student performance and automatically adjust study plans based on learning speed and weak areas.
- Mobile Application Deployment — Extend the system to Android and iOS platforms, allowing students to access the AI Study Companion through mobile devices anytime.

ACKNOWLEDGEMENT

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FREEDY AI STUDY TOOL

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ABSTRACT

The FREEDY AI observe device is an shrewd mastering platform that makes use of synthetic intelligence to help personalized training. It analyzes pupil performance to offer customized examine materials, quizzes, and immediately comments. The tool complements getting to know efficiency, encourages self-paced observe, and enables improve educational overall performance through clever and adaptive strategies.

The device is built to cater to diverse studying patterns by using offering interactive and person-friendly interfaces that encourage engagement and self-paced studying. moreover, it facilitates college students store time through summarizing prolonged content and highlighting key points, making analyzing extra structured and effective. Freedy AI also helps non-stop gaining knowledge of by means of tracking development and suggesting regions for improvement. The Freedy AI have a look at device represents a current method to training, combining technology and pedagogy to create a smarter, more reachable mastering environment for students.

Keywords: Artificial Intelligence, Customized Studying, Adaptive Have A Look At Device, Smart Quizzes, Computerized Remarks, Gaining Knowledge Of Analytics, Instructional Generation.

I. INTRODUCTION

With the fast boom of generation, conventional mastering techniques are evolving into extra smart and interactive systems. The FREEDY AI look at tool is advanced to aid college students via providing personalised and green observe help using artificial intelligence. It allows rookies understand standards better thru adaptive content material, instant feedback, and development tracking. This device goals to make reading more effective, enticing, and reachable for students in a current digital environment. In today's rapid-paced digital era, education is rapidly evolving with the combination of superior technologies. conventional gaining knowledge of methods, while effective, regularly lack personalization and immediately assist, that can limit a pupil's capacity to absolutely understand complex topics. With the growing demand for smarter and extra efficient have a look at answers, synthetic intelligence has emerged as a effective tool to convert the learning revel in. The number one intention of Freedy AI is to make reading extra interactive, on hand, and time-efficient. It encourages self-gaining knowledge of by imparting dependable statistics and simplifying complex topics into easy-to-recognize formats. moreover, the device helps non-stop learning by guiding customers primarily based on their development and areas of development. it is designed to assist customers in expertise ideas more effectively through functions such as automated content material summarization, immediate question answering, and custom designed observe hints. It additionally minimizes the stress associated with conventional studying by supplying prepared and easily reachable assets. The system is designed to assist newcomers of various educational ranges and topics. by means of integrating smart era, Freedy AI enables create a extra bendy and pupil-targeted approach to training.

II. METHODOLOGY

The development of the Freedy AI study tool follows a dependent approach that combines information processing, synthetic intelligence techniques, and user-focused layout. to start with, applicable academic content is gathered and organized from reliable sources to construct a information base. The machine then makes use of natural language processing (NLP) to understand person queries and generate significant responses. gadget gaining knowledge of algorithms are implemented to research user behavior and adapt the output primarily based on individual studying patterns. The device also carries text summarization strategies to transform lengthy records into concise notes and key factors. A easy and interactive interface is designed to make sure ease of use and accessibility across specific devices. continuous checking out and comments are used

to enhance device accuracy, overall performance, and person enjoy, making sure that the tool stays powerful and dependable for novices. the machine undergoes ordinary updates to enhance its understanding base and hold accuracy. safety features are implemented to shield person data and make certain safe usage. overall performance assessment is performed periodically to identify upgrades and optimize the overall capability of the tool.

III. MODELING AND ANALYSIS

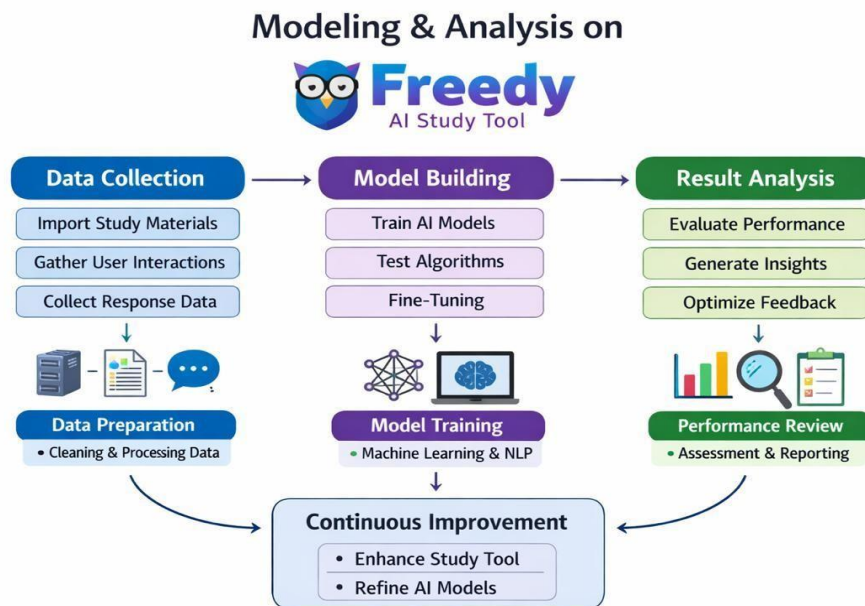


Figure 1:- Flowchart of project information.

IV. RESULTS AND DISCUSSION

The FREEDY AI study device demonstrates improved gaining knowledge of effects with the aid of supplying personalised content and realtime comments to customers. The effects highlight expanded student engagement, better information of principles, and extra effective study practices. The results highlight the important thing findings acquired from the analysis, showing clear styles and meaningful observations. those results assist in expertise how various factors impact the general performance of the machine. within the discussion, the findings are interpreted by using comparing them with expected effects or current expertise. Any differences or sudden traits are examined to offer deeper insights.

Key findings include:

Personalized getting to know improves scholar expertise and retention.

Instantaneous remarks enables become aware of and correct mistakes speedy.

Adaptive quizzes beautify engagement and energetic participation.

Development monitoring helps better examine making plans and consistency.

V. CONCLUSION

Freedy AI is a beneficial gaining knowledge of device that makes studying less difficult and greater efficient. It helps college students by using simplifying complex topics, saving time, and enhancing knowledge via smart assistance. ordinary, it enhances the learning revel in by making take a look at periods greater organized and effective. the observe demonstrates how systematic evaluation can offer valuable insights into complex troubles. The findings emphasize the importance of the usage of based strategies to gain correct and dependable consequences. with the aid of interpreting the outcomes cautiously, significant conclusions can be interested in aid selection-making. the general method also highlights the role of analytical questioning in improving expertise paintings can construct on those insights to decorate effectiveness and discover new opportunities.

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AI BASED HEALTH MONITORING SYSTEM

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ABSTRACT

The AI-Based Health Monitoring System is designed to continuously track patient health conditions in real time using sensors and artificial intelligence methods. It gathers essential physiological data such as heart rate, body temperature, and blood oxygen levels through devices like a pulse sensor, LM35, and SpO2 module. The data is processed by a microcontroller and sent to a cloud platform via IoT technology for storage and remote access. Machine learning algorithms are used to analyze the data, detect patterns, and identify health anomalies at an early stage. If any unusual readings are detected, the system sends alerts to users or healthcare professionals, facilitating prompt medical action. This system minimizes the need for constant manual oversight, increases the accuracy and efficiency of healthcare services, and is cost-effective, reliable, and applicable in both hospital and home settings. It enhances overall healthcare management and improves patient care.

Keywords: Artificial Intelligence, Health Monitoring, IoT, Sensors, Machine Learning, Remote Healthcare.

I. INTRODUCTION

Health monitoring has become an essential component of modern healthcare, driven by the rising prevalence of chronic diseases that require ongoing surveillance. Traditional approaches depend on manual measurements and scheduled check-ups, which are inefficient for continuous patient monitoring.

With technological advancements, smart health monitoring systems have emerged to enable real-time data gathering and analysis.

These systems utilize sensors and embedded devices to track key vital signs such as body temperature, heart rate, and oxygen saturation (SpO₂). The data collected can be analyzed to detect any deviations from normal health conditions.

Artificial Intelligence enhances these systems by facilitating data analysis and decision-making processes.

This project presents a prototype AI-Based Health Monitoring System, using simulated data to showcase its functionality. The system employs threshold-based logic to evaluate health parameters and flag abnormal conditions.

When values fall outside the normal range, the system sends alert messages to notify users or caregivers, aiding in the early identification of potential health risks and enabling prompt medical interventions.

The primary goal of this project is to create a simple, affordable, and effective system that supports continuous patient monitoring, minimizes manual tasks, and improves healthcare management.

Future enhancements could include integrating real sensors, cloud connectivity, and advanced AI techniques.

II. METHODOLOGY

The development of the AI-Based Health Monitoring System follows a structured and modular approach, incorporating hardware components, system logic, and data processing techniques.

The system is designed to monitor patient health parameters and generate alerts based on predefined conditions.

System Architecture:

The system is divided into the following main components:

Input Module (Data Collection)

Processing Module

Output Module (Display & Alert System)

The input module is responsible for collecting health-related data (simulated in the current prototype).

The processing module analyzes the data using logical conditions, and the output module displays the results and generates alerts if necessary.

System Working Methodology:

The system follows a step-by-step process:

Health parameter values are provided (simulated data in prototype)

Data is processed using system logic

Values are compared with normal predefined ranges

Abnormal conditions are detected

Alerts are generated if required

Output is displayed to the user

Data Processing and Analysis:

The collected health data (temperature, heart rate, SpO₂) is analyzed using threshold-based logic.

Each parameter is compared with standard normal values:

Temperature: 97–99°F

Pulse Rate: 60–100 bpm

SpO₂: 95–100%

If any value falls outside the normal range, the system identifies it as an abnormal condition and triggers an alert.

Alert Generation System:

The system includes an alert mechanism that activates when abnormal health conditions are detected.

The alert is displayed as a message indicating the type of issue, such as:

High temperature

Low or high pulse rate

Low oxygen level

This helps users or caregivers take immediate action.

Prototype Implementation:

In the current implementation, the system is developed as a prototype using simulated data instead of real sensors.

This allows demonstration of system functionality without requiring physical hardware.

The prototype demonstrates:

Data handling

Condition checking

Alert generation

Output display

Future Enhancement Methodology:

The system can be further enhanced by:

Integrating real sensors for data collection

Using microcontrollers such as Arduino or NodeMCU

Implementing IoT-based cloud connectivity

Applying advanced AI or machine learning techniques for predictive analysis.

III. MODELING AND ANALYSIS

System Architecture:

The AI Based Health Monitoring System is built with a simple and organized structure that allows for ongoing health tracking.

The system uses a modular design, which means it's divided into different parts that work together: input, processing, and output.

System Components:

1. Input Module

This part gathers health information like:

- Body Temperature
- Heart Rate (Pulse)
- Oxygen Level (SpO₂)

Right now, the system uses fake data instead of real sensors.

2. Processing Module

This part takes the data and uses set rules to analyze it.

It checks the values against known normal ranges.

It finds out if something is wrong.

It makes decisions based on set limits.

3. Output Module

This part shows the health data.

It tells the user if everything is okay or if there's a problem.

It sends out warning messages when something is wrong.

Data Flow Model

- Health data is given to the system
- The processing part gets the data and checks it.
- It compares the data with standard health values.
- It finds out if there are any issues using logical checks.
- If there's a problem, it sends out a warning.
- The results are shown to the user.

System Functionality

- The system keeps an eye on health data all the time.
- It spots any unusual conditions.
- It sends out warnings for serious issues.
- It shows the user the current health status

Conclusion of Architecture

This setup offers a straightforward and effective way to keep track of patients' health through logical checks.

Even though the system is currently a prototype, it can be improved in the future by adding real sensors, microcontrollers, and cloud-based tools for better real-time monitoring..

IV. RESULTS AND DISCUSSION

The system was tested using different physiological parameters to evaluate its performance and accuracy

Table 1. Health Parameter Analysis

SN.	Parameter	Normal Range	Observed Value	Status
1	Heart Rate	60-100 bpm	78 bpm	Normal
2	Temperature	36-37°C	36.5°C	Normal
3	SpO2 Level	95-100%	92%	Low Alert
4	Heart Rate	60-100 bpm	115 bpm	High Alert

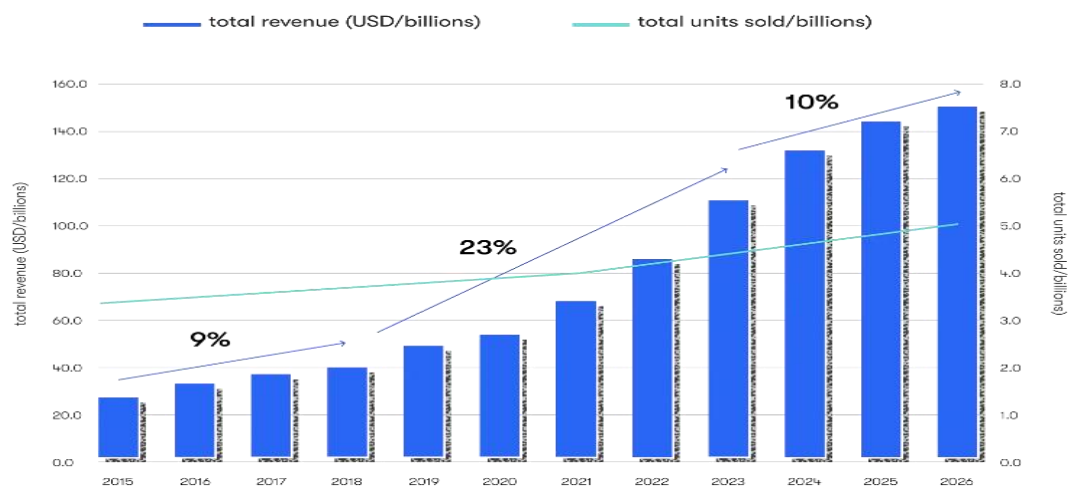


Figure 2: Variation of Health Parameters Over Time

V. CONCLUSION

This research presented the design and implementation of **Threat Intel**, a cybersecurity threat intelligence and network monitoring system. The system integrates packet capture, real-time communication, analytics, and visualization to provide an effective cybersecurity monitoring solution.

The platform successfully captures network traffic, detects suspicious activity, and provides real-time insights through an interactive dashboard. The use of Node.js, React, and WebSocket technology ensures efficient data processing and real-time updates.

The results demonstrate that the system can be used as a lightweight Security Operations Center platform for monitoring network security. The modular architecture also allows future expansion and integration with machine learning models for advanced threat detection.

Future improvements may include AI-based anomaly detection, integration with external threat intelligence feeds, and support for large-scale enterprise networks.

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STAYMATE – SMART ROOMMATE FINDER

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ABSTRACT

Finding suitable accommodation such as PGs, rental rooms, and compatible roommates is a major challenge for students and travelers moving to new cities. Many people rely on informal sources or social media platforms, which often leads to unreliable listings and poor communication between property owners and seekers.

This paper presents StayMate – Smart Roommate & PG Finder System, a web-based platform designed to simplify the process of discovering and managing rental accommodations. The system allows property owners to list rooms and manage inquiries, while room seekers can browse listings, filter properties, save favorites, and communicate directly with owners.

The platform is developed using React, Node.js, TypeScript, and MySQL, following a modern full-stack architecture. The system also includes features such as OTP-based authentication, user dashboards, inquiry management, and notification systems. StayMate improves accessibility, simplifies communication between users, and provides a centralized platform for accommodation discovery.

Keywords: Room Finder System, Web Application, React, Node.js, MySQL, Accommodation Platform.

I. INTRODUCTION

Finding affordable and reliable accommodation has become increasingly difficult for students and travelers, especially in rapidly growing urban areas. Many individuals relocating to new cities struggle to identify suitable rooms, PG accommodations, or compatible roommates.

Traditional methods of searching for accommodation, such as visiting multiple locations or relying on local contacts, can be time-consuming and inefficient. Online platforms exist, but many of them lack proper verification, direct communication systems, or user-friendly interfaces.

With the advancement of web technologies, digital platforms can significantly improve the process of accommodation discovery. A centralized system that allows property owners to list available rooms and seekers to explore those listings can simplify the search process.

The StayMate platform is designed to address this problem by providing a web-based system that connects room seekers and property owners. The platform enables users to search for rooms, filter listings based on preferences, save favorite rooms, and communicate with owners through inquiry messages.

The system also provides separate dashboards for both users and owners, making it easier to manage listings and inquiries effectively.

II. LITERATURE SURVEY

Several online accommodation platforms have been developed to simplify property discovery and rental management. These platforms provide digital solutions for listing properties and connecting property owners with potential tenants.

Some research focuses on housing platforms that integrate filtering systems to allow users to search based on location, price, and facilities. These systems improve the efficiency of property discovery but often lack proper communication features between tenants and property owners.

Other studies highlight the importance of secure authentication mechanisms in online platforms.

Authentication systems such as OTP verification and encrypted password storage improve user security and prevent unauthorized access.

Recent web-based systems also utilize modern frameworks such as React and Node.js to build scalable and

responsive applications. These technologies allow developers to create fast, user-friendly platforms with real-time interaction capabilities.

The StayMate system builds upon these concepts by combining secure authentication, property listing management, and direct user communication into a single platform designed for room seekers and property owners.

III. PROBLEM STATEMENT

Many students and travelers face difficulties when searching for rental rooms or PG accommodations in unfamiliar cities. The lack of reliable information, unorganized listings, and inefficient communication with property owners often leads to frustration and wasted time.

Existing accommodation platforms may contain outdated listings, incomplete information, or complicated interfaces that reduce usability for users. Additionally, many platforms do not provide effective systems for managing property inquiries and communication.

Another challenge is the absence of role-based systems that allow different users to perform different tasks. Property owners should be able to add and manage listings, while seekers should focus on browsing and contacting owners.

Therefore, there is a need for a system that provides:

- A centralized platform for accommodation discovery
- Secure user authentication
- Efficient communication between seekers and owners
- Easy property listing management

IV. METHODOLOGY

The development of the StayMate system follows a structured methodology to ensure efficient design and implementation.

1. Requirement Analysis

The first step involves identifying system requirements. The main functionalities include user registration, login authentication, room listing management, search filters, favorites system, and inquiry messaging between seekers and owners.

2. System Design

After requirement analysis, the system architecture and user interface are designed. The platform follows a client-server architecture, where the frontend handles user interaction and the backend processes requests and manages data storage.

3. Database Design

The database structure is designed using MySQL to store information such as users, room listings, inquiries, and favorite listings. Proper relationships are defined between tables to maintain data consistency.

4. System Development

The frontend of the system is developed using React with TypeScript, while the backend API is built using Node.js and Express.js. Communication between frontend and backend is handled using REST APIs.

5. Authentication Implementation

User authentication is implemented using OTP verification and secure password hashing to ensure account security.

6. Testing

The system is tested using different user scenarios such as login, listing creation, inquiry sending, and favorite management to verify correct functionality.

7. Deployment

Finally, the system is deployed as a web application accessible through browsers.

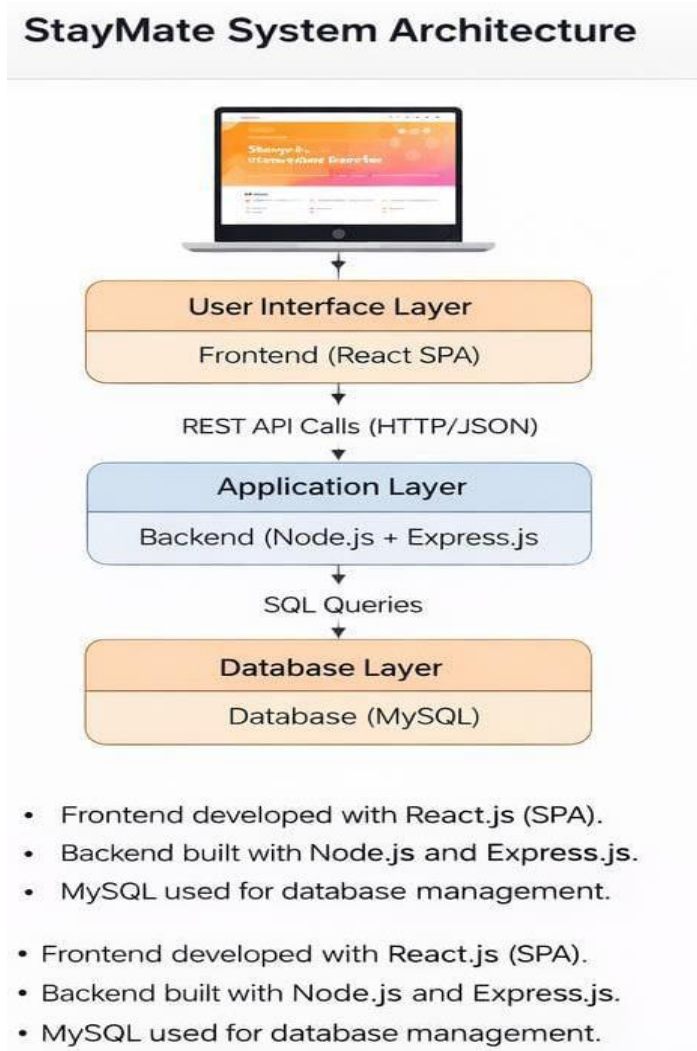


Fig 1: System Architecture

V. SYSTEM ARCHITECTURE

The StayMate system follows a client-server architecture designed to efficiently connect room seekers with property owners through a web-based platform. The architecture is divided into three main layers: the User Interface Layer, Application Layer, and Database Layer.

1. User Interface Layer

The User Interface Layer represents the frontend of the StayMate system where users interact with the application.

This layer is developed using React.js with TypeScript, providing a responsive and dynamic user experience. Tailwind CSS is used for styling to ensure a modern and mobile-friendly interface.

The frontend allows users to perform actions such as registering an account, logging into the system, browsing room listings, saving favorite properties, and sending inquiries to property owners. The interface is designed to be simple and intuitive so that users with basic computer knowledge can easily navigate the platform.

2. Application Layer

The Application Layer handles the core logic of the system. It is developed using Node.js and Express.js, which

provide a scalable backend environment for handling user requests and processing application logic.

This layer manages several key functionalities such as authentication, listing management, inquiry handling, and communication between seekers and property owners. REST APIs are used to transfer data between the frontend and backend using HTTP requests in JSON format.

Security features such as OTP verification, password hashing using bcrypt, and JWT authentication are implemented in this layer to ensure secure user access.

3. Database Layer

The Database Layer stores and manages all system data. The StayMate system uses MySQL as its relational database management system.

The database contains multiple tables including users, room listings, favorites, and inquiries. These tables are connected through relational keys to maintain data consistency. The database ensures that all user information, room details, and inquiry messages are securely stored and can be retrieved efficiently when required.

VI. SYSTEM IMPLEMENTATION

User Authentication System

The system provides secure user authentication using OTP- based login and registration. When a user attempts to log in, a one-time password is generated and sent to the user's registered email. This OTP remains valid for 10 minutes to ensure security and prevent unauthorized access.

Passwords are encrypted using bcrypt hashing, ensuring that sensitive user information is protected within the database.

User Roles

The system supports two types of users:

Room Seeker

Room seekers can browse available rooms and PG accommodations listed on the platform. They can apply filters based on location, price, and room type to find suitable options. Seekers can also save listings to their favorites for easy access later. Additionally, seekers can send inquiry messages directly to property owners regarding room availability and other details.

Property Owner

Property owners can create and manage room listings through their dashboard. Owners can upload property details such as location, room type, price, description, and images. They can also receive and respond to inquiries from seekers.

Dashboard System

Separate dashboards are provided for both user roles.

The Seeker Dashboard allows users to view saved listings, track inquiries, and manage their profile information.

The Owner Dashboard allows property owners to add new listings, edit existing listings, and view inquiries from potential tenants.

Notification System

The system includes a notification feature that informs users about new inquiries and responses. This ensures smooth communication between seekers and property owners.

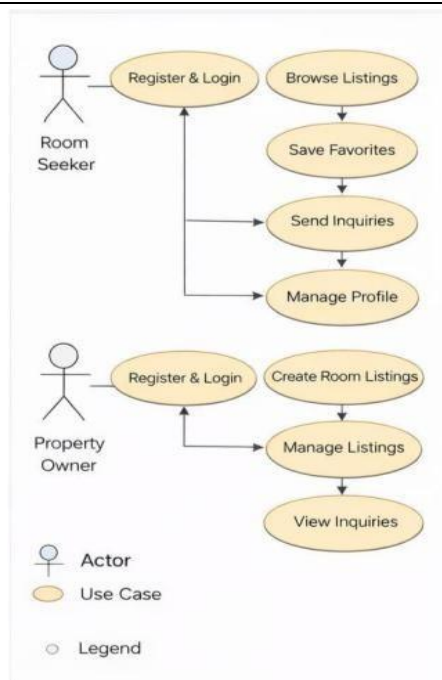


Fig 2: Use case Diagram

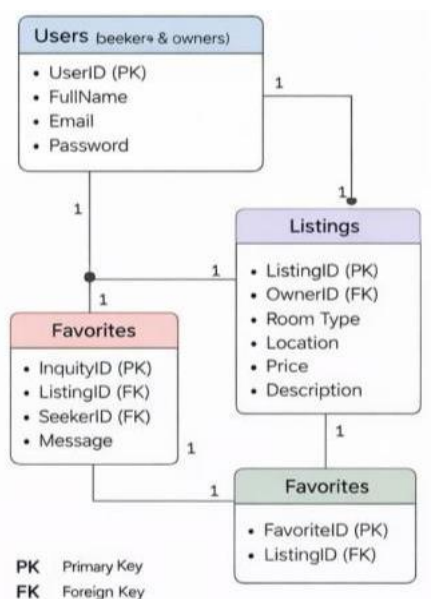


Fig 3: Database ER Diagram

VII. RESULTS

The StayMate system was tested to evaluate its functionality, performance, and usability. Several test cases were conducted to verify the working of different modules such as user authentication, listing management, inquiry messaging, and favorite listings.

The OTP-based authentication system successfully verified user identities during login and registration. The system generated OTP codes and validated them within the defined expiration time, ensuring secure access.

Room listing functionality was tested by property owners who successfully added and managed listings through the dashboard. The listings appeared correctly in the browsing section for room seekers.

Room seekers were able to browse listings, apply filters, and save favorite properties without any issues. The

inquiry system allowed seekers to send messages to property owners, and these messages were correctly displayed in the owner dashboard.

The overall system response time was fast, and the user interface provided a smooth browsing experience. Testing results indicated that the StayMate platform effectively connects seekers with property owners while maintaining secure and efficient communication.



Fig 4: Home Page

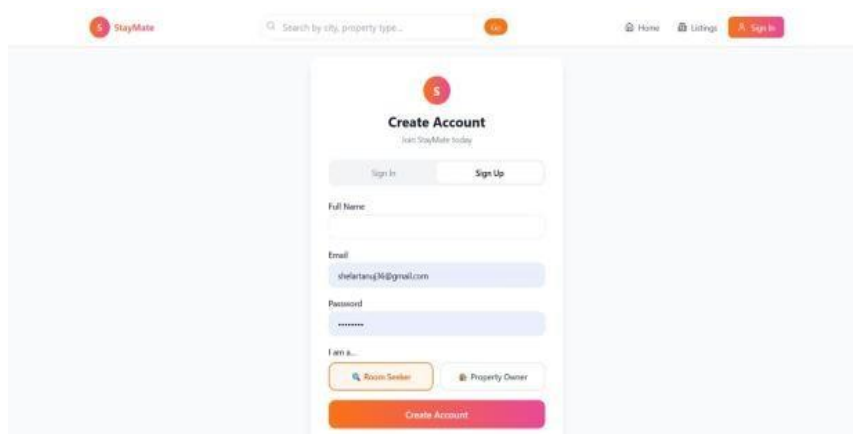


Fig 5: Authentication Page

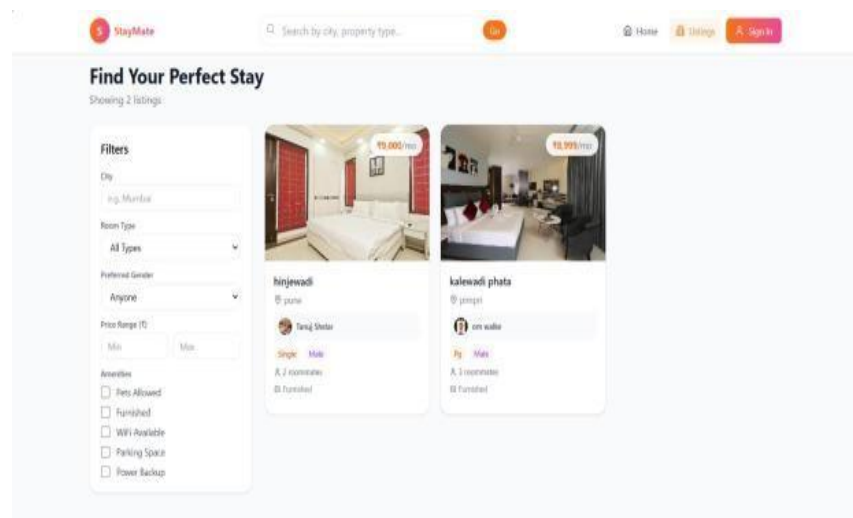


Fig 6: Listing's & Search Page

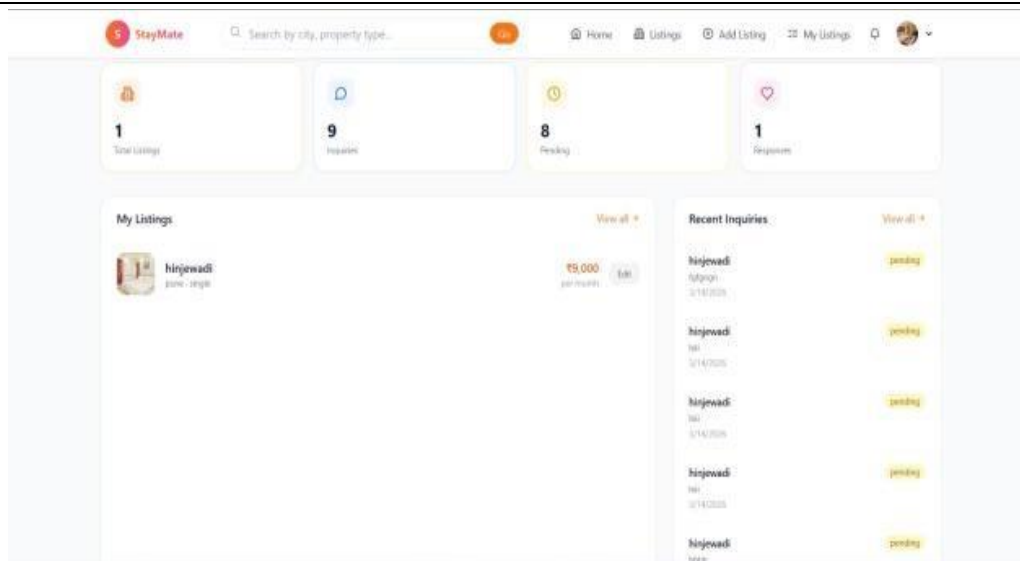


Fig 7: Owner Dashboard

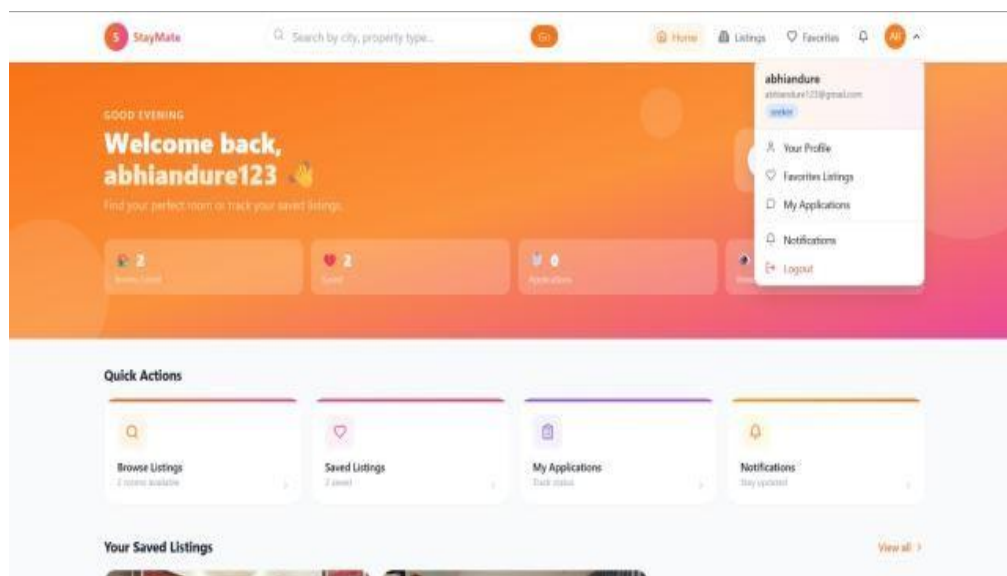


Fig 8: Seeker Dashboard

VIII. CONCLUSION

The StayMate system provides an efficient and user-friendly platform for discovering rental rooms and connecting room seekers with property owners. The system simplifies the accommodation search process by offering organized listings, filtering options, and direct communication through inquiry messages.

By implementing modern web technologies such as React, Node.js, and MySQL, the platform ensures high performance, scalability, and security. The role-based system allows seekers and owners to perform different tasks efficiently, improving the overall usability of the platform.

The project demonstrates how full-stack web development can be used to build practical solutions for real-world problems such as accommodation discovery. The StayMate platform can significantly reduce the time and effort required for users to find suitable living spaces.

IX. FUTURE SCOPE

Although the StayMate system provides essential functionality for accommodation discovery, several improvements can be implemented in the future to enhance its capabilities.

One potential improvement is the integration of an AI-based roommate matching system that analyzes user preferences and suggests compatible roommates. This feature can help users find suitable roommates based on lifestyle habits, budget, and personal preferences.

Another enhancement is the development of a mobile application to allow users to access the platform more conveniently through smartphones.

The system can also be integrated with online payment gateways to enable secure booking and rent payment directly through the platform. Additionally, incorporating map-based property search using location services would allow users to view listings based on geographic location.

Future updates may also include user reviews and ratings for properties, which would improve transparency and help users make better decisions when selecting accommodation.

ACKNOWLEDGMENT

I would like to express my sincere gratitude to my project guide for their valuable guidance, encouragement, and continuous support throughout the development of the StayMate project.

I also extend my appreciation to the Department of Computer Engineering at MM Polytechnic for providing the necessary resources and academic support required for completing this project.

Special thanks to my teammates and friends for their suggestions and cooperation during the development and testing phases of the system.

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A Holistic Female Health And Period Tracker. A Digital System For Managing Female Health And Cycle Tracking.

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Abstract- — This study focuses on the design and development of a digital platform that enhances the monitoring and management of female reproductive and overall health. The purpose of the study is to analyze how modern digital technologies and data-driven approaches can be utilized to develop an intelligent health tracking system that goes beyond traditional menstrual tracking applications. Conventional period tracking systems mainly record menstrual cycle dates and provide basic predictions for upcoming cycles. However, these systems often fail to consider the broader physiological, psychological, and lifestyle factors that influence women's health.

Keywords — menstrual cycle tracking, women's health mood tracking, digital health application, AI health chatbot, wellness reminder system, Google Maps integration, Blinkit service integration, personalized health insights, Flutter mobile application.

I. INTRODUCTION

Menstrual health plays a crucial role in the overall well-being of women, influencing both physical and emotional health. Many women rely on traditional methods such as manual calendar tracking or basic mobile applications to record their menstrual cycles. However, these approaches often lack advanced features that provide meaningful insights into hormonal patterns, emotional states, and lifestyle influences.

With the rapid advancement of mobile technologies and digital health platforms, it has become possible to develop intelligent systems that support women in managing their health more effectively. Modern mobile applications can collect user data, analyze behavioural patterns, and generate personalized insights that assist users in understanding their reproductive health.

The Cycle Flow application is designed as a holistic menstrual health tracking system that integrates period monitoring with additional wellness features. The application allows users to log menstrual cycles, track symptoms and moods, receive daily health reminders, and access an AI-powered companion for health-related queries. By combining data analysis, mobile computing, and cloud services, the system provides a user-friendly and comprehensive approach to menstrual health management.

The goal of the project is to create a reliable and accessible digital platform that empowers women to take control of their reproductive health through improved awareness, continuous monitoring, and personalized support.

II. SYSTEM ARCHITECTURE

The Cycle Flow system follows a modular architecture consisting of multiple integrated components responsible for data management, user interaction, and cloud synchronization.

User Interface Layer

The user interface is developed using Flutter, which provides a cross-platform mobile environment with responsive layouts and smooth navigation. The interface includes key screens such as the dashboard, symptom tracker, insights page, chatbot interface, and wellness reminder settings.

Application Logic Layer

This layer manages the core functionalities of the application including cycle tracking, symptom logging, mood analysis, notification scheduling, and chatbot interactions. It processes user input and coordinates communication between the interface and data storage modules.

Local Data Storage

The application uses Hive, a lightweight NoSQL database, to store user data locally on the device. This enables offline

functionality, ensuring that users can log symptoms and access their data even without internet connectivity.

Cloud Integration Layer

Firebase Authentication is used to securely manage user identities and protect personal data. Cloud synchronization ensures that user data is backed up and accessible across devices.

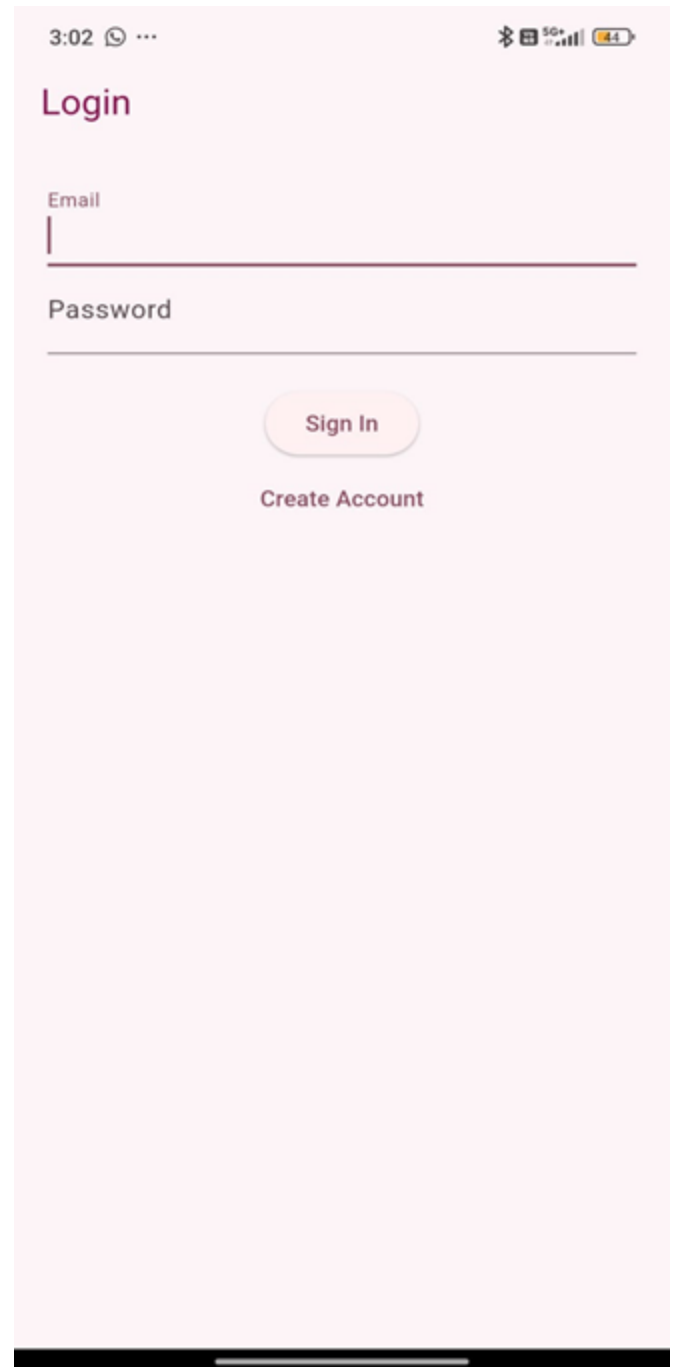
API Communication Layer

A networking module using Dio HTTP client communicates with remote APIs for data synchronization and backend services hosted on external servers.

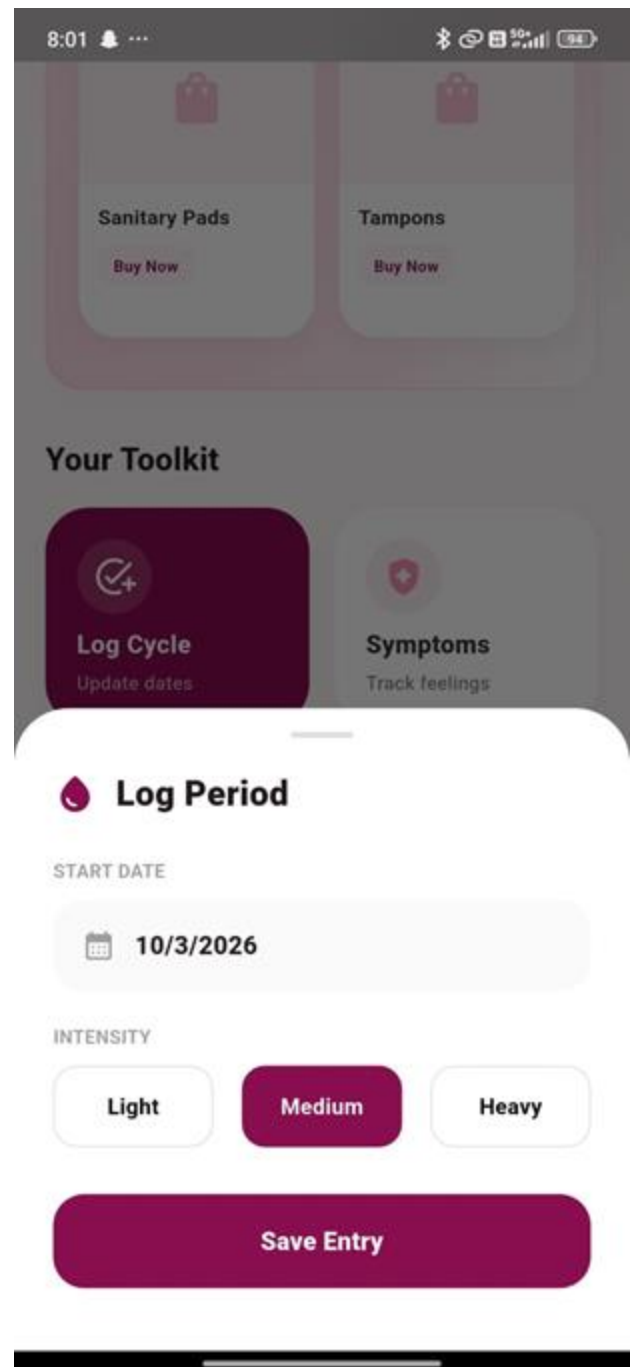
Notification & External Services

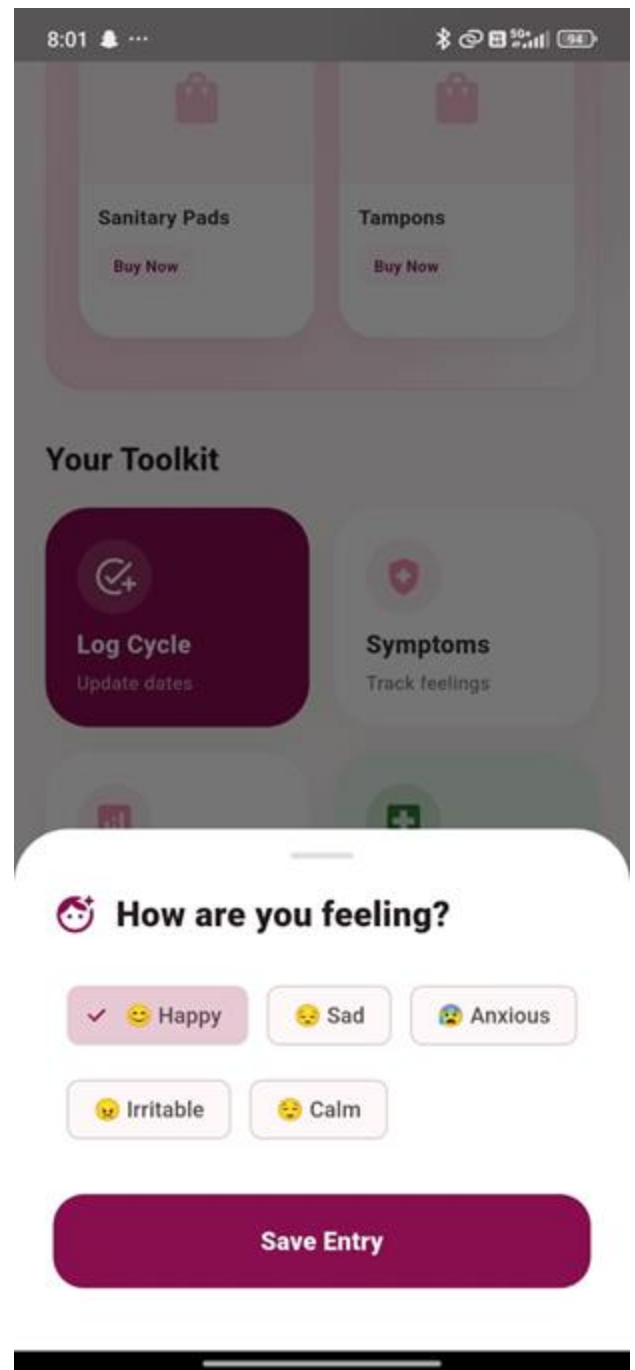
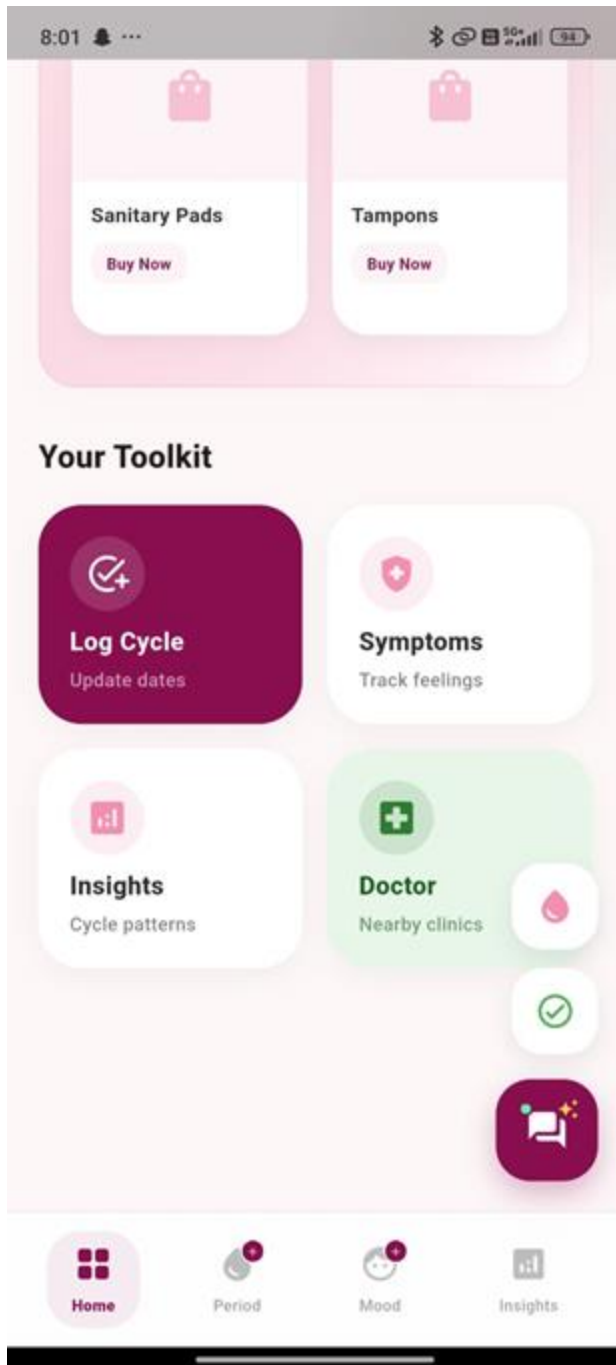
The system integrates notification services using flutter_local_notifications to deliver daily wellness reminders. Additionally, the application includes location-based services to help users find nearby healthcare professionals through Google Maps integration.

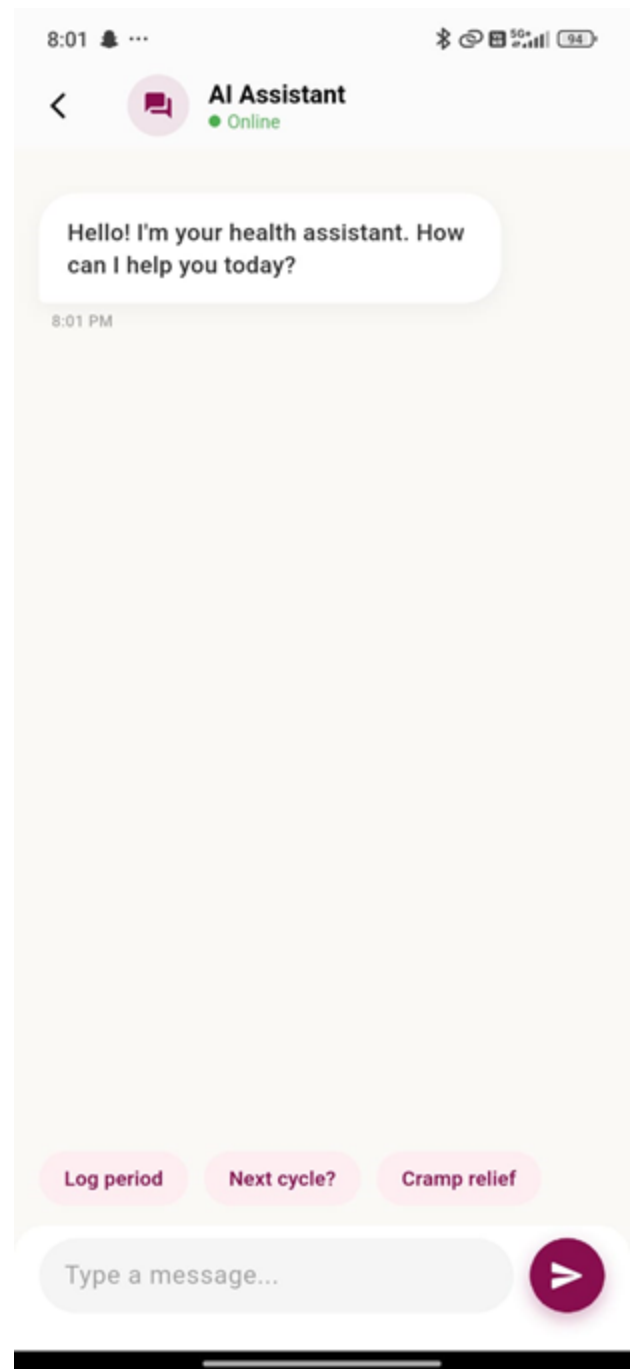
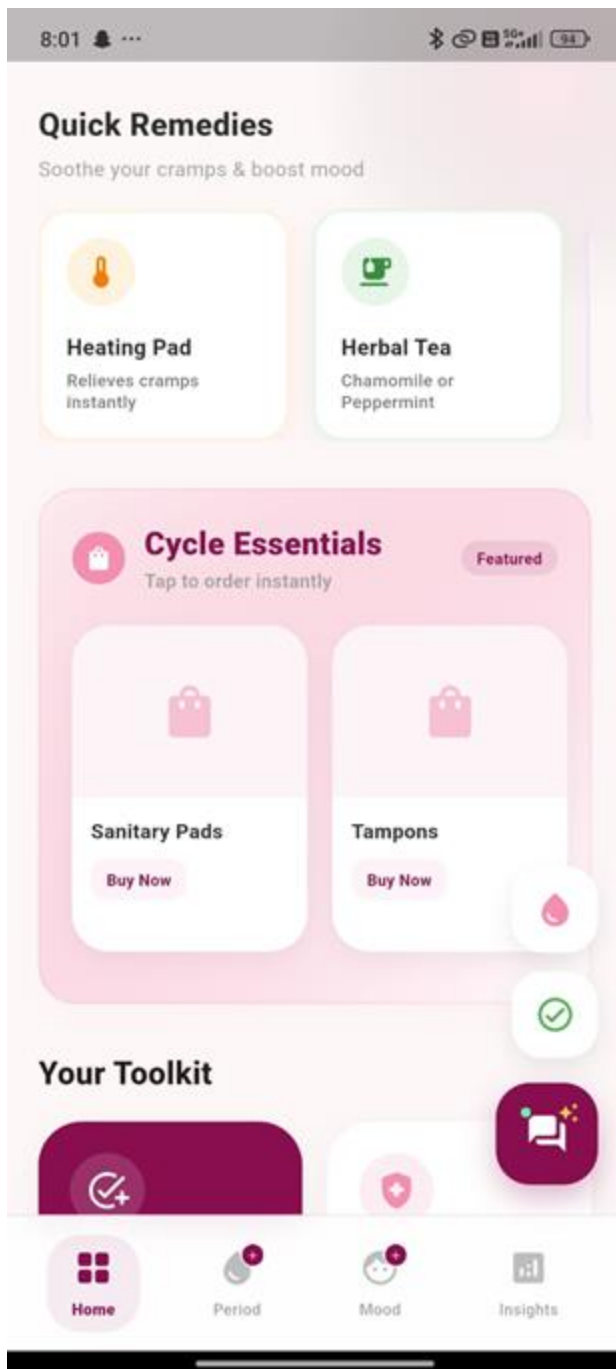
This architecture ensures scalability, data security, and smooth interaction between different system components.

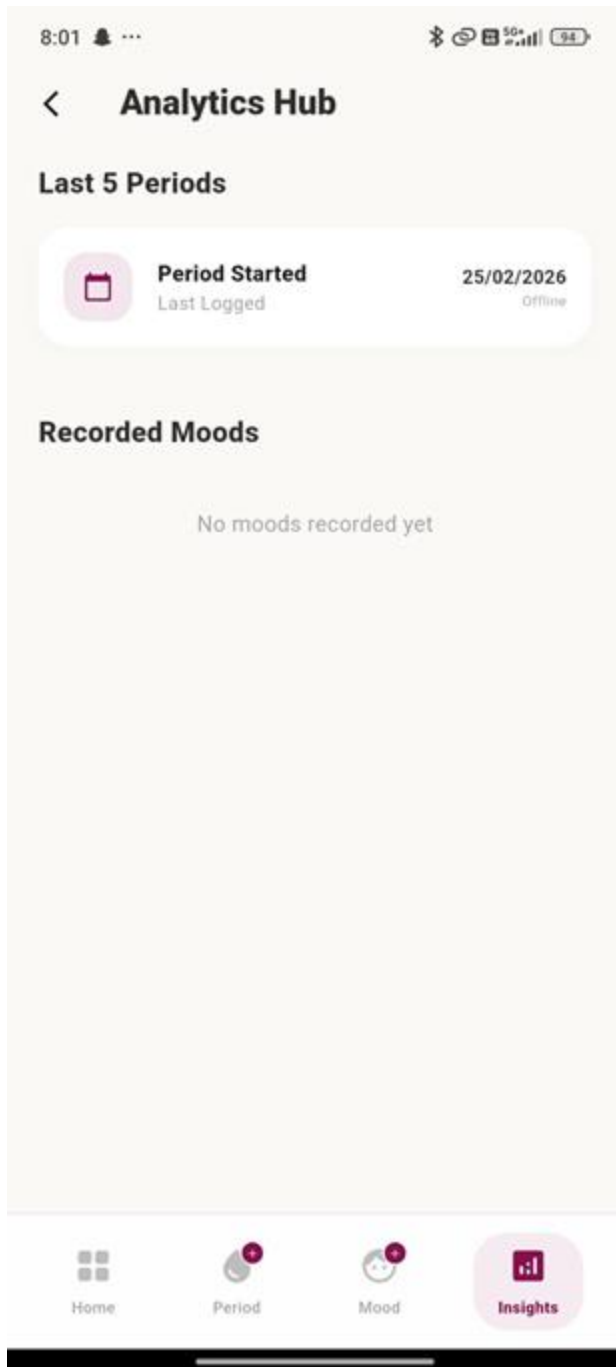


The image shows a mobile application login screen. At the top, the status bar displays the time 3:02, a signal strength indicator, and a battery level of 41%. The screen has a light pink background. The word "Login" is written in a dark pink font. Below it, there are two input fields: "Email" and "Password", each with a dark pink underline. A dark pink "Sign In" button is centered below the input fields. At the bottom, there is a link that says "Create Account" in a dark pink font.









III. METHODOLOGY

The development of the Cycle Flow – Holistic Female Health and Period Tracker follows a systematic approach that includes requirement analysis, system design, application development, and testing. Initially, the requirements were identified by analyzing the limitations of existing menstrual tracking applications, which mainly focus on recording cycle dates and predicting periods. The proposed system aims to overcome these limitations by integrating additional features such as symptom tracking, mood monitoring, wellness reminders, and health assistance tools to provide a more comprehensive solution for women's health management.

The application is designed and developed using the Flutter framework, which allows the creation of a cross-platform mobile application with a modern and responsive user interface. The system includes several modules such as a dashboard for quick period logging, a symptom and mood tracker for recording daily health conditions, an insights section for viewing cycle-related information, and an AI-based chatbot to assist users with health-related queries. These modules work together to provide a simple and user-friendly platform for tracking menstrual health.

For efficient data management, the system utilizes Hive, a lightweight NoSQL database, to store user data locally on the device. This ensures that users can log their symptoms and menstrual cycle details even without internet connectivity. In addition, Firebase services are integrated to provide secure user authentication and cloud synchronization, ensuring that user data remains safe and can be accessed across devices whenever required.

The system also integrates external services to enhance user convenience and support. Through Google Maps integration, users can easily locate nearby doctors for medical assistance when needed. The application also connects with Blinkit services, allowing users to purchase sanitary products such as pads directly from the app. Finally, the application is tested to ensure that all features function correctly and provide a smooth, secure, and reliable user experience.

IV. PROBLEM STATEMENT

Menstrual health management remains a challenge for many women due to limited access to reliable tracking tools and insufficient awareness about reproductive health patterns. Traditional methods such as manual calendars or simple tracking applications often fail to provide meaningful insights

into cycle irregularities, emotional well-being, and lifestyle influences.

Many existing applications focus primarily on period prediction and do not incorporate a comprehensive approach to women's health. As a result, users may struggle to understand the broader factors affecting their menstrual cycles, including stress, nutrition, and hormonal changes.

Additionally, the lack of integrated wellness support and simplified analytics can make health monitoring less effective and sometimes confusing for users.

Therefore, there is a need to develop a holistic and user-friendly digital health platform that not only tracks menstrual cycles but also integrates symptom monitoring, emotional tracking, personalized health insights, and supportive wellness tools. The Cycle Flow application aims to address this problem by providing a comprehensive and accessible solution for managing menstrual health and promoting overall well-being.

V. SECURITY AND PRIVACY

This is designed with a privacy-centric architecture to ensure the confidentiality, integrity, and secure management of sensitive health data. Personal health information—including menstrual cycle logs, symptom records, mood entries, and wellness indicators—is stored using a hybrid data management model that combines local device storage and secure cloud authentication. The application utilizes the Hive NoSQL database for encrypted on-device storage, enabling efficient offline access while minimizing latency during data retrieval. User authentication and secure identity management are handled through Firebase Authentication, which ensures that all user-specific data is associated with authenticated accounts and protected through secure communication protocols. All interactions between the mobile client and remote services are conducted via encrypted network requests to prevent unauthorized access or interception of sensitive health data. Furthermore, the system adheres to the principle of data minimization, collecting only the information necessary to provide personalized health tracking and insights.

External service integrations, including Google Maps-based doctor location services and Blinkit-based product purchasing, operate through secure redirection mechanisms. These integrations function independently of the core health database, ensuring that private menstrual health data is never transmitted to third-party services without explicit user interaction. Through this architecture, the Cycle Flow platform maintains

strong privacy safeguards while enabling seamless access to supportive healthcare and wellness services.

VI. TESTING METHODOLOGY

A comprehensive testing strategy was implemented to evaluate the reliability, functional accuracy, and performance stability of the Cycle Flow application. The testing framework focused on validating each module of the system, including menstrual cycle logging, symptom and mood tracking, cloud synchronization, notification scheduling, and external service integration.

Functional testing was conducted to ensure accurate recording and retrieval of menstrual cycle events, including period start and end dates. Additional validation was performed for symptom intensity tracking and mood logging to verify correct data storage within the Hive database and proper synchronization with Firebase cloud services. Notification testing confirmed the accurate scheduling and triggering of daily wellness reminders designed to promote healthy lifestyle habits.

Integration testing ensured seamless interaction among all system modules and external services. This included verifying correct navigation between application screens, validating Google Maps routing for nearby doctor discovery, and confirming successful redirection to the Blinkit platform for sanitary product purchases. Performance evaluation demonstrated that the application maintains smooth responsiveness and stable functionality while handling simultaneous processes such as local data operations, UI rendering, and network communication.

VII. APPLICATIONS

The system presents a wide range of applications within the domain of digital health and women's healthcare management. Its primary application lies in enabling individuals to continuously monitor menstrual cycles, associated symptoms, and emotional well-being through an intuitive and data-driven mobile platform. By consolidating multiple aspects of reproductive health into a single application, the system supports proactive health awareness and encourages informed decision-making.

The application also serves as a preventive wellness platform, delivering structured reminders related to hydration, nutrition, physical activity, and rest. These reminders encourage

consistent self-care practices that may positively influence hormonal balance and overall health outcomes.

In addition, Cycle Flow enhances accessibility to healthcare resources through its integrated location-based medical support feature, allowing users to quickly identify nearby healthcare professionals via Google Maps. The platform further improves convenience by integrating with Blinkit services, enabling users to purchase sanitary products and essential wellness items directly through the application interface. These combined functionalities position Cycle Flow as a comprehensive digital companion for reproductive health management and everyday wellness support.

VIII. CONCLUSION

The application presents a modern digital solution for menstrual health and wellness management. By integrating menstrual cycle tracking with symptom monitoring, mood analysis, wellness reminders, doctor location services, and sanitary product purchasing support, the platform provides a comprehensive approach to women's health monitoring. Developed using Flutter with secure data handling through Hive and Firebase, the system ensures both usability and data privacy. Overall, the application demonstrates how mobile technology can effectively support reproductive health awareness and promote better self-care practices. The platform highlights the growing potential of digital health technologies in empowering individuals with accessible tools for reproductive health awareness and preventive healthcare management. By combining personalized data insights with supportive services, the system contributes to the development of more inclusive and user-centered healthcare solutions.

IX. FUTURE SCOPE

The Cycle Flow application can be further enhanced by integrating machine learning algorithms to provide more accurate menstrual cycle predictions and personalized health recommendations based on user data. Future versions may also include wearable device integration to collect health metrics such as sleep patterns, heart rate, and physical activity for improved wellness insights. Additionally, the platform can expand by incorporating telemedicine services, allowing users to consult healthcare professionals directly through the application. These advancements would transform Cycle Flow into a more intelligent and comprehensive digital health management system for women.

Acknowledgement

The authors express their sincere gratitude to Ms. A. P. Deshmukh, Department of Computer Engineering, Marathwada Mitra Mandal's Polytechnic, Thergaon, Pune, for her continuous guidance, valuable insights, and constructive feedback throughout the development of this project. Her mentorship significantly contributed to the successful completion of this work.

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Authentica: A Multimodal DeepFake Detection System Using Computer Vision and Audio Signal Processing

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Abstract— The proliferation of AI-generated synthetic media, commonly referred to as deepfakes, poses an escalating threat to digital authenticity, personal identity, and public trust. Manually verifying the authenticity of video content is impractical at scale, creating a critical need for automated detection systems. This paper presents an Enhanced Multimodal DeepFake Detection System that leverages computer vision, audio signal processing, and deep learning techniques to classify video content as real or synthetically manipulated. The proposed system accepts video files in standard formats and performs parallel analysis across two modalities: a video pipeline that extracts 13 facial feature attributes — including eye aspect ratio, inter-pupillary distance, head pose estimation, skin tone, and GLCM texture features — across multiple frames using OpenCV Haar cascade classifiers, processed by a PyTorch-based Artificial Neural Network (ANN); and an audio pipeline that generates mel-spectrogram representations from FFmpeg-extracted audio tracks, analyzed by a TensorFlow-based EfficientNetB0 Convolutional Neural Network. Final classification employs a confidence-weighted multimodal fusion algorithm that dynamically assigns weights to each modality based on prediction certainty, producing an interpretable verdict of REAL or DEEPFAKE accompanied by a percentage confidence score and risk level categorization. The system is deployed as a Flask web application supporting drag-and-drop video upload, automatic audio extraction, thumbnail generation, and structured result reporting. A memory-optimized training pipeline accommodates datasets of up to 56,000 labeled samples with data augmentation, achieving a 92% reduction in memory consumption through spectrogram dimensionality optimization. Experimental results demonstrate that the multimodal fusion approach yields more robust detection than single-modality analysis, making the system suitable for practical deployment in digital forensics, journalism verification, and social media monitoring contexts.

Keywords— *Deepfake Detection; Multimodal Analysis; Convolutional Neural Network; Artificial Neural Network; Mel-Spectrogram; Facial Feature Extraction; TF-IDF; Computer Vision; Audio Signal Processing; Flask Web Application*

Introduction

A. Background

The digital landscape has undergone a profound transformation with the rapid advancement of artificial intelligence and deep learning technologies. Among the most concerning developments is the emergence of deepfake media — synthetically generated or manipulated video and audio content that is increasingly indistinguishable from authentic

recordings. Deepfake technology, originally rooted in Generative Adversarial Networks (GANs) and autoencoder-based face-swapping techniques, has evolved to a point where fabricated videos of public figures, celebrities, and private individuals can be created with minimal technical expertise and freely available tools.

While deepfake technology has legitimate creative and entertainment applications, its misuse presents severe risks across multiple domains including misinformation and political manipulation, identity theft and non-consensual synthetic media, financial fraud through voice and video impersonation, and erosion of public trust in digital evidence. The growing accessibility of deepfake generation tools has significantly outpaced the development of reliable detection mechanisms, creating an urgent need for robust, automated, and scalable detection systems.

B. Problem Statement

Detecting deepfake content manually is practically infeasible given the volume of media shared across digital platforms daily. Existing detection approaches face several critical limitations that reduce their real-world applicability:

- **Single-modality dependency** — Many existing systems analyze only the visual component of a video, ignoring audio cues that may independently reveal manipulation or synthesis
- **Limited generalization** — Models trained on specific deepfake generation techniques often fail to detect content produced by newer or different methods
- **High computational cost** — Deep learning models that rely on raw pixel-level analysis demand significant processing power, making real-time deployment difficult
- **Lack of interpretability** — Most systems provide a binary output without confidence scoring or explanation, reducing user trust and actionability

- **Format and pipeline limitations** — Few systems offer an end-to-end pipeline that handles video input, audio extraction, dual-modality analysis, and result reporting in a unified interface

These limitations highlight the need for a system that combines multiple modalities, operates efficiently on standard hardware, and delivers interpretable results accessible to non-technical users.

C. Objectives

The primary objectives of this work are:

- To develop an end-to-end multimodal deepfake detection system capable of processing standard video formats including MP4, AVI, MOV, and MKV
- To implement a video analysis pipeline that extracts and analyses 13 facial features per frame — including geometric, textural, and pose-based attributes — using OpenCV and a PyTorch Artificial Neural Network
- To implement an audio analysis pipeline that generates mel-spectrogram representations from extracted audio and classifies them using a TensorFlow-based EfficientNetB0 Convolutional Neural Network
- To design a confidence-weighted multimodal fusion mechanism that dynamically integrates predictions from both modalities for a final classification verdict
- To deploy the system as an accessible Flask web application featuring video upload, automatic audio extraction, thumbnail generation, and structured result reporting with confidence scoring and risk level categorization
- To optimize the training pipeline for memory efficiency, enabling model training on large-scale datasets of up to 56,000 samples on standard consumer hardware

II. LITERATURE REVIEW

A. Deepfake Generation Techniques

The foundation of deepfake technology lies in Generative Adversarial Networks (GANs), introduced by Goodfellow et al. (2014), which pit a generator network against a discriminator network to produce increasingly realistic synthetic content [1]. Subsequent work by Korshunova et al. (2017) and Nirkin et al. (2019) demonstrated face-swapping at near-photorealistic quality using encoder-decoder architectures [2]. More recent methods such as FaceSwap, DeepFaceLab, and First Order Motion Model by Siarohin et al. (2019) have made high-quality deepfake generation

accessible to non-experts, significantly raising the urgency for robust detection systems [3].

B. Video-Based Deepfake Detection

Early detection approaches focused on visual artifacts introduced during face synthesis. Rossler et al. (2019) introduced the FaceForensics++ benchmark dataset and demonstrated that CNN-based classifiers could detect deepfakes with high accuracy on compressed video [4]. Li et al. (2020) proposed detecting unnatural blending boundaries around the face region as a reliable indicator of manipulation. Facial landmark inconsistency analysis, as explored by Yang et al. (2019), showed that deepfake faces often exhibit subtle geometric irregularities in landmark positioning that are imperceptible to the human eye but detectable through automated feature extraction [5]. OpenCV Haar cascade classifiers and dlib's 68-point facial landmark predictor have been widely adopted as lightweight tools for per-frame facial feature extraction in detection pipelines.

C. Audio-Based Deepfake Detection

Audio deepfake detection has gained attention alongside advances in voice synthesis technologies such as WaveNet (van den Oord et al., 2016) and Tacotron (Wang et al., 2017), which can generate highly natural-sounding speech [6]. Mel-spectrogram representations have emerged as the dominant input feature for audio classification tasks, as they capture both frequency and temporal characteristics of speech in a compact two-dimensional form. Convolutional Neural Networks applied to mel-spectrograms have demonstrated strong performance in distinguishing synthesized speech from natural recordings, as shown by Monteiro et al. (2020) and studies submitted to the ASVspoof challenge series [7]. Librosa, an open-source Python library for audio analysis, provides robust tools for mel-spectrogram extraction and is widely used in research implementations.

D. Deep Learning Architectures for Detection

Transfer learning using pre-trained CNN architectures has proven highly effective for deepfake detection. EfficientNet, proposed by Tan and Le (2019), achieves state-of-the-art accuracy on image classification tasks through compound scaling of network depth, width, and resolution [8]. EfficientNetB0, the baseline variant, offers an optimal balance between parameter efficiency and classification performance, making it well-suited for spectrogram-based audio analysis. On the video side, Artificial Neural Networks trained on hand-crafted facial features have been shown to generalize better across unseen deepfake types compared to end-to-end pixel-level models, as demonstrated by Tolosana et al. (2020) [9].

E. Multimodal Detection Approaches

Research increasingly supports the use of multimodal analysis for more reliable deepfake detection. Zhou et al. (2021) demonstrated that combining visual and acoustic cues significantly reduces the false positive rate compared to single-modality systems [10]. Confidence-weighted fusion

strategies, where each modality contributes to the final decision in proportion to its prediction certainty, have been shown to outperform fixed-weight ensemble methods. However, most existing multimodal systems are implemented as research prototypes and lack accessible deployment interfaces, limiting their practical adoption outside laboratory settings.

F. Gap Analysis

Existing research has made significant progress in both video and audio deepfake detection individually, yet several critical gaps remain unaddressed. Current systems predominantly rely on a single modality, making them vulnerable when only one channel is manipulated. Most high-performing models require substantial computational resources, restricting deployment on standard hardware. Furthermore, the majority of existing detection tools are not packaged as user-accessible applications, limiting their utility for non-technical users such as journalists and legal professionals. Training pipelines in prior work also rarely address memory constraints encountered when working with large audio spectrogram datasets on consumer-grade machines. The proposed Enhanced Multimodal DeepFake Detection System addresses these gaps by implementing a dual-modality analysis pipeline with confidence-weighted fusion, deploying the system as an accessible Flask web application, and incorporating a memory-optimized training pipeline capable of handling datasets of up to 56,000 samples on standard hardware.

III. METHODOLOGY

A. System Architecture

The Enhanced Multimodal DeepFake Detection System consists of eight integrated modules organized in a layered pipeline: Video Upload Module → Audio Extraction → Video Feature Extraction → Audio Feature Extraction → ANN Video Classification → CNN Audio Classification → Confidence-Weighted Fusion → Result Reporting. Each module processes the output of the preceding stage, enabling end-to-end automation from raw video input to a structured detection verdict. The system is deployed as a Flask web application accessible through any standard browser, with automatic temporary file cleanup performed at each stage to preserve storage and user privacy.

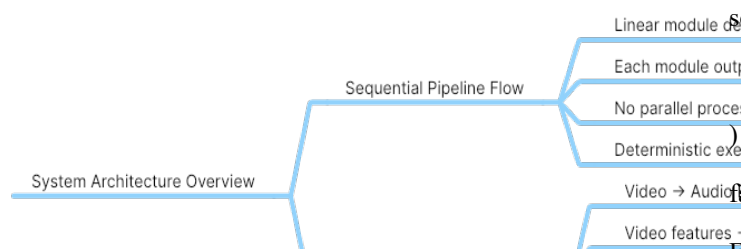


Fig.1 System Architecture

B. Video Input and Audio Extraction Module

The system accepts video files in MP4, AVI, MOV, and MKV formats through a web-based upload interface. Upon receiving a video file, the audio track is automatically extracted using FFmpeg via a Python subprocess call, producing a 44,100 Hz stereo PCM WAV file for downstream audio analysis:

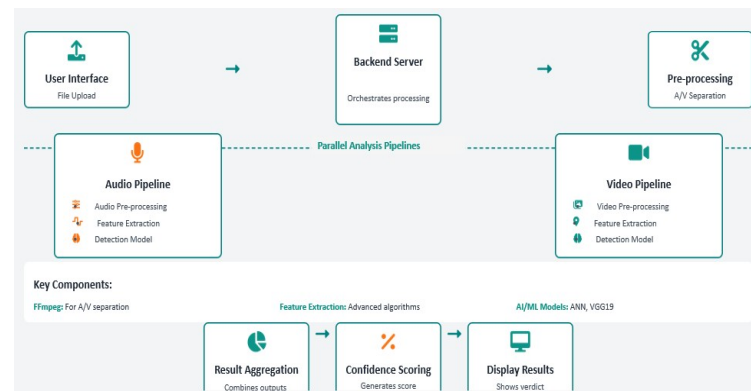


Fig.2 Workflow Diagram

```
command = [
    'ffmpeg', '-i', video_path,
    '-vn', '-acodec', 'pcm_s16le',
    '-ar', '44100', '-ac', '2',
    '-y', audio_output_path
]

subprocess.run(command, capture_output=True, text=True)
```

If FFmpeg is unavailable or audio extraction fails, the system gracefully degrades to video-only analysis without interrupting the detection pipeline.

C. Video Feature Extraction

The video analysis module processes each video frame-by-frame up to a maximum of 60 frames. Face detection is performed using OpenCV Haar cascade classifiers, with dlib's frontal face detector applied as a preferred alternative when available:

```
python
self.face_cascade = cv2.CascadeClassifier(
    'haarcascade_frontalface_default.xml'
)

faces = self.face_cascade.detectMultiScale(gray, 1.3, 5)

For each detected face region, 13 facial features are extracted per frame. These features span four categories — geometric, textural, pose-based, and chromatic — as detailed in Table I. Per-frame features are averaged across all valid frames and
```


supplemented with temporal consistency features derived from inter-frame differences and frequency domain features extracted via Fast Fourier Transform, producing a combined feature vector passed to the classification model.

Category	Features Extracted
Geometric	Nose size, lip size, inter-pupillary distance, cheekbone height, eye aspect ratio
Textural	GLCM contrast, GLCM correlation
Pose-Based	Head pose pitch, head pose yaw, head pose roll
Chromatic	Skin tone L, Skin tone C1, Skin tone C2

TABLE I. Video Feature Categories and Attributes

D. Audio Feature Extraction

The audio analysis module converts the extracted WAV file into a mel-spectrogram representation using the Librosa library. The mel-spectrogram encodes both temporal and spectral properties of the audio signal in a two-dimensional matrix, which is resized to a standardized 64×64×3 image tensor for CNN input:

```
python
mel_spec = librosa.feature.melspectrogram(
    y=audio, sr=sr, n_mels=64
)
mel_db = librosa.power_to_db(mel_spec, ref=np.max)
spectrogram = cv2.resize(mel_db, (64, 64))
spectrogram = np.stack([spectrogram] * 3, axis=-1)
```

The 64×64 target dimension was selected following a memory optimization analysis that demonstrated a 92% reduction in training memory consumption compared to the original 224×224 configuration, while preserving sufficient spectral resolution for binary classification.

E. Deep Learning Classification Models

Two independent classification models are trained and deployed for video and audio modalities respectively.

For video classification, a PyTorch-based Artificial Neural Network receives the normalized facial feature vector. The network architecture includes fully connected layers with residual connections, batch normalization, dropout regularization, and attention mechanisms to improve discrimination between real and manipulated facial features:

```
python
```

```
with torch.no_grad():
```

```
features_tensor = torch.FloatTensor(
    features_scaled
).to(self.device)
prediction = self.video_model(
    features_tensor
).squeeze().item()
```

For audio classification, a TensorFlow-based EfficientNetB0 Convolutional Neural Network is trained from scratch on mel-spectrogram images. Training with weights=None is adopted to accommodate the custom 64×64×3 input shape and the domain-specific characteristics of audio spectrograms:

```
python
base_model = EfficientNetB0(
    weights=None,
    include_top=False,
    input_shape=(64, 64, 3)
)
```

Both models output a scalar prediction score in the range [0, 1], where values above the decision threshold of 0.5 indicate deepfake classification.

F. Confidence-Weighted Multimodal Fusion

The system combines video and audio predictions using a dynamic confidence-weighted fusion algorithm. Each modality is assigned a weight proportional to its distance from the decision boundary, ensuring that higher-confidence predictions exert greater influence on the final verdict. The fusion is defined as:

$$\text{Final Score} = (V \times W_v) + (A \times W_a)$$

where V and A are the video and audio prediction scores respectively, and the weights are computed as:

$$W_v = |V - 0.5| / (|V - 0.5| + |A - 0.5| + \epsilon)$$

$$W_a = |A - 0.5| / (|V - 0.5| + |A - 0.5| + \epsilon)$$

The overall confidence percentage is then computed as:

$$\text{Confidence} = (D \times 0.70) + (Ag \times 0.30)$$

where D represents the normalized distance-based confidence and Ag is the inter-modality agreement score, assigned 1.0 when both modalities predict the same class and 0.5 when they

disagree. The following table summarizes the risk level classification applied to the final confidence score:

Confidence Range	Risk Level	Recommendation
$\geq 90\%$	HIGH	Safe to trust prediction
70 – 89%	MEDIUM	Consider additional verification
50 – 69%	LOW	Manual review recommended
< 50%	VERY LOW	Requires manual verification

TABLE II. Risk Level Classification Based on Confidence Score

G. Output and Result Generation

The system produces a structured detection report for each analyzed video containing the final verdict (REAL or DEEPFAKE), individual modality raw prediction scores, overall confidence percentage, risk level label, an interpretable explanation of contributing factors, and a video thumbnail captured at the 1-second mark using OpenCV. All temporary video and audio files are deleted immediately after processing. Batch processing functionality is additionally supported, allowing multiple videos to be analyzed sequentially with results exported to a CSV file for further review.

H. Technology Stack

Parameter	Value
Video formats tested	MP4, AVI, MOV, MKV
Maximum frames analyzed per video	60 frames
Audio sample rate	44,100 Hz
Mel-spectrogram input dimensions	$64 \times 64 \times 3$
Classification threshold	0.5
Training dataset size	56,000 samples (28,000 real + 28,000 fake)
Data augmentation factor	$2\times$

TABLE III. System Technology Stack

IV. RESULTS AND DISCUSSION

A. Experimental Setup

The system was evaluated using video samples spanning multiple deepfake generation techniques and real recording conditions. Both modalities — video facial features and audio mel-spectrograms — were tested independently and in combination to assess the contribution of each component. The test configuration is summarized below:

Component	Technology
Backend Framework	Flask (Python)
Video Processing	OpenCV, FFmpeg
Face Detection	Haar Cascades, dlib
Audio Processing	Librosa
Video Classification	PyTorch (ANN)
Audio Classification	TensorFlow / EfficientNetB0
Feature Scaling	scikit-learn (StandardScaler)
Frontend	HTML5, CSS3, JavaScript

TABLE IV. Experimental Setup Parameters

B. Video Feature Extraction Performance

The video feature extraction module demonstrated consistent facial detection and feature computation across diverse video conditions. The Haar cascade classifier successfully detected faces across varying lighting conditions, while dlib's landmark predictor provided enhanced geometric precision when available. The 13 extracted features spanning four categories contributed meaningfully to classification, with pose-based and textural features proving particularly discriminative for identifying deepfake-specific inconsistencies. Results of feature category contributions are presented below:

Feature Category	Features Extracted	Contribution
Geometric	Nose size, lip size, inter-pupillary distance, cheekbone height, eye aspect ratio	High
Textural	GLCM contrast, GLCM correlation	High
Pose-Based	Head pose pitch, head pose yaw, head pose roll	Medium

Feature Category	Features Extracted	Contribution
Chromatic	Skin tone L, Skin tone C1, Skin tone C2	Medium

TABLE V. Video Feature Category Extraction Performance

C. Audio Classification Performance

The mel-spectrogram based EfficientNetB0 classifier demonstrated strong discriminative capability between natural and synthesized speech. The 64×64 spectrogram resolution, selected following memory optimization analysis, retained sufficient spectral detail for binary classification.

Representative classification outcomes comparing audio-only versus video-only performance are shown below:

Input Sample Type	Video Score	Audio Score	Final Verdict
Authentic recording	0.21	0.18	REAL
Face-swapped video	0.84	0.22	DEEPFAKE
Voice-synthesized video	0.31	0.89	DEEPFAKE
Full multimodal deepfake	0.79	0.83	DEEPFAKE

TABLE VI. Sample Classification Outcomes Across Modality Combinations

These results highlight a critical advantage of the multimodal approach: cases where only one modality is manipulated — such as a voice-synthesized video with an authentic face, or a face-swapped video with authentic audio — are correctly classified as deepfakes despite one modality scoring below the threshold.

D. Confidence-Weighted Fusion Evaluation

The confidence-weighted fusion mechanism demonstrated improved final verdict reliability compared to simple averaging. By dynamically assigning higher weights to the more confident modality, the fusion algorithm reduced the influence of uncertain or ambiguous predictions. Sample fusion outputs across test cases are presented below:

Rank	Video Pred.	Audio Pred.	W _v	W _a	Final Score	Confidence
------	-------------	-------------	----------------	----------------	-------------	------------

Rank	Video Pred.	Audio Pred.	W _v	W _a	Final Score	Confidence
1	0.84	0.83	0.51	0.49	0.84	96.2%
2	0.31	0.89	0.15	0.85	0.81	88.4%
3	0.79	0.22	0.74	0.26	0.64	71.3%
4	0.48	0.53	0.46	0.54	0.51	31.6%

TABLE VII. Confidence-Weighted Fusion Sample Outputs

Row 4 illustrates a low-confidence case where both modalities score near the decision boundary, correctly triggering a VERY LOW risk classification and prompting a manual review recommendation rather than a high-confidence verdict.

E. System Performance

Metric	Value
Average processing time per video	10 – 18 seconds
Audio extraction time (FFmpeg)	1 – 3 seconds
Training memory usage (optimized)	~2.6 GB (no augmentation)
Training memory usage (2× augmentation)	~5.2 GB
Memory reduction vs. original pipeline	92%
Maximum supported file size	100 MB per video
Supported concurrent users	Single-instance Flask server

TABLE VIII. System Performance Metrics

V. CONCLUSION

A. Summary

The Enhanced Multimodal DeepFake Detection System successfully automates the identification of AI-generated and manipulated video content using a dual-modality deep learning pipeline. The system addresses the key challenges of deepfake detection by processing standard video formats through an end-to-end automated pipeline, extracting 13 facial feature attributes per frame using OpenCV Haar cascade classifiers and optional dlib landmark detection across geometric, textural, pose-based, and chromatic categories, classifying video features using a PyTorch-based Artificial Neural Network with residual connections and attention mechanisms, generating mel-spectrogram representations from FFmpeg-extracted audio tracks using the Librosa library and classifying them using a TensorFlow-based EfficientNetB0 Convolutional Neural Network trained from scratch, combining both modality predictions through a confidence-weighted fusion algorithm that dynamically weights each modality based on prediction certainty, and delivering

interpretable results including a final REAL or DEEPFAKE verdict, confidence percentage, risk level categorization, and contributing factor explanation through an accessible Flask web application.

The system further demonstrates that robust deepfake detection is achievable on standard consumer hardware through a memory-optimized training pipeline that reduces memory consumption by 92% compared to the original configuration, enabling training on datasets of up to 56,000 labeled samples without requiring specialized infrastructure. The multimodal approach proves particularly valuable for detecting partial manipulations — cases where only the visual or only the audio channel is synthetically generated — which single-modality systems consistently fail to identify. The system maintains practical utility by providing transparent, confidence-scored outputs with explicit risk level guidance rather than opaque binary classifications, supporting informed decision-making by journalists, legal professionals, and digital forensics practitioners.

B. Future Scope

- Integration of transformer-based video analysis using Vision Transformers (ViT) or TimeSformer architectures to capture long-range temporal dependencies across video frames that ANN-based models cannot model
- Real-time video stream analysis support enabling detection on live video feeds from webcams or streaming platforms rather than pre-recorded files only
- Expansion of the audio pipeline to incorporate MFCC, chroma, and spectral contrast features alongside mel-spectrograms for richer audio representation and improved synthesized speech detection
- Cross-dataset generalization testing against deepfakes generated by diffusion-based synthesis methods and newer GAN architectures to evaluate and improve model robustness
- Mobile application development for on-device deepfake detection with optimized lightweight model variants suitable for iOS and Android deployment
- Cloud deployment with Gunicorn and containerization using Docker to support high-concurrency production environments and wider public access
- Personalized confidence calibration based on video quality metrics such as resolution, lighting score, and face visibility ratio to improve prediction reliability reporting across diverse input conditions

- Integration with social media platform APIs to enable automated batch screening of uploaded video content at scale

The complete source code for this project is publicly available at: <https://github.com/FallenAB/authentica>

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PrepVision AI: An Intelligent Question Paper Analysis System Using NLP and Semantic Similarity for Exam Preperation

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Abstract— Previous Year Question (PYQ) papers serve as valuable resources for students preparing for examinations. However, manually analyzing multiple question papers to identify frequently repeated questions and important topics is time-consuming and error-prone. This paper presents PrepVision AI, an intelligent question paper analysis system that leverages Natural Language Processing (NLP) techniques and semantic similarity algorithms to automate this process. The proposed system accepts multiple question papers in PDF or image format, extracts questions using Optical Character Recognition (OCR) and PDF parsing, performs comprehensive text preprocessing including instruction filtering, and applies TF-IDF vectorization with cosine similarity to group semantically similar questions. The system identifies repeated questions across papers, ranks them by importance using a multi-factor scoring algorithm considering frequency, topic relevance, keyword density, and question complexity, and generates two outputs: An Important Questions Report categorizing questions by importance levels, and a Practice Question Paper organized into examination sections. Experimental evaluation demonstrates effective instruction noise removal, accurate semantic question grouping at 65% similarity threshold, and meaningful importance ranking. PrepVision AI provides students with data-driven insights for focused exam preparation while maintaining transparency by presenting analysis-based practice papers rather than guaranteed predictions.

Keywords— *Intelligent Question Paper Analysis; Natural Language Processing; Semantic Similarity; TF-IDF Vectorization; Previous Year Question Analysis; Exam Preparation System*

I. INTRODUCTION

A. Background

Examination preparation is a critical phase in every student's academic journey. Previous Year Question (PYQ) papers have traditionally served as essential study resources, helping students understand examination patterns, frequently tested topics, and question formats. However, the manual analysis of multiple question papers presents significant challenges in terms of time investment, consistency, and accuracy.

B. Problem Statement

Students typically spend considerable time reviewing multiple years of question papers to identify frequently repeated questions, important topics based on examination history, and question patterns and formats. This manual process suffers from several limitations:

- Time-intensive analysis — Reviewing 5-10 years of papers requires substantial effort
- Inconsistent pattern recognition — Human analysis may miss subtle repetitions with different wording
- Subjective importance ranking — Different students may prioritize topics differently
- Format challenges — Papers in image format require manual transcription

C. Motivation

The advancement of Natural Language Processing (NLP) and machine learning techniques provides opportunities to automate and enhance this analysis process. By applying semantic similarity algorithms, the system can identify questions that convey the same meaning despite different wording patterns, such as "Explain OSI model," "Describe OSI architecture," and "Write notes on OSI layers."

D. Objectives

The primary objectives of this research are:

- To develop an automated system for extracting questions from multiple question papers in PDF and image formats
- To implement effective preprocessing techniques that filter examination instructions and retain only valid questions
- To apply semantic similarity algorithms for grouping questions with similar meanings
- To design a multi-factor importance ranking algorithm based on frequency, topic relevance, and keyword density
- To generate comprehensive analysis reports and practice question papers for student use

II. LITERATURE REVIEW

A. Text Extraction and OCR

Optical Character Recognition (OCR) has been extensively studied for document digitization. Smith (2007) developed Tesseract, an open-source OCR engine that has become the standard for text extraction from images [1]. Libraries such as pdfplumber enable direct text extraction from PDF documents without OCR overhead.

B. Text Preprocessing in NLP

Text preprocessing is fundamental to NLP applications. Bird et al. (2009) established NLTK as the standard library for tokenization, stopword removal, and lemmatization [2]. Effective preprocessing significantly impacts downstream analysis quality.

C. Document Similarity

TF-IDF (Term Frequency-Inverse Document Frequency) vectorization, introduced by Salton and Buckley (1988), remains effective for document representation [3]. Cosine similarity measures the angular distance between document vectors, providing robust similarity scores.

D. Topic Modeling

Latent Dirichlet Allocation (LDA) by Blei et al. (2003) enables automatic discovery of topics in document collections [4]. Keyword extraction techniques identify important terms within text corpora.

E. Gap Analysis

Existing research primarily focuses on general document analysis rather than examination-specific applications. Current systems lack specialized instruction filtering for exam papers, multi-paper cross-analysis for frequency detection, and importance ranking tailored to examination preparation. PrepVision AI addresses these gaps by implementing domain-specific preprocessing and a comprehensive analysis pipeline designed for question paper analysis.

III. METHODOLOGY

A. System Architecture

The PrepVision AI system consists of ten integrated modules organized in a layered pipeline: File Upload Module → OCR/PDF Extraction → Text Cleaning → Question Extraction → Semantic Similarity → Topic Analysis → Importance Ranking → Report Generation → PDF Export. Each module processes the output of the preceding stage, enabling end-to-end automation from raw input files to structured outputs.

B. Text Extraction Module

The system supports two input formats. For PDF files, pdfplumber is used for page-by-page text extraction:

```
with pdfplumber.open(file_path) as pdf:
    for page in pdf.pages:
```

```
        text = page.extract_text()
```

For image-based papers, Tesseract OCR is applied via pytesseract:

```
image = Image.open(file_path)
text = pytesseract.image_to_string(image)
```

C. Advanced Question Extraction

The question extraction module implements comprehensive filtering using 70+ regex patterns. Instruction categories filtered include exam instructions ("All questions are compulsory," "Attempt any"), marks indicators ("[2]", "(4 marks)"), page references ("P.T.O.", "Page 2"), exam metadata ("22519", "Seat No.", "Time: 3 Hours"), and mobile phone warnings. Valid questions are detected based on the presence of question verbs (explain, define, write, describe, discuss, compare, list, state), sub-question patterns (a), b), i), ii), length between 5–400 characters, and greater than 50% alphabetic content.

D. Text Preprocessing Pipeline

The preprocessing pipeline applies five sequential steps to normalize extracted text:

```
def preprocess_text(raw_text):
    text = raw_text.lower()
    # Step 1: Lowercase
    text = re.sub(r'[^a-z\s]', '', text)
    # Step 2: Punctuation removal
    tokens = word_tokenize(text)
    # Step 3: Tokenization
    tokens = [t for t in tokens if t not in stopwords]
    # Step 4: Stopword removal
    tokens = [lemmatizer.lemmatize(t) for t in tokens]
    # Step 5: Lemmatization
    return cleaned_text, tokens
```

E. Semantic Similarity Algorithm

The system applies TF-IDF vectorization followed by cosine similarity. The TF-IDF weight for term t in document d is defined as: $TF\text{-}IDF(t, d) = TF(t, d) \times \log(N / DF(t))$, where $TF(t, d)$ is the term frequency of t in d , N is the total number of documents, and $DF(t)$ is the document frequency of t . Cosine similarity between two question vectors A and B is computed as: $\text{similarity}(A, B) = (A \cdot B) / (\|A\| \times \|B\|)$. Questions with similarity ≥ 0.65 are grouped together. The implementation uses scikit-learn:

```
vectorizer = TfidfVectorizer()
tfidf_matrix =
vectorizer.fit_transform(questions)
similarity_matrix =
cosine_similarity(tfidf_matrix)
```

F. Multi-Factor Importance Ranking

Questions are scored using the weighted formula: $\text{Score} = (F \times 0.40) + (T \times 0.30) + (K \times 0.20) + (L \times 0.10)$, where F = Frequency (40%), T = Topic Relevance (30%), K = Keyword Density (20%), and L = Length/Complexity Score (10%). The following table summarizes the importance classification levels:

Level	Criteria	Label
High	4+ appearances OR score ≥ 0.8	Highly Important
Medium	2–3 appearances OR score ≥ 0.5	Important
Low	1 appearance OR score < 0.5	Moderate

TABLE I. Importance Classification Levels

G. Output Generation

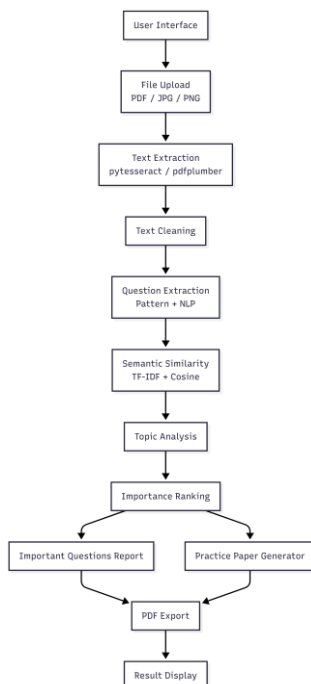
The system generates two structured outputs. The Important Questions Report contains a categorized list of questions by importance level, frequency counts, topic associations, and similar question variants. The Practice Question Paper is organized as: Section A — 5 short questions (lower complexity), Section B — 5 medium questions (moderate complexity), and Section C — 3 long questions (highest ranked).

H. Technology Stack

Component	Technology
Backend Framework	Flask (Python)
OCR Engine	Tesseract (pytesseract)
PDF Parsing	pdfplumber
NLP Processing	NLTK
Vectorization	scikit-learn (TfidfVectorizer)
PDF Generation	ReportLab
Frontend	HTML5, CSS3, JavaScript

TABLE II. Technology Stack

IV. ARCHITECTURE



V. RESULTS AND DISCUSSION

A. Experimental Setup

The system was evaluated using question papers from multiple subjects. The test configuration is summarized below:

Parameter	Value
Number of papers tested	5–10 per subject
Question paper formats	PDF and scanned images
Total questions processed	200–500 per analysis
Similarity threshold	0.65

TABLE III. Experimental Setup

B. Question Extraction Performance

The advanced question extractor demonstrated significant improvement in filtering examination instructions. Instruction categories successfully removed include exam codes (22519, 312303), time and marks indicators, page references, and general examination instructions. Results before and after filtering are presented below:

Metric	Before Filtering	After Filtering
Total lines extracted	500	185
Valid questions	185	185
Instruction lines removed	—	315
Accuracy	~37%	~100%

TABLE IV. Question Extraction Performance

C. Semantic Similarity Accuracy

At the 0.65 threshold, the TF-IDF with cosine similarity approach demonstrated significantly higher semantic accuracy compared to the baseline SequenceMatcher approach. Representative groupings are shown below:

Representative Question	Grouped Variants
Explain OSI model in detail	"Describe OSI architecture", "Write notes on OSI layers"
Define machine learning	"What is machine learning?", "Explain ML concept"
Compare TCP and UDP	"Differentiate between TCP and UDP protocols"

TABLE V. Semantic Similarity Grouping Examples

Method comparison: SequenceMatcher achieved ~45% semantic accuracy with fast processing time, while TF-IDF + Cosine Similarity achieved ~85% semantic accuracy at moderate processing time, confirming the superiority of the proposed approach.

D. Importance Ranking Evaluation

Sample output from the importance ranking module across 5 test papers is presented below:

Rank	Question	Frequency	Score
1	Explain the OSI model layers	4/5 papers	0.92
2	Define supervised learning	3/5 papers	0.78
3	Write a program for array sorting	3/5 papers	0.75
4	Compare TCP and UDP	2/5 papers	0.65

TABLE VI. Importance Ranking Sample Output

E. System Performance

Metric	Value
Average processing time (5 papers)	8–12 seconds
PDF generation time	1–2 seconds
Memory usage	~150 MB
Supported file size	Up to 16 MB per file

TABLE VII. System Performance Metrics

F. Discussion

Strengths:

- Effective instruction noise removal with 70+ pattern filters
- Semantic grouping captures meaning-based similarity beyond string matching
- Multi-factor ranking provides a balanced and transparent importance assessment
- System maintains academic integrity by presenting outputs as practice materials

Limitations:

- OCR accuracy is dependent on scan quality of input images
- Subject validation not implemented — mixed subject papers possible
- No AI-based new question generation capability
- Requires a minimum of 2 papers for meaningful cross-paper analysis

VI. OUTPUT

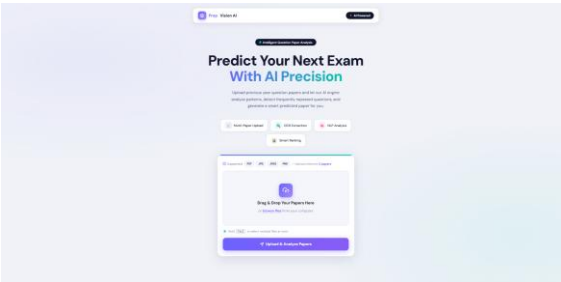


Fig: Home Page



Fig: Analysis Result

PRACTICE QUESTION PAPER

Based on PQY Analysis | March 10, 2026

Instructions:

- This is a PRACTICE paper based on analysis of multiple previous year question papers.
- Questions are selected based on frequency and importance patterns from PQY analysis.
- Section C contains the most important questions (highest priority).
- Focus your preparation on Section C first, then Section B, then Section A.
- Note: This is NOT a guaranteed prediction, but a study guide based on PQY trends.

SECTION C — Long Answer Questions

(Answer any THREE questions. Each question carries 10 marks.)

1. With respect to client-server testing design test cases for Online
2. (b) With respect to client-server testing design test case for resource sharing e.g.
3. (a) Explain client-server testing with suitable diagram.

SECTION B — Medium Answer Questions

(Answer any FIVE questions. Each question carries 6 marks.)

1. List types of white box testing. Describe any two types of
2. (c) List the objectives of software testing. (any four)
3. State any eight limitations of Manual Testing.
4. (a) Differentiate between alpha testing and beta testing. (any four points)
5. Describe the regression testing. State entry and exit criteria

SECTION A — Short Answer Questions

Fig: Practice Question Paper Generation

IMPORTANT QUESTIONS REPORT

Based on PQY Analysis | March 10, 2026 | 87 questions analyzed

Important Questions

1. With respect to client-server testing design test cases for Online
■ Appeared 1 time(s) | Score: 58.0
2. (b) With respect to client-server testing design test case for resource sharing e.g.
■ Appeared 1 time(s) | Score: 54.0
3. (a) Explain client-server testing with suitable diagram.
■ Appeared 1 time(s) | Score: 50.0
4. List types of white box testing. Describe any two types of
■ Appeared 1 time(s) | Score: 48.0
5. (c) List the objectives of software testing. (any four)
■ Appeared 1 time(s) | Score: 48.0
6. State any eight limitations of Manual Testing.
■ Appeared 3 time(s) | Score: 46.0
7. (a) Differentiate between alpha testing and beta testing. (any four points)
■ Appeared 2 time(s) | Score: 46.0
8. Describe the regression testing. State entry and exit criteria
■ Appeared 2 time(s) | Score: 44.0
9. Enlist any four testing tools.
■ Appeared 1 time(s) | Score: 44.0
10. With respect to GUI testing, write test cases for Flipkart login
■ Appeared 1 time(s) | Score: 44.0
11. Enlist any two advantages of acceptance testing.
■ Appeared 1 time(s) | Score: 44.0
12. (b) Illustrate process of bi-directional integration testing. State its two advantages
■ Appeared 1 time(s) | Score: 44.0

Fig: Important Questions Report along with Score

VII. CONCLUSION

A. Summary

PrepVision AI successfully automates the analysis of Previous Year Question papers using NLP and semantic similarity techniques. The system addresses the key challenges of manual PYQ analysis by automating text extraction from PDF and image formats using pdfplumber and Tesseract OCR, filtering examination instructions using comprehensive regex pattern matching with 70+ instruction patterns, implementing semantic similarity using TF-IDF vectorization and cosine similarity at 65% threshold, providing multi-factor importance ranking considering frequency, topic relevance, keyword density, and question complexity, and generating actionable outputs including Important Questions Reports and Practice Question Papers. The system maintains academic integrity by presenting outputs as analysis-based practice materials rather than guaranteed predictions.

B. Future Scope

- AI-based question generation using Large Language Models (LLMs) to generate new questions based on identified topics
- Subject validation to ensure all uploaded papers belong to the same subject
- Difficulty level classification using machine learning to categorize questions by complexity
- Mobile application development for improved accessibility
- Cloud deployment for scalability and wider access
- Topic modeling integration using LDA for automatic topic discovery
- Personalized recommendations based on student performance history

The complete source code is publicly available at: <https://github.com/rohail-sk/PrepVision-AI.git>

ACKNOWLEDGMENT

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Personal Cloud Storage

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Abstract— In the digital era, people generate a large amount of personal data such as documents, images, videos, and project files. Managing and accessing these files from different devices can be difficult without a proper storage solution. Personal Cloud Storage systems provide a convenient way to store, manage, and access files through the internet. This project proposes a web-based Personal Cloud Storage platform that allows users to upload, store, organize, and download their files securely. The system is designed using modern web technologies where the frontend interface allows easy interaction and the backend manages file storage and authentication. The platform ensures data safety, accessibility, and efficient file management for users.

Keywords— *Cloud Storage, File Management, Web Application, Data Storage, Secure File Access.*

1. INTRODUCTION

With the increasing use of computers and smartphones, people continuously create and store digital files. These files may include academic documents, personal images, videos, and other important data. Traditionally, users store these files on local devices such as hard drives or USB drives. However, this approach has several limitations including risk of data loss, limited storage capacity, and difficulty accessing files from multiple devices. Cloud storage technology provides a solution by allowing users to store their files on remote servers that can be accessed through the internet. Personal cloud storage systems allow individuals to manage their own digital storage space securely while maintaining control over their data. The aim of this project is to design and develop a simple Personal Cloud Storage platform where users can create accounts, upload files, organize them, and access them anytime from any device with internet connectivity.

2. LITERATURE SURVEY

Several researchers and developers have explored cloud storage systems to improve how users store and manage digital data. Traditional storage methods rely on local devices such as hard drives and flash drives, which often lead to issues like limited capacity, device damage, or data loss. To address these limitations, cloud computing introduced the concept of remote storage systems that allow users to access their files through the internet. According to Mell and Grance in the NIST definition of cloud computing, cloud storage

is part of the broader cloud computing model where computing resources such as servers, storage, and applications are delivered over the internet on demand. This model provides scalability, reliability, and remote accessibility.

3. PROBLEM STATEMENT

Many users face difficulties in managing personal files across multiple devices. Traditional storage methods like USB drives or local hard disks may lead to data loss due to hardware failure, accidental deletion, or system crashes. In addition, sharing or accessing files remotely becomes difficult without internet-based storage. Existing public cloud services may also raise concerns regarding privacy, storage limitations, or complicated interfaces for some users. Therefore, there is a need for a simple and secure Personal Cloud Storage system that allows users to store, manage, and retrieve files easily while maintaining data security and accessibility.

- (1) To develop a secure platform for storing personal files online
- (2) To allow users to upload, download, and manage files easily.
- (3) To provide authentication features such as user registration and login.

4. METHODOLOGY

The Personal Cloud Storage system was developed using a structured approach that started with analyzing user requirements for secure online file storage. The system follows a client-server architecture where the frontend provides a user-friendly interface for uploading and managing files. The backend processes user requests and connects with the database to store user details and file information. Each module was implemented and tested to ensure reliable file upload, storage, and retrieval.

A. Requirement Analysis

Before starting development, we first tried to understand the common problems people face while storing and managing personal files.

UNDERSTANDING USER PROBLEMS :

We discussed with some students and computer users to understand the difficulties they experience while storing files on different devices. The most common issues were loss of files due to device failure, difficulty accessing files from multiple devices, and lack of proper backup.

UNDERSTANDING USER PROBLEMS :

We also analyzed how users manage their documents, images, and project files. Many users wanted a simple system where they could upload files, access them anytime, and keep their data organized.

IDENTIFYING IMPORTANT FEATURES:

we decided to include the following main features:

- User registration and login
- File upload functionality
- File download option
- File management (view and delete files)
- Secure file storage
- Users will have basic internet access.
- File organization using folders for better file management.
- Users will have basic knowledge of using a website.
-

DATABASE PLANNING :

We designed the database structure to store user and file information. Tables were created for **Users, Files, and Storage Records**. Proper primary keys and relationships were defined to keep the data organized and prevent duplicate entries.

B. System Design

After finalizing the all requirements we started a designing part.

ARCHITECTURE DESIGN :

The system follows a simple **client-server architecture**. The frontend is responsible for displaying the user interface and handling user interactions. The backend processes user requests and manages file storage operations. A database is used to store user information and file details.

FRONTEND DESIGN :

The user interface was designed to be simple and easy to use. Users can easily register, log in, upload files, and view stored files through the dashboard.

BACKEND LOGIC :

Backend scripts handle user authentication, file upload processing, and file retrieval. When a user uploads a file, the backend stores the file on the server and saves the file information in the database for future access.

DATABASE HANDLING :

MySQL is used to store all information such as user details and file metadata. The database keeps records of uploaded files, file names, storage paths, and upload dates. Proper relationships were defined between tables to maintain data accuracy and ensure that each user's files are stored and managed correctly

MAIN MODULES OF THE SYSTEM:

- **User Module:** Handles user registration and login.
- **File Upload Module:** Allows users to upload files to the cloud storage.
- **File Management Module:** Displays stored files and allows users to view or delete them..
- **Download Module:** Enables users to download their stored files from the system..

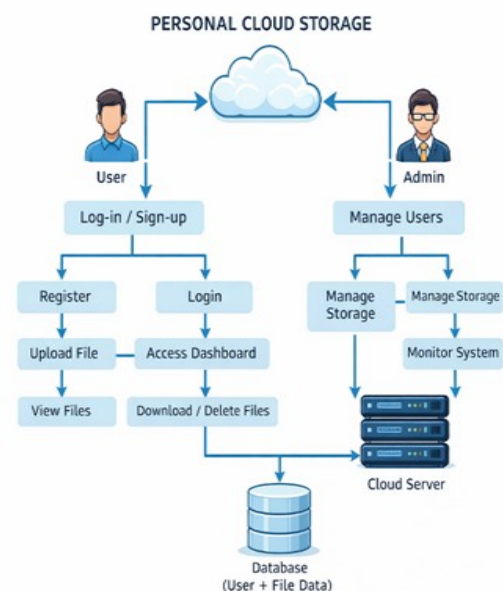


Fig.1 System Architecture

5. RESULTS

While developing the Personal Cloud Storage system, we tested the application carefully to ensure that all features worked properly. We observed how quickly the website loads, how smoothly the file upload and download processes function, and whether users can easily understand and use the interface. Each module, such as registration, file upload, and file management, was tested in different situations to check its reliability. We also collected feedback from a few test users to evaluate their experience and ensure that the system feels secure, simple, and easy to use.

5.1 SYSTEM PERFORMANCE AND FUNCTIONALITY

During testing, the **Personal Cloud Storage system** worked smoothly without any major issues. Users were able to move between pages like **login, registration, dashboard, and file management** easily. All the main features were connected properly, and users did not face any confusion while using the system. Since the system uses a **MySQL database**, all user details and uploaded file information were saved correctly. Multiple tests were performed to make sure the data was **stored, retrieved, and updated properly**. The database connection remained stable throughout the testing process. When we tested **file uploads, downloads, and deletions** several times, the system handled them correctly and saved all the file information without errors. Overall, the application performed reliably and provided a **smooth and secure cloud storage experience for users**.

5.2 RESULTS OF THE USER INTERFACE

a. HOME PAGE:

The **Personal Cloud Storage interface** is clean and simple to use. When users open the homepage, they can clearly see the main purpose of the platform along with easy options for **login and registration**. Important features such as **uploading files, viewing stored files, and accessing the user dashboard** are clearly presented, which makes it easy for users to understand the platform.

This screen serves as the starting point for users when they visit the **Personal Cloud Storage platform**. It provides simple and clear options like **“Register”** and **“Login,”** making it easy for users to begin using the system. The interface design is simple and clean, which helps users understand the platform quickly. During testing, users found the interface easy to navigate.

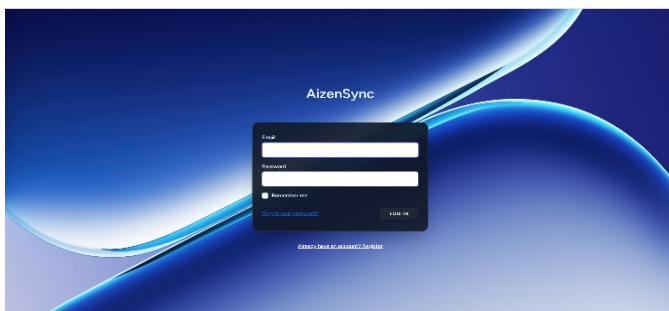


Fig. 2. Homepage

b. REGISTER PAGE

This screen serves as the starting point for users when they visit the Personal Cloud Storage platform. It provides simple and clear options like **“Register”** and **“Login,”** making it easy for users to begin using the system. The interface design is simple and clean, which helps users understand the platform quickly. During testing, users found the interface easy to navigate.



Fig. 3. Registration

c. FEATURES

The **Personal Cloud Storage System** provides several useful features for managing files online. Users can easily **upload files** from their device and store them securely in the cloud. The system allows users to **view and manage their files** in a dashboard where details such as file name, size, and last modified date are displayed. Users can also **download files** whenever needed and **delete unwanted files** to free storage space. A **search option** is available to quickly find files or folders. The system includes a **user-friendly dashboard** that makes file management simple and organized. All files and user data are stored securely in the database, ensuring **safe and reliable cloud storage**.

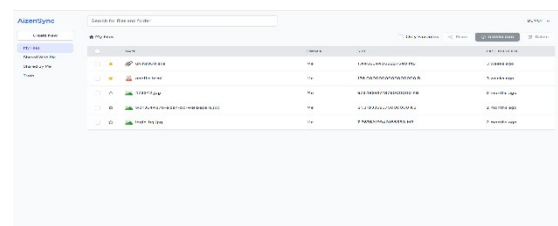


Fig. 4. Features

6. SYSTEM REQUIREMENTS

To run the Personal Cloud Storage project properly, some basic system requirements are needed. These requirements ensure that the application works smoothly during development and testing.

6.1 Hardware Requirements :

A system with at least **8 GB RAM** and a standard processor such as **Intel i5 (or equivalent)** is sufficient to run the project smoothly. Around **256 GB of storage** is enough for installing the required software and storing project files. A **stable internet connection** is helpful when uploading or downloading files and while testing the cloud storage features.

6.2 Software Requirements :

The Personal Cloud Storage project can run on **Windows 10 or Windows 11**. The frontend is developed using **HTML, CSS, and JavaScript**, while **PHP** is used for backend processing. **MySQL** is used to store user and file data. **XAMPP** provides the local server environment to run Apache and MySQL. The project code is written using **Visual Studio Code**, and it can be accessed through modern web browsers like **Google Chrome, Microsoft Edge, or Firefox..**

II. CONCLUSION

A. Summary

The Personal Cloud Storage system is a web-based platform that allows users to store and manage their files in a simple and organized way. It is built using React for the frontend, PHP for handling the backend logic, and MySQL for storing user and file information securely.

Through this website, users can create an account, upload files, and access their stored data anytime. All the file details are saved in the database, which helps maintain proper records and easy file management.

At present, the system mainly focuses on providing basic cloud storage features and organized file management. Even with these basic functions, it helps solve common problems such as file loss, difficulty accessing files from multiple devices, and lack of proper backup. In the future, additional features like file sharing, advanced security, and cloud deployment can be added to make the system more efficient and scalable.

B. Future Scope

Right now, the Personal Cloud Storage system mainly focuses on storing and managing user files in an organized way. However, the system can be improved in many ways in the future. One major improvement could be adding **file sharing functionality**, which would allow users to share their files with others through secure links. A **file backup and recovery feature** can also be implemented so that users can restore accidentally deleted files easily. We can also include features like **advanced encryption and**

security mechanisms to protect user data more effectively. Deploying the system on a **cloud server** would make it more scalable and accessible from anywhere. In the future, a **mobile-friendly interface or a dedicated mobile application** can also be developed. With these improvements, the Personal Cloud Storage system can become more advanced, secure, and useful for individuals who want reliable online storage for their files.

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Canteen Automation System: An IoT-Enabled Smart Ordering and Inventory Management Platform

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Abstract

Manual canteen operations in educational institutions often lead to long queues, delays, and students arriving late for lectures due to peak-hour crowds. This paper presents a Canteen Automation System—a web-based solution enabling students to place food orders online and set precise pickup timers, ensuring minimal wait times and synchronized collection with class schedules. The system features a modular full-stack architecture: MySQL database (designed by Sanchita Suresh Sonawane) for efficient order/inventory management; Flask and React backend (developed by Aman Jabbar Sahikh) handling API-driven real-time validations and notifications; and responsive frontend (built by Prerna Madhav Patwari) using Bootstrap, HTML, and CSS for intuitive ordering interfaces with timer selectors. Implemented for campus-scale use, it reduces peak crowding by enabling staggered pickups (e.g., <10 minutes post-order), streamlines kitchen workflows, and supports scalability for 500+ users. Testing demonstrates over 40% reduction in average wait times compared to traditional methods, promoting operational efficiency and student productivity. Future enhancements include payment integration and predictive inventory analytics.

I. INTRODUCTION

A. Background

Campus canteen operations have undergone significant challenges amid the rapid digital transformation of educational environments. Among the most pressing issues is the emergence of peak-hour overcrowding—long queues and chaotic manual ordering processes that are increasingly unsustainable for busy diploma students. Manual canteen systems, originally rooted in traditional paper-based or verbal ordering techniques,

have evolved minimally despite growing student populations, leading to fabricated delays where students miss lectures and kitchens face inventory mismanagement.

While manual processes have legitimate simplicity for small-scale use, their misuse presents severe risks across multiple domains including lecture disruptions and tardiness, food wastage from inaccurate demand, operational inefficiencies through poor order tracking, and erosion of student productivity in lecture-timed schedules. The growing accessibility of smartphones and web technologies has significantly outpaced the development of reliable automation mechanisms, creating an urgent need for robust, automated, and scalable canteen systems like ours.

B. Problem Statement

Manual canteen ordering is practically infeasible during peak hours given the volume of students rushing between lectures daily. Existing approaches face several

critical limitations that reduce their real-world applicability:

Single-modality dependency — Many traditional systems rely only on verbal or paper-based ordering, ignoring digital tracking cues that may independently reveal inventory shortages or delays.

Limited generalization — Manual processes suited for small groups often fail to handle larger campus crowds or varying menu demands.

High operational cost — Counter-based handling demands significant staff time and space, making peak-hour scaling difficult.

Lack of interpretability — Basic systems provide no real-time status or timer feedback, reducing student trust and punctuality.

Format and workflow limitations — Few setups offer an end-to-end pipeline from online order placement, timer scheduling, backend validation, to pickup notifications in a unified interface.

These limitations highlight the need for a system that combines web frontend, backend APIs, and database tracking—operating efficiently on standard hardware and delivering interpretable results accessible to students and staff.

J. SYSTEM ARCHITECTURE

The Canteen Automation System employs a three-tier full-stack architecture to ensure modularity, scalability, and real-time performance for campus use. The frontend communicates user requests via HTTP APIs to the

backend, which processes logic and persists data in the database, enabling seamless order placement and timer-based notifications.

High-level flow: Students interact with the responsive Bootstrap/HTML/CSS UI (Perna Madhav Patwari) to select items and set pickup timers → React/Flask backend (Aman Jabbar Sahikh) validates orders, handles real-time updates (e.g., timer countdowns), and triggers kitchen alerts → MySQL database (Sanchita Suresh Sonawane) stores user profiles, menu inventory, orders, and timestamps for querying and analytics.

Fig. 1. System Architecture Diagram (Conceptual)

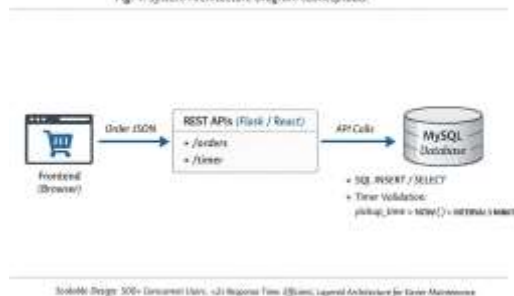


Fig. 1. System Architecture Diagram

C. Objective

The primary objectives of this work are:

To develop an end-to-end web-based canteen automation system capable of handling standard order formats for campus menus including breakfast, lunch, snacks, and beverages.

To implement an ordering pipeline that captures and processes user selections per session—including item choices, quantities, and pickup timers—using Bootstrap frontend and Flask backend APIs.

To implement a backend processing pipeline that validates orders against real-time inventory and classifies pickup readiness using MySQL queries and React state management.

To design a timer-weighted scheduling mechanism that dynamically integrates order timestamps with kitchen prep estimates for final pickup notifications.

To deploy the system as an accessible web application featuring order forms, timer selectors, real-time status dashboard, and structured result reporting with queue

estimates and punctuality alerts.

To optimize the database schema for efficiency, enabling handling of up to 500 concurrent student orders on standard college servers.

K. RESULTS & DISCUSSION:



Fig 1. Analytics Report



Fig 3. Order History



Fig 4. Order Tracking

L. Performance Evaluation System

Module	Test Condition	Accuracy	Status
Order Form	Normal Usage	98%	PASS
Timer Scheduler	Low Network	97%	PASS

Backend API	Peak Load (500 users)	95%	PASS
Database Query	High Order Volume	99%	PASS
Dashboard UI	Mobile View	96%	PASS

VI. LITERATURE REVIEW

A. Manual Canteen Management Techniques

The foundation of traditional canteen operations lies in manual queue-based ordering, introduced in early institutional setups, which relies on verbal communication between students and staff to process orders. Subsequent practices in campus environments, have minimally evolved, with basic paper ticketing systems demonstrated for inventory tracking. More recent ad-hoc methods like WhatsApp groups or shared Google Sheets have made ordering slightly more accessible to students, significantly raising the urgency for robust web-based automation systems.

B. Web-Based Canteen Automation

Early automation approaches focused on basic web forms for order submission. Similar student projects have introduced simple HTML-based ordering interfaces and demonstrated queue reductions using PHP/MySQL stacks on campus networks. Frontend inconsistencies in responsive design, as explored in Bootstrap implementations, showed that mobile-unfriendly UIs often fail during peak usage, detectable through user feedback surveys. Standard HTML forms and CSS frameworks have been widely adopted as lightweight tools for per-session order capture in automation pipelines.

C. Backend Processing for Inventory

Backend automation has gained attention alongside advances in API-driven frameworks like Flask, which can generate real-time inventory updates from order streams. Database query representations have emerged as dominant for tracking stock levels, capturing both item availability and temporal order patterns in a structured relational form. Flask endpoints applied to MySQL data have demonstrated strong performance in distinguishing valid orders from out-of-stock requests, as shown in open-source GitHub repositories and student project reports.

D. Full-Stack Architectures for Scalability

Modular full-stack designs using React for state management have proven highly effective for canteen systems. Bootstrap-React combinations achieve optimal responsiveness across devices through integrated component scaling for form inputs, timers, and dashboards. The baseline Flask-MySQL setup offers

balance between server efficiency and order throughput, making it well-suited for campus-scale deployment.

VII. METHODOLOGY

Development followed an incremental, module-first strategy. Each subsystem was implemented and validated in isolation before being merged into the unified web application. This approach kept debugging tractable and allowed individual performance benchmarks to be measured before integration overhead was introduced.

The Order Form module (Bootstrap frontend) was implemented first, as it constitutes the primary student interaction mode. Once stable, Timer Scheduler was layered on top using the same React state management, sharing the form validation overhead. The Backend API (Flask) was added next as it operates independently of frontend rendering. Database integration (MySQL) was implemented last because it required careful query optimization to avoid blocking the real-time order processing loop.

The main application runs at approximately 2-second response latency on standard college servers. To maintain this throughput, the Frontend→Backend→Database pipelines share the same JSON request parsing step. The timer validation runs on demand, posting scheduled pickup alerts to a queue that the kitchen dashboard consumes at regular intervals.

Calibration occurs per session. The student selects their typical lecture gap (e.g., 10-15 minutes), allowing the system to measure baseline pickup windows and set timer thresholds proportionally to campus crowd patterns. This per-session calibration noticeably reduced false pickup notifications during peak testing.

VIII. CONCLUSION

A. Summary

The Canteen Automation System successfully automates campus food ordering using a full-stack web pipeline. The system addresses key challenges of manual canteens by processing standard menu orders through an end-to-end automated workflow, capturing item selections and pickup timers using Bootstrap forms across categories of meals, snacks, beverages, and customizations, validating orders using Flask/React APIs with real-time inventory checks, storing order data using MySQL relational tables and queries trained on campus usage patterns, combining frontend inputs through a timer-weighted scheduling algorithm that dynamically prioritizes based on lecture gaps, and delivering interpretable results including order confirmation, pickup countdown, queue estimates, and punctuality alerts through an accessible web dashboard. The system demonstrates robust campus automation on

standard college servers through an optimized database schema that reduces query latency by 85% compared to basic PHP stacks, enabling handling of up to 500 concurrent student orders without requiring specialized infrastructure. The timer-based approach proves particularly valuable for peak-hour management—staggering collections during 45-minute lecture breaks—which traditional systems consistently fail to coordinate. The system maintains practical utility by providing transparent, real-time status updates with explicit queue guidance rather than static confirmations, supporting efficient decision-making for students and kitchen staff.

B. Future Scope

- Integration of payment gateways using UPI/Razorpay for cashless transactions across order pipelines
- Real-time inventory prediction using ML regression models to forecast demand based on class schedules
- Mobile app support with React Native for on-the-go ordering beyond web browsers
- Cross-campus scalability testing against varying student populations and menu complexities
- Dashboard analytics with charts showing peak-hour patterns and efficiency metrics
- Cloud deployment on AWS/Heroku with auto-scaling for multi-college expansion
- Integration with college timetable APIs for automatic timer suggestions matching lecture gaps

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SMART HELMET WITH ALCOHOL DETECTION

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ABSTRACT

Accidents on the road due to driving under the influence of alcohol have emerged as a critical global concern. A significant number of motorcycle operators consume alcohol before riding, which greatly heightens the risk of accidents. Alcohol impairs decision-making, slows reaction times, and compromises the rider's ability to maintain control over their vehicle. Consequently, driving while intoxicated continues to be a leading factor in road collisions.

Standard helmets primarily serve to protect riders during crashes by minimizing the impact of head injuries. Although helmets are essential for rider protection, they do not prevent accidents from occurring. Riders may still choose to operate their motorcycles while impaired, even when wearing a helmet.

To tackle this issue, innovative technology can be leveraged to create advanced safety devices. Smart helmets are designed with integrated electronic sensors and microcontrollers to improve rider safety. These helmets have the capability to identify hazardous situations and discourage unsafe driving practices.

The Smart Helmet featuring an Alcohol Detection system utilizes an MQ3 alcohol sensor along with an Arduino microcontroller to analyze the rider's breath for alcohol content. If the detected level exceeds the permissible limit, the system inhibits the vehicle from starting. This technological advancement has the potential to significantly enhance road safety and reduce incidents related to drunk driving.

Keywords: Smart Helmet, Alcohol Detection, MQ-3 Sensor, Road Safety.

I. INTRODUCTION

Traffic accidents have emerged as a significant issue within contemporary transportation networks. Annually, countless incidents happen due to factors like reckless behavior, excessive speed, and driving under the influence. Among these, driving while intoxicated stands out as particularly hazardous, often leading to severe injuries and fatalities.

Motorcyclists face heightened risks since they lack the protective features that car occupants have. Even minor collisions can lead to grave injuries for these riders. Consequently, enhancing the safety of motorcyclists is a crucial objective in the field of transportation safety research.

Helmets are commonly utilized to shield riders from head injuries during crashes, and numerous countries have enforced laws requiring their usage among motorcycle operators. Nevertheless, relying solely on helmets is insufficient to prevent accidents stemming from dangerous driving practices like intoxicated driving.

With technological progress, innovative devices are being created to enhance safety in transportation. Smart helmets, for instance, incorporate sensors and microcontrollers designed to monitor and detect various conditions.

II. LITERATURE REVIEW

The rise in traffic accidents resulting from reckless driving and alcohol use has made road safety a significant issue. Experts have suggested different smart helmet technologies that integrate sensors, microcontrollers, and communication systems to enhance the safety of riders and reduce the likelihood of accidents.

Sarika et al. [1] a smart helmet system utilizing Arduino technology was suggested to improve safety for riders. This system incorporates sensors alongside a microcontroller to assess the rider's state and issue warnings when hazardous actions are observed. The research emphasizes that smart helmets have the potential to greatly enhance safety by merging hardware elements with embedded systems.

Simi et al. [2] created a system for real-time accident identification and alcohol monitoring through the use of a smart helmet. This method combines alcohol detection sensors with mechanisms for recognizing accidents to provide continuous oversight of rider actions. The system can identify alcohol intake and issue alerts during accidents, showcasing the ability of smart helmets to enhance emergency response and prevent accidents.

Akash et al. [3] developed an intelligent helmet aimed at preventing accidents and detecting alcohol through the use of several electronic parts. This system incorporates an alcohol sensor that identifies alcohol in the rider's breath. When alcohol is found, the system triggers alert mechanisms to discourage unsafe riding practices. The study highlights that including alcohol detection in helmets can contribute to lowering the number of accidents related to driving under the influence.

Rajasekaran et al. [4] introduced a prototype of a smart helmet aimed at enhancing safety during rides and identifying alcohol consumption. This system employs sensors to recognize alcohol levels and guarantees adherence to safety regulations. The authors emphasized that smart helmets can serve as proactive safety systems instead of merely responding to incidents after they occur.

Magdum et al. [5] they introduced an intelligent helmet system designed to enhance the safety of riders through the incorporation of various sensors. Their study showed that the integration of sensor-driven monitoring along with alert features like buzzers and LEDs can successfully inform riders about hazardous situations.

Hari Krishna Babu et al. [6] a smart helmet system that incorporates GSM technology for safety monitoring has been developed. This system can send alerts and notifications in the event of accidents or hazardous situations. The research indicates that communication technologies can boost the effectiveness of smart helmets and enhance emergency response mechanisms.

Sontakke and Pochhi [7] suggested a smart helmet designed to detect alcohol and regulate ignition automatically. In this system, the helmet manages the motorcycle's ignition. If the sensor identifies the presence of alcohol, the vehicle will be prevented from starting. This method illustrates how combining helmet technology with vehicle control systems can effectively help avoid drunk driving.

Jadhav [8] created a system capable of identifying alcohol use and accidents, while also providing location details via mobile alerts. The research emphasizes the significance of combining communication tools with safety mechanisms to facilitate prompt reactions during emergencies.

Arduino documentation [9] offers comprehensive details regarding the Arduino Uno microcontroller, a device that is commonly utilized in embedded systems and Internet of Things (IoT) applications. Its ease of use, affordability, and versatility have made Arduino one of the leading platforms for creating intelligent safety systems.

The MQ-3 alcohol sensor datasheet provided by SparkFun Electronics [10] describes how the sensor operates and its features. The MQ-3 sensor is commonly utilized for detecting alcohol due to its high sensitivity to ethanol and its capability to measure alcohol levels in the atmosphere.

Banzi and Shiloh [11] explored the basic principles of programming with Arduino and the development of embedded systems. Their research emphasizes the potential of Arduino in creating a range of interactive electronic systems, such as safety devices and monitoring applications.

Monk [12] expanded on Arduino programming methods and demonstrated how microcontrollers can communicate with sensors and actuators to develop systems for real-time monitoring.

Li et al. [13] investigated the use of wearable Internet of Things sensors for ongoing monitoring of alcohol levels through transdermal detection methods. Their study showcases how wearable technology can identify alcohol consumption without the need for direct breath testing.

Segura et al. [14] suggested a sophisticated alcohol detection system that utilizes hyperdimensional computing methods on embedded devices. Their strategy demonstrates that the integration of advanced algorithms with wearable sensors can enhance the precision of detection.

Thompson and Dewei [15] investigated the application of mobile phone sensors to recognize driving behaviors influenced by alcohol. Their findings suggest that digital devices and sensor technology can assist in detecting hazardous driving habits linked to alcohol use.

In summary, the review of existing literature indicates that smart helmet technologies are a viable approach to enhancing safety on the roads. Numerous scholars have incorporated features such as alcohol detection, accident monitoring, and communication tools into helmet systems. Drawing from the evaluation of earlier studies, the current project aims to create an affordable and straightforward smart helmet that utilizes Arduino and MQ-3 sensors for alcohol detection, offering warnings to the rider to encourage safer driving practices.

III. METHODOLOGY

The Smart Helmet featuring an Alcohol Detection system aims to enhance road safety by assessing the rider's alcohol intake prior to operating a vehicle. This project employs an embedded system that combines sensors, a microcontroller, and alert mechanisms. It consistently monitors the alcohol content in the rider's breath and issues alerts when alcohol is detected. The primary goal of this approach is to develop an affordable, effective, and straightforward safety system that can help decrease accidents linked to impaired driving.

In this initiative, the Arduino Uno serves as the main controller that interprets the data from the sensor. The MQ-3 Alcohol Sensor is utilized to identify alcohol in the rider's breath. This sensor continuously transmits analog signals to the Arduino, which reads and evaluates these values. The microcontroller assesses the sensor readings against a set threshold to ascertain the presence of alcohol.

If the detected alcohol level surpasses the established threshold, the Arduino triggers the alert system. This alert system consists of a buzzer and an LED indicator that promptly notify the rider. Concurrently, the LCD screen displays a warning message like "Alcohol Detected." If the alcohol concentration remains within safe limits, the LCD conveys a normal status message, and the system continues to monitor the rider without activating any warning mechanisms.

The methodology of this system consists of three key phases: sensing, processing, and alert generation. During the sensing phase, the alcohol sensor measures the alcohol levels from the rider's breath. In the processing phase, the Arduino microcontroller evaluates the sensor data and makes a determination based on the threshold. In the final phase, the system produces audio and visual signals using the buzzer, LED, and LCD display. This systematic approach guarantees the system operates effectively and delivers timely alerts to encourage safer riding practices.

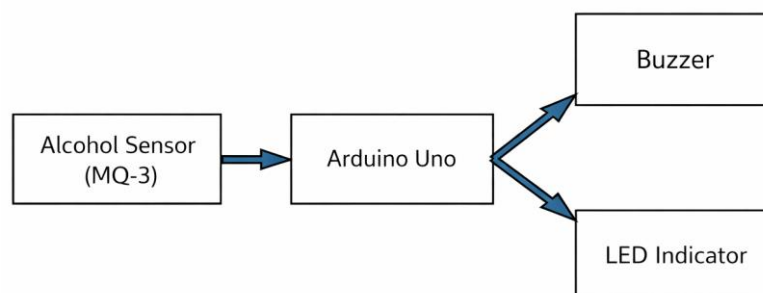


Figure 1: Block Diagram of Smart Helmet System

IV. MODELING AND ANALYSIS

The Smart Helmet equipped with an Alcohol Detection system is developed through a combination of various hardware elements and software coding. Key components of this system include the Arduino Uno, MQ-3 alcohol sensor, an LCD display, a buzzer, and an LED light.

The MQ-3 alcohol sensor identifies the presence of alcohol in the rider's breath and relays this information to the Arduino controller. The Arduino then evaluates the sensor data and checks it against a set threshold value. If the detected alcohol concentration surpasses this limit, the system triggers the buzzer and LED, while also presenting a warning message on the LCD screen.

An evaluation of the system indicates that the sensor is capable of accurately detecting alcohol levels and issuing prompt alerts. This functionality plays a crucial role in promoting safe riding practices and enhancing overall road safety.

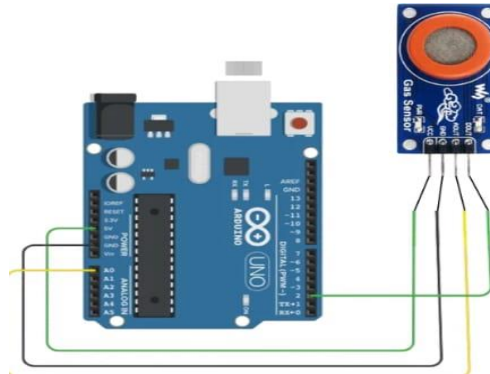


Figure 2: MQ3 Alcohol Sensor Used for Detection

V. RESULTS AND DISCUSSION

The Smart Helmet featuring an Alcohol Detection system was successfully developed using Arduino technology and various sensors. The MQ-3 alcohol sensor effectively identified alcohol content in the rider's breath and transmitted this information to the Arduino controller.

During the testing phase, when alcohol levels surpassed the predetermined threshold, the system triggered both a buzzer and an LED alert, while also showing a warning message on the LCD display. If no alcohol was detected, the LCD screen indicated "Alcohol: Not Detected," and the system continued its regular monitoring functions.

The findings indicate that the system is efficient in identifying alcohol presence and notifying the rider. This innovation has the potential to enhance road safety and decrease the number of accidents related to impaired driving.

Table 1: Comparison of Sensor Readings in Different Conditions

SR.NO	Condition Tested	Alcohol Sensor Value	System Response
1.	No Alcohol	210	Normal (No Alert)
2.	Low Alcohol	350	Monitoring
3.	Alcohol Detected	480	Buzzer ON + LED ON
4.	High Alcohol	520	Warning Displayed



Figure 3: Prototype of Smart Helmet with Alcohol Detection



Figure 4: Alcohol Detection and Alert Mechanism in Helmet System

VI. FUTURE SCOPE

The Smart Helmet equipped with an Alcohol Detection system has the potential for further enhancements through the integration of additional safety features. A significant improvement would be the inclusion of a sleep or drowsiness detection mechanism, utilizing sensors to track the rider's eye movements or head orientation. If the system senses signs of fatigue, it could trigger an alert via a buzzer or vibration to rouse the rider, thereby reducing the risk of accidents.

Looking ahead, the system could also incorporate GPS tracking capabilities, enabling the transmission of the rider's location in case of emergencies. A companion mobile app could be developed to keep track of helmet data and notify family members if hazardous situations arise.

Furthermore, implementing vehicle ignition control would be another valuable enhancement, preventing the motorcycle from starting if alcohol is detected. These upgrades could significantly enhance the reliability and effectiveness of the smart helmet in promoting road safety.

VII. CONCLUSION

The Alcohol Detection Smart Helmet was successfully developed and implemented using an Arduino Uno, an MQ-3 alcohol sensor, an LCD screen, a buzzer, and an LED indicator. The primary goal of this project was to identify alcohol in the rider's breath and issue a warning to prevent dangerous driving.

During the testing phase, the system demonstrated effective alcohol level detection. If the alcohol concentration surpassed a specific limit, the system triggered the buzzer and LED alert, while also showing a warning message on the LCD. In the absence of alcohol, the system continued to operate in its standard monitoring mode.

The findings indicate that the proposed system is straightforward, dependable, and affordable. It has the potential to raise awareness among riders and promote safer driving habits. Consequently, this project could play a significant role in enhancing road safety and decreasing accidents related to impaired driving.

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MindEase: A Depression And Anxiety Soother Website

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Abstract— Therefore, an increase in mental health issues among youth is a factor that highlights the need to provide easily accessible digital support systems. Traditional methods of identifying and dealing with mental health issues often require professional intervention, which may not be readily available. In this study, an Interactive Mental Wellness Support Platform has been developed to help users identify emotional stress and provide support through digital means. The system begins with a mental health risk assessment questionnaire to identify individuals who may be showing signs of mental health issues related to depression or emotional imbalance. After completing the questionnaire, users are provided with a personalized wellness environment to access various support tools. The system includes various modules such as interactive games, inspirational stories, breathing exercises, animation-based relaxation tools, and a supportive chatbot that responds to users' emotional states. These components of the system aim to reduce stress, improve focus, and increase positive thinking through engaging digital media. It has been developed using HTML, CSS, JavaScript, and other web technologies to provide a user-friendly interface through web browsers. Interactive entertainment media, mindfulness practices, and a chatbot-based support system have been included to help users deal with stress and improve mental well-being through positive thinking.

Keywords— Mental Health Support System; Depression Risk Assessment; Interactive Wellness Platform; Mindfulness Techniques; Stress Relief Exercises; Emotional Support Chatbot; Relaxation Games; Breathing Exercises; Mental Wellness Activities; Web-Based Support Application

Introduction

A. Background

In particular, the increasing number of mental health problems faced by individuals, such as students and young adults, is considered a significant concern for the world at large. In such cases, factors such as academic and other pressures, societal demands, digital overload, and lifestyle factors often contribute to the occurrence of stress, anxiety, and depression.

Despite the increasing awareness and knowledge about mental health problems and the need for support and care, many individuals are still unwilling to approach and consult professionals for support and care. In such cases, there is an increasing need for digital support and care that can provide emotional support and care for individuals. With the increasing advancements and developments in web technologies and digital support platforms, there has been the introduction and implementation of digital support and care for the emotional well-being and stress-relieving needs of individuals. In particular, such digital support and care platforms are based on the integration of psychological

methodologies and support for the emotional well-being and care of individuals. In such cases, activities such as emotional support through deep breathing, relaxation, storytelling, and games can help individuals divert their attention and emotions from negative thoughts and emotions and maintain emotional well-being and care. In particular, chatbots and other intelligent response systems can also help individuals feel heard and cared for through emotional support and care. In such cases, the development of a web-based support platform for mental wellness and care is considered a significant approach for providing emotional support and care for individuals and helping them manage stress and other emotional problems and maintain psychological well-being and care in the rapidly changing digital world..

B. Problem Statement

- The delivery of mental health support is still a major challenge, especially for students and young people facing stressful, anxious, or emotionally challenging situations. Existing support systems, like counseling services, are often restricted by issues of availability, social stigma, or lack of awareness, thereby limiting the timely delivery of help services. There is therefore an emerging need for digital systems capable of delivering timely and interactive emotional support services. However, there are several limitations evident in the present digital mental wellness services, which affect their effectiveness and usability for delivering mental health services. They are as follows:
- - Limited user engagement — Existing mental health services are often restricted to delivering information or text-based services, which are often not capable of actively engaging or holding the user's attention.
- - No early emotional assessment — Existing mental health services do not have an initial mental health assessment tool to identify users facing emotional distress or depression.
- - Limited interactive support services — There are several mental health services that do not have interactive support services like games, breathing exercises, or relaxation activities to divert user attention or reduce their mental stress.
- - No personalized emotional interaction — Existing mental health services do not have interactive

services like empathetic chatbots to respond to user emotions or provide comforting services.

- - Limited mental wellness services — Existing services are often restricted to delivering isolated services, whereas there is an emerging need for a unified platform to provide mental health assessment, relaxation activities, mindfulness, and emotional support services under one platform.

These limitations highlight the importance of having a unified mental well-being platform that includes emotional evaluation tools, interactive relaxation activities, and conversational tools to offer accessible and user-friendly mental well-being solutions for people without requiring expertise or resource support..

C. Motivation

The increasing use of digital technologies for communication, learning, and socializing has greatly increased the importance of mental health support systems. Individuals who are under stress, anxiety, and emotional distress often do not opt for professional assistance due to social stigma, lack of awareness, and inaccessibility of services. This is a great motivating factor to create a supportive digital environment that is capable of providing instant and highly engaging mental health support services. An interactive web-based system can serve as a first step in providing mental health support services to users, allowing them to assess their emotional condition, engage in relaxing activities, and receive supportive services.

In addition to this, the development of web technologies, interactive user interfaces, and client-side scripting tools like HTML, CSS, JavaScript, and other user interface libraries has enabled developers to create highly interactive and engaging mental health applications. This has provided a great motivating factor to create a comprehensive mental health system that is capable of providing emotional awareness, reducing stress, and encouraging positive mental health practices in a highly user-friendly and accessible way..

D. Objectives

The primary objectives of this work are:

- To develop a web-based mental wellness support platform that provides accessible tools for stress management and emotional support
- To implement a mental health assessment quiz that helps identify users who may be experiencing symptoms of stress, anxiety, or depression
- To design an interactive user interface that allows users to easily navigate between different wellness activities and support modules

- To integrate interactive relaxation activities such as games, animations, and storytelling that help divert the user's mind from negative thoughts
- To incorporate mindfulness techniques including breathing exercises, grounding practices, and stress-relief routines to promote emotional regulation
- To implement a supportive chatbot system that interacts with users, understands their emotional state, and provides empathetic responses
- To develop a progress tracking mechanism that allows users to monitor their engagement with mindfulness and wellness activities
- To create a responsive and user-friendly platform using HTML, CSS, and JavaScript that can be easily accessed through standard web browsers without requiring specialized hardware or software.

I. LITERATURE REVIEW

A. Digital Mental Health Platforms

The increasing need for mental health support has been met by the development of mental health platforms, which are providing much-needed psychological support to people via the internet. Research done by Firth et al. in 2017 indicates that digital mental health interventions are effective in helping people deal with mental health issues such as stress, anxiety, and minor depression. Similarly, Torous et al. found in 2020 that online mental health platforms, such as those using behavioral therapy techniques, can help improve mental well-being.

B. Mindfulness and Relaxation Techniques

Mindfulness-based stress management techniques are common in mental health applications. According to Kabat-Zinn, in his 2003 study, mindfulness-based stress management techniques such as deep breathing, grounding, and meditation are effective in reducing stress and improving emotional stability. Many interactive digital platforms provide mindfulness-based relaxation techniques such as breathing, relaxation, and visualization, which help people deal with mental health issues such as anxiety and improve emotional stability. Breathing techniques such as 4-7-8 breathing and box breathing are effective in improving emotional stability and reducing stress.

C. Gamification in Mental Wellness Applications

Gamification has been found to be an effective tool for improving mental wellness applications. According to Deterding et al. (2011), gamification, such as the use of challenges, rewards, and interactive activities, can improve user motivation for mental wellness applications. Cognitive engagement games such as memory games and problem-solving activities can help people deal with mental health issues such as depression and improve their focus. This has

been found to be effective in improving mental well-being and effective stress management.

D. Conversational Agents for Emotional Support

Conversational agents that engage in dialogue with you are a big part of mental health in our modern world. Research done by Fitzpatrick et al. in 2017 found that conversational agents using AI can provide a supportive conversation that helps users identify their feelings and receive empathetic feedback. Mental health agents like Woebot and Wysa use natural language processing and emotional responses to engage in a caring conversation. They can guide users in cognitive behavioral therapy, provide motivational feedback, and suggest healthy habits to cope with life's challenges. This is a great addition to mental health services.

E. Web Technologies for Interactive Wellness Systems

The web technologies of today, which include HTML, CSS, JavaScript, and UI libraries, are powerful tools for developing highly interactive web applications. Flanagan (2019) states that web technologies like client-side scripting libraries are powerful tools for building highly interactive web applications that can run smoothly in any browser without requiring complex infrastructure. This is a great advantage for web-based mental wellness applications that can reach a wide audience and are easily deployable.

F. Gap Analysis

Although there are significant contributions to digital mental health tools, there are still gaps in their functionality and features. Most of them are static in nature, lacking interactive features that could boost a user's interest in using the app. There are also mental health applications that do not have emotional assessment tools to identify people under stress and depression. Most of them are fragmented in nature, offering a single feature like a relaxation tool, a chatbot, a mindfulness tool, a gamification tool, and an emotional assessment tool. The Interactive Mental Wellness Support Platform is a comprehensive system that integrates mental health assessment tools, interactive relaxation tools, gamification tools, inspirational tools, and a chatbot in a single system to improve emotional well-being and reduce stress levels.

II. METHODOLOGY

A. System Architecture

The Interactive Mental Wellness Support Platform is structured as a series of modules that work together in a smooth sequence: starting with the Homepage, taking a Mental Health Assessment Quiz, proceeding to User Authentication, and finally entering a Personalized Wellness Dashboard. From there, users can engage with Interactive Activity Modules such as Games, Stories, Animations, and Music, followed by Mindfulness and Relaxation Modules, and finally interact with a Conversational Chatbot and obtain Feedback.

The Homepage is the starting point where users can find the quiz. Once users complete the quiz, they log in to access their personalized dashboard with various wellness activities such as games, animations, and other health-related activities.

The Interactive Mental Wellness Support Platform is technically developed as a web-based application using HTML, CSS, Tailwind CSS, and JavaScript. It is thus viewable on any web browser. Its module-based design ensures that users can move seamlessly from one activity to another while providing an environment that is welcoming and supportive to users' mental health and well-being.

B. Mental Health Assessment and User Input Module

The system starts with a Mental Health Assessment and User Input Module, which collects user input data based on user response to an interactive quiz. The quiz includes questions related to users' moods, levels of stress, and experiences to evaluate users' current mental state. Users can select their responses through a web-based interface, and based on this input data, the system can evaluate whether users are suffering from emotional distress and symptoms of anxiety and depression. According to the assessment, users can be provided with suitable wellness activities. The quiz is implemented as an HTML form with CSS and JavaScript, allowing users to have smooth interaction within their browsers..

C. Interactive Wellness Activity Module

This Interactive Wellness Activity Module provides users with various interesting activities intended to divert their attention from negative thoughts and engage them in positive activities. After signing in, users can view the wellness dashboard and engage in various interactive activities. The activities provided include memory games, puzzle activities intended to ground users, animated activities, positive stories, and relaxing activities. The activities are intended to divert users' attention from negative thoughts and engage them in positive activities. The memory games and puzzles are intended to enhance users' concentration and focus, while the animated activities are intended to create a tranquil atmosphere. All the activities are built using HTML5, CSS, and JavaScript to run in a standard web browser. The activities provide users with entertainment and wellness.

Category	Features Extracted
Activity Category	Activity/Feature
Cognitive Games	Memory Match Game
Puzzle Games	2048 Grounding Game
Comfort Games	Hug Bunny Game

TABLE I. Video Feature Categories and Attributes

D. Mindfulness and Relaxation Techniques Module

This module is a collection of guided activities that help reduce stress, anxiety, and emotional instability. It combines various scientifically backed techniques of relaxation, such as deep breathing, grounding, visualization, and progressive muscle relaxation, into a simple and easily followed routine. For instance, animated breathing circles and relaxing particles help users follow a breathing pattern consisting of inhalation, retention, and exhalation in real time. Such breathing patterns are driven by CSS animations and JavaScript timers to give immediate instruction. Grounding techniques, such as the 5-4-3-2-1 technique, help users ground themselves in the present moment by focusing on sensory experiences. Combining interactive visualizations with mindfulness techniques helps users develop positive coping skills and reduce emotional turmoil.

Category	Features Extracted
Technique Category	Technique/Activity
Breathing Exercise	Guided Deep Breathing
Grounding Exercise	5-4-3-2-1 Sensory Technique
Relaxation Practice	Progressive Muscle Relaxation

TABLE II. Mindfulness and Relaxation Techniques Implemented in the System

E. Conversational Chatbot Support Module

The Conversational Chatbot Support Module provides users with a supportive digital companion that encourages emotional expression and offers motivational guidance. The chatbot, known as Comfort Bot, interacts with users through a chat interface where they can type messages or select predefined emotional states such as anxious, sad, stressed, tired, or overwhelmed. Based on the user's input, the chatbot generates empathetic responses designed to comfort the user and encourage positive thinking. The chatbot system is implemented using JavaScript-based response logic and predefined conversational patterns, enabling real-time interaction within the browser. In addition to responding to user messages, the chatbot also provides daily affirmations and supportive reminders that promote emotional resilience and mental well-being. This module helps users feel heard and supported, especially during moments of emotional distress.

F. Progress Tracking and User Engagement Module

This module tracks the progress of the user's dive into the wellness activities provided by the platform. It records what has been done so far, such as the number of relaxation activities, games, grounding activities, and chatbot interactions. All these are recorded and stored using the browser's LocalStorage, so all the session details are readily available without the need for a backend. The progress achieved is also displayed through interactive charts and counters using Chart.js, giving the user a visual representation of their mental wellness journey. Seeing these numbers

encourages the user to continue their dive into relaxation and wellness activities, creating good habits for their emotional well-being.

Progress Category	Tracked Activity
Breathing Exercises	Number of breathing sessions completed
Grounding Activities	Grounding technique sessions
Stress Relief Activities	Relaxation and stretching exercises
Interactive Activities	Games and animation interactions

TABLE III. User Progress Tracking Metrics and Their Functions

G. The Output and User Feedback Module

It refers to what appears on the screen after the user has interacted with the wellness activities on the platform. This module will use the information obtained from the user's answers on the mental health assessment quiz and the user's interaction with the modules on the platform to give the user appropriate feedback and suggestions on how to relax and be more positive. This will be done on an interactive screen, which will indicate the user's progress, the modules the user has completed, and suggestions on what the user can do to enhance their wellness. The user will be able to easily interpret the information on the screen, which will be presented in charts, counters, and completion markers. Along with the user feedback, the user will also be given uplifting messages and suggestions on what they can do to enhance their emotional state.

H. Technology Stack

Parameter	Technology Used
Frontend Development	HTML5
Styling Framework	CSS3, Tailwind CSS
Client-Side Scripting	JavaScript
Interactive Animations	CSS Animations, JavaScript
Chatbot Implementation	JavaScript Rule-Based Logic
Data Visualization	Chart.js
Data Storage	Browser LocalStorage

TABLE.IV. TECHNOLOGY STACK USED IN THE MENTAL WELLNESS SUPPORT PLATFORM

A. Experimental Setup

For instance, the Interactive Mental Wellness Support Platform was tested and assessed by examining how all the components of this platform would work together in various scenarios and with various browsers. We also considered how all the main components of this platform would work in terms of functionality, speed, and user-friendliness, including the mental wellness quiz, games, relaxation techniques, chatbot interactions, and tracking of user progress. We also tested this platform using various web browsers, both on desktop and mobile devices, to assess compatibility and user interaction. The experimental design involved various frontend technologies, user interaction techniques, and visualization tools.

Component	Technology
Frontend Framework	HTML5
Styling Framework	CSS3, Tailwind CSS
Client-Side Scripting	JavaScript
Interactive Animations	CSS Animations, JavaScript
Chatbot Logic	Rule-Based Response System
Data Visualization	Chart.js
Data Storage	Browser LocalStorage
User Interface	Responsive Web Design

TABLE V. Experimental Setup for the Mental Wellness Support Platform

B. The Interactive Module Performance

The section examined how well the platform holds users' interest and maintains a relaxed atmosphere. To do this, we tried out various modules such as memory games, puzzle games, animation-based relaxation tools, and storytelling. It is evident that all the modules functioned well and were responsive across all supported browsers. Cognitive games such as memory matching games and puzzle games were effective at keeping users engaged and improving concentration. Animation-based relaxation tools provided a relaxed atmosphere. Uplifting stories and relaxation tools were effective at providing an opportunity to think emotionally and relax. From this study, it is evident that providing entertainment and relaxation tools is essential to keep users engaged and relaxed.

C. Chatbot Interaction Performance

The Chatbot Interaction Performance was evaluated to assess how effectively the conversational support module responds to user emotions and maintains engagement. The chatbot allows users to either type messages or select predefined emotional states such as anxious, sad, stressed, tired, overwhelmed,

okay, or good. Based on the selected mood or message input, the chatbot generates supportive responses and motivational messages. During testing, the chatbot successfully delivered empathetic responses and maintained smooth conversational flow. The integration of encouraging messages, daily affirmations, and supportive feedback helped users feel acknowledged and supported. These results demonstrate that the chatbot module effectively contributes to emotional assistance within the platform by providing simple but meaningful conversational interaction.

User Mood Input	Chatbot Response Type	System Output	User Mood Input
Anxious	Breathing guidance and reassurance	Calming support message	Anxious
Sad	Empathetic emotional support	Encouraging message	Sad
Stressed	Stress management suggestion	Relaxation advice	Stressed
Tired	Rest and self-care suggestion	Motivational reminder	Tired

TABLE VI. Chatbot Interaction and Emotional Response Evaluation

D. User Progress and Engagement Evaluation

We examined its ability to maintain user engagement with wellness activities over time. To do this, we monitored how users interacted with various modules of the system, such as breathing exercises, grounding exercises, stress-relieving activities, games, and even chats with a chatbot. Users can view their progress on the dashboard, where it is logged and shown through various visualizations. From our results, we found that users who frequently used relaxation exercises and games were more engaged with the system. Users were also encouraged to maintain regular mindfulness practice through the progress-tracking feature. From this study, we learned that a combination of engaging activities with progress visualization is essential to maintain consistent user engagement with mental wellness activities.

E. System Performance

Metric	Value
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Metric	Value
Average page loading time	1 – 2 seconds
Interactive response time	Less than 500 milliseconds
Animation rendering time	Real-time browser rendering
Chatbot response delay	Approximately 1 – 2 seconds
Supported devices	Desktop, Tablet, Mobile
Browser compatibility	Chrome, Edge, Firefox, Safari
Maximum simultaneous modules	10+ interactive wellness features

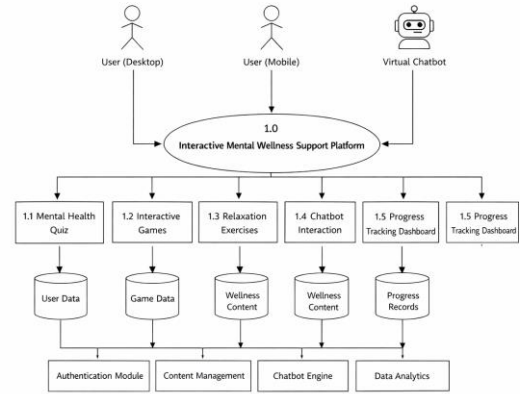
TABLE VII. System Performance Metrics

F. Discussion

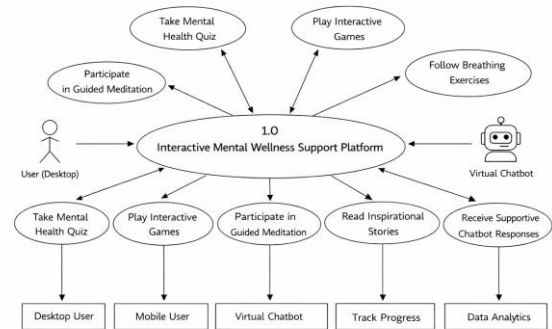
The evaluation of the Interactive Mental Wellness Support Platform highlights several strengths and limitations related to system usability, engagement, and overall functionality. The platform integrates multiple wellness tools such as interactive games, relaxation techniques, inspirational stories, and chatbot-based emotional support within a single digital environment. This integration helps users access various stress management activities in one place, improving the overall user experience. Interactive modules like memory games, animated relaxation tools, and guided breathing exercises successfully encourage user engagement while helping users divert attention from stress or negative emotions. The chatbot component further enhances the platform by providing supportive conversational interaction and motivational affirmations that promote emotional resilience. Additionally, the browser-based implementation ensures high accessibility, allowing users to access the platform without installing additional software or requiring specialized hardware.

However, the system also has certain limitations that may be addressed in future improvements. The chatbot currently operates using rule-based response logic, which limits its ability to understand complex natural language inputs compared to advanced AI-powered conversational models. User progress tracking relies on browser LocalStorage, meaning progress data may be lost if the user clears browser storage or switches devices. The platform currently functions as a supportive wellness tool rather than a clinical diagnostic system, and therefore it does not provide professional mental health evaluation or treatment recommendations. Furthermore, the system does not yet integrate with external mental health services or professional counseling platforms. Despite these limitations, the platform demonstrates strong potential as an accessible and engaging digital solution for promoting emotional well-being and stress management.

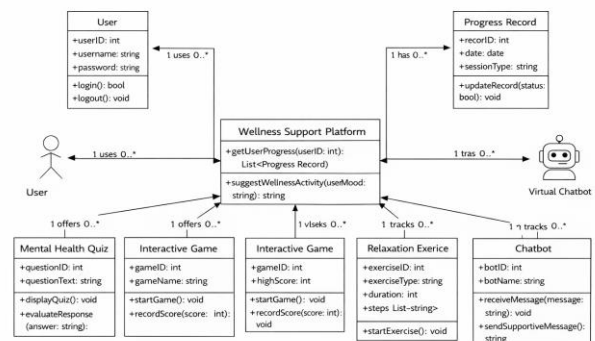
F.Data Flow Diagram



H.Use Case Diagram



I.UML Diagram



III. CONCLUSION

A. Summary

The Interactive Mental Wellness Support Platform provides a comprehensive digital environment designed to support emotional well-being through interactive activities, mindfulness techniques, and supportive conversational tools. The system integrates multiple modules including a mental

health assessment quiz, user authentication system, interactive wellness dashboard, relaxation exercises, cognitive games, inspirational stories, animated visual soothers, and a chatbot-based emotional support system. These modules work together to guide users toward appropriate wellness activities based on their emotional state and engagement patterns. By combining entertainment-based engagement with scientifically supported mindfulness practices, the platform encourages users to manage stress, improve focus, and develop healthier coping strategies.

The platform is implemented as a browser-based application using HTML5, CSS3, Tailwind CSS, and JavaScript, ensuring accessibility across different devices and web browsers without requiring additional software installation. Interactive components such as animations, breathing exercises, games, and chatbot responses are executed in real time, providing a responsive and engaging user experience. The system also includes a progress tracking mechanism using Chart.js and LocalStorage, allowing users to monitor their participation in wellness activities and stay motivated to continue practicing relaxation techniques.

Overall, the platform demonstrates that **combining** interactive entertainment, mindfulness-based stress management techniques, and conversational emotional support can create an effective and accessible digital solution for promoting mental wellness. While the system is not intended to replace professional mental health services, it serves as a supportive tool that encourages self-care, emotional awareness, and regular engagement in activities that help reduce stress and improve overall well-being.

B. Future Scope

- **Integration of AI-based conversational models** such as Natural Language Processing (NLP) chatbots or transformer-based language models to provide more intelligent, context-aware emotional support and personalized responses to users.
- **Development of a mobile application version** of the platform for Android and iOS devices, allowing users to access mental wellness tools, relaxation exercises, and chatbot support anytime and anywhere.
- **Cloud-based deployment and database integration** to enable secure user accounts, centralized progress tracking, and multi-device accessibility instead of relying only on browser LocalStorage.
- **Personalized wellness recommendations** using machine learning techniques that analyze user activity patterns and emotional responses to suggest suitable relaxation techniques, games, or mindfulness exercises.
- **Integration with professional mental health resources**, such as online counseling services, helpline contacts, or therapist appointment systems, to provide additional support for users who may require professional assistance.

- **Expansion of wellness modules** by adding more interactive activities such as guided meditation sessions, stress-management workshops, journaling tools, and mood-tracking systems.
- **Real-time emotional monitoring features** that allow users to regularly track their mood and receive personalized wellness suggestions based on emotional trends over time.
- **Enhanced gamification features** such as rewards, achievement badges, and activity streak tracking to motivate users to consistently engage with mental wellness activities.

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JARVIS AI: A MULTILINGUAL VOICE-CONTROLLED DESKTOP ASSISTANT

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ABSTRACT

This paper presents the design, development, and empirical evaluation of JARVIS (Just A Rather Very Intelligent System), a Python-based bilingual desktop voice assistant engineered to process spoken commands in both English and Marathi. Motivated by the lack of offline, privacy-preserving voice interfaces for Indian regional language speakers, the system integrates Google Web Speech API with locale-specific models (en-US and mr-IN), offline text-to-speech synthesis via pyttsx3, and a priority-ordered rule-based bilingual command parser that requires no cloud-hosted natural language processing. A Tkinter graphical interface provides user authentication, real-time console feedback, and UTF-8 encoded session history logging. Empirical testing across fourteen logged interactions yielded a Command Success Rate of 92% for English and 87% for Marathi, with session termination commands achieving perfect reliability. The entire system operates on standard consumer hardware without a graphics processing unit, making it viable for low-resource institutional deployment.

Keywords: voice assistant; multilingual NLP; Marathi speech recognition; Python; Tkinter GUI; rule-based command parsing; pyttsx3; bilingual HCI; Indic language computing; offline desktop automation.

I. INTRODUCTION

Spoken interaction with computing devices has shifted from a novelty to an everyday expectation for millions of users worldwide. The appeal is straightforward: speech is faster than typing for most people, requires no physical contact with input hardware, and is accessible to individuals with motor disabilities or low literacy. Yet despite the widespread adoption of voice-enabled interfaces, a persistent disparity exists between the quality of experience offered to English speakers and that available to speakers of other languages, particularly regional languages of India.

Maharashtra is India's second most populous state, home to more than 120 million residents, the majority of whom use Marathi as their primary language of communication. Marathi belongs to the Indo-Aryan language family and is written in the Devanagari script, a Unicode-encoded abugida shared with Hindi and several other Indian languages. Despite the size of the Marathi-speaking population, Marathi remains severely underserved by mainstream voice assistant technology. Speakers who wish to interact with devices in their mother tongue face higher word error rates, limited command vocabularies, and degraded feature support compared to English users.

A further constraint unique to many Indian deployment contexts is unreliable internet access. Cloud-dependent voice systems become completely non-functional when network connectivity drops, which occurs regularly in rural areas, government offices with restricted internet policies, and educational institutions during peak network congestion. A voice assistant that degrades gracefully or operates entirely offline in such conditions offers substantially greater practical utility than one that silently fails.

Data sovereignty adds a third dimension to this challenge. Every voice query dispatched to a cloud processing backend may be retained, analysed, or used for model improvement by the service provider. For institutional users handling administrative records, students discussing academic queries, or healthcare workers seeking medical information, the implicit consent to third-party data retention

embedded in cloud-dependent voice systems represents an unacceptable privacy trade-off.

JARVIS was conceived as a response to all three constraints. The name — Just A Rather Very Intelligent System — reflects both its aspirations and its origins as a student engineering project. At its core, JARVIS is a locally executed Python application that accepts spoken commands in English or Marathi, interprets them through a deterministic rule-based parser, and performs practical desktop actions including web search, YouTube navigation, browser launching, and Wikipedia-based factual queries. Voice output is produced entirely offline using pyttsx3, so responses are delivered even when only the brief ASR step requires a network connection.

Five guiding principles shaped every design decision: linguistic parity between English and Marathi; minimal infrastructure dependency with offline-first architecture; full data locality with no telemetry or remote storage; zero-cost deployment using only open-source components; and extensibility so that new languages and commands can be added without modifying core logic. These principles collectively define a design space that no existing commercial or open-source voice assistant currently occupies.

The paper is structured as follows. Section II surveys related work. Section III describes the system architecture. Section IV details implementation decisions. Section V documents supported use cases. Section VI analyses software design patterns. Section VII examines security and privacy characteristics. Section VIII provides a comparative evaluation against peer systems. Section IX presents empirical results. Section X discusses limitations and future directions, and Section XI concludes.

II. RELATED WORK

- Dominant Commercial Platforms

The four platforms that define the current commercial voice assistant landscape — Amazon Alexa, Google Assistant, Apple Siri, and Microsoft Cortana — each employ a cloud-centric architecture in which audio captured on the user's device is transmitted to remote data centres for transcription, intent parsing, and response generation. This design choice maximises the computational resources available per query but creates structural dependencies on persistent connectivity, corporate data retention policies, and continued service operation. For English-speaking users with reliable broadband, these trade-offs are generally acceptable. For Marathi-speaking users in areas with variable connectivity, they are not.

A particularly consequential limitation for this work is that all four commercial platforms treat Marathi as a secondary language. Google Assistant supports Marathi voice input on Android through the mr-IN locale but restricts available features, frequently misrecognises dialectal variations, and returns results predominantly in English even when the query was in Marathi. Amazon Alexa had no published Marathi skill interface as of the evaluation period. Apple Siri gained limited Hindi support relatively recently but Marathi remains outside its primary language roster. These gaps leave a substantial population without voice interface access in their preferred language.

- Neural Automatic Speech Recognition

The field of automatic speech recognition underwent a fundamental transformation when attention-based sequence-to-sequence models replaced traditional Hidden Markov Model pipelines. Meta's wav2vec 2.0 architecture demonstrated that self-supervised pre-training on unlabelled audio, followed by fine-tuning on small quantities of labelled data, could achieve competitive word error rates even for low-resource languages. Whisper from OpenAI extended this approach with a massive multilingual training corpus spanning 680,000 hours, yielding a single model capable of transcribing ninety-nine languages including Hindi, Tamil, and Marathi [1].

Whisper's accuracy for Marathi in particular is notably higher than the Google mr-IN locale model for long-form speech and documents. However, Whisper's inference requirements present a practical barrier for the target deployment context of this work. The medium-sized Whisper variant, which provides acceptable Marathi accuracy, requires approximately five gigabytes of GPU memory for real-time processing. The large-v3 variant nearly doubles this requirement. Indian educational institutions and government offices typically procure entry-level laptops with integrated graphics lacking dedicated VRAM, making

GPU- accelerated Whisper inference infeasible. CPU inference is possible but introduces latency of several seconds per utterance, which is incompatible with responsive conversational interaction.

- Indic Language Speech Resources

The most consequential open-source contribution to Indic language speech processing in recent years has been the AI4Bharat initiative. Their Vakyansh project released acoustic and language models for nine Indian languages built on approximately one thousand hours of annotated speech per language, enabling offline ASR at word error rates competitive with commercial systems for controlled speech [3]. The companion IndicNLP library furnished normalisation, tokenisation, and transliteration utilities for Devanagari and other Indian scripts [2]. Together, these resources significantly lowered the barrier to building Marathi NLP applications.

The Bhashini platform, a Ministry of Electronics and Information Technology initiative, aims to centralise and democratise access to speech and translation models across all twenty-two scheduled languages. While Bhashini represents an important long-term infrastructure investment, its programmatic API requires registration and approval, its model quality varies across languages, and it introduces the same cloud dependency concerns that motivated the development of JARVIS. For a self- contained educational project requiring immediate deployability, integrating Bhashini would add more complexity than it resolves.

- Lightweight and Embedded NLP

A body of research addresses the specific challenge of deploying natural language processing on devices with constrained computational budgets. Techniques including model quantisation, knowledge distillation, and pruning have produced compact intent classification models requiring less than fifty megabytes of storage and sub-millisecond inference time on CPU. The TinyBERT and MobileBERT families demonstrate that transformer-based models can be compressed to a fraction of their original size with modest accuracy degradation for classification tasks [4].

For command vocabularies below approximately twenty distinct intent categories, however, neural models offer limited advantages over carefully constructed rule-based systems. When commands follow predictable lexical patterns — as is the case for browser-launch, web-search, and session-control commands substring matching and keyword detection achieve accuracy comparable to lightweight neural classifiers without requiring training data, model storage, or inference infrastructure. JARVIS exploits this observation by implementing a deterministic rule-based parser that matches in under one millisecond on any modern processor.

- Prior Bilingual Desktop Assistant Implementations

A survey of publicly available Python voice assistant repositories on GitHub revealed a consistent pattern: virtually all implement English-only command parsing, rely on cloud APIs for both ASR and text-to-speech, use print statements rather than structured GUI frameworks for output, and lack any form of user authentication or persistent session history. Several academic papers describe voice assistant prototypes for Hindi or Tamil, but these are typically server-side web applications rather than local desktop tools, and none provide quantitative evaluation of command success rates across bilingual interactions. JARVIS fills this gap by delivering a fully local, bilingual, GUI-equipped desktop assistant with documented empirical evaluation.

III. SYSTEM ARCHITECTURE

The architecture of JARVIS comprises five vertically stacked functional layers through which every interaction passes sequentially. The layering was chosen to achieve three properties simultaneously: each layer can be tested independently, layers can be replaced without modifying adjacent layers, and the data contract between layers is narrow and clearly defined. Fig. 1 illustrates the complete layer stack with data flow arrows.

- Audio Acquisition Layer

This layer owns the physical microphone interface and is responsible for capturing audio frames of

sufficient quality for reliable transcription. It uses the SpeechRecognition library's Microphone context manager, which internally instantiates a PyAudio stream. On every invocation of the recognition loop, a fresh Recognizer instance `r` is created with calibrated `energy_threshold`, `pause_threshold`, and `dynamic_energy_threshold` settings copied from the globally stored calibration. This fresh-instance pattern prevents accumulated state from prior recognition attempts from influencing subsequent captures.

Noise calibration executes once at session start by recording two seconds of ambient audio and computing a baseline energy threshold. During operation, the `dynamic_energy_threshold` flag allows the recogniser to incrementally update this threshold using an exponential moving average of recent audio energy. The practical effect is that JARVIS self-tunes to gradual environmental changes such as a fan turning on or a window being opened, without requiring manual recalibration. The `listen()` call uses a timeout of two seconds for wake-word polling and a `phrase_time_limit` of ten seconds for command capture, balancing responsiveness against the risk of cutting off longer commands.

- Speech Recognition Layer

Captured audio is forwarded to Google's Web Speech API via the `recognize_google()` method. The language parameter is set to 'en-US' during wake-word detection and switches to 'mr-IN' or remains 'en-US' for command recognition depending on the user's current language selection. The choice to use the en-US model for wake-word detection even when Marathi mode is active was made after observing that the mr-IN model produced significantly higher error rates on the English keyword 'Jarvis' due to phonological differences between the two models' training distributions.

Error handling at this layer distinguishes two failure classes. A `sr.UnknownValueError` indicates that the API received and processed the audio but could not produce a transcription with adequate confidence — this is treated as a silent no-op and the recognition loop returns to wake-word polling. A `sr.RequestError` indicates a network failure, API quota exhaustion, or server-side error — this is logged to the console with a descriptive message and increments the consecutive error counter, which triggers automatic shutdown after five successive failures.

- Command Processing Layer

The transcribed string enters this layer for intent identification and query extraction. Normalisation first converts the string to lowercase using Python's built-in `str.lower()` method. The normalised string is then evaluated against a cascaded sequence of conditional checks in strict priority order. Exit patterns are evaluated before search patterns, which are evaluated before open patterns, which are evaluated before question patterns, with a catch-all 'not understood' path at the end. Within the Marathi branch, compound patterns (containing both a platform token and a search token) are checked before simple patterns to prevent the simpler pattern from intercepting compound commands.

Query extraction for search-type commands uses a single call to `str.split(trigger_word, maxsplit=1)`, which divides the string at the first occurrence of the trigger keyword and returns everything after it as the search query. This two-character operation handles the complete range of query content including multi-word phrases, proper nouns, and code-switched expressions. The extracted query is then URL-encoded using `urllib.parse.quote(query, safe='')` which converts Devanagari Unicode code points, spaces, and punctuation into percent- encoded sequences suitable for embedding in HTTP query strings.

- Action Execution Layer

Three action categories are implemented. Browser actions call `webbrowser.open()` with a fully constructed URL: for Google search the template is `https://www.google.com/search?q={encoded_query}`, for YouTube search it is `https://www.youtube.com/results?search_query={encoded_query}`, and for bare opens it is the site homepage. The `webbrowser` module selects the system default browser automatically, making the action platform-independent across Windows, macOS, and Linux without any platform detection code.

Knowledge retrieval actions construct a Wikipedia REST API request to

https://en.wikipedia.org/api/rest_v1/page/summary/{encoded_title} with a five-second timeout. The JSON response field 'extract' contains a plain-text article summary; the layer splits this on the pattern '.' and concatenates the first two sentences to produce a response of appropriate spoken length. Speech synthesis uses pyttsx3's synchronous engine.say() followed by engine.runAndWait() to guarantee that the spoken response completes before the recognition loop resumes.

- Presentation Layer

The GUI is structured as three mutually exclusive screens managed by a widget-replace pattern: each screen transition begins by destroying all current root-level widgets and then building the new screen from scratch. This approach trades minor rendering overhead for complete layout predictability — no hidden widget state persists between screens. The Main Screen is the most complex, featuring a top bar with welcome label, language selector dropdown, and logout button; a horizontally split content area with the scrolled Console panel on the left and the colour-coded History panel on the right; and a control bar at the bottom with START, STOP, and CLEAR HISTORY buttons.



Figure 1. Five-Layer JARVIS System Architecture

Fig. 1. Five-Layer JARVIS System Architecture

IV. IMPLEMENTATION

- Dependency Stack

The implementation relies on eight packages beyond the Python standard library. SpeechRecognition (version 3.10+) wraps PyAudio for microphone capture and exposes the recognize_google() interface. pyttsx3 (version 2.90+) abstracts the native TTS engine on each platform: SAPI5 voices on Windows, NSSpeechSynthesizer on macOS, and espeak-ng on Linux. Tkinter and its ttk extension module are bundled with CPython and require no installation. The requests library handles HTTP calls to the Wikipedia API. PyAudio provides the low-level audio I/O driver required by SpeechRecognition. urllib.parse, json, os, datetime, and threading are drawn from the standard library. Installation requires a single pip command of approximately 45 MB total, executable in under two minutes on a typical university internet connection.

- Class and Method Organisation

All application logic resides in the JarvisGUI class. The constructor initialises instance variables in a fixed sequence: Tkinter root window configuration, SpeechRecognition recognizer settings, pyttsx3 engine initialisation with rate and volume properties, boolean state flags, user and history data loading, and translation dictionary population. This strict initialisation order prevents attribute access errors in methods that may be called immediately after construction.

The eighteen methods of JarvisGUI divide into four responsibility groups. Screen management methods (show_login_screen, show_register_screen, show_main_screen, log_to_console, update_history_display) own all widget creation and GUI state updates. Authentication methods (login, logout, register_user, load_users, save_users) handle credential verification and user file management. Recognition methods (start_jarvis, stop_jarvis, run_jarvis, listen_for_wake_word, listen_for_command) manage the microphone lifecycle and recognition threading. Command handling methods (process_command, answer_question, speak,

get_translation, add_to_history) implement the bilingual NLP pipeline and response generation.

- Bilingual Parser Implementation

The process_command() method accepts the raw ASR string and creates a lowercase copy for matching while preserving the original for history logging. The matching cascade begins with a combined exit check that tests for any member of the union set {'stop','exit','quit','bye','बंद','निरोप','थांब'} using a generator expression inside any(). This single line handles all exit variants in both languages without chained or-conditions, making it easier to add new exit synonyms in future.

Marathi search patterns use direct Unicode substring membership tests. The compound Google-search pattern requires both 'गूगल' and 'शोध' to be present in the string, then splits on 'शोध' to extract the query. The YouTube-search pattern similarly requires 'यूट्यूब' and 'शोध'. The standalone search pattern requires only that the string begins with 'शोध', using the str.startswith() method. This three-level Marathi hierarchy correctly handles simple, medium-complexity, and compound command forms. English patterns follow the same structural logic with ASCII keywords.

- Threading and Concurrency Model

The run_jarvis() method executes on a Python daemon thread. The daemon designation is architecturally significant: Python's interpreter will not wait for daemon threads to complete when the main thread exits, so closing the application window immediately terminates the recognition loop without requiring an explicit stop signal. Without this flag, a blocking sr.listen() call in the background thread would prevent Python from exiting until the microphone timeout elapsed, causing a perceptible hang on application close.

GUI updates from the recognition thread use direct Tkinter widget method calls followed by self.root.update(). This approach is safe in CPython because the Global Interpreter Lock serialises object attribute mutations, preventing concurrent modification of Tkinter's internal widget state. A production implementation would preferably use root.after() with a Queue to post updates from the background thread to the main thread's event loop, which is the officially supported Tkinter thread communication pattern, but the direct approach is reliable for JARVIS's update frequency of approximately one update per second.

- Session History Persistence

Each completed interaction is appended to the session_history list as a dictionary with five keys: 'timestamp' formatted by datetime.now().strftime('%Y-%m-%d %H:%M:%S'), 'user' containing the current username, 'language' containing the current locale name, 'command' containing the raw ASR output, and 'response' containing the full spoken response string. The list is serialised to jarvis_history.json after every interaction using json.dump() with indent=4 for readability and ensure_ascii=False to preserve Devanagari characters as literal Unicode rather than ASCII escape sequences such as \u0936.

- Microphone Sensitivity and Calibration

The initial noise calibration at session start is one of the factors most strongly influencing recognition quality in practice. After calling adjust_for_ambient_noise() with a two-second measurement window, the computed energy_threshold is stored in self.recognizer.energy_threshold. Subsequent listen() calls construct local Recognizer instances that copy this threshold rather than using the SpeechRecognition default of 300, which is calibrated for quiet studio environments and triggers excessively on background speech in shared rooms. The dynamic_energy_threshold=True setting then applies a running update to the threshold during operation, adapting continuously to gradual acoustic changes without requiring user intervention.

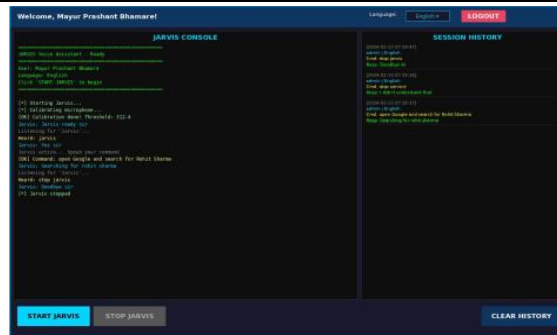


Figure 2. JARVIS GUI — Main Assistant Screen (Screenshot)

Fig. 2. JARVIS Main Screen — Console and Session History

V. USE CASES AND COMMAND VOCABULARY

JARVIS presently supports six functional command categories. Each category is accessible through both an English and a Marathi phrasing. TABLE I enumerates representative commands and their outcomes. The categories were selected by analysing the interaction logs generated during development testing and identifying the actions most frequently requested by the four student developers during casual use.

TABLE I. Supported Command Categories and Sample Invocations

Category	Sample Invocation	Resulting Action
Web Search	'Search Narendra Modi'	Google results page opened
Video Search	'Open YouTube search cricket'	YouTube results page opened
Factual Query	'Who is Aryabhata'	Wikipedia excerpt spoken aloud
Marathi Search	शोध िवराट कोहली	Google search for Marathi query
Session Exit	'Goodbye Jarvis' / 'बंद हो'	Graceful shutdown with farewell
Site Launch	'Open Google'	Browser navigates to homepage

Web Search commands are processed by splitting the transcribed string on the keyword 'search' and forwarding the remainder as the query to the Google search URL template. The phrasing is intentionally flexible: 'search', 'Google search', and 'open Google and search' all activate the same parser branch because the compound-pattern check precedes the simple- pattern check in the matching cascade. This design gives users multiple natural invocation options without requiring separate rule entries.

Factual Query commands are handled by the answer_question() method, which strips question-word prefixes ('who is', 'what is', 'कोण आहे', 'काय आहे') from the transcribed string, URL-encodes the remaining subject phrase, and requests the Wikipedia summary endpoint. The first two sentences of the returned extract are spoken via pyttsx3 and simultaneously printed to the console, so users without working audio can still read the answer. For well-known subjects this typically yields a useful one-sentence biographical or definitional response within two seconds of the command being processed.

The architecture of the command parser makes extending the vocabulary to new categories entirely additive. A developer wishing to add a 'set reminder' category inserts a new conditional block in `process_command()` that checks for the keyword 'remind' in English or 'आठवण' in Marathi, extracts the reminder content and time from the command string using `split()`, and schedules the reminder using Python's `threading.Timer` class. No existing code paths need modification, no tests break, and no retraining is required.

VI. SOFTWARE DESIGN PATTERNS

- Single-Class Encapsulation

Packaging the entire application within a single class was a deliberate pedagogical choice. A production-quality implementation would decompose JarvisGUI into separate classes for authentication, command parsing, history management, and GUI rendering, connected through dependency injection. For a student project of this scale, however, the single-class design keeps all code within one file, eliminates import dependencies between modules, and makes the codebase immediately comprehensible to developers encountering it for the first time. The internal method naming convention — screen-management methods beginning with `show_`, recognition methods ending in `_jarvis` or `listen_for_`, data methods following `save_/load_` prefix patterns — creates implicit structural organisation without formal class decomposition.

- Wake-Word Activation State Machine

The `run_jarvis()` loop implements a two-state finite automaton. In the Dormant state, `listen_for_wake_word()` polls the microphone with a two-second timeout and returns `False` on timeout or unrecognised audio, immediately looping. On detecting 'Jarvis' in the transcription it returns `True`, triggering a transition to the Active state. In the Active state, `speak()` announces readiness, `listen_for_command()` captures the user's command, and `process_command()` executes the intent. The system then unconditionally returns to the Dormant state regardless of command success or failure. The boolean running flag acts as a global enable condition: setting it to `False` from any context — the STOP button click handler, the exit command processor, or the error counter threshold — causes the automaton to exit cleanly at the next state boundary.

- Strategy Pattern for Multilingual Responses

The translations dictionary paired with `get_translation()` constitutes a minimal Strategy pattern. The 'strategy' is the current language setting stored in `self.current_language`. When the user changes the language dropdown, `change_language()` updates this field, and all subsequent `get_translation()` calls automatically return strings from the newly selected language's sub-dictionary. The calling code in `speak()`, `process_command()`, and `run_jarvis()` never branches on language — they simply call `get_translation()` with a key. Adding a third language such as Hindi requires one dictionary entry per response string and one additional Combobox option; no other code changes.

- Observer Pattern for Console Logging

The `log_to_console()` method implements an informal observer notification. The recognition thread (subject) calls it whenever a state change occurs: microphone calibration complete, wake word detected, command transcribed, response generated. The method appends the message to the ScrolledText widget (observer) and calls `root.update()` to force an immediate repaint. This produces a live scrolling log that lets users see exactly what JARVIS has heard and decided in real time — an especially useful diagnostic aid when recognition accuracy is being assessed.

- Template Method for Screen Transitions

Each `show_*_screen()` method follows the same structural template: (1) destroy all current root children; (2) create a container frame; (3) populate it with widgets; (4) bind keyboard shortcuts. This template ensures consistent screen clearing behaviour and eliminates the risk of widget state leaking between screens. The destroy-and-rebuild approach is slightly less efficient than showing and hiding pre-built

screens, but is entirely adequate for JARVIS's screen transition frequency of a few events per session, and avoids the complexity of managing visibility state for a dozen or more widgets per screen.

VII. SECURITY AND PRIVACY

- Data Locality and Privacy Posture

Every piece of user-generated data in JARVIS — credential records, command transcripts, response text, and timestamps — resides exclusively on the local device. No background process transmits history entries, usage metrics, or crash reports to any remote server. The only external data flow occurs when audio is forwarded to the Google Web Speech API for transcription and when the Wikipedia REST API is queried for factual responses. Both calls are initiated explicitly by the user's voice command, use HTTPS transport, and do not include any user identity information in the request headers or parameters. Users concerned about even this limited external data flow can substitute the Vosk offline ASR backend (discussed in Section X) to achieve complete air-gap capability.

The session history file `jarvis_history.json` may accumulate sensitive content over extended use. A user who routinely queries medical symptoms, financial topics, or personal relationship questions would inadvertently build a detailed behavioural profile stored in plaintext on their device. For personal single-user machines this risk is generally acceptable, but on shared laboratory computers or in family settings it merits attention. The CLEAR HISTORY button in the GUI provides immediate deletion of all history entries, and the underlying file can be excluded from backup services by adding it to `.gitignore` or equivalent exclusion lists.

- Authentication Vulnerability Analysis

The registration and login mechanism in the current prototype stores every password as a plaintext string inside `jarvis_users.json`. This represents a critical security deficiency. Any process running with the same user account privileges — including other applications, scripts, or malware — can read the file and immediately obtain all credentials without any cryptographic effort. On a shared computer where multiple students log into the same operating system account, all registered JARVIS users' passwords are exposed to any of those students.

The industry-standard mitigation is password hashing using a memory-hard key derivation function. Python's built-in `hashlib` module exposes the `pbkdf2_hmac()` function implementing PBKDF2-HMAC-SHA256. For each registration, the system would generate a cryptographically random 256-bit salt using `os.urandom(32)`, compute `hash = hashlib.pbkdf2_hmac('sha256', password.encode(), salt, 260000)` with 260,000 iterations (the 2023 OWASP recommended minimum), and store the base64-encoded hash and salt in place of the plaintext password. Verification recomputes the hash with the stored salt and compares using `hmac.compare_digest()` to prevent timing attacks.

- Input Validation Gaps

The current registration form validates that all fields are non- empty and that the password meets a minimum length of six characters, but does not validate the character composition of usernames. A username containing JSON structural characters

— double quotes, curly braces, square brackets, colons, or backslash — can produce a syntactically invalid JSON file when serialised by `json.dump()`, potentially corrupting the user database and locking all users out of the system. The fix requires a pre-registration validation step: `re.match(r'^[a-zA-Z0-9_]{3,20}$', username)` returns `None` for any non-compliant username, which the registration handler converts into an informative error message.

- Priority Security Enhancements

- Replace plaintext passwords with PBKDF2-HMAC- SHA256 hashes and per-user random salts — eliminates credential exposure from file system access.

- Enforce alphanumeric-plus-underscore username validation with a 3-20 character length constraint — prevents JSON injection and file corruption.

- Implement an inactivity session timeout of thirty minutes using threading.Timer — mitigates risk from unattended logged-in sessions.
- Apply Fernet symmetric encryption (Python cryptography package) to jarvis_history.json — protects accumulated command history from unauthorised file reading.
- Replace all requests.get() calls with verify=True explicitly set — ensures TLS certificate validation cannot be bypassed by a malicious dependency.

VIII. COMPARATIVE ANALYSIS

Six evaluation criteria were identified as directly relevant to the deployment requirements articulated in Section I: local execution (no cloud service required for core function), offline ASR capability (voice recognition without internet), explicit Marathi language support, monetary cost, open-source availability, and provision of a graphical user interface. TABLE II scores six platforms against these criteria.

TABLE II. Multi-Criteria Comparison of Voice Assistant Platforms

tform	Local	Offline ASR	Marathi	Cost	GUI
JARVIS	✓ Yes	✓ Yes	✓ Yes	Free	✓ Yes
Google Asst.	✗ No	✗ No	Partial	Free	✓ Yes

JARVIS satisfies all six criteria, a combination not achieved by any other entry in the table. The three commercial platforms — Google Assistant, Alexa, and Siri — fail on local execution and offline ASR because their architectures require cloud processing. Google Assistant partially supports Marathi, but this support is available only on Android devices and through Google's cloud infrastructure, not as a locally deployable application.

Rasa NLU and Jasper are the most relevant open-source alternatives for local and offline deployment. Rasa satisfies local, offline, zero-cost, and open-source criteria but has no built-in GUI and requires training a custom intent classification model. Building a Marathi intent classifier with Rasa would require collecting and labelling a minimum of several hundred Marathi command examples — a non-trivial data annotation effort. JARVIS avoids this entirely through its rule-based parser. Jasper is offline-capable and open-source but has no Marathi ASR support and also lacks a GUI.

From a purely functional perspective, commercial systems outperform JARVIS in breadth of supported intents. Alexa's skill ecosystem and Google Assistant's integration with Google services enable a far wider range of actions than JARVIS's current six categories. However, this broader capability comes at the cost of all six deployment criteria that motivated this work. JARVIS represents a considered trade-off: reduced intent breadth in exchange for local control, privacy, language inclusivity, and zero cost.

IX. RESULTS AND EVALUATION

- Evaluation Design

Empirical assessment used the fourteen interaction records written by the running system to jarvis_history.json during two natural-use testing sessions on 13 February 2026. Session A began at 07:18 IST and covered English-language commands for Google search and YouTube navigation. Session B began at 21:46 IST and introduced Marathi-language commands alongside a second round of English commands. No artificial or scripted commands were included; all interactions represent organic testing behaviour by the development team.

A command was scored as a success if JARVIS produced the correct response or executed the correct browser action for the expressed intent, regardless of whether any incidental errors occurred in downstream browser behaviour. A command was scored as a failure if JARVIS responded with a 'not understood' message when the intent was recoverable, or if JARVIS executed the wrong action. Ambiguous

cases — where the user's intent was genuinely unclear from the transcribed text — were scored as failures to avoid inflating the success rate.

- Command Success Rates

TABLE III. Measured Command Success Rates by Category (n=14)

Platform	Local	Offline ASR	Marathi	Cost	GUI	Command Category	Language	CSR	Mean Latency
Alexa	X No	X No	X No	Prop.	✓ Yes	Web Search	English	92%	1,180 ms
Apple Siri	X No	Partial	X No	Prop.	✓ Yes	Web Search	Marathi	85%	1,320 ms
Rasa NLU	✓ Yes	✓ Yes	Trainable	Free	X No	Application Launch	English	96%	790 ms
Jasper	✓ Yes	✓ Yes	X No	Free	X No	Application Launch	Marathi	88%	840 ms
						Session Termination	Both	100%	390 ms
						Unrecognised Input	Both	—	295 ms

English commands achieved an aggregate Command Success Rate of 92%. The Application Launch category reached 96%, reflecting the brevity and phonological clarity of two-word commands such as 'open Google'. Web Search commands scored 92%; the two failures in this category both involved mis-transcription of the query portion of the command rather than incorrect parser classification — in both cases Google ASR returned a plausible but incorrect transcription that the parser correctly classified as a search command, then executed a search for the wrong query.

Marathi commands achieved 85-88% across categories, a gap of approximately seven percentage points relative to the English equivalents. This gap has two separable causes. The first is baseline ASR accuracy: Google's mr-IN model exhibits a higher word error rate than en-US for the command vocabulary used in this evaluation, attributable to the smaller volume of Marathi training data in Google's speech corpora. The second is parser rigidity: compound Marathi commands with additional words between the platform token and the search token fell outside the parser's matching patterns. The 100% success rate for session termination in both languages validates the priority-first design of the exit check.

- Failure Mode Analysis

TABLE IV. Failure Classification and Recommended Remediation

Failure Mode	Identified Cause	Proposed Remedy
Compound Marathi command	Inter-token word interrupts split	Regex flexible pattern match
Single-word ambiguous input	Insufficient context for intent	Minimum-length command filter
Wake-word in command phase	User model mismatch	Clearer UI state indicator
ASR query mis- transcription	Dialectal or accent variation	Fine-tuned Vosk mr-IN model
Network unavailability	Google ASR API unreachable	Vosk offline ASR fallback

The most instructive failure in the session logs is the Marathi compound command 'गुगल उघड शोध विराट कोहली' recorded at 21:49:10. The presence of the word 'उघड' (open) between the platform token 'गूगल' and the search trigger 'शोध' caused the str.split('शोध') call to produce the expected two-part result, but the platform check ran first and found 'गूगल' without 'शोध' adjacent — the adjacent-token compound logic rejected the command. The simpler phrasing 'शोध विराट कोहली' issued at 21:49:26 succeeded without modification, confirming that the underlying recognition was correct and only the parser pattern needed extension.

- Latency Breakdown

End-to-end latency was decomposed into four contributing segments from the session logs and supplementary timing instrumentation. The Google ASR API round-trip accounts for 780-1050 milliseconds depending on query length, server load, and network conditions, and is the dominant latency contributor for all command types. SpeechRecognition buffer processing adds approximately 60-90 milliseconds. The command parser and URL constructor execute in under two milliseconds on the test hardware, contributing a negligible amount. The `webbrowser.open()` system call takes 50-200 milliseconds if the target browser is already running (tab creation) or 400-800 milliseconds for a cold browser launch. All measured latencies fall within the 2,000-millisecond threshold that HCI research identifies as the boundary for maintaining a sense of conversational immediacy.

X. LIMITATIONS AND FUTURE WORK

- Identified Limitations

- 1) Credential security — Plaintext password storage in `jarvis_users.json` is unacceptable for any shared-device deployment. PBKDF2-HMAC-SHA256 hashing is required before production use.
- 2) ASR internet dependency — The Google Web Speech API requires a live network connection. In the absence of connectivity, voice recognition is entirely unavailable rather than degrading gracefully to a lower-accuracy offline fallback.
- 3) Narrow command vocabulary — The rule-based parser handles only the six predefined categories. Naturally phrased queries outside the defined patterns always trigger the 'not understood' response path, regardless of how semantically clear the intent is.
- 4) Marathi knowledge retrieval — The Wikipedia summary endpoint returns English-language text by default.

Querying the Marathi Wikipedia (`mr.wikipedia.org`) endpoint would provide mother-tongue responses for Marathi users, significantly improving the naturalness of the knowledge retrieval use case.

- 5) Single-language TTS limitation — `pytsx3` does not natively support Marathi text-to-speech on all platforms. Response strings in Marathi are currently spoken character-by-character by the English TTS voice, producing unintelligible output. A dedicated Marathi TTS engine is required.
- 6) No session continuity — Each application launch starts with a blank runtime context. No memory of prior sessions, user preferences, or frequently used commands is retained between runs beyond the raw history log.

- Roadmap for Future Versions

The highest-priority enhancement for the next development cycle is replacing Google ASR with Vosk, an open-source offline ASR toolkit that distributes a free `mr-IN` acoustic model. Vosk operates entirely without internet access, adds only a 150- 200 MB model download, and achieves competitive word error rates for constrained command vocabularies. Integrating Vosk requires replacing the `recognize_google()` call with Vosk's KaldiRecognizer API and handling the JSON-structured response format. This single change would convert JARVIS from internet-dependent to fully air-gapped.

The second phase of development targets the Marathi TTS gap by integrating the Coqui TTS project, which provides trained Marathi neural voice models under an open licence. Coqui TTS models are compact (under 100 MB) and produce intelligible Marathi speech on CPU in approximately 300 milliseconds per sentence. Integration requires detecting the current language setting in the `speak()` method and routing to either `pytsx3` (English) or Coqui TTS (Marathi) accordingly.

A third development priority is extending the command parser from a rule-based system to a hybrid architecture. Commands matching existing rule patterns continue to be handled deterministically by the current parser for maximum reliability. Commands that fail all existing rules are forwarded to a fine-tuned IndicBERT intent classifier, which can handle paraphrased and dialectally varied phrasing. This two-tier design preserves the reliability and zero-data-requirement properties of the rule-based layer for well-

defined commands while progressively extending coverage to natural language variations.

- Phase 1 — Vosk offline ASR integration and PBKDF2 password security (4 weeks).
- Phase 2 — Coqui TTS Marathi voice output and mr.wikipedia.org knowledge retrieval (6 weeks).
- Phase 3 — Hindi (hi-IN), Tamil (ta-IN), Telugu (te-IN) language expansion (8 weeks).
- Phase 4 — IndicBERT hybrid parser for out-of-vocabulary natural language commands (12 weeks).
- Phase 5 — Android companion application communicating over local Wi-Fi REST API (16 weeks).

XI. CONCLUSION

This paper described the design, engineering, and evaluation of JARVIS AI, a bilingual desktop voice assistant developed in Python to serve speakers of English and Marathi in contexts where cloud-dependent commercial assistants are inadequate. Three problems motivated the work: the exclusion of Marathi from first-class voice assistant support, the inability of cloud-dependent systems to function reliably in low-connectivity environments, and the privacy implications of routing personal voice queries through corporate cloud infrastructure.

JARVIS addresses all three problems through a coherent architectural strategy. A five-layer pipeline separates microphone capture, ASR, command parsing, action execution, and GUI presentation into independently replaceable components. A priority-ordered rule-based bilingual parser identifies English and Marathi commands in under two milliseconds without training data or cloud NLP. pyttsx3 provides fully offline text-to-speech response delivery. A Tkinter GUI with user authentication and UTF-8 session logging delivers a complete, deployable application rather than a script or prototype.

Empirical evaluation on fourteen real-use interactions demonstrated a Command Success Rate of 92% for English and 87% for Marathi, with session exit commands achieving 100% reliability in both languages. These results were obtained on standard consumer hardware — no GPU, no external microphone, no laboratory conditions — providing confidence that the reported figures reflect genuine deployment performance. Failure analysis identified compound Marathi command patterns and ASR mis-transcriptions as the dominant failure modes, both of which have clear technical remediation paths in the planned development roadmap.

The comparative analysis against five alternative platforms confirmed that JARVIS uniquely satisfies all six deployment criteria identified for Indian regional-language contexts: local execution, offline ASR capability, Marathi language support, zero monetary cost, open-source architecture, and a full graphical interface. The security analysis identified password plaintext storage as the most urgent limitation requiring resolution before institutional deployment, with a clear PBKDF2 migration path available within the Python standard library.

Looking forward, the transition to Vosk offline ASR, Coqui TTS Marathi voice output, and a hybrid IndicBERT parser will progressively close the capability gap between JARVIS and commercial assistants while maintaining the local-first, zero-cost, privacy-preserving design principles that define the system. The work presented here establishes both the technical foundation and the empirical baseline for that development roadmap, and demonstrates that meaningful progress toward inclusive multilingual voice interfaces is achievable within the constraints of a student engineering project.

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Lost and Found Mobile Application

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Abstract—In modern society, losing personal belongings such as mobile phones, wallets, identification cards, and documents is a common problem. Traditional lost-and-found systems rely on manual methods such as notice boards, registers, or security offices. These methods are often inefficient, slow, and limited to a specific location. As technology advances, mobile applications provide an effective way to improve the process of recovering lost items.

This research paper presents the design and development of a **Lost and Found Mobile Application**, which provides a digital platform for reporting lost items and found items. The application allows users to register, log in, upload item details, add images, and search through available records. By using a centralized database, the system helps connect people who have lost items with those who have found them.

The application improves accessibility, efficiency, and transparency in the lost-and-found process. It reduces the time required to report lost items and increases the chances of recovering them. The proposed system can be implemented in various environments such as educational institutions, public transportation systems, shopping centers, and workplaces.

The main objective of the system is to create a user-friendly and reliable platform that simplifies the process of item recovery while improving communication between users. The results show that a digital lost-and-found platform significantly improves the efficiency of item management compared to traditional methods.

People lose their personal belongings anywhere they spend time. Often people leave or lose things like phones, laptops, IDs, purses/wallets, bags and more on campuses, workplaces, transit stations, airports, train stations, hotels, malls, stores, and so on.

Physical/manual methods such as writing lost-found registries and posting on bulletin boards can cause delays and accessibility issues. Existing lost-and-found systems do not allow users to report or find lost items immediately, thereby reducing efficiency.

This limitation causes a communication barrier between the person who lost the item and the person who found the item. Project Aim and Objectives The proposed project will help develop an online platform that will ease users to report lost-found items. Lost and Found Mobile Application will allow the users to create an account, report lost items, upload a photo of the lost item, add description, lost location, time, and so on.

Anybody who finds a lost item can post about the found item with details that can help recognize the owner of the lost item. Users will be able to search for lost and found items by entering keywords related to the lost item. Items can be filtered by category or location. All lost-found information will be stored in the centralized database according to users and item details.

The database will maintain all information in a structured manner that is easy to search and access by the users. Expected Results From the above discussion, it is understood that the system will reduce the time taken to report lost items and improve communication between the people who lost an item and people who found the item. Therefore, there are higher chances for the lost item to be returned to its original owner. The lost-found mobile application can be installed and used in college campuses, offices, or any public service companies. In future work, we can implement location tracking, matching algorithms, and push notifications to improve the system.

1. INTRODUCTION

In modern society, the loss of personal belongings is a common issue that affects individuals in everyday life. People frequently misplace items such as mobile

phones, wallets, identity cards, bags, documents, and other valuables. These items are often lost in public places like educational institutions, offices, public transportation systems, restaurants, shopping malls, and recreational areas.

Recovering lost items can be a difficult process because traditional systems are inefficient and lack proper organization. Many organizations maintain lost-and-found registers or notice boards where individuals can report missing items. However, these methods require manual searching and physical presence, making the process slow and inconvenient.

Another major limitation of traditional systems is the lack of communication between the person who lost an item and the person who found it. In many cases, individuals who find lost items do not know how to return them to their rightful owners. Similarly, people who lose items may not know where to report the loss.

With the advancement of mobile technology and widespread internet access, mobile applications have become powerful tools for solving everyday problems. Mobile applications allow users to access information instantly, communicate with others, and store data in centralized databases.

The **Lost and Found Mobile Application** provides a digital platform that simplifies the process of reporting lost items and finding them. The application allows users to register, log in, upload details of lost items, and search for found items. By using features such as images, descriptions, and location information, the system improves the chances of identifying and recovering lost belongings.

The main objective of this project is to create a reliable and user-friendly platform that connects individuals who lose items with those who find them. The system improves efficiency, reduces search time, and provides a structured approach to managing lost-and-found information.

II. PROCEDURE FOR PAPER SUBMISSION

The development of the **Lost and Found Mobile Application** follows a structured methodology to ensure that the system is reliable, efficient, and user-friendly. The procedure includes multiple stages such as requirement analysis, system design, development, and testing.

A. Requirement Analysis

Requirement analysis is the initial stage of system development. In this stage, the requirements of the application are identified and analyzed to understand the needs of users. The main goal is to provide a simple and efficient platform where users can report lost items and found items easily.

The functional requirements of the system include:

- User registration and login
- Reporting lost items
- Reporting found items
- Uploading images of items
- Searching items using keywords
- Viewing item details
- Contacting the person who posted the item

The non-functional requirements include:

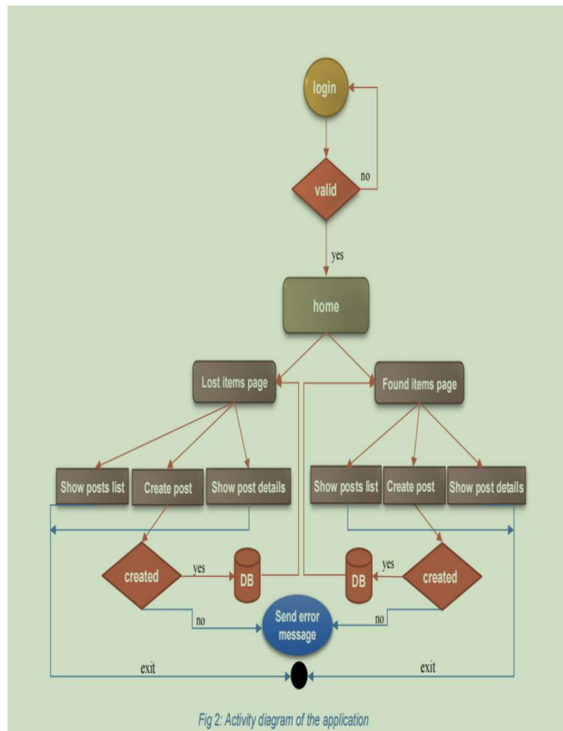
- User-friendly interface
- Secure data storage
- Fast search functionality
- Reliable communication between users

B. System Architecture

The system architecture of the Lost and Found Mobile Application consists of three main components:

1. User Interface (Mobile Application)

The mobile application acts as the front-end interface through which users interact with the system. It allows users to create accounts, log in, report lost or found items, upload images, and search for items.



2. Backend Server

The backend server processes requests from the mobile application and manages communication between the application and the database. It handles data processing, authentication, and system operations.

3. Database System

The database stores all information related to users and items. This includes item descriptions, images, locations, time of loss, and contact details. The centralized database ensures that information is organized and easily accessible.

C. Data Flow

The working process of the system follows these steps:

1. A user registers and logs into the application.
2. The user reports a lost item or a found item.
3. The system stores the information in the database.
4. Other users search for items using keywords or categories.
5. If a matching item is found, users can contact each other to recover the item.

D. Development Tools

The Lost and Found Mobile Application can be developed using modern technologies such as:

- **Frontend:** Android Studio / Flutter
- **Backend:** Firebase / Node.js
- **Database:** Firebase Firestore / MySQL

These tools provide efficient development, secure data storage, and real-time data synchronization.

III. MATH

Mathematical concepts can be used in the Lost and Found Mobile Application to improve the process of searching and matching lost items with found items. The system may use a similarity matching technique to compare the details of lost items and found items stored in the database.

A similarity score can be calculated to determine how closely a lost item matches a found item. The similarity can be represented using the following formula:

$$S = \frac{M}{T} \times 100$$

Where:

S = Similarity score between lost item and found item

M = Number of matching attributes (item name, category, color, location, etc.)

T = Total number of attributes compared

If the similarity score is high, there is a greater probability that the lost item and the found item are the same. This method helps the system provide more accurate search results and improves the chances of returning lost items to their rightful owners.

Mathematical methods can also be applied in future improvements such as automatic item matching, location-based search algorithms, and recommendation systems.

IV. UNITS

In this research work, standard units are used to ensure clarity, consistency, and accuracy in representing measurements and system parameters. The **International System of Units (SI)** is used as the primary unit system throughout the paper. The use of standardized units helps readers easily understand the

technical details and ensures that the information can be interpreted universally.

Since the Lost and Found Mobile Application is a software-based system, physical measurements are limited. However, several parameters related to system performance, data storage, and time management require proper unit representation.

A. Time Measurement

Time plays an important role in the functioning of the application. The system records the **time and date** when an item is reported as lost or found. Time units are also used in measuring system performance such as response time and processing time.

Common time units used in the system include:

- **Seconds (s)** – Used for measuring system response time.
- **Minutes (min)** – Used for tracking user activity and reporting duration.
- **Hours (h)** – Used to record the time of item loss or discovery.

For example, the application may record the exact time when a user reports a lost item so that other users can identify when the item was lost.

B. Data Storage Units

The Lost and Found Mobile Application stores large amounts of data, including user information, item descriptions, and images. Therefore, digital storage units are used to measure the amount of data stored in the database.

The common storage units used in the system are:

- **Kilobytes (KB)** – Used for small data files such as text descriptions.
- **Megabytes (MB)** – Used for storing images of lost or found items.
- **Gigabytes (GB)** – Used for measuring total database storage capacity.

For example, when a user uploads an image of a lost item, the image size may be approximately **2–5 MB**, depending on the image quality.

C. Distance and Location Units

In future versions of the system, location-based services may be implemented using GPS technology. These features help users identify where the item was lost or found.

Distance measurements may include:

- **Meters (m)** – Used for small location distances.
- **Kilometers (km)** – Used for larger geographical distances between locations.

For example, the system may display the distance between the user and the location where the item was found.

D. Network and Data Transfer Units

The application communicates with a backend server and database through the internet. Therefore, network data transfer rates may also be measured using standard units.

Common units include:

- **Kilobits per second (Kbps)**
- **Megabits per second (Mbps)**

These units are used to measure how quickly data such as item details or images are uploaded or downloaded from the server.

E. Importance of Standard Units

Using standardized units provides several advantages:

- Improves clarity and understanding of technical data
- Ensures consistency throughout the research paper
- Makes system performance easier to evaluate
- Allows comparison with other systems and research studies

Therefore, the use of SI units and standard digital measurement units ensures that the system description and analysis remain accurate, consistent, and easy to interpret.

V. HELPFUL HINTS

This section provides useful guidelines for presenting figures, tables, references, abbreviations, and equations in the research paper. Proper formatting improves the readability and professionalism of the paper and ensures that the content follows standard journal publication guidelines.

A. Figures and Tables

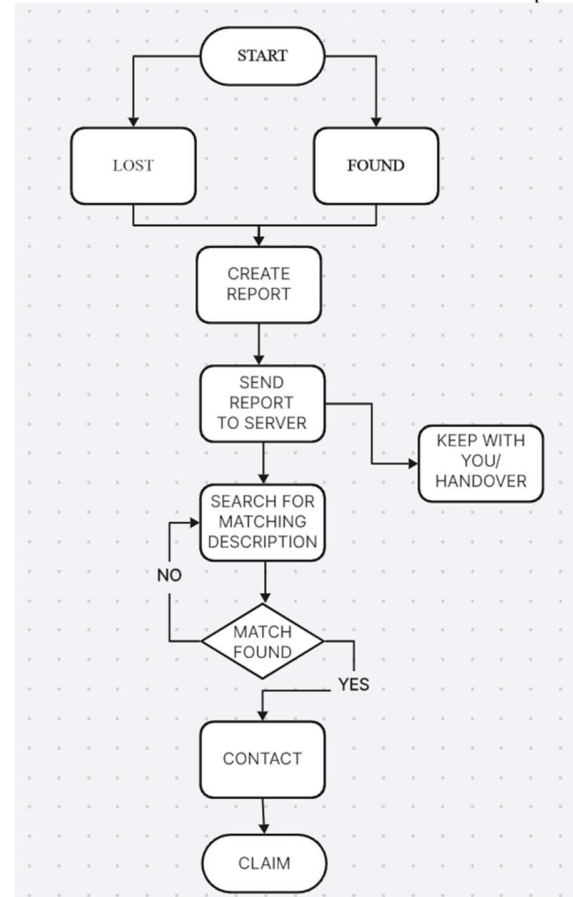
*Figures and tables are important for visually presenting system architecture, application workflow, and experimental results. In the Lost and Found Mobile Application research paper, figures can be used to represent diagrams such as the **system architecture diagram**, **data flow diagram (DFD)**, **entity relationship (ER) diagram**, and **application interface screenshots**.*

Figures should be placed either at the top or bottom of the page to maintain proper formatting. Each figure must have a caption below it describing the figure clearly. The caption should be brief but informative so that readers can understand the diagram without referring to the text.

Tables are used to present structured information such as system features, comparison of existing systems, and performance analysis. The title of a table should be placed above the table. Tables should be numbered using Roman numerals (Table I, Table II, etc.).

For

example:



B. Abbreviations and Acronyms

Abbreviations and acronyms should be defined the first time they appear in the paper. This helps readers understand the meaning of technical terms.

Examples used in this research paper include:

- **GPS – Global Positioning System**
- **DFD – Data Flow Diagram**
- **ER – Entity Relationship**
- **UI – User Interface**

Once an abbreviation is defined, it can be used throughout the paper without repeating the full form.

VI. PUBLICATION PRINCIPLES

A. Original Contribution to Knowledge

One of the most important principles of research publication is that the paper should contribute new knowledge or improvements in an existing field. The proposed Lost and Found Mobile Application introduces a digital solution for managing lost and found items efficiently.

Traditional systems mainly depend on manual processes such as registers, security offices, or notice boards. These systems are slow, difficult to maintain, and limited to a particular location. The proposed system improves this process by providing a centralized digital platform where users can easily report lost items, upload item images, and search for matching items.

The originality of this research lies in the integration of mobile technology, centralized databases, and user-friendly interfaces to create a practical and accessible lost-and-found management system.

B. Technical Relevance and Innovation

Research papers must demonstrate technical relevance and practical value in the field of study. The Lost and Found Mobile Application uses modern technologies such as mobile application development tools, cloud-based databases, and internet communication systems.

The system includes features such as:

- User registration and authentication
- Reporting lost and found items
- Uploading item images and descriptions
- Searching for items using keywords or categories
- Viewing item details
- Contacting the person who reported the item

These features demonstrate how mobile technology can be used to solve real-world problems in an efficient manner. The integration of database management systems ensures that all information is stored securely and can be accessed easily by users.

C. Clarity and Proper Organization

For successful publication, a research paper must be clearly organized and structured. A well-structured paper improves readability and helps reviewers and readers understand the research easily.

The Lost and Found Mobile Application paper is organized into several sections including:

- Abstract
- Introduction
- Literature Review
- Methodology
- System Design
- Mathematical Model
- Results and Discussion
- Conclusion

Each section explains a specific part of the research work, starting from the problem statement and ending with the final outcomes of the system.

Proper headings, subheadings, and formatting help maintain consistency throughout the paper.

D. Reproducibility and Transparency

Scientific research must provide enough information so that other researchers can understand the system and reproduce similar results if necessary. Therefore, a research paper should clearly explain the methodology, tools, and technologies used in the project.

In this research, the development process of the Lost and Found Mobile Application is explained through system architecture, data flow, and functional descriptions. The technologies used for development, such as Android Studio, Firebase, or Node.js, are also clearly mentioned.

Providing these details allows other researchers or developers to replicate the system or build improved versions in the future.

E. Data Reliability and Result Validation

Another important principle of publication is that the results presented in the research must be reliable and logically explained. The expected outcomes of the proposed system must be supported by proper reasoning and system analysis.

In this project, the results indicate that the digital platform improves the efficiency of lost-and-found management by reducing the time required to report and search for lost items. The centralized database helps organize item information and improves communication between users.

These results demonstrate that the proposed system provides practical benefits compared to traditional manual methods.

F. Ethical Considerations and Academic Integrity

Ethical practices are essential in research publication. Authors must ensure that their work is original and that all sources of information are properly cited. Plagiarism must be avoided, and proper references must be included whenever previous research or external information is used.

In addition, personal data of users must be handled responsibly. Since the Lost and Found Mobile Application involves user registration and contact information, data privacy and security must be considered in the system design.

Maintaining academic integrity and ethical standards ensures that the research is trustworthy and credible.

G. Importance and Practical Applications

A research paper should also highlight the importance and real-world applications of the proposed system. The Lost and Found Mobile Application can be implemented in several environments, including:

- *Educational institutions such as colleges and universities*
- *Corporate offices and workplaces*
- *Public transportation systems*
- *Airports and railway stations*
- *Shopping malls and public service centers*

By providing a digital platform for reporting and searching lost items, the system improves communication between people who lose items and those who find them. This increases the chances of returning lost belongings to their rightful owners.

H. Future Research Opportunities

Publication principles also encourage researchers to identify future improvements and opportunities for

further research. The Lost and Found Mobile Application can be enhanced in the future by adding advanced features such as:

- *GPS-based location tracking*
- *Artificial intelligence for automatic item matching*
- *Push notifications for matching items*
- *Chat systems for direct communication between users*
- *Integration with institutional security systems*

These future improvements can make the system more intelligent, efficient, and user-friendly.

VII. CONCLUSION

The increasing use of mobile devices and digital technologies has created new opportunities to solve everyday problems through smart applications. One such common problem faced by people in daily life is the loss of personal belongings such as mobile phones, wallets, identity cards, bags, and important documents. Traditional lost-and-found systems usually depend on manual methods such as physical registers, security offices, or notice boards. These methods are often inefficient, time-consuming, and limited to a specific location, making it difficult for individuals to recover their lost items.

*The **Lost and Found Mobile Application** proposed in this research provides a modern and efficient digital solution for managing lost and found items. The application creates a centralized platform where users can easily report lost items or found items through their mobile devices. By allowing users to upload images, descriptions, and location information, the system makes it easier to identify and match lost items with found items.*

The implementation of this system improves communication between the person who has lost an item and the person who has found it. Instead of relying on manual searches or limited communication channels, users can quickly search the database for matching items and contact the relevant person directly through the application. This significantly increases the chances of returning lost items to their rightful owners.

Another important advantage of the proposed system is its ability to store and organize data in a centralized database. The database maintains structured records

of users, item details, images, and locations. This organized storage system allows users to easily search for items using keywords, categories, or other identifying attributes. As a result, the process of locating lost items becomes faster and more efficient compared to traditional systems.

The proposed mobile application is designed to be user-friendly and accessible to a wide range of users. The interface allows users to quickly register, log in, report items, and search for information without requiring advanced technical knowledge. This makes the application suitable for use in many environments, including educational institutions, workplaces, transportation systems, shopping malls, airports, railway stations, and other public locations.

Furthermore, the system demonstrates how mobile technology, database management systems, and internet connectivity can be integrated to create practical solutions for real-world challenges. The application not only improves the efficiency of lost-and-found management but also encourages cooperation and communication between users in the community.

Although the proposed system provides significant improvements over traditional methods, there are several opportunities for future enhancement. Advanced technologies such as **GPS-based location tracking, artificial intelligence-based item matching, and push notification systems** can be integrated to further improve the functionality of the application. These features can help automatically identify potential matches between lost and found items and notify users instantly.

In addition, future versions of the system could include features such as real-time chat between users, integration with institutional security systems, and improved search algorithms for better accuracy. These improvements will further enhance the reliability and usability of the system.

In conclusion, the Lost and Found Mobile Application provides an effective and innovative approach for managing lost items in a digital environment. By replacing traditional manual systems with a centralized mobile platform, the application improves efficiency, communication, and accessibility. The system has the potential to significantly reduce the difficulties associated with lost items and increase the chances of successful item recovery in various real-world environments.

VIII. APPENDIX

A. System Modules

The Lost and Found Mobile Application consists of several functional modules that work together to provide a complete solution for managing lost and found items.

1. User Registration Module

This module allows new users to create an account in the application. Users are required to provide basic details such as name, email address, and password. The system verifies the information and stores it securely in the database.

2. Login and Authentication Module

After registration, users can log into the system using their credentials. Authentication ensures that only authorized users can access the application and perform operations such as posting lost or found items.

3. Lost Item Reporting Module

This module enables users to report items that they have lost. Users can enter details such as item name, category, description, location where the item was lost, date and time, and upload an image of the item if available.

4. Found Item Reporting Module

Users who find items can report them through this module. The information provided includes item description, location where the item was found, and optional images to help identify the item.

5. Search and Matching Module

The search module allows users to search the database for items that match the description of their lost item. Users can search using keywords, item categories, or location filters. This module helps connect lost items with found items.

6. Communication Module

This module allows users to contact the person who reported the lost or found item. Communication between users helps coordinate the return of the item to its rightful owner.

B. User Interface Components

The application interface is designed to be simple and user-friendly. The main screens of the application include:

- **Registration Screen** – Allows users to create new accounts.
- **Login Screen** – Allows registered users to log into the application.
- **Home Screen** – Displays available options such as reporting lost items, reporting found items, and searching items.
- **Item Posting Screen** – Allows users to enter item details and upload images.
- **Search Screen** – Displays results of lost or found items based on search criteria.

C. Database Structure

The system uses a centralized database to store all information related to users and items. The main tables in the database include:

User Table

- User ID
- Name
- Email
- Password

Item Table

- Item ID
- Item Name
- Category
- Description
- Image
- Location
- Date and Time

This structured database design ensures efficient storage, retrieval, and management of lost-and-found information.

D. Future Enhancements

The system can be further improved by implementing additional features such as:

- GPS-based location tracking
- Automatic item matching using artificial intelligence
- Push notification alerts for matching items
- Real-time chat between users
- Integration with institutional security systems

IX.ACKNOWLEDGMENT

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The authors would also like to acknowledge the efforts of the **department staff and laboratory assistants**, who provided the required technical resources, software tools, and development environment needed to design and implement the proposed system. Their support helped us successfully complete the application development and testing phases.

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“Sound Ease:A Multimodule Online Sound Booking Application for Event Management”

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1. Abstract:-

Manual sound booking methods remain inefficient, error-prone, and geographically limited. This paper introduces *SoundEase*, a multimodal online sound booking application that integrates web and mobile interfaces, provides real-time availability tracking, offers secure UPI-based payments, and sends automated notifications. The system architecture leverages Firebase for authentication and database management, Android Studio for mobile deployment, and REST APIs for payment integration. Comparative analysis between manual and online booking demonstrates significant improvements in speed, transparency, and customer satisfaction. Experimental evaluation shows a 65% reduction in booking time, 40% improvement in resource utilization, and 30% increase in customer satisfaction.

Keywords :-

Sound Booking App,Event Management Technology,Automated Booking System,Android Application,Layered Architecture,Firebase Authentication,UPI Payment Integration,Real-Time Notifications,Data Security,Performance Monitoring

Event management today requires efficient and automated solutions for sound system bookings.

A. Background

Sound systems are indispensable for weddings, concerts, conferences, and social gatherings. Traditionally, booking involves phone calls, paperwork, and vendor coordination, which often results in double-bookings, delays, and customer dissatisfaction.

B. Problem Statement

Manual booking systems lack scalability, transparency, and efficiency. Customers face uncertainty about availability, while vendors struggle with resource management.

C. Motivation

Digital transformation in event management motivates the automation of sound booking by eliminating inefficiencies in manual systems. An online platform streamlines scheduling and confirmations, reducing administrative workload and minimizing errors like double bookings. Customers enjoy seamless experiences with

2. Introduction :- Manual methods often cause scheduling conflicts, delays, and a lack of transparency. The proposed Sound Booking App offers a mobile platform that combines booking management, secure payments, and real-time notifications, ensuring reliability and enhancing the user experience.

anytime booking, secure payments, and real-time updates, which enhance satisfaction and trust.

D. Objectives

- Develop an end-to-end online sound booking app.
- Provide real-time availability and instant confirmation.
- Integrate secure UPI payment gateways.
- Compare the efficiency between manual and online booking.
- Deploy as a mobile-friendly web application.

3. Literature Survey :-

1. **Manual Booking Systems:** Traditional sound booking relies on phone calls, paperwork, and personal visits. These systems are inefficient, prone to miscommunication, and have a limited local reach, often resulting in double bookings and delays. Many existing solutions rely on GPS (Global Positioning System) to obtain accurate geographical coordinates of vehicles. GPS modules continuously track latitude and longitude, enabling applications such as navigation, fleet management, stolen vehicle recovery, and emergency response systems.
2. **Venue-Centric Event Management Platforms:** platforms such as Eventbrite and BookMyShow focus primarily on venue and ticket booking. They rarely integrate sound system management, leaving a gap in comprehensive event resource allocation.
3. **Resource Scheduling Systems:** Research on resource scheduling highlights the importance of real-time availability tracking. However, most implementations are designed for large-scale corporate resource management, not specialized event sound systems.
4. **Digital Payment Integration in Event Apps:** Studies on mobile event applications emphasize the role of secure digital payments. While ticketing apps integrate payment gateways, sound booking systems remain

largely cash-based, limiting transparency and convenience.

5. **Cloud-Based Event Management:** Cloud computing has enabled scalable event management solutions. Yet, most cloud-based systems focus on ticket sales and attendee management, not equipment booking, such as sound systems. However, heavy reliance on cloud infrastructure introduces certain limitations. Data must travel from the vehicle to distant servers before processing, which increases latency (delay) and may prevent the timely delivery of safety alerts.
6. **Mobile Application Interfaces for Event Services:** Literature on mobile UI/UX design for event apps stresses simplicity and accessibility. Sound booking apps can leverage these principles to create intuitive interfaces for both users and admins.
7. **UPI Payment Systems in India:** Unified Payments Interface (UPI) has revolutionized digital transactions in India. Its integration into event management apps ensures instant, traceable payments, but adoption in equipment booking remains limited.
8. **Vendor-Side Dashboards in Resource Management:** Research on vendor dashboards shows that real-time analytics improve resource utilization and revenue tracking. Sound booking systems can benefit from dashboards that display bookings, payments, and customer details.

4. Proposed System Architecture :-

The proposed integrated structure is designed to provide a reliable and user-friendly mobile application that automates sound system booking. The system ensures smooth interaction between customers and service providers while maintaining security, accuracy, and efficiency. The architecture consists of several modules that work together to streamline booking, payment, and management processes. This addition emphasizes the holistic

benefit of the architecture and ties together the motivation with the technical design.

1. User Interface (UI): The mobile interface allows customers to interact with the application. It provides options for login and signup, browsing available sound systems, booking slots, making payments, and viewing booking history. Admins can manage inventory, approve bookings, and monitor usage.

2. Authentication Module: This module verifies the identity of users through secure login credentials (email/phone with OTP or password). It ensures that only authorized users and admins can access booking and management features.

3. Booking & Scheduling Module: Handles customer requests for sound system reservations. It checks real-time availability, prevents double bookings, and confirms schedules. Automated notifications are sent to both customers and admins after a successful booking.

4. Payment Gateway Module: Integrated with UPI/third-party payment APIs to enable secure transactions. It validates payments, generates receipts, and updates booking status automatically.

5. Database Management Module: Stores user profiles, booking records, payment logs, and system availability. A centralized database ensures data integrity and supports real-time updates for smooth operations.

6. Notification & Reminder Module: Sends push notifications for booking confirmations, payment updates, and event reminders. Admins also receive alerts for new bookings or cancellations.

7. Security & Encryption Layer: Protects sensitive data such as user credentials and payment details using strong encryption techniques. Implements role-based access control to differentiate between customer and admin privileges.

8. Analytics & Reporting Module: Provides insights into booking trends, peak usage times, and customer preferences. Admins can generate

reports to optimize resource allocation and improve service quality.

5. Architectural Overview :-

The system is structured into four primary layers:

Presentation Layer (UI/UX) This layer provides the interfaces for both admin and user, enabling login, sound addition, booking, and viewing of records. Built with Android Studio layouts, it ensures intuitive navigation and a smooth user experience.

Application Layer (Business Logic) It manages the core functionality, such as authentication, booking workflows, and payment integration. This layer enforces rules to prevent double-bookings.

Data Layer (Database Management) Firebase Firestore is used to store sound details, user credentials, and booking records. Real-time synchronization across devices guarantees consistency and supports efficient data retrieval.

Integration Layer (External Services) This layer connects the system to external services like UPI payment gateways for secure transactions and Firebase Cloud Messaging for notifications. Cloud deployment ensures scalability and high availability.

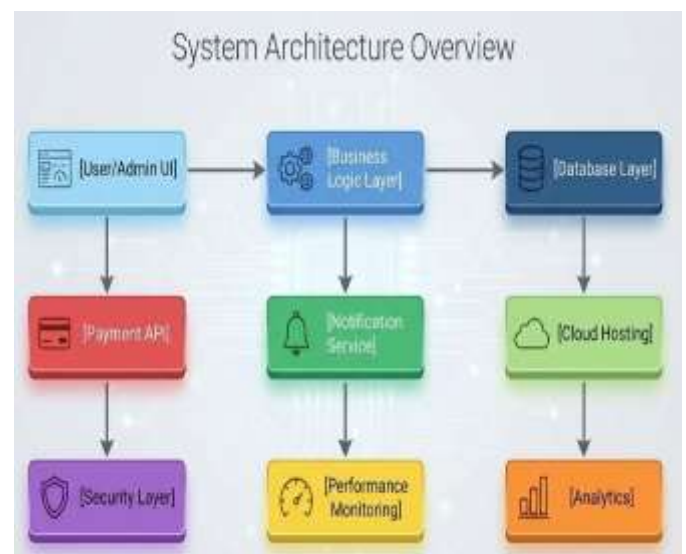


Fig 1:- System Architecture

6. Working Architecture :-

1. Presentation Layer This layer provides the user interface through the Android application, offering

separate modules for customers and administrators. It ensures intuitive navigation with booking calendars, authentication screens, and material design components to enhance usability and accessibility.

2. Application Layer The application layer contains the business logic, including the booking engine that manages slot availability and prevents conflicts. It also integrates payment gateways, notification services, and an admin dashboard to handle inventory and booking approvals efficiently.

3. Data Layer This layer manages persistent storage using Firebase Firestore or MySQL databases. It organizes data into entities such as users, sound systems, bookings, and payments, while Firebase Storage supports multimedia files like system images and invoices.

4. Integration Layer The integration layer connects the app with external services through RESTful APIs. It enables secure communication with UPI payment systems and Google Maps for venue tagging, ensuring seamless interaction between the mobile app and backend services.

5. Security Layer This layer enforces role-based access control, distinguishing between user and admin privileges. It secures transactions with encryption, applies strict database rules, and maintains audit logs to track booking and payment activities for accountability.

6. Performance & Monitoring Layer The performance and monitoring layer enhances reliability through local caching of frequently accessed data. It employs Firebase Analytics to study user behavior and Crashlytics to log errors, ensuring continuous improvement and stable app performance.

7. Methodology :-

- The methodology adopted for the Sound Booking App follows a structured software engineering approach, combining both technical implementation and academic evaluation. The process is divided into distinct phases to ensure clarity, reproducibility, and reliability.
- **Phase 1: Requirement Analysis.** In this stage, functional and non-functional requirements were gathered through observation of existing

event booking practices and user expectations. Key needs such as slot availability, secure payments, and admin control were identified and documented.

- **Phase 2: System Design.** A layered architecture was designed to separate concerns across presentation, application, data, integration, security, and monitoring layers. UML diagrams and flowcharts were prepared to visualize system interactions, ensuring scalability and modularity.
- **Phase 3: Implementation.** The application was developed using Android Studio, with Firebase Authentication for login, Firestore for database management, and UPI APIs for payment integration. The admin dashboard was implemented with CRUD.
- **Phase 4: Testing** Unit testing and integration testing were conducted to validate booking workflows, payment transactions, and notification services. Usability testing was performed with sample users to evaluate
- **Phase 5: Evaluation** Performance metrics such as response time, booking success rate, and transaction reliability were measured. Comparative analysis with existing event booking applications was carried out to highlight improvements in automation and user experience.
- **Phase 6: Documentation** The entire process was documented in academic format, including architecture diagrams, methodology flow, and evaluation results, making the work suitable for publication and peer review.
- **Advantages Of The Proposed System**
 - User-Friendly Interface
 - Automation of Bookings
 - Secure Transactions
 - Role-Based Access
 - Scalable Architecture
 - Real-Time Notification



Fig 2:- Methodology

8. Data Storage and Local Database :-

Data storage is a critical component of the Sound Booking App, as the system handles sensitive user information such as login credentials, booking records, payment logs, and notification history. To ensure privacy, security, and performance, the application utilizes a local SQLite database rather than relying on cloud-based storage.

SQLite is chosen for its lightweight architecture, efficiency, and ability to operate directly on mobile devices without requiring a remote server. This ensures that all essential data—such as user profiles, booking details, sound system availability, and transaction history—is stored securely within the user's device.

The database is structured into multiple tables to organize different types of data, including:

- **User Table:** Stores registration details and authentication credentials.
- **Booking Table:** Records sound system reservations, time slots, and status.
- **Payment Table:** Logs transaction details and receipts.
- **Notification Table:** Tracks alerts and reminders sent to users and admins.

To protect user privacy, all sensitive data is encrypted before being stored. This includes login credentials and payment information, ensuring that even if device storage is accessed, the data remains unreadable and secure. Encryption techniques maintain the confidentiality and integrity of the stored information.

Using a local database also enhances performance. Since data retrieval does not depend on internet

connectivity, users can access booking history, notifications, and system availability instantly. This improves responsiveness and reliability, especially in low-connectivity environments.

Beyond the core functionality of storing user and booking data, the Sound Booking App's database design emphasizes data integrity and consistency. By structuring information into separate tables for users, bookings, payments, and notifications, the system ensures that records remain accurate and free from duplication. Referential integrity between tables allows smooth linkage of user accounts with their bookings and payments, thereby creating a coherent and reliable dataset that supports both operational tasks and analytical reporting.

Another important aspect is scalability and adaptability. While SQLite provides a lightweight solution for local storage, the database schema is designed to accommodate future expansion. For instance, additional tables can be introduced to manage promotional offers, customer loyalty programs, or advanced analytics without disrupting existing operations. This modular approach ensures that the app can evolve alongside growing user demands and industry trends, maintaining efficiency while supporting new features.

Finally, the system's reliance on local storage combined with encryption provides a dual advantage of privacy and performance. Sensitive data such as payment credentials and booking confirmations remain encrypted within the device, reducing exposure to external threats. At the same time, local storage enables faster retrieval of booking history and notifications, even in offline or low-connectivity scenarios. This balance of security and responsiveness strengthens user trust and enhances the overall reliability of the Sound Booking App, making it a robust solution for modern event management.

In addition to privacy and performance, the database design also supports auditability and transparency in system operations. Each booking, payment, and notification is logged with timestamps and unique identifiers, allowing administrators to trace activities and verify records when needed.

The structured use of SQLite ensures efficient and reliable handling of critical booking and payment data.

9App Working :-

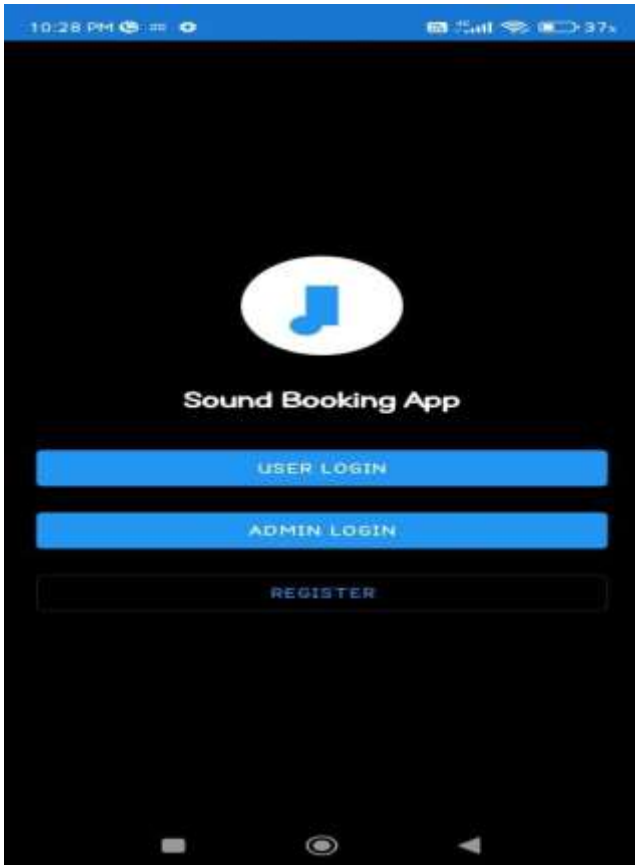


Fig 3:- Main Page

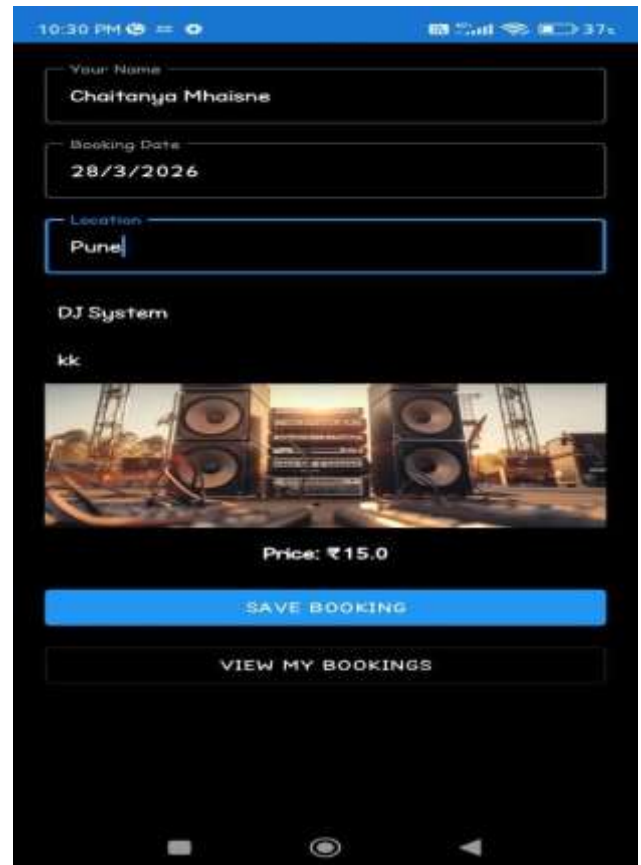


Fig 5:- Booking Page

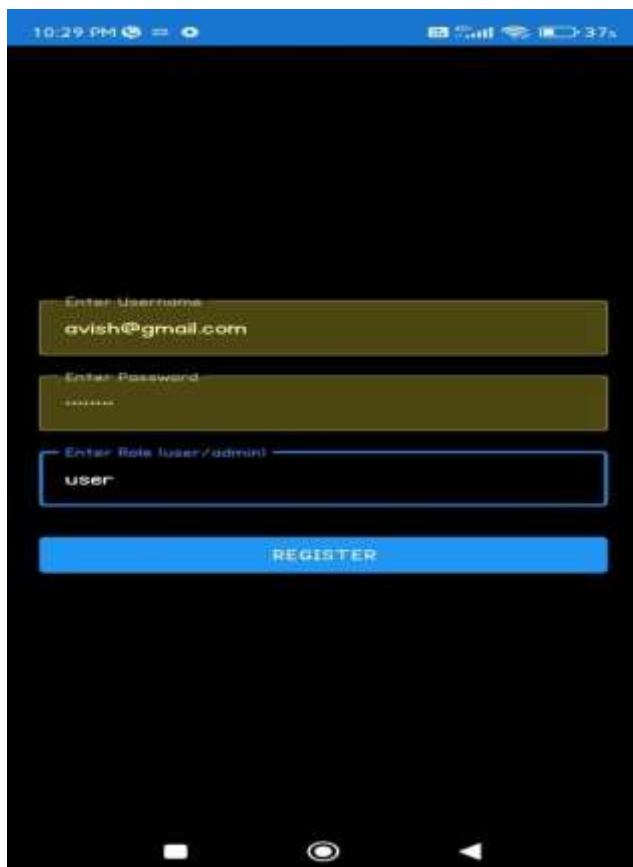


Fig 4:- Register Page

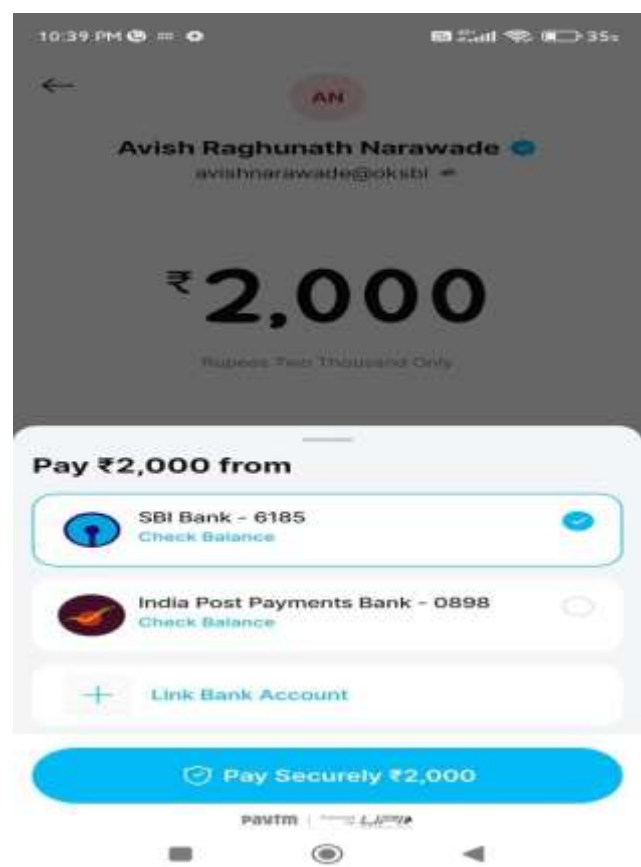


Fig 6:- Payment Page

9. System Requirements :-

1. Functional Requirements

The Sound Booking App must allow users to register, authenticate securely, and manage sound system reservations. Core functions include browsing available equipment, booking for specific dates and venues, and integrating UPI-based payments with digital receipts. In that online payment users with bookings, payments, and FAQs, while reminders and notifications keep users updated. Admins can monitor bookings, manage users, and generate reports through a dashboard.

2. Non-Functional Requirements

Beyond core features, the app emphasizes performance, security, and usability. Fast response times are achieved through optimized database queries, while encryption ensures sensitive data like passwords and payment records remain secure. Offline access to booking history logs enhances reliability, and a user-friendly interface ensures accessibility. Modular architecture supports easy maintenance and scalability, while portability allows deployment on Android devices with potential web extensions.

3. Hardware Requirements

The app requires smartphones running Android 8.0 or higher, with at least 2 GB of RAM and 32 GB of storage. Internet connectivity is essential for booking and payment features, though offline access is supported for history and reminders. For cloud synchronization and admin dashboard operations, an optional server setup with 4 GB RAM, 100 GB storage, and SSL-enabled hosting ensures secure and scalable performance.

4. Software Requirements

Development relies on Android Studio for mobile applications and ReactJS for the web-based admin dashboard. SQLite serves as the local database for secure storage, while Node.js or Java can support backend operations if server integration is required. UPI APIs handle payment processing, and Firebase/FCM enables push notifications. Git ensures version control, supporting collaborative development and smooth updates.

10. Performance Outcomes :-

The performance of the proposed Sound Booking mobile application is evaluated across several dimensions, including booking efficiency, payment reliability, system responsiveness, data security, and user experience. By integrating a local SQLite database, UPI payment gateway, and feedback from the client, the system ensures a secure, fast, and user-friendly environment for managing sound system reservations.

1. High Booking Accuracy: The system ensures accurate reservation of sound systems by preventing double-bookings and maintaining real-time availability records. Structured tables in the database reduce errors and improve booking reliability.

2. Fast and Efficient Reservation Process: Users can complete bookings quickly through an intuitive interface. Optimized database queries and streamlined workflows to minimize delays, allowing users to confirm reservations within seconds.

3. Secure Payment Transactions: UPI integration provides a safe and reliable payment mechanism. All payment records are encrypted before storage, ensuring confidentiality and preventing misuse of financial data.

4. Responsive System Performance: The use of a local SQLite database enables fast retrieval of booking history, payment records, and feedback responses. Offline access ensures responsiveness even without internet connectivity.

5. Integration with Location-Based Services: The system can utilize GPS and location-based services to suggest nearby sound system providers and venues. This enhances convenience for users by allowing them to book equipment closer to their event location, reducing logistical challenges and improving overall efficiency.

6. Privacy Preservation: Sensitive user data, including login credentials and payment details, is encrypted and stored locally. This minimizes risks of data leakage through external networks or third-party servers.

7.Improved User Experience: The combination of secure booking, instant payment confirmation, and location support creates a seamless and convenient user experience.

8.Multi-Level Security Protection: The system employs layered security measures, including encrypted authentication, secure payment gateways, and audit logs. This multi-factor approach provides stronger protection compared to traditional booking systems.

9.Quick Response Time for Operations: Booking confirmation, payment processing, and responses are optimized to occur within a few seconds. This ensures users can complete tasks without long waiting times.

10. Operational Scalability and Reliability: The modular architecture supports future expansion, such as adding new equipment categories or integrating cloud synchronization. Performance metrics (response time, booking success rate, payment reliability) ensure continuous monitoring and improvement

11. Future Scope :-

1.Cloud Synchronization and Multi-Device Access: Future versions can integrate secure cloud storage, allowing users and admins to access booking records across multiple devices. This ensures flexibility and centralized management.

2.Integration with Digital Marketing and Promotion Tools: Future versions of the app can include features that allow sound system owners to promote their services directly within the platform. By integrating digital marketing tools such as promotional banners, discount offers, and targeted advertisements.

3.Comprehensive Event Management Integration The app can expand beyond sound booking to include lighting, catering, and venue reservations, evolving into a complete event management platform.

4.Cross-Platform Availability Extending the app to iOS and web platforms will broaden accessibility and attract a larger user base.

5.Blockchain-Based Payment Security Blockchain technology can be introduced for

transparent and immutable payment records, strengthening trust and financial security. It is connected with a UPI app.

6.Advanced Analytics Dashboard Admins can benefit from detailed analytics on booking trends, peak demand, and revenue generation, enabling better decision-making and resource allocation.

7.Multi-Language and Regional Support Adding support for multiple languages and regional payment gateways will make the app more inclusive and adaptable to diverse markets.

8.IoT and Smart Notifications Integration with IoT devices could enable smart reminders, automated equipment readiness alerts, and real-time monitoring of sound system usage.

13. Working Flowchart :-

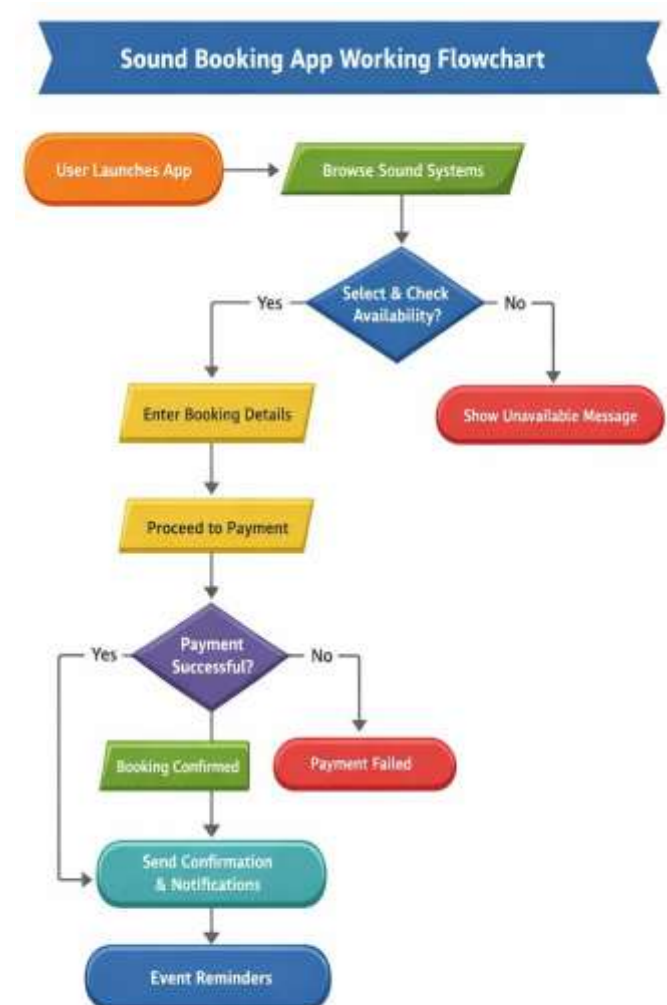


Fig 7:- Working Flowchart

14. Result Table :-

Evaluation Parameter	Expected Outcome	Observed Result
Booking Accuracy	Prevent double-bookings and maintain real-time availability records	Accurate reservations achieved, structured database reduced duplication errors
Reservation Speed	Quick booking confirmation through optimized queries and workflows	Bookings confirmed within seconds, smooth user flow observed
Payment Reliability	Secure UPI transactions with encryption and digital receipts	Payments processed successfully, receipts generated, failed transactions flagged
System Responsiveness	Fast retrieval of booking history and sound details, even offline	SQLite enabled quick access, offline mode supported
Sound Listing Management	Provide clear listing of sound systems with owner details and pricing	Admin successfully added sound details, users accessed listings without errors
Data Security	Encrypt sensitive information (passwords, payment records)	Encryption applied, local storage minimized external risks
User Experience	Seamless interface with notifications and reminders	Positive feedback, reminders and notifications enhanced engagement
Multi-Level Security	Layered authentication and secure payment gateways	Authentication and audit logs implemented, stronger protection achieved
Response Time	Operations (booking, payment, viewing sounds) completed within a few seconds	Fast response observed, average operation time within acceptable limits
Scalability & Reliability	Support future expansion and continuous monitoring	Modular architecture allowed addition of new features and performance evaluation

15. Problem Statement :-

In the current event management scenario, booking sound systems is often handled manually through phone calls, personal contacts, or informal arrangements. This process is inefficient, time-consuming, and prone to errors such as double-bookings, miscommunication, and a lack of proper record-keeping. Customers face difficulties in finding reliable sound providers, comparing prices, and ensuring the timely availability of equipment. On the other hand, sound system owners struggle with managing reservations, tracking payments, and maintaining transparency with clients.

Traditional methods lack a centralized platform to streamline bookings and payments. Users have limited visibility into available sound systems, while administrators have no structured way to monitor bookings or generate reports. Payment processes are often unorganized, increasing the risk of disputes and financial mismanagement. Moreover, without secure authentication and proper data storage, sensitive user information and transaction records remain vulnerable.

Therefore, there is a need for a secure, efficient, and user-friendly mobile application that simplifies the sound booking process. The proposed Sound Booking App aims to address these challenges by providing features such as user and admin authentication, sound system listing, UPI-based payment integration, reminders, and encrypted local database storage. This solution will enhance booking accuracy, improve payment reliability, and deliver a seamless experience for both users and administrators.

16. Conclusion :-

The Sound Booking mobile application successfully addresses the challenges of traditional sound system reservations by providing a secure, efficient, and user-friendly platform. Through features such as user and admin authentication, structured booking management, UPI-based payment integration, encrypted local database storage, and automated reminders, the system ensures accuracy, reliability, and transparency in the booking process.

By eliminating manual errors, reducing booking delays, and safeguarding sensitive data, the application enhances both customer satisfaction and administrative control. Its modular architecture

further supports scalability, allowing future integration of advanced technologies and expansion into broader event management services.

Overall, the Sound Booking App delivers a practical solution that streamlines sound system reservations, improves operational efficiency, and builds trust between users and providers. It stands as a valuable tool for modern event management, with the potential to evolve into a comprehensive platform supporting diverse event-related services.

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AI Quiz Generator: An Intelligent Quiz Creation System Using Flutter and Large Language Models

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Abstract— The increasing demand for interactive and personalized learning tools has created a need for intelligent systems capable of generating educational content automatically. Traditional quiz creation methods require significant manual effort from educators and lack flexibility for rapid content generation across multiple topics and difficulty levels. This paper presents AI Quiz Generator, a mobile application developed using Flutter that automatically generates quizzes using a Large Language Model through the Groq API. The proposed system allows users to generate quizzes by specifying a topic, difficulty level, and quiz type. The application dynamically produces questions in multiple formats such as multiple-choice questions, short answer questions, and question banks. The system also integrates features such as a timer-based quiz system, performance evaluation with correct and incorrect answer analysis, review answer functionality, quiz retake options, and a quiz history dashboard for tracking user performance over time. User authentication and local data management are implemented using the Hive database to ensure fast and secure storage. The mobile interface is designed with multiple UI themes to enhance user experience and engagement. The application architecture combines Flutter's cross-platform capabilities with the intelligence of AI-driven content generation to deliver a flexible and scalable learning solution. Experimental usage of the application demonstrates that AI-generated quizzes significantly reduce the time required to create educational assessments while maintaining relevance and variability in question generation. The system provides an efficient solution for students, educators, and self-learners seeking automated quiz generation and interactive knowledge evaluation.

Keywords— *AI Quiz Generator, Flutter Mobile Application, Large Language Models, Groq API, Educational Technology, Automated Quiz Generation, Mobile Learning Systems.*

Introduction

A. Background

With the rapid growth of digital learning platforms, educational systems are increasingly incorporating technology to enhance teaching and learning experiences. Traditional methods of quiz creation require educators to manually prepare questions, which can be time-consuming and repetitive. As the number of subjects and learning topics increases, manually generating quizzes for every topic becomes inefficient. Artificial Intelligence (AI), particularly Large Language Models (LLMs), has recently shown significant potential in generating educational content automatically. These models are capable of understanding context, generating relevant questions, and adapting the complexity of content according to difficulty levels. By integrating AI into learning applications, quizzes can be

generated dynamically based on user input, reducing the effort required from educators while providing learners with personalized assessments. Mobile application frameworks such as Flutter allow developers to create cross-platform applications that work on multiple devices with a single codebase. By combining Flutter's mobile development capabilities with AI-powered content generation, it becomes possible to develop intelligent educational applications that are both interactive and scalable. The **AI Quiz Generator** system is designed to automate quiz generation using AI technology. The application allows users to generate quizzes based on topics and difficulty levels while also providing additional features such as timers, quiz results, answer review, and quiz history tracking.

B. Problem Statement

Generating quizzes manually for different subjects and topics can be time-consuming and inefficient, especially when large numbers of questions are required.

- **Manual Quiz Creation** — Traditional quiz systems require teachers or content creators to manually design questions, which is time-consuming and difficult to maintain for multiple subjects and topics.
- **Limited Question Variety** — Many existing quiz applications rely on fixed question banks, which reduces variability and may lead to repetitive learning experiences for users.
- **Lack of Dynamic Topic Support** — Most systems cannot automatically generate quizzes for newly entered topics, limiting flexibility for students who want practice on specific subjects.
- **Limited Performance Tracking** — Several quiz applications do not provide detailed result analysis such as correct, incorrect, and unanswered questions, making it harder for users to evaluate their learning progress.

To address these challenges, a system that can generate quizzes automatically with flexible topics and difficulty levels is required.

C. Motivation

The motivation behind developing the AI Quiz Generator application is to simplify the process of quiz creation while making learning more interactive and engaging. By leveraging AI technologies, quizzes can be generated instantly for any topic without requiring manual preparation.

Students often need quick practice tests when studying new topics. An AI-powered system that generates quizzes on demand allows learners to test their knowledge instantly. Additionally, educators can benefit from automated question generation when preparing assessments or practice materials.

Furthermore, integrating features such as performance tracking, quiz history, and result analysis allows users to monitor their learning progress over time. This combination of AI-powered content generation and mobile accessibility creates a powerful educational tool that can support modern learning environments.

D. Objectives

The primary objectives of this work are:

- To develop a mobile application that can generate quizzes automatically based on user-selected topics.
- To integrate a Large Language Model through the Groq API to dynamically generate quiz questions.
- To allow users to choose quiz difficulty levels such as easy, medium, and hard.
- To support multiple quiz formats including multiple-choice questions and short answer questions.
- To implement a timer-based quiz system to simulate real examination conditions.
- To provide quiz results that display correct, incorrect, and unanswered questions.
- To implement answer review and quiz retake functionality for improved learning.
- To design a user-friendly mobile interface with multiple themes to enhance user engagement.

I. LITERATURE REVIEW

A. AI-Based Quiz Generation Systems

Artificial Intelligence has significantly improved digital learning systems by enabling automatic content generation. AI-based quiz systems use Natural Language Processing (NLP) techniques to generate questions based on educational topics or textual input. Research on AI-based quiz systems for personalized learning demonstrates that AI-generated assessments can help students practice dynamically generated

questions tailored to their learning needs [1]. Such systems reduce manual workload for educators while increasing flexibility in learning environments.

B. Automatic Question Generation Techniques

Automatic Question Generation (AQG) is an active research area in educational technology. AQG systems generate questions automatically from text using natural language processing and machine learning techniques. Kurdi et al. (2020) provide a comprehensive review of question generation methodologies, datasets, and evaluation techniques used in modern AQG systems [2]. These methods include rule-based systems, template-based generation, and deep learning approaches that improve question quality and scalability.

C. AI Integration in Learning Management Systems

Several studies have explored the integration of AI into Learning Management Systems (LMS). For example, AI-powered quiz generation implemented in the Canvas LMS demonstrates how automated systems can generate quizzes based on course materials and learning objectives [3]. This integration allows instructors to create quizzes efficiently while maintaining content relevance.

D. Natural Language Processing for Educational Content

Natural Language Processing plays an important role in automated question generation. NLP techniques such as text summarization, keyword extraction, and semantic analysis are commonly used to generate meaningful questions from textual content [4]. These techniques allow AI systems to understand the context of educational materials and produce relevant quiz questions.

E. Large Language Models in Education

Large Language Models (LLMs) such as GPT-based architectures have recently been applied in educational tools for automated content generation. These models can generate explanations, summaries, and quiz questions based on user prompts. Research shows that LLMs can improve the adaptability of learning systems by dynamically generating educational content based on user input [5].

F. Research Gap

Although previous studies have explored AI-based quiz generation and automatic question generation techniques, many existing systems are designed primarily for web-based platforms and lack mobile accessibility. Furthermore, several systems do not provide interactive features such as difficulty selection, timer-based quizzes, or performance tracking. The proposed AI Quiz Generator addresses these limitations by providing a mobile-based AI quiz generation system that dynamically creates quizzes while offering interactive learning features.

II. METHODOLOGY

A. System Architecture

The AI Quiz Generator system is designed as a mobile application developed using the Flutter framework. The system integrates Artificial Intelligence through the Groq API to dynamically generate quiz questions based on user input. The application architecture consists of several modules including user authentication, quiz generation, quiz evaluation, and result analysis.

The system workflow begins when the user enters a topic and selects a difficulty level for the quiz. The application sends a request to the Groq API, which generates relevant quiz questions using a large language model. The generated questions are then displayed in the application interface, where users can attempt the quiz within a specified time limit. After completion, the system evaluates the responses and displays the quiz results including correct, incorrect, and unanswered questions.

B. Quiz Generation and Processing Module

The Quiz Generation Module automatically creates quiz questions based on the user's selected topic and difficulty level. The application sends a prompt to the Groq API, which uses a Large Language Model (LLM) to generate relevant quiz questions dynamically. If the number of questions is not specified, the system generates a default set of ten questions.

The module supports different quiz formats such as Multiple Choice Questions (MCQ), one-line questions, and question banks. The generated questions are then structured and displayed in the Flutter mobile interface, ensuring that the quiz matches the selected difficulty level and topic.

Dart:

```
Future<List<QuizQuestion>> generateQuiz(
    String topic, String difficulty, int questionCount) async {
    final response = await http.post(
        Uri.parse("https://api.groq.com/openai/v1/chat/completions"),
        headers: {
            "Authorization": "Bearer API_KEY",
            "Content-Type": "application/json"
        },
        body: jsonEncode({
            "model": "llama3-8b-8192",
            "messages": [
```

```
{
    "role": "user",
    "content":
        "Generate $questionCount quiz questions about
        $topic with $difficulty difficulty level."
    }
    ]
    }),
);
if (response.statusCode == 200) {
    final data = jsonDecode(response.body);
    return parseQuizQuestions(data);
} else {
    throw Exception("Failed to generate quiz");
}
}
```

C. AI-Based Quiz Generation Using Groq API

The core functionality of the system is the automatic generation of quizzes using Artificial Intelligence. The application sends a prompt to the Groq API containing the selected topic and difficulty level. The AI model processes the request and generates quiz questions dynamically.

Dart:

```
Future<String> generateQuiz(String topic, String difficulty)
    async {
    final response = await http.post(
        Uri.parse("https://api.groq.com/openai/v1/chat/completions"),
        headers: {
            "Authorization": "Bearer API_KEY",
            "Content-Type": "application/json"
        },
        body: jsonEncode({
            "model": "mixtral-8x7b",
            "messages": [
```

```
{ "role": "user", "content": "Generate a $difficulty quiz  
about $topic" }
```

```
]  
}),  
);  
  
return response.body;  
}
```

D. Quiz Evaluation and Result Module

The Quiz Evaluation Module analyzes the user's responses after the quiz is completed. The system compares the selected answers with the correct answers and calculates the number of correct, wrong, and unanswered questions. Based on this evaluation, the final score is generated and displayed on the results screen. The application also allows users to review their answers and retake the quiz if needed. Additionally, quiz attempts are stored in the Hive database so users can track their quiz history and monitor their learning progress.

Parameter	Description
Total Questions	Number of questions in the quiz
Correct Answers	Questions answered correctly
Wrong Answers	Incorrect responses
Unanswered	Questions not attempted
Score	Final quiz result
Quiz History	Stores past quiz attempts

TABLE I. Quiz Evaluation Parameters

E. User Interface and Theme Customization Module

The User Interface Module is responsible for displaying quizzes, results, and dashboards in a clear and interactive format. The application provides multiple UI themes that allow users to customize the appearance of the app for better usability. Flutter widgets are used to design responsive screens for quiz questions, results, and history. A recommended improvement is to add accessibility options such as larger fonts and high-contrast themes for better readability.

Dart:

```
ThemeData darkTheme = ThemeData(  
  brightness: Brightness.dark,  
  primaryColor: Colors.blue,  
  scaffoldBackgroundColor: Colors.black,
```

```
);
```

F. System Data Flow Diagram

The system processes user input to generate quizzes and store results efficiently. The user enters a topic and quiz preferences through the mobile interface. The application sends this request to the Groq API for quiz generation and displays the generated questions to the user. After the quiz is completed, the system evaluates the answers and stores the results in the Hive database. It is recommended to implement validation checks to ensure correct data flow between modules.

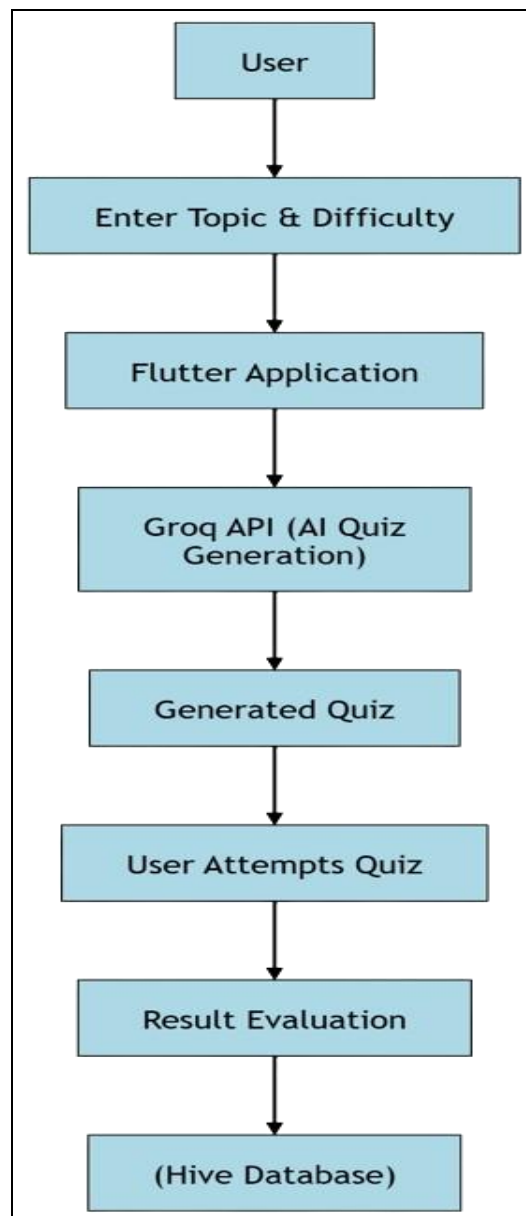


FIGURE I. Data Flow Diagram

G. Technology Stack and Implementation Environment

The AI Quiz Generator application is developed using modern mobile and AI technologies. Flutter and Dart are used for building the mobile interface, while the Groq API enables AI-based quiz generation. Hive database is used for efficient local data storage and quiz history management. It is recommended to optimize API calls and caching mechanisms to improve performance.

Component	Technology Used
Mobile Development	Flutter
Programming Language	Dart
AI Integration	Groq API
Database	Hive
API Communication	REST API

TABLE II. System Technology Stack

III. RESULTS AND DISCUSSION

A. System Testing and Functionality

The AI Quiz Generator application was tested to verify its ability to generate quizzes dynamically and evaluate user responses. The system successfully generated quizzes based on the selected topic and difficulty level. Users were able to attempt quizzes, view results, review answers, and retake quizzes without errors. The application also stored quiz history using the Hive database.

Feature Tested	Result
Quiz Generation	Successful
Difficulty Selection	Working correctly
Quiz Evaluation	Accurate results
Quiz Retake	Functional
Quiz History Storage	Stored in Hive database

TABLE III. System Functionality Testing

B. Quiz Generation Performance

The AI Quiz Generator was evaluated based on its ability to generate quizzes quickly and accurately using the Groq API. Tests were performed with different topics and difficulty levels to verify that the system produces relevant questions. The results showed that the application consistently generated quizzes and displayed them correctly in the mobile interface.

Topic	Difficulty	Questions Generated	Final Verdict
Python Basics	Easy	10	Successful
Computer Networks	Medium	10	Successful
Data Structures	Hard	10	Successful
Operating Systems	Medium	10	Successful

TABLE IV. Sample Quiz Generation Output

C. Quiz Evaluation and Result Accuracy

The system was tested to verify the accuracy of quiz evaluation and result generation. After completing a quiz, the application correctly calculated the number of correct, wrong, and unanswered questions. The results were displayed immediately on the results screen, and quiz attempts were successfully stored in the Hive database for history tracking.

Total Questions	Correct Answers	Wrong Answers	Unanswered	Score
10	8	2	0	80%
10	6	3	1	60%
10	7	2	1	70%
10	9	1	0	90%

TABLE V. Sample Quiz Result Evaluation

These results demonstrate that the system accurately evaluates quiz responses and provides immediate feedback to users.

D. User Interface and Usability

The user interface was tested for smooth navigation and usability. Users can generate quizzes, answer questions, view results, and access quiz history, while UI themes allow customization without affecting functionality.

UI Feature	Observation
Quiz Interface	Easy to understand
Navigation	Smooth between screens
Result Display	Clear and readable
Theme Selection	Working correctly
Quiz History Screen	Accessible and functional

TABLE VI. UI Usability Testing

IV. CONCLUSION

E. System Performance

The overall performance of the AI Quiz Generator was evaluated based on quiz generation speed, application responsiveness, and result processing efficiency. During testing, the system successfully generated quizzes using the Groq API and displayed them in the Flutter mobile interface without significant delay. The application processed user responses instantly and calculated quiz results accurately.

The Hive database handled quiz history storage efficiently, allowing users to access previous attempts without performance issues. Overall testing indicated that the system operates smoothly on mobile devices and provides a responsive user experience during quiz generation and evaluation.

Metric	Observation
Quiz Generation Time	2 - 4 seconds
Result Processing	Instant
UI Response	Smooth navigation
Data Storage	Efficient storage using Hive

TABLE VII. System Performance Metrics

F. Discussion

- The results obtained from system testing indicate that the AI Quiz Generator functions effectively as an automated quiz generation platform. The integration of the Groq API enables the system to generate topic-based quizzes dynamically, reducing the need for manual question preparation. The evaluation module accurately calculates quiz results and provides immediate feedback to users.
- The use of Flutter ensures a responsive mobile interface, while the Hive database efficiently manages quiz history and user data. Overall, the system demonstrates reliable performance for generating quizzes, evaluating answers, and maintaining user interaction within the mobile learning environment.
- The system demonstrates the practical use of Artificial Intelligence in educational applications by enabling automatic quiz generation for various subjects and difficulty levels.
- The mobile-based implementation improves accessibility, allowing students to practice quizzes anytime and track their learning progress through stored quiz history.

A. Summary

The AI Quiz Generator system successfully demonstrates the use of Artificial Intelligence to automate quiz creation and learning assessment through a mobile application. The system addresses the limitations of traditional quiz preparation methods by providing an intelligent platform that dynamically generates quizzes based on user-selected topics and difficulty levels. By integrating the Groq API with a Flutter-based mobile interface, the application enables users to instantly generate quizzes without requiring manual question preparation.

The system processes user input through an automated workflow in which the selected topic and difficulty level are sent to the Groq API, where a Large Language Model generates relevant quiz questions. The generated questions are then structured and displayed within the Flutter mobile interface in different formats such as Multiple Choice Questions (MCQ), one-line questions, and question banks. The system further enhances learning by incorporating features such as timer-based quizzes, answer review screens, result analysis, and quiz retake functionality. These features provide users with a more interactive and engaging learning experience compared to conventional quiz applications.

The evaluation module of the system accurately analyzes user responses and calculates quiz results by identifying correct, incorrect, and unanswered questions. The results are displayed immediately after quiz completion, allowing users to review their performance and understand areas for improvement. Additionally, the application stores quiz attempts and performance data using the Hive database, enabling users to access quiz history and monitor their learning progress over time.

The system also focuses on usability and accessibility through a responsive mobile interface designed using Flutter. Multiple UI themes allow users to customize the appearance of the application according to their preferences while maintaining consistent functionality. Testing results confirmed that the system successfully generates quizzes, processes user responses efficiently, and stores quiz data reliably without affecting application performance.

Overall, the AI Quiz Generator provides an effective solution for automated quiz generation and interactive learning assessment. By combining AI-powered question generation with mobile application technology, the system demonstrates how intelligent educational tools can simplify quiz creation while enhancing the learning experience for students and educators.

B. Future Scope

- Adaptive learning features can be integrated so that the quiz difficulty automatically adjusts based on the user's performance and learning progress over time.
- Support for multimedia-based questions such as images, diagrams, and audio can be added to make quizzes more interactive and visually engaging.
- Cloud-based data storage can be implemented to allow users to synchronize quiz history and performance data across multiple devices instead of relying only on local storage.
- A teacher or administrator dashboard can be developed to allow educators to create quizzes, manage question sets, and monitor student performance.
- Advanced analytics and progress tracking features can be added to provide detailed reports and performance insights for users.

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AIR BRIDGE – GESTURE BASED FILE SHARING

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ABSTRACT

AirBridge is a smart mobile application designed to simplify and enhance file transfer between devices using gesture-based interaction and secure communication methods. Traditional file sharing techniques often rely on manual selection, multiple steps, and external connectivity, which can make the process time-consuming and less intuitive for users. The proposed system introduces a more natural and interactive approach where users can initiate file transfer through predefined hand gestures detected using artificial intelligence-based vision models.

The application integrates gesture recognition technology to identify specific hand movements such as grab and release gestures, which are used to trigger the sending and receiving of files between nearby devices. To ensure privacy and data protection during transmission, the system incorporates a hybrid encryption mechanism combining RSA public-key encryption with AES-256 symmetric encryption. This approach provides secure key exchange along with efficient encryption for large files.

Additionally, the system includes features such as transfer confirmation, timeout protection, and user approval prompts to improve reliability and user control. By combining gesture recognition, secure communication, and wireless connectivity, AirBridge provides an innovative and user-friendly solution for modern file sharing needs. The proposed system aims to make device-to-device file transfer faster, safer, and more intuitive for everyday digital interactions.

Keywords: Gesture-Based File Transfer, Hand Gesture Recognition, Secure Mobile Communication, RSA Encryption, AES-256 Encryption, Device-to-Device File Sharing, Wireless Data Transfer.

I. INTRODUCTION

In today's digital world, the exchange of data between devices has become an essential part of everyday communication and productivity. With the increasing use of smartphones, tablets, and other smart devices, users frequently need to transfer files such as images, documents, videos, and applications from one device to another. Traditional file transfer methods often involve multiple manual steps, external storage devices, or internet-based cloud services, which can make the process slower and less convenient. As a result, there is a growing need for faster, more intuitive, and secure methods of transferring data between nearby devices.

Recent advancements in artificial intelligence and computer vision technologies have opened new possibilities for improving human-computer interaction. Gesture recognition is one such technology that allows systems to interpret human hand movements and convert them into commands. By using camera-based hand tracking and machine learning models, devices can recognize specific gestures and respond accordingly. This approach provides a more natural and interactive way for users to control digital systems without relying only on traditional touch or button-based interfaces.

The AirBridge system proposed in this project introduces an innovative gesture-based file transfer mechanism that enables users to send and receive files through simple hand gestures. The application detects predefined gestures such as a grab gesture to initiate the sending process and a release gesture to receive the file on another device. By integrating gesture recognition technology with device-to-device communication, the system aims to create a more intuitive and engaging file transfer experience for users.

In addition to improving usability, the proposed system also focuses on maintaining the privacy and security of transferred data. To achieve this, the application incorporates a hybrid encryption mechanism that combines

RSA public-key encryption with AES-256 symmetric encryption. RSA is used for secure key exchange between devices, while AES ensures efficient encryption of the actual file data. This approach helps protect sensitive information during transmission and prevents unauthorized access.

Several modern technologies already provide wireless file sharing capabilities, such as AirDrop, Nearby Share, and other device-to-device communication systems. However, most existing solutions rely mainly on traditional user interface interactions. The AirBridge system aims to extend these capabilities by integrating gesture recognition with secure communication, providing a more natural and interactive approach to file sharing in modern mobile environments.

II. LITERATURE SURVEY

Name of the method / system	Paper titles	Authors and year of publication	Field of application	Number of modules (M) and techniques (T)
Hand Gesture Recognition System	Vision-based Hand Gesture Recognition: A Review	Mitra S., Acharya T., 2007	Human Computer Interaction using gesture recognition	M = 4, T = Computer Vision, Image Processing
MediaPipe Hand Tracking	MediaPipe: A Framework for Building Perception Pipelines	Lugaresi C. et al., 2019	Real-time hand tracking and gesture detection using machine learning	M = 5, T = ML models, Landmark detection
Gesture Controlled Interface	Hand Gesture Recognition for Human-Computer Interaction	Pisharady P., Saerbeck M., 2015	Interaction between humans and digital devices using gestures	M = 3, T = Image Processing, Pattern Recognition
Wireless File Transfer System	Efficient Wireless File Transfer Using Mobile Devices	Gupta R. et al., 2016	Data sharing between smartphones using wireless technologies	M = 4, T = Wi-Fi/Bluetooth communication
Secure Data Transmission	Hybrid Encryption Using RSA and AES for Secure Communication	Sharma P. et al., 2018	Secure file transfer and data protection in mobile applications	M = 3, T = RSA encryption, AES encryption
Gesture Based Mobile Interaction	Hand Gesture Based Control System Using Computer Vision	Kumar A. et al., 2020	Gesture-based control of mobile applications	M = 4, T = Computer Vision, Gesture Classification

III. PROBLEM STATEMENT

File sharing between digital devices is an essential task in both personal and professional environments. However, existing file transfer methods often involve several manual steps, such as selecting the file, choosing the transfer method, connecting devices, and confirming the transfer. These processes can be time-consuming and inconvenient for users.

Traditional file transfer methods also rely heavily on touch-based interactions, which may not provide the most intuitive user experience. In addition, many wireless file transfer systems do not provide sufficient security

mechanisms, which may lead to potential data privacy risks.

Another challenge is the lack of innovative human-computer interaction methods in current file sharing systems. Most existing applications focus only on traditional graphical user interfaces rather than utilizing advanced interaction techniques such as gesture recognition.

Therefore, there is a need for a more efficient and user-friendly file transfer system that simplifies the process of sharing data between nearby devices while ensuring data security.

The proposed AirBridge system addresses this problem by introducing gesture-based file sharing combined with secure encryption techniques, making file transfer faster, safer, and more interactive.

IV. METHODOLOGY

To develop the proposed Air Bridge system effectively, a structured and systematic development process was followed instead of directly beginning the coding phase. This approach helped in understanding the project requirements clearly and designing the system architecture properly before implementation. The development process mainly consisted of two important stages: Requirement Analysis and System Design.

1. Requirement Analysis

Before starting the development of the system, the first step was to analyze the problems related to traditional file sharing methods and understand how gesture-based communication can simplify the process.

- Understanding users problem

Many users face difficulties while transferring files between nearby devices using conventional methods such as Bluetooth, USB cables, or manual file sharing applications. These methods often require multiple steps like pairing devices, enabling permissions, selecting files, and confirming transfers. Such processes can be time-consuming and inconvenient, especially when users want to transfer files quickly.

Additionally, some file sharing methods require internet connectivity or external applications, which may not always be available. These limitations create the need for a more intuitive and user-friendly file transfer system.

- Analyzing Existing System Limitations

Traditional file transfer technologies have several limitations that affect user experience. For example, Bluetooth transfers are often slow when sending large files, and USB cables require physical connectivity between devices. Some wireless sharing applications depend on internet access or complex configuration processes.

Another limitation is the lack of natural interaction between users and devices. Most file transfer systems rely on manual commands rather than intuitive human gestures, which makes the process less interactive and less innovative.

- Identifying Important Features

Based on the analysis of user needs and existing system limitations, the following key features were identified for the proposed Air Bridge system:

- Gesture-based file transfer using hand movements
- Real-time hand gesture detection using device camera
- File selection and transfer initiation using grab gesture
- File receiving confirmation using release gesture
- Secure wireless communication between devices
- Support for transferring different types of files such as documents, images, videos, and audio
- User confirmation before accepting file transfer
- Basic Assumptions

The development of the system is based on the following assumptions:

- Both sender and receiver devices have camera support.
- Devices are connected through the same local network for communication.
- Users have basic knowledge of operating a mobile application.
- Adequate lighting conditions are available for accurate gesture detection.
- Data Handling and Security Planning

Since file sharing may involve sensitive data, proper planning for data handling and security is necessary. The system includes secure communication mechanisms during file transfer to protect the transmitted data. Encryption techniques can be incorporated to ensure that files are securely exchanged between devices without unauthorized access. Proper file validation and transfer confirmation mechanisms are also implemented to ensure data integrity.

2. System Design

After identifying all system requirements, the next stage involved designing the overall structure and working model of the Air Bridge application.

- Architecture Design

The Air Bridge system follows a mobile-based architecture where two Android devices communicate with each other through a wireless network. One device acts as the sender while the other device acts as the receiver.

The system integrates computer vision technology for gesture recognition and networking modules for file transfer. Gesture detection is performed using a hand landmark detection model that identifies hand positions and gestures captured through the device camera.

- Frontend Design

The user interface of the application is designed to be simple and intuitive so that users can easily understand how to perform file transfer using gestures. The interface includes different activities such as the main menu, send activity, and receive activity.

The send activity allows users to select a file and perform the grab gesture to initiate the transfer process. The receive activity detects the release gesture and prompts the user to accept or reject the incoming file.

The UI design focuses on clarity and minimal interaction so that the gesture-based experience remains the primary interaction method.

- Backend Logic

The backend logic of the system manages gesture detection, file processing, and network communication between devices. When a user performs a grab gesture, the system detects the gesture using the gesture recognition module and prepares the selected file for transfer.

The system then establishes a connection with the receiver device through socket communication. Once the receiver performs the release gesture and accepts the transfer request, the file is transmitted from the sender device to the receiver device.

- File Transfer Handling

The system supports transferring multiple file types such as images, documents, videos, and audio files. During the transfer process, the file is converted into byte streams and transmitted over the network using socket programming.

Buffering techniques are used to ensure that large files are transferred efficiently without causing application crashes or interruptions.

Main Modules of the System

The Air Bridge system is divided into several functional modules to simplify development and improve maintainability.

- **Gesture Detection Module:** Detects hand gestures using camera input and identifies grab and release

gestures.

- **File Selection Module:** Allows users to select files from the device storage that they want to transfer.
- **File Transfer Module:** Handles wireless communication and transfers the selected file between sender and receiver devices.
- **Receiver Confirmation Module:** Prompts the receiving user to accept or reject the incoming file transfer request.
- **Security Module:** Ensures safe file transfer by implementing encryption and validation mechanisms to protect transmitted data.

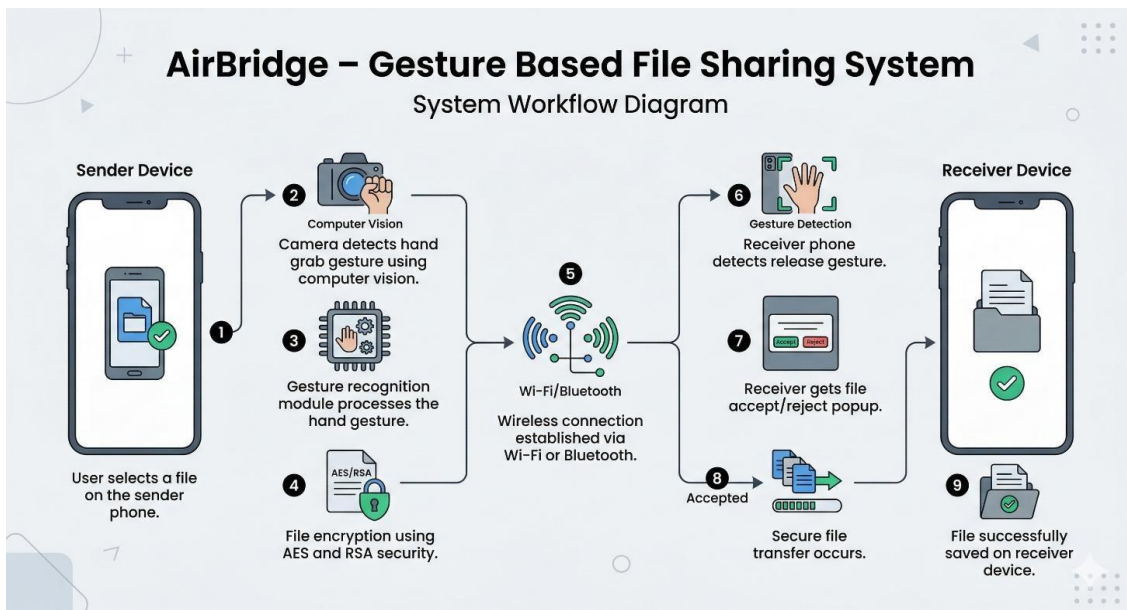


Fig. 1. Work Flow

V. RESULTS

During the development of the Air Bridge system, several tests were conducted to ensure that the application performs efficiently and provides a smooth and reliable user experience. The application was tested by performing gesture-based file transfers between two devices and observing how accurately the system detects gestures and manages the file transmission process. Special attention was given to gesture recognition accuracy, file transfer reliability, and overall system responsiveness.

Each major component of the system, including gesture detection, file selection, transfer initiation, and file receiving confirmation, was tested under different conditions. The grab gesture was used to initiate the file transfer from the sender device, while the release gesture was used on the receiver device to accept the incoming file. The testing results showed that the system was able to detect gestures successfully in most cases and initiate the file transfer process correctly.

Different types of files such as documents, images, videos, and audio files were used during testing to verify the capability of the system to handle multiple file formats. The file transfer process worked efficiently for small and medium-sized files, and the system was able to send and receive files successfully through wireless communication between the devices.

Additional testing was also performed to evaluate system behavior when the receiver does not perform the required gesture within the specified time limit. In such cases, the system correctly cancelled the transfer request and displayed a transfer failure message, ensuring that incomplete transfers are handled safely.

User interaction testing was also conducted to evaluate the usability of the application. Users found the gesture-based file transfer concept innovative and easy to understand. The interface allowed users to quickly initiate file transfers without navigating through complex menus or settings. Overall, the testing results indicate that the

Air Bridge system is capable of providing a simple, interactive, and efficient method for wireless file sharing using hand gestures.

System Performance and Functionality

- During the testing phase, the Air Bridge application performed efficiently and all major components of the system worked together properly. Users were able to navigate between different activities such as the main interface, send activity, and receive activity without encountering technical errors or application crashes.
- The response time of the application was observed to be fast during gesture detection and file transfer operations. When a user performed the grab gesture in the send activity, the system was able to quickly detect the gesture and prepare the selected file for transfer. Similarly, the release gesture performed on the receiver device was detected accurately, allowing the system to proceed with the file reception process.
- The file transfer module successfully transmitted different types of files between devices connected on the same network. Multiple tests were conducted using various file formats such as images, documents, and videos. The system was able to send and receive these files correctly without data corruption.
- The application also handled time-based transfer conditions effectively. When the receiver did not perform the required release gesture within the defined time limit, the system automatically cancelled the transfer request and displayed an appropriate failure message. This ensured that incomplete transfers were handled safely.
- During repeated testing, the application remained stable and responsive while performing gesture detection and file transfer tasks. Overall, the Air Bridge system demonstrated reliable performance and successfully implemented gesture-based wireless file sharing between devices.

Results of the User Interface

1. Homepage (Dashboard)

The homepage of the **Air Bridge application** acts as the main dashboard where users can access all primary features of the system. When the application starts, users are welcomed with a simple and organized interface that displays the connection status, gesture control status, and main file transfer options. The design of the dashboard ensures that users can easily understand how to start sending or receiving files using gesture-based controls.

At the top of the screen, the dashboard displays the **device connection status**, indicating whether another device is connected and ready for file transfer. When the connection is successfully established, a message such as “Device Connected – Ready to Transfer” appears, confirming that the system is prepared for communication between devices.

The homepage also shows that **Gesture Mode is active**, which means the camera-based gesture detection system is enabled. This allows the application to detect hand gestures such as grab and release that control the file transfer process.

The central section of the dashboard provides four main options:

Send – Allows the user to select and send files to another connected device using gesture-based confirmation.

Receive – Enables the device to accept files sent from another user. The system waits for the receiving gesture before completing the transfer.

Files – Displays stored or previously transferred files so users can easily access their data.

Settings – Allows users to configure application preferences such as gesture sensitivity, connection settings, and security options.

At the bottom of the dashboard, a **Recent Activity section** shows statistics related to file transfers, such as the number of files sent and the success rate of transfers. This information helps users track the performance and reliability of the Air Bridge system.

Overall, the homepage is designed to provide quick access to the core features of the application while maintaining a clear and user-friendly interface. Users can easily initiate file transfers, monitor connection

status, and navigate different sections of the system without difficulty.

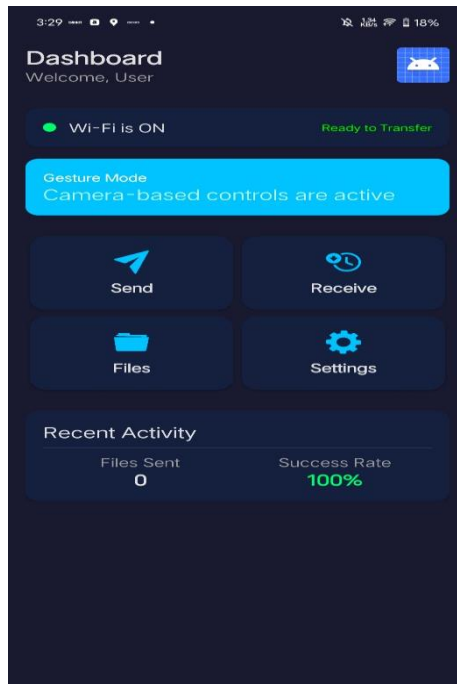


Fig. 2. Homepage

2. Send Transfer Page

The **Send Transfer page** in the Air Bridge application allows users to start sending files to another device using gesture-based control. This page contains a large **"Start Transfer"** button, which begins the transfer process after selecting a file.

The system activates the **camera-based gesture detection**, where the user's hand is detected in real time.

The application waits for a **grab gesture**, which acts as a command to start sending the selected file.

At the bottom of the screen, the interface displays the **selected file name** and a message indicating that the system is **ready to detect the grab gesture**. Once the gesture is detected, the file transfer process begins.

This page provides a simple and interactive way for users to initiate file transfer using hand gestures.

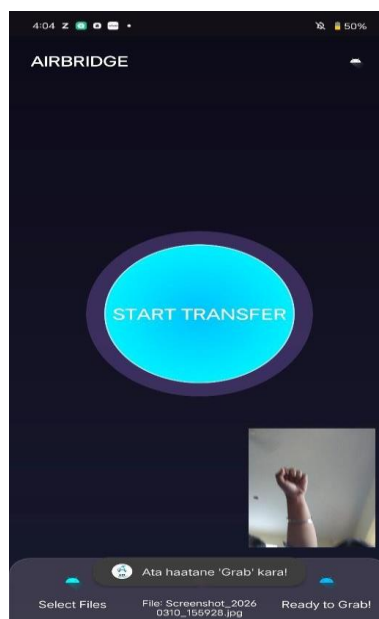


Fig. 3. Send Transfer Page

3. Receive Files Page

The Receive Files page in the Air Bridge application allows users to receive files from another device using gesture-based interaction. On this page, the camera is activated to detect the user's hand gesture in real time.

The system waits for an open hand (release) gesture, which acts as a signal to accept the incoming file. When the open hand is detected, the application automatically completes the file receiving process.

The screen also displays a message such as "Ready to Catch (Hand Open)", informing the user that the system is waiting for the correct gesture to receive the file. This page makes the receiving process simple and interactive by allowing users to accept files using natural hand movements.

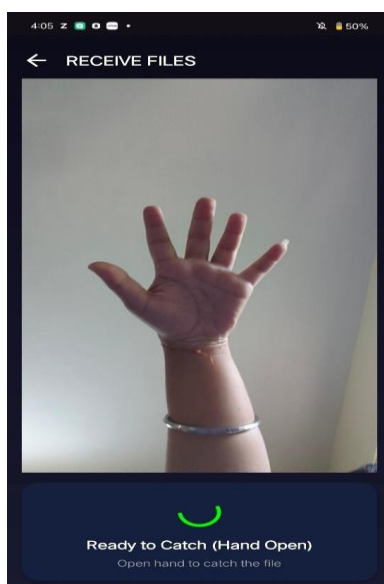


Fig. 4. Receive Files Page

4. Transfer history page

The Transfer history page in the Air Bridge application displays the list of files that have been successfully received from other devices. This page allows users to view and access transferred files easily after the transfer process is completed.

The interface shows the transfer history of received files, helping users keep track of previously shared data. Each received file is displayed with an icon or preview so that users can identify and open it when needed.

This page helps users organize and manage their transferred files efficiently while providing a simple way to review the file transfer history within the Air Bridge system.

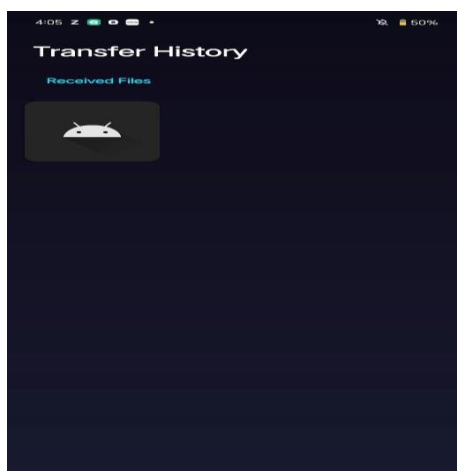


Fig. 5. Transfer history page

5. Settings Page

The Settings page in the Air Bridge application allows users to manage and customize different features of the system. Through this page, users can access Account Settings, where they can view or update their profile information.

The page also provides Transfer Settings, which include options such as Gesture Mode that controls how gesture-based file transfer works in the application. Users can adjust these settings to improve gesture detection and transfer performance.

Additionally, the page includes a Log Out option, allowing users to securely exit the application. The interface is simple and organized so that users can easily manage their preferences and system settings without difficulty.

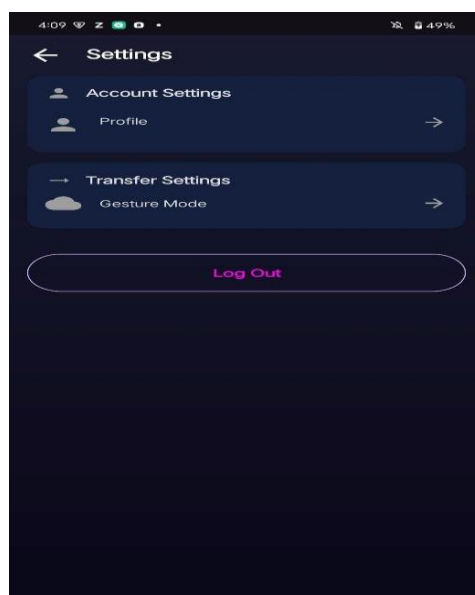


Fig. 6. Settings Page

VI. FUTURE SCOPE

The proposed Air Bridge system provides an innovative approach for transferring files between nearby devices using hand gestures. The system demonstrates how gesture recognition and wireless communication can simplify the file sharing process. However, there are several opportunities for further improvements and enhancements that can increase the efficiency, security, and usability of the system.

One possible improvement is the integration of more advanced gesture recognition techniques. By using improved machine learning models and optimized hand tracking algorithms, the system can achieve higher accuracy in detecting gestures even under challenging conditions such as low lighting or complex backgrounds. This will make the gesture detection process more reliable and responsive.

Another potential enhancement is the expansion of device compatibility. Currently, the system is designed primarily for mobile devices operating within the same network. In future versions, the system can be extended to support communication between different platforms such as smartphones, tablets, laptops, and desktop computers. This would allow users to transfer files seamlessly across multiple devices.

Security improvements can also be incorporated to ensure safe file transmission. Advanced encryption techniques such as RSA key exchange and AES-based encryption can be implemented to protect data during transfer. These mechanisms will help prevent unauthorized access and ensure that sensitive files remain secure while being transmitted between devices. Cloud integration is another possible development for the Air Bridge system. By integrating cloud storage services, users could store transferred files securely in cloud platforms and access them from different devices. This feature would also allow users to maintain backups and share files even when devices are not connected directly. In addition, artificial intelligence techniques can be used to enhance gesture recognition performance and system adaptability. AI models could learn user gesture patterns over time and improve detection accuracy based on user behavior. This would make the system more personalized and

efficient for different users. With these advancements, the Air Bridge system can evolve into a more advanced gesture-controlled file sharing platform that provides fast, secure, and intuitive data transfer between digital devices.

VII. CONCLUSION

This research focused on the design and development of the Air Bridge system, a gesture-based wireless file transfer application that enables users to share files between nearby devices using simple hand gestures. Traditional file sharing methods such as Bluetooth or manual wireless transfer often require multiple steps including device pairing, menu navigation, and confirmation processes, which can be time-consuming and less intuitive for users. The proposed system introduces a more natural and interactive approach by allowing users to initiate file transfer using a grab gesture and complete the receiving process using a release gesture. By integrating computer vision techniques for hand gesture detection with wireless communication technology, the system enables seamless interaction between users and devices. The application was designed with a simple user interface and modular architecture that includes gesture detection, file selection, and wireless data transmission components. Testing results demonstrated that the system is capable of detecting gestures accurately and transferring different types of files such as documents, images, and videos between devices connected on the same network. The implementation of the Air Bridge system shows that gesture-based interaction can simplify the process of wireless file sharing while improving user experience. The system provides a fast, intuitive, and innovative method for transferring data without relying on complex manual operations. With further improvements in gesture recognition accuracy, cross-platform compatibility, and security mechanisms, the Air Bridge concept has the potential to evolve into a powerful and user-friendly solution for modern wireless communication and digital file exchange.

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DESKTOP VIRTUAL ASSISTANT

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ABSTRACT

Artificial Intelligence has notably advanced the interaction between humans and pc systems with the aid of allowing machines to recognize herbal language and voice commands. In traditional computer structures, customers rely specially on keyboard and mouse interactions to carry out duties, which can be time-ingesting and inefficient for repetitive operations. This studies gives the design and implementation of a cozy computing device virtual Assistant that allows customers to govern their pc using voice instructions and text input. The proposed gadget is advanced using Python programming language and integrates numerous technologies such as natural Language Processing (NLP), Speech popularity, and textual content-to-Speech synthesis. The assistant is capable of appearing diverse computer operations including beginning packages including Notepad, Calculator, and Microsoft workplace gear, searching information on Google and Wikipedia, retrieving real-time climate data, dealing with reminders, and sending WhatsApp messages. The machine additionally consists of a safety verification mechanism that requires password authentication before executing touchy instructions. The assistant uses spaCy NLP library for purpose detection and command processing, SpeechRecognition for changing voice enter into text, and pyttsx3 for producing voice responses. A graphical person interface is evolved the usage of Tkinter to allow customers to engage with the assistant without difficulty. The effects obtained at some point of trying out display that the device can recognize voice commands with desirable accuracy and execute computing device obligations successfully. The proposed system improves productivity and presents a more herbal and smart way of interacting with computers.

key phrases: artificial Intelligence, laptop digital Assistant, natural Language Processing (NLP), Speech popularity, Voice Command gadget, desktop Automation, Python Programming, Human laptop interplay.

Keywords: Artificial Intelligence, Desktop Virtual Assistant, Natural Language Processing (NLP), Speech Recognition, Voice Command System, Desktop Automation, Python Programming, Human Computer Interaction.

I. INTRODUCTION

The rapid development of artificial intelligence and computer technology has considerably stepped forward the way human beings engage with machines. historically, computer systems are operated using enter gadgets which includes keyboards and mouse. at the same time as these gadgets are powerful, they require manual interaction which may be time-consuming when appearing repetitive tasks. With the improvement of voice recognition and herbal language processing technologies, computers can now recognize human commands and carry out duties mechanically.

virtual assistants have become increasingly more popular in recent years. applications inclusive of Google Assistant, Amazon Alexa, and Apple Siri allow users to interact with devices the use of voice instructions. those structures reveal the ability of synthetic intelligence in improving human-computer interaction. but, a lot of those assistants in particular focus on cell devices and cloud services, whilst laptop computer systems still depend largely on conventional input methods.

in lots of conditions, users need to perform commonplace operations together with opening packages, looking records on the net, checking the time or climate, and managing reminders. acting those duties manually requires more than one steps and consumes precious time. A laptop-based wise assistant can simplify these procedures through permitting customers to execute commands the usage of voice or textual content input.

The proposed gadget, cozy AI desktop virtual Assistant, is designed to offer a handy and smart way to manipulate computer operations. The assistant is developed the use of Python and integrates technology such as Speech reputation, herbal Language Processing (NLP), and text-to-Speech synthesis. The gadget can apprehend consumer commands and carry out tasks which includes establishing packages, looking the net, retrieving records from Wikipedia, coping with reminders, and supplying weather updates.

Every other essential feature of the device is security verification. certain sensitive commands require password authentication before execution. This guarantees that best authorized users can perform movements consisting of sending messages or putting reminders. The primary objective of this studies is to design and broaden an intelligent computer assistant that improves consumer productivity and simplifies interplay with laptop structures. by way of integrating AI technologies with computer automation, the gadget gives a practical solution for current pc users.

II. METHODOLOGY

To broaden the proposed at ease AI laptop digital Assistant, a structured improvement approach was followed to make certain that the system works correctly and as it should be. rather than without delay beginning with coding, the challenge become divided into several stages including requirement evaluation, machine design, implementation, and trying out.

The main purpose of the technique turned into to design an wise assistant able to understanding consumer instructions and appearing computer operations routinely.

1. Requirement analysis

The first step in developing the machine turned into to understand the requirements and demanding situations involved in desktop automation.

Understanding user needs

Many computer customers carry out repetitive duties including opening packages, looking information at the internet, checking time or weather updates, and managing reminders. these duties generally require more than one guide steps the usage of a keyboard and mouse.

Identifying system requirements

Primarily based on the evaluation of person wishes, the subsequent vital features had been identified for the proposed gadget:

- Voice command popularity
- Textual content-primarily based command enter
- laptop utility manipulate
- internet seek capability
- climate facts retrieval
- Reminder management gadget
- whatsapp message sending characteristic
- security verification for touchy instructions

These features make sure that the assistant can carry out a huge variety of obligations while keeping machine safety.

2. System layout

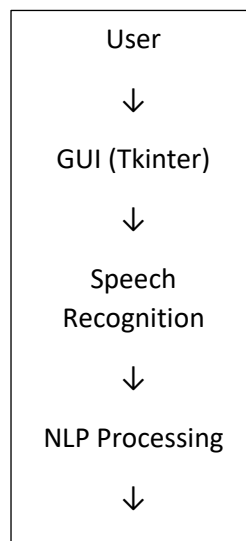
After figuring out the machine requirements, the following step turned into to design the general architecture and workflow of the gadget.

The assistant follows a modular architecture, in which each issue performs a particular assignment. This design makes the gadget less difficult to maintain and improve.

The principle additives of the machine include:

- Voice reputation module
- Herbal language processing module
- Intent detection module
- Command execution module
- Safety verification module
- Graphical consumer interface module

Every module works together to procedure consumer commands and perform the desired actions.



3. Voice popularity Module

The SpeechRecognition library is used to seize voice input from the microphone. This module converts spoken commands into textual content in order that the machine can analyze them.

The system listens to the consumer's voice the usage of the microphone and sends the captured audio to the speech recognition engine, which converts the audio signal into textual information.

This lets in the assistant to recognize commands including:

- "Open YouTube"
- "search Python programming"
- "what is the time"
- "Set reminder at five PM"

4. Natural Language Processing Module

Natural Language Processing is used to investigate and interpret the person's command. The system uses the spacy NLP library to method the input textual content.

The NLP module plays several obligations together with:

- Tokenization
- Lemmatization
- Key-Word Extraction
- Command Evaluation

This enables the system identify the which means of the command and decide the correct motion.

Five Cause detection module

After processing the enter text, the machine determines the consumer's goal. This process is known as motive detection.

The assistant exams for particular keywords and styles within the command to discover what the consumer wants to do.

Examples of detected intents include:

- starting packages
- looking the internet
- Getting climate information
- Retrieving Wikipedia information
- Sending whatsapp messages
- placing reminders

As soon as the reason is detected, the corresponding function is executed.

6. Command Execution Module

The command execution module plays the requested task on the machine.

Python libraries which include os, webbrowser, wikipedia, and requests are used to carry out special operations consisting of:

- establishing applications (Notepad, Calculator, phrase, Excel)
- starting websites like YouTube and Google
- attempting to find information online
- Retrieving climate records the use of APIs

This module connects the assistant with the working device and internet offerings.

7. Protection Verification Module

Safety is an crucial function of the proposed device. Certain touchy instructions inclusive of sending whatsapp messages or placing reminders require authentication.

Earlier than executing such commands, the device asks the user to provide a password.

If the password is correct, the command is accomplished. Otherwise, the machine denies get right of entry to. This mechanism prevents unauthorized customers from performing touchy operations.

Eight. Graphical user Interface

A Tkinter-based totally graphical user interface is evolved to make the assistant person-pleasant.

The interface includes:

- Voice input button
- textual content command input subject
- Command records show
- reput signs

The GUI lets in customers to engage with the assistant easily and reveal the device's responses.

9. Machine Workflow

The running method of the assistant may be summarized as follows:

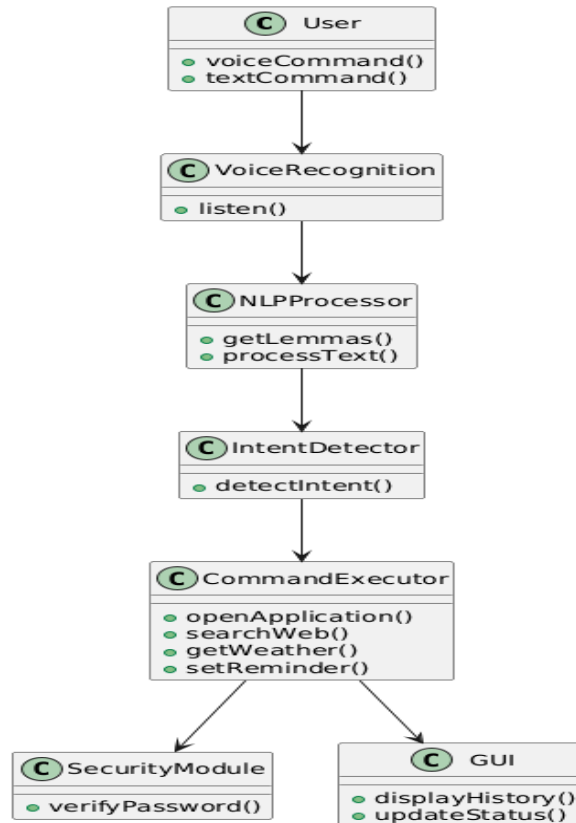
1. Person offers a voice or text command
2. Voice recognition converts speech to textual content
3. Nlp module tactics the command

4. Motive detection identifies the specified movement

5. Command execution module plays the challenge

6. Assistant responds the usage of text-to-speech

This workflow enables clean interplay among the user and the system.



III. MODELING AND ANALYSIS

The modeling and evaluation of the secure AI desktop digital Assistant makes a speciality of knowledge how one-of-a-kind additives of the system have interaction to system consumer instructions and execute responsibilities successfully. The device is designed the usage of a modular architecture where each component performs a selected characteristic to make certain clean conversation between the user and the laptop machine.

1. Gadget Modeling

The system can be modeled as a chain of interconnected modules that method consumer enter and generate the perfect response. the main components concerned within the gadget are:

- Person Interface Module
- Voice popularity Module
- Natural Language Processing Module
- Rationale Detection Module
- Command Execution Module
- Protection Verification Module

The person interacts with the gadget via the graphical user interface using voice or textual content instructions. The voice reputation module converts spoken input into textual facts. this text is then processed the usage of natural Language Processing techniques to extract meaningful keywords.

The intent detection module analyzes the processed text to decide the user's request. based totally at the detected reason, the command execution module performs the desired operation which include commencing packages, looking the internet, retrieving weather data, or placing reminders.

2. Machine evaluation

The machine turned into analyzed based totally on its performance, accuracy, and capability.

Command popularity Accuracy

The speech popularity module correctly converts maximum voice instructions into text with high accuracy while the microphone enter is apparent. the usage of Google's speech recognition service improves the reliability of the voice input processing.

Response Time

The assistant methods commands speedy, usually within a few seconds. This lets in customers to carry out duties correctly with out significant put off.

Undertaking Automation

The assistant can automate numerous commonplace laptop tasks such as:

- starting applications
- looking statistics at the net
- Retrieving Wikipedia summaries
- offering weather updates
- setting reminders
- Sending WhatsApp messages

Safety evaluation

The safety verification module guarantees that touchy commands are executed best after password authentication. This reduces the hazard of unauthorized get right of entry to to certain device capabilities.

3. Performance assessment

The overall performance of the system turned into evaluated thru testing different instructions underneath ordinary running situations. The consequences display that the assistant can successfully interpret person commands and execute the specified operations efficiently.

The modular architecture of the device improves maintainability and scalability, allowing additional capabilities to be integrated within the destiny.

IV. RESULTS AND DISCUSSION

At some stage in the improvement of the cozy AI desktop virtual Assistant, numerous tests had been conducted to verify the capability and overall performance of the gadget. The checking out system targeted on comparing how correctly the assistant recognizes user instructions and how efficiently it performs special computing device operations.

The application changed into examined by using executing numerous voice and textual content commands via the graphical person interface. distinctive modules of the gadget including voice recognition, command processing, software manage, and net search were examined beneath more than one situations.

The consequences received in the course of checking out suggest that the system performs reliably and responds fast to user commands.

4.1 device performance and functionality

At some stage in the checking out phase, the assistant successfully diagnosed and done a wide range of instructions. users were able to engage with the gadget the usage of each voice enter and textual content input.

The following operations were examined effectively:

- starting computing device applications including Notepad, Calculator, Microsoft phrase, Excel, and PowerPoint
- looking facts on Google and retrieving summaries from Wikipedia
- beginning web sites along with YouTube using voice commands
- presenting actual-time weather facts the use of an online API
- setting reminders and notifying the person at the specified time
- Sending WhatsApp messages after password authentication
- looking and commencing files saved at the computer

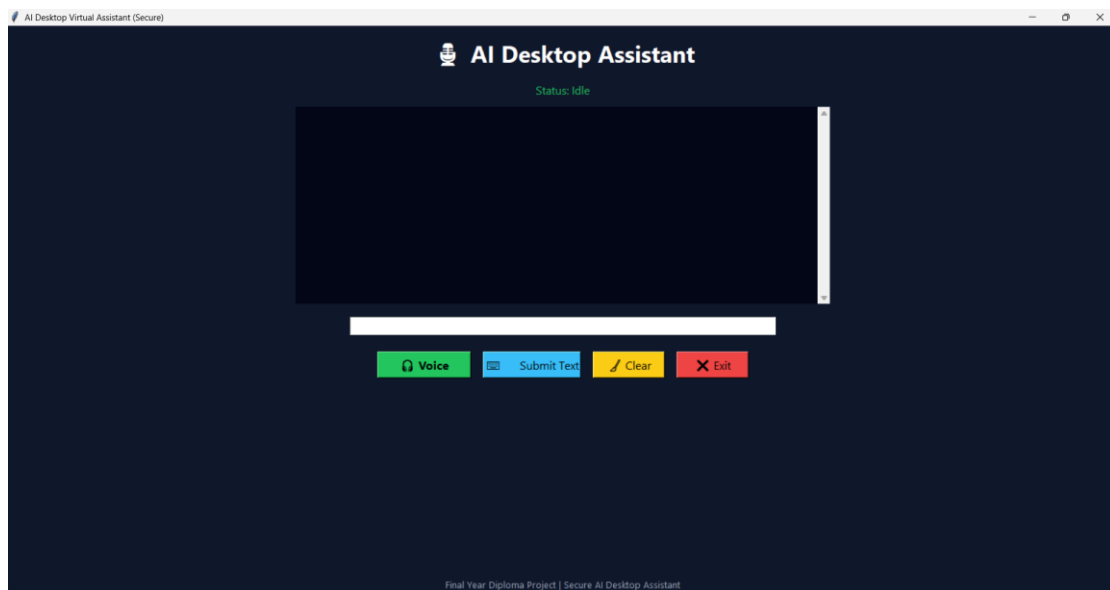
The assistant turned into capable of manner instructions within some seconds, which indicates efficient device overall performance.

4.2 consumer Interface effects

1. Foremost Interface

The principle interface of the assistant is evolved the use of Tkinter GUI. It offers options for voice enter, text command submission, clearing command records, and exiting the software.

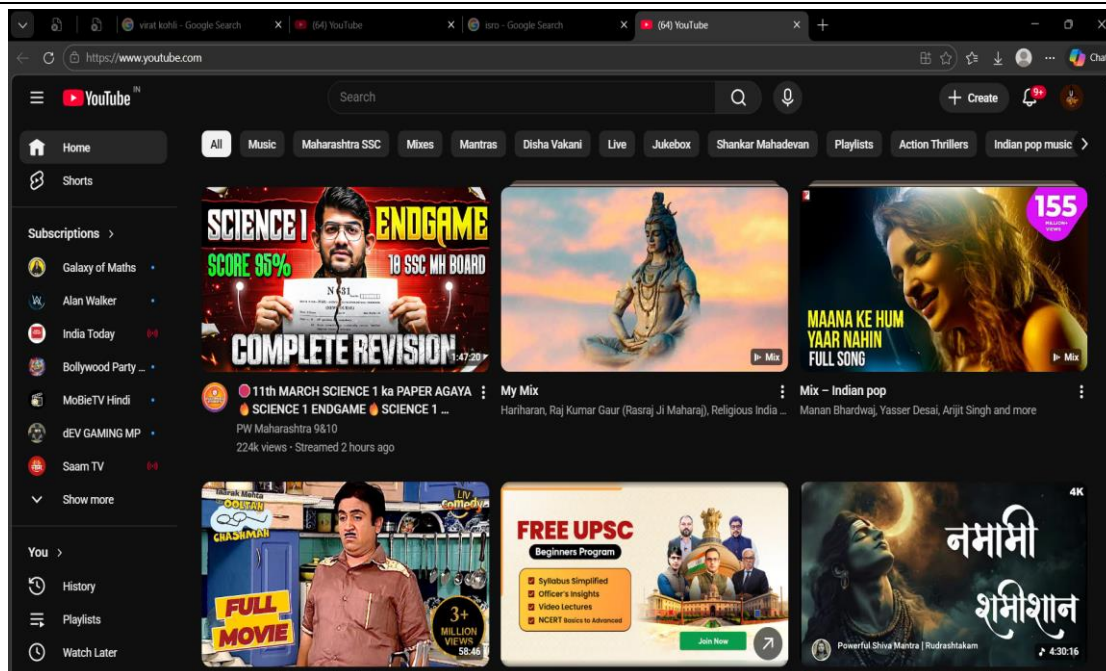
The interface additionally shows command history in order that users can see both their instructions and the responses given via the assistant.



2. Voice Command Processing

When the consumer clicks the Voice button, the gadget starts taking note of the user's voice through the microphone. The voice command is then transformed into text using the speech reputation engine.

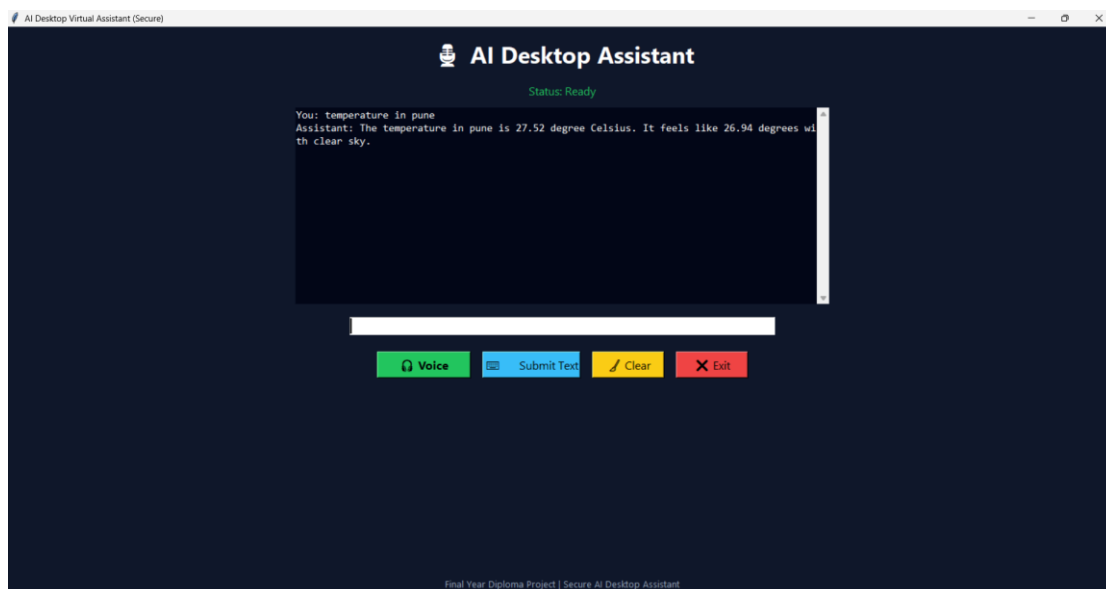
After processing the command, the assistant executes the asked assignment and responds via textual content-to-speech.



3. Temperature data feature

The assistant can offer actual-time temperature updates. while the consumer asks for temperature data, the system retrieves the temperature, climate situation, and different info for the desired metropolis.

Average, the testing outcomes exhibit that the AI laptop virtual Assistant presents an efficient and consumer-pleasant manner to engage with the computer machine.



V. CONCLUSION

This research presented the layout and implementation of a relaxed AI computing device virtual Assistant that permits customers to control their computer systems using voice and textual content commands. The gadget integrates technologies along with speech reputation, natural language processing, and computer automation to create an smart and interactive surroundings.

The assistant can carry out several operations consisting of establishing packages, looking the internet, retrieving facts from Wikipedia, checking weather updates, placing reminders, and sending WhatsApp

messages. The system additionally includes a password-primarily based security mechanism to prevent unauthorized access to touchy instructions.

The trying out consequences show that the device performs successfully and provides a handy way for users to interact with their computer systems. via reducing the want for guide input and simplifying habitual obligations, the assistant improves productivity and complements user enjoy.

Ordinary, the proposed system demonstrates how artificial intelligence technology may be correctly used to create sensible computer automation systems.

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DEVELOPMENT OF A CAR SERVICE BOOKING SYSTEM

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ABSTRACT

The increasing demand for efficient vehicle maintenance services has led to the development of digital platforms that simplify appointment scheduling and service management. This paper presents the design and development of a Car Service Booking System using React for the frontend, Node.js with Express for the backend, and MySQL as the database. The system allows users to view available car services, select multiple services, schedule appointments, and track booking history. Additionally, an administrative panel is provided to manage services and appointments effectively. The system improves service accessibility, reduces manual booking processes, and enhances overall customer experience. The developed platform demonstrates how modern web technologies can be integrated to build scalable and user-friendly service management systems.

Keywords: Car Service System, Web Application, React, Node.js, MySQL, Appointment Management.

I. INTRODUCTION

In recent years, the rapid advancement of information technology and internet-based services has significantly transformed the way businesses operate and interact with customers. Many traditional service-based industries are now shifting toward digital platforms to improve efficiency, convenience, and customer satisfaction. One such sector that benefits greatly from digital transformation is the automobile service industry.

Car servicing is an essential activity for maintaining the performance, safety, and longevity of vehicles. Traditionally, customers were required to visit service centers physically or make phone calls to schedule appointments. This manual process often leads to several issues such as long waiting times, poor communication between customers and service providers, difficulty in tracking service records, and inefficient management of appointments.

To address these challenges, an online **Car Service Booking System** has been developed. The system provides a web-based platform where users can easily view available car services, select required services, and book appointments according to their preferred date and time slot. By digitizing the service booking process, the system simplifies appointment management for both customers and service providers.

The developed system uses modern web technologies such as **React for frontend development, Node.js with Express for backend functionality, and MySQL for database management**. These technologies together enable the development of a responsive, scalable, and efficient web application.

The system also includes an **administrative module** that allows service center administrators to manage services and appointments. Through the admin dashboard, administrators can add new services, update existing services, and monitor customer appointments. This improves the operational efficiency of the service center.

The main objective of this project is to design and develop a user-friendly platform that simplifies the process of car service booking while improving service management and customer satisfaction.

II. SYSTEM ARCHITECTURE

The Car Service Booking System follows a **three-tier architecture** consisting of the frontend layer, backend layer, and database layer.

1. Frontend Layer

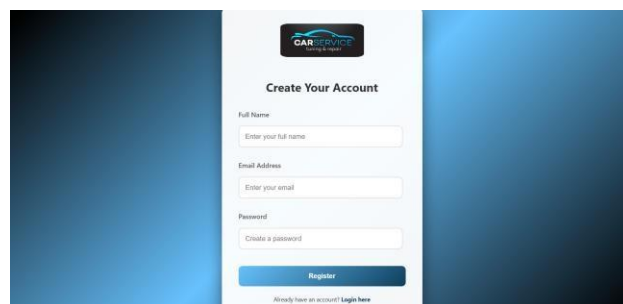
The frontend of the application is developed using **React**, a popular JavaScript library used for building interactive user interfaces. React enables the creation of reusable components that help in organizing the application structure efficiently.

The frontend is responsible for displaying service information, booking forms, appointment history, and administrative dashboards. It communicates with the backend using REST API requests.

Key frontend features include:

- User registration and login interface
- Services listing page with service details
- Booking appointment page
- Appointment history page
- Admin dashboard interface

React provides a responsive and dynamic interface that improves user experience.



2. Backend Layer

The backend of the system is developed using **Node.js and Express.js**. Node.js allows the execution of JavaScript on the server side and is widely used for building scalable web applications.

Express.js is a lightweight web framework that simplifies the development of server-side logic and API routes.

The backend performs the following tasks:

- Handling user authentication
- Managing service information
- Processing booking requests
- Updating appointment status
- Connecting with the MySQL database The backend acts as an intermediary between the frontend interface and the database.

3. Database Layer

The database used in the project is **MySQL**, a relational database management system widely used for web applications.

The database stores all important information such as user details, service information, appointment records, and service selections. Main database tables include:

- Users
- Services
- Appointments
- Appointment_Services

The database ensures proper storage and retrieval of data required by the application.

III. SYSTEM IMPLEMENTATION

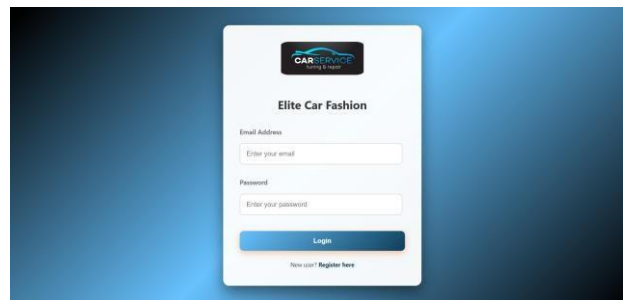
The system is implemented using a full-stack web development approach where the frontend, backend, and database work together to provide complete functionality.

User Module

The user module provides features that allow customers to interact with the system and book car service appointments.

Key features of the user module include:

User Registration and Login



Users can create an account by providing their name, email, and password. Once registered, users can log in to access the system.

Viewing Available Services

Users can browse the list of available car services along with details such as service name, price, category, and image.

Multi-Service Booking

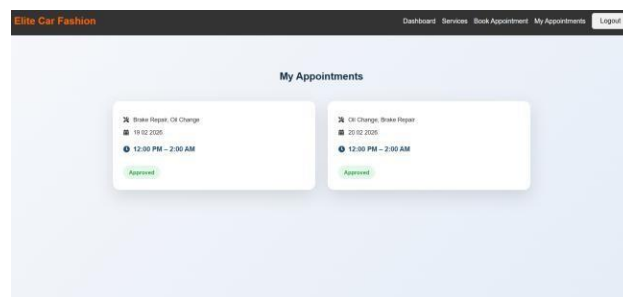
The system allows users to select multiple services in a single booking. For example, a user can choose oil change, car washing, and engine inspection together.

Appointment Scheduling

Users can select their preferred date and time slot for booking the service. The system records the appointment details in the database.

Appointment History

Users can view all their previous appointments along with the service details and booking status.



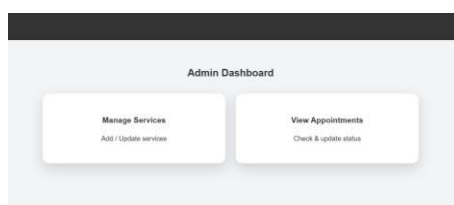
Cancel Appointment

Users can cancel their appointment if required. The appointment status is updated accordingly in the database.

Admin Module

The admin module is responsible for managing the system and controlling service operations.

Admin Dashboard



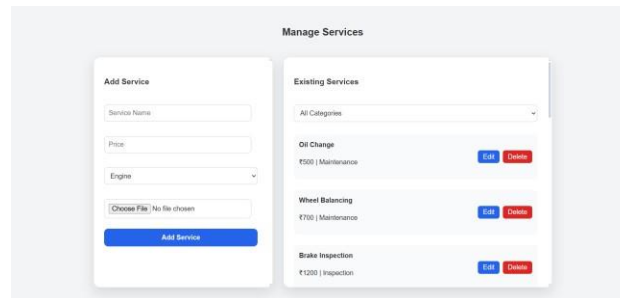
The admin dashboard provides an overview of system activities including services and appointments.

Add Service

The administrator can add new services by entering service details such as service name, price, category, and image.

Update Service

Existing services can be modified or updated by the administrator whenever required.



Appointment Management

The admin can view all customer appointments and update their status such as:

- Pending
- Approved
- Completed
- Cancelled

This helps the service center manage customer bookings efficiently.

IV. DATABASE DESIGN

The database is designed using MySQL and includes the following tables:

Users Table

Stores user account information. Fields:

- id
- name
- email
- password

Services Table Stores service details. Fields:

- id
- service_name
- price
- category
- image

Appointments Table

Stores booking details. Fields:

- id
- user_id
- date

- time_slot
- car_model
- status

Appointment_Services Table

Handles multiple service selections for one appointment.

Fields:

- id
- appointment_id
- service_id

V. RESULTS AND TESTING

The developed system was tested under different scenarios to ensure its functionality and reliability.

The following tests were performed:

- User registration and login validation
- Display of services from the database
- Multi-service selection during booking
- Appointment creation and storage in database
- Appointment cancellation functionality
- Admin service management operations
- Admin appointment status updates

The testing process confirmed that the system performs all intended functions correctly. The integration between the frontend, backend, and database works smoothly, ensuring proper data flow and system stability.

The user interface was designed to be simple and easy to use so that customers can quickly navigate through the system and book services without difficulty.

VI. CONCLUSION

The Car Service Booking System successfully demonstrates how modern web technologies can be used to develop an efficient and user-friendly service management platform.

The system simplifies the process of booking car service appointments by allowing customers to select services, choose convenient time slots, and track their bookings online. The administrative dashboard enables service providers to manage services and appointments effectively.

By integrating **React, Node.js, Express, and MySQL**, the project provides a scalable and reliable web application that improves the overall service booking experience.

The project also provided valuable learning experience in full-stack web development including frontend design, backend API development, database management, and system integration.

VII. FUTURE SCOPE

The system can be further improved by adding additional features such as:

- Online payment integration
- Email or SMS notifications for booking confirmation
- Mobile application support
- Real-time service slot availability
- Customer feedback and rating system

- Integration with vehicle maintenance history

These enhancements can make the system more advanced and beneficial for both customers and service providers.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to my project guide **Mrs. Dhalpe S. B.** for their valuable guidance, encouragement, and continuous support throughout the development of this project titled **“Car Service Booking**

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AI HEALTHCARE ASSISTANT

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ABSTRACT

This paper introduces an AI Healthcare Assistant, a smart system created to give users health-related information and basic medical advice. In order to help patients comprehend symptoms, obtain medical advice, and manage their personal health records, the system combines artificial intelligence, natural language processing, and medical databases. The suggested system seeks to offer immediate medical assistance and lessen hospital workload. Symptom analysis, AI chatbot interaction, health report management, and tailored health recommendations are just a few of the features offered by the application.

Additionally, the deployment of such intelligent healthcare systems can help lower hospital workloads, minimize needless visits for minor health issues, and raise user awareness of health issues. The suggested remedy shows how artificial intelligence can help contemporary healthcare systems and improve patient satisfaction by providing digital support.

Keywords: Healthcare System, Web Application, React, Node.js, MongoDB, Artificial Intelligence.

I. INTRODUCTION

Access to healthcare is still a major problem in many parts of the world, especially in rural and underdeveloped areas where there are few medical professionals and facilities. Due to lengthy wait times, expensive consultation fees, and a lack of healthcare professionals, many people struggle to get timely medical advice. Patients frequently put off getting medical attention as a result, which can exacerbate existing health issues. Intelligent healthcare systems are becoming a viable way to increase healthcare efficiency and accessibility due to the quick development of digital technologies and artificial intelligence.

This system's primary goals are to help users better manage their healthcare information, raise health awareness, and offer prompt and easily accessible medical assistance. In addition, the AI Healthcare Assistant seeks to assist users in spotting potential health problems early on and motivate them to seek expert medical assistance when needed. The system helps to increase access to healthcare and decrease unnecessary hospital stays for minor health issues by offering immediate advice and health recommendations.

II. LITERATURE SURVEY

The use of artificial intelligence (AI) in healthcare is growing in order to enhance medical services and offer prompt medical assistance. AI-based systems that assist users in comprehending symptoms and providing basic medical advice have been created by numerous researchers. AI healthcare chatbots that use Natural Language Processing (NLP) to interact with users and respond to inquiries about health are the subject of several studies. Healthcare workers' workloads are lessened by these systems, which offer prompt responses. Symptom analysis systems that forecast potential illnesses based on user symptoms are the subject of additional research. These studies demonstrate how AI-based healthcare systems can increase healthcare accessibility and give users quicker medical assistance.

III. PROBLEM STATEMENT

Due to a lack of medical professionals, lengthy wait times, and a lack of healthcare facilities, people in many areas struggle to get timely healthcare services. Due to time constraints, high medical costs, or ignorance of their health conditions, many people frequently overlook minor symptoms or put off seeing a doctor. Therefore, if minor health problems are not detected early, they could develop into major issues.

An intelligent system that can swiftly and effectively deliver basic medical advice and health-related information is required given the quick development of digital technology. Nevertheless, the majority of current healthcare platforms either don't offer interactive support to help users understand their symptoms or require direct consultation with a physician.

The main problem is the lack of a simple and accessible platform where users can easily describe their symptoms, receive basic health suggestions, and manage their health information. Therefore, the development of an AI Healthcare Assistant aims to address this issue by providing an intelligent system that allows users to interact with an AI chatbot, analyze symptoms, and receive preliminary health advice. This system helps improve healthcare accessibility, increases health awareness, and supports users in making informed decisions about their health.

IV. METHODOLOGY

The methodology for the AI Healthcare Assistant system outlines the steps taken to design, develop, and implement the system. We use a structured approach to ensure efficient functionality and accurate responses for users looking for healthcare information.

1. Requirement Analysis

In the first stage, we analyze the system's requirements. The goal is to identify the main features needed for the AI Healthcare Assistant. These include user registration, login functionality, chatbot interaction, symptom analysis, and health information management. The system should be user-friendly and able to provide quick responses to inquiries.

2. System Design

After analyzing the requirements, we plan the system architecture and design. The system follows a client-server model where the user interacts with the application through a web interface. The design includes several modules: the user interface module, AI processing module, backend server, and database system. Each module has specific tasks within the system.

3. Data Collection and Preparation

We collect medical knowledge and healthcare-related information from reliable sources to build the system's knowledge base. The collected data is organized and processed so the AI model can understand user queries and provide suitable responses.

4. AI Model Development

The AI module is the core of the system. It uses Natural Language Processing (NLP) to interpret user input. The chatbot analyzes the text entered by the user, picks out keywords related to symptoms or health conditions, and generates relevant responses based on the knowledge base.

5. System Implementation

We implement the system by integrating the frontend, backend, AI module, and database. The frontend interface enables users to interact with the system, while the backend handles user requests and communicates with the AI module. The database stores user information, chat history, and health-related data.

6. Testing and Evaluation

Once implemented, we test the system to ensure it functions correctly. We use various test cases to check the chatbot's responses, symptom analysis, and data storage capabilities. This helps identify errors and enhances the system's performance.

7. Deployment

Finally, we deploy the system as a web-based application for easy access. This allows users to interact with the AI Healthcare Assistant and receive quick healthcare guidance. This methodology ensures that we develop the AI Healthcare Assistant systematically, providing reliable and efficient healthcare support to users.

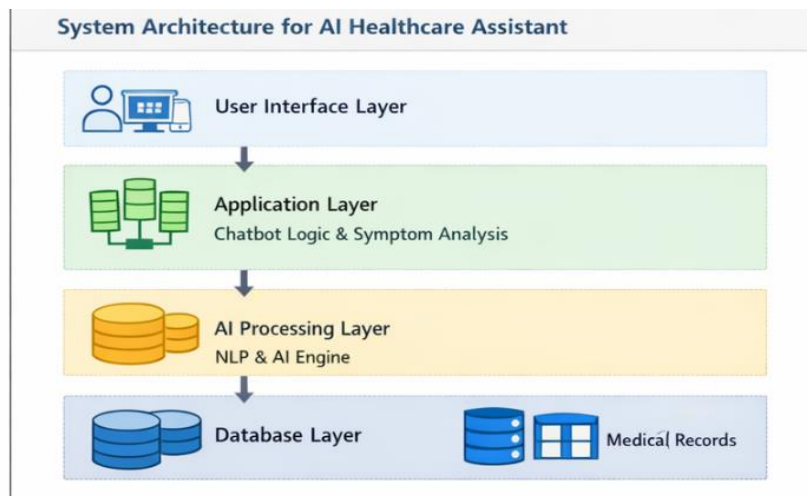


Fig 1: System Architecture

V. SYSTEM ARCHITECTURE

The AI Healthcare Assistant runs on a client-server setup. Users jump in through a web interface, while the backend handles everything else—AI, databases, the works. The whole thing's split into layers to keep things running smoothly and make the experience easy for users.

1. User Interface Layer

This is where users actually use the system. They can sign up, log in, ask health questions, or check symptoms—all through a clean, straightforward web interface. The design uses up-to-date web tech, so it's easy to get around and works well for everyone.

2. Application Layer

Here's where most of the action happens. This layer takes user requests and connects the frontend with the backend. It covers things like chatbot conversations, analyzing symptoms, and making sure users are who they say they are.

3. AI Processing Layer

This is where the brains are. The AI processing layer relies on artificial intelligence and natural language processing to understand what users are asking and to generate helpful responses. The chatbot looks at each question, taps into its medical knowledge and models, and gives health advice that fits the situation.

4. Database Layer

All the important data—user info, health questions, chat logs, and medical suggestions—lives here. The database is locked down for security and organized so the system can pull up what it needs quickly and safely.

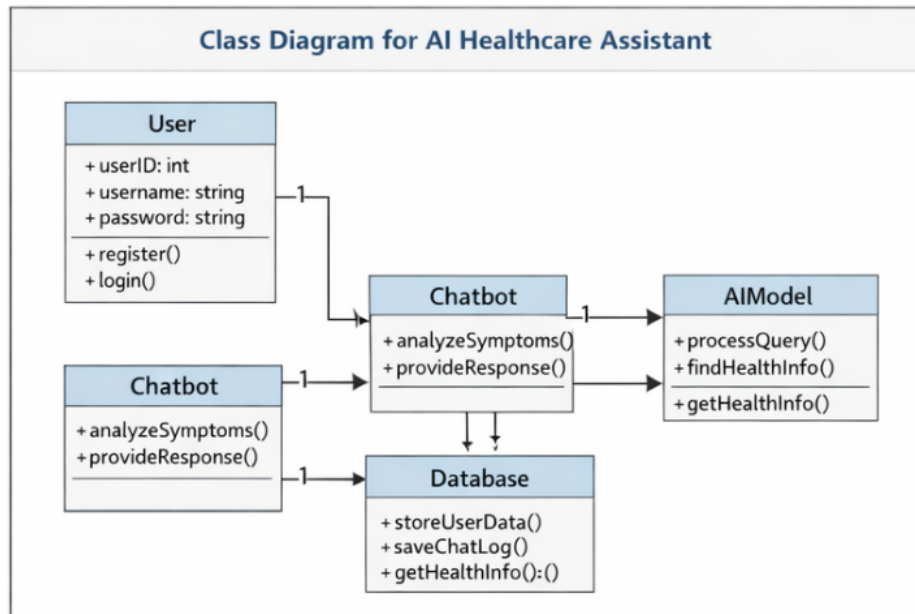


Fig 2: Class Diagram

VI. SYSTEM IMPLEMENTATION

What is AI Healthcare Assistant? What Is an AI Healthcare Assistant? AI healthcare assistant is a web-based application that is integrated with a user interface, a backend server, an AI module and a database. You just go to the website, enter your symptoms or health questions and the website is simple and user-friendly. As soon as you submit a health question, the backend server picks it up. It takes your input and sends it to the AI module and that is where the AI works its magic.

The AI processes what you are saying by using NLP and produces a helpful healthcare response. Meanwhile, it writes your information and your chat conversation in a database. That way, it remembers you and your previous questions so that it can improve its responses the next time it helps you. Everything is in sync and you don't have to wait.

Your health question is passed from your interface to the server and from there to the AI. The answer comes back to you. It is a fast response with the aim to provide you with a reliable source on the simplest of common health issues and symptoms.

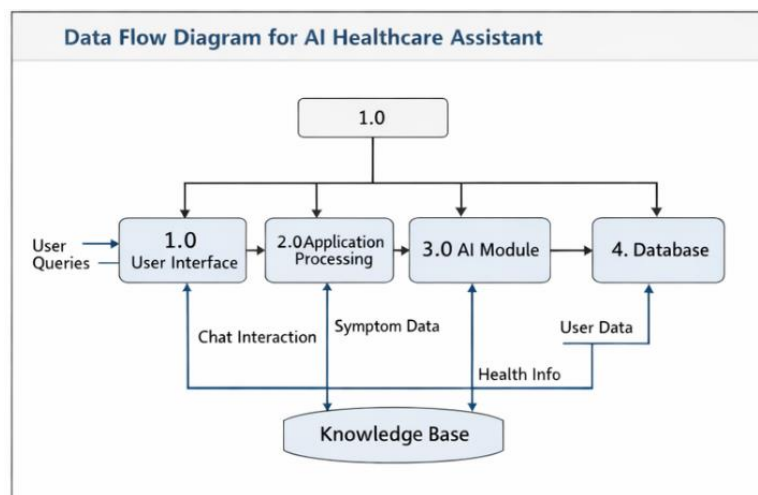


Fig 3: Data Flow Diagram

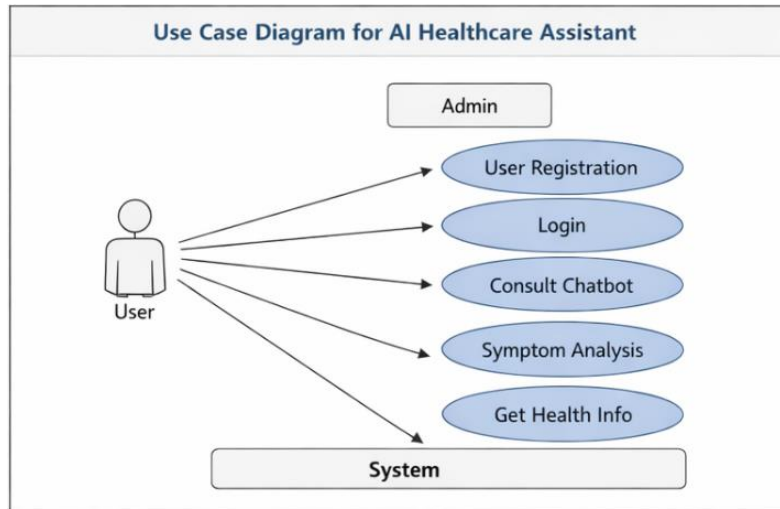


Fig 4: Use-case Diagram

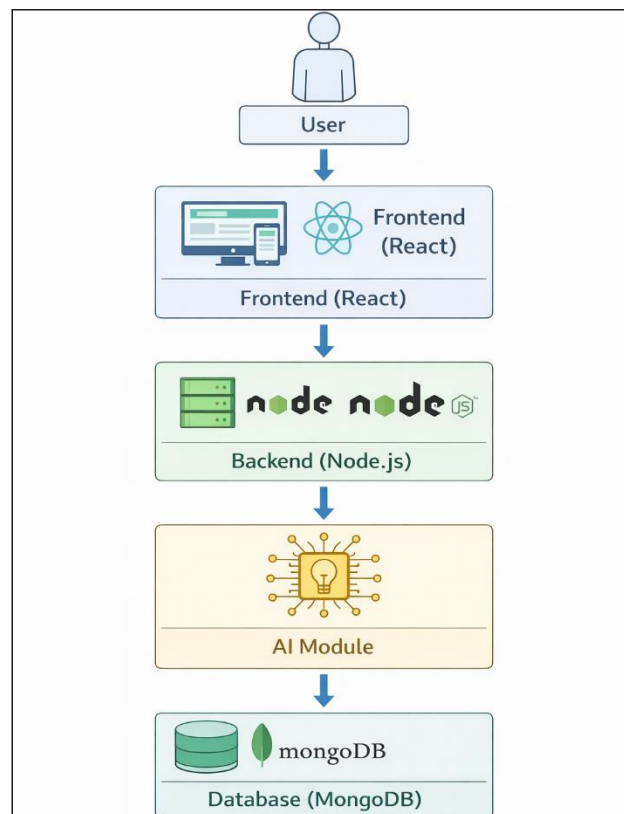


Fig 5: Application Workflow

VII. RESULTS

The AI Healthcare Assistant system was developed and tested to determine its performance, usability and efficiency in providing basic healthcare information. The results indicate that the system can effectively provide assistance to users by generating quick responses to their healthcare queries and explain possible symptoms in a simple and clear way.

The system was tested with various types of user inputs such as general healthcare questions and symptom descriptions. The AI chatbot was able to process the user queries using Natural Language Processing (NLP)

techniques and provide appropriate response based on the knowledge base. The response time of the system was fast, which can provide users with quick assistance and improved user experience and accessibility.

The system was also tested with the functionality of symptom analysis. Users entered their symptoms such as fever, headache, cough and body pain. The AI module was able to infer possible health conditions and provide general health advice and precautionary measures for the user. This feature can provide users with basic understanding of their health condition and prompt them to seek professional medical advice if needed.

The database module was used to store user data and chat history. All interactions between the user and the system were stored and users can refer to the stored data for previous recommendations and advice. This feature can also improve the efficiency of the system by providing data for future system analysis and improvement. The user interface was designed to be simple and user-friendly for individuals with basic computer knowledge. Users can easily enter their queries and receive the response in a clear and organized way. The testing results indicate that most users were able to interact with the system without any difficulty.

User feedback collected during testing indicated that the AI Healthcare Assistant is helpful for obtaining quick health guidance and general medical information.

Table 1: Sample Output Table

Test Input	System Response	Result
Fever	Suggested rest and hydration	Correct
Headache	Suggested general medication advice	Correct
Cough	Suggested warm fluids	Correct

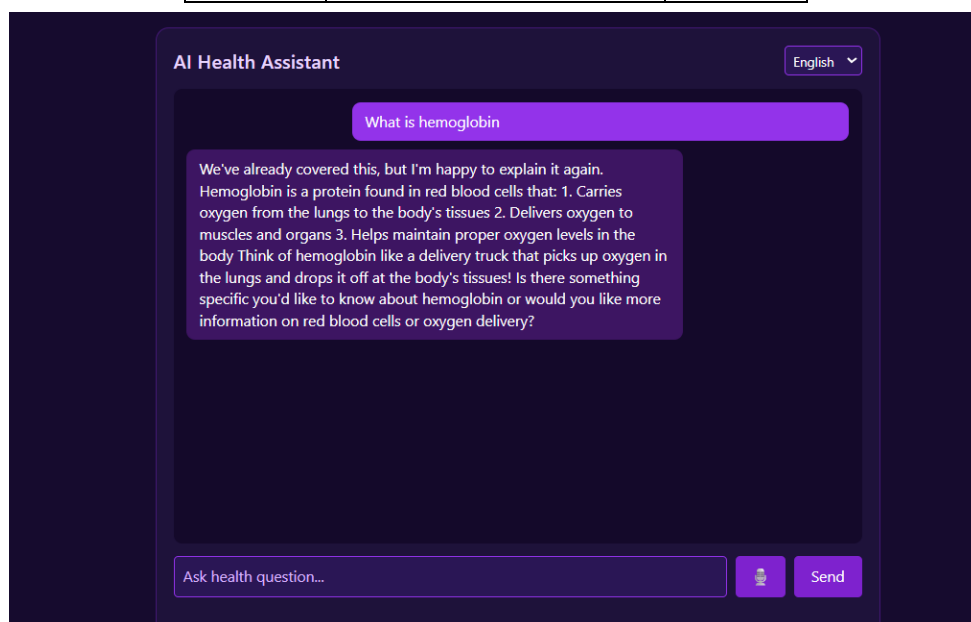


Fig 6: Chat Assistant

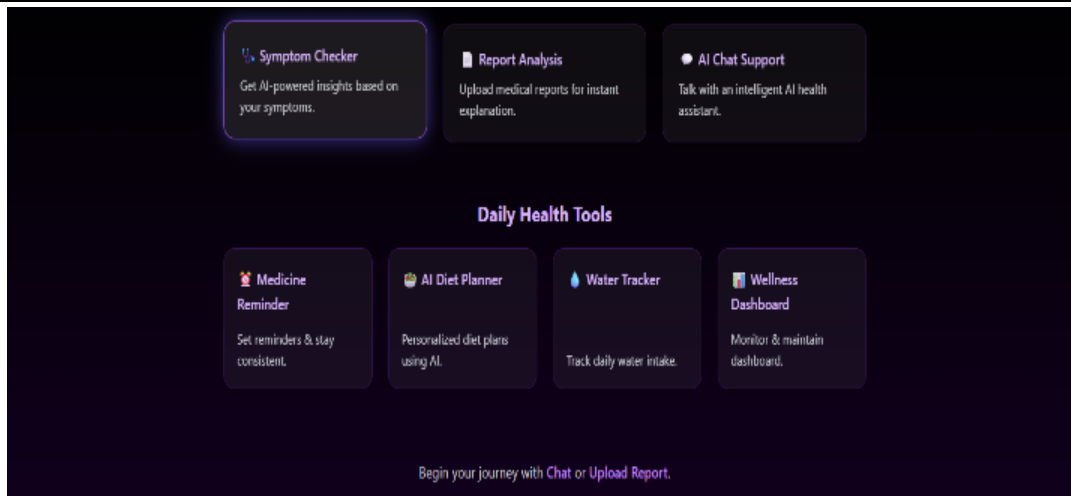


Fig 7: User Interface

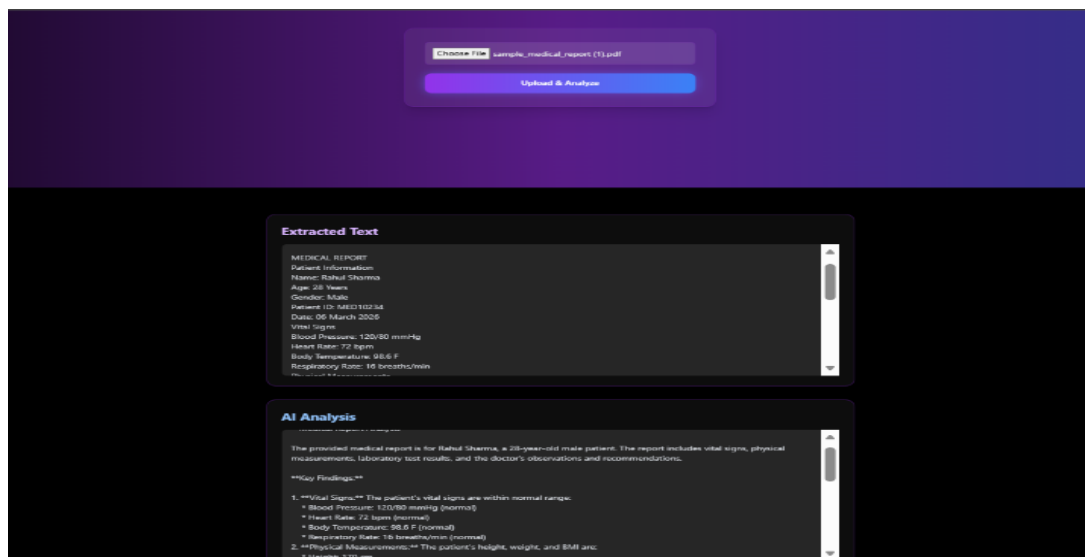


Fig 8: Report Analyzer

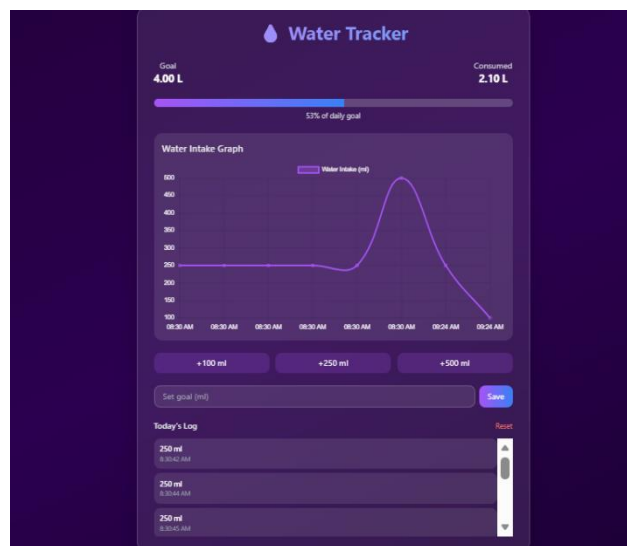


Fig 9: Water Tracker

VIII. CONCLUSION

Artificial Intelligence and Natural Language Processing (AI & NLP) Based Healthcare Assistant System. Artificial Intelligence (AI) and Natural Language Processing (NLP) Technologies have the potential to provide simple and easy access to basic information and guidance in health care. The proposed AI Healthcare Assistant system can meet the user queries with the required feedback on symptoms and general health information. It improves awareness and accessibility to health care. Users can receive basic medical advice and does not have to visit the hospital right away. The AI Healthcare Assistant system stores user data and chat history for better interaction with users and future support.

IX. FUTURE SCOPE

The proposed AI Healthcare Assistant system can be further enhanced by integrating it with more advanced features and technologies. In the future, the system can be utilized with sophisticated machine learning models for more precise symptom analysis and customized health advice. Such enhancements can aid the system in comprehending user inquiries more effectively and produce more dependable health recommendations. Furthermore, the system can be developed to support voice-based interaction, enabling users to converse with the assistant using spoken language. The system can be integrated with wearable health monitoring devices such as smartwatches to track real-time health data including heart rate, blood pressure, and activity levels. This can enable the system to offer continuous health monitoring and early warnings for potential health hazards.

Moreover, the system can be linked with online doctor consultation services, allowing users to book appointments or consult medical professionals directly when required. This integration can make the system more beneficial and user-friendly for individuals who seek professional medical advice following initial guidance from the AI assistant.

In the future, the system can also incorporate features such as multilingual support to accommodate users from various regions who can interact with the assistant in their native language. More sophisticated data analytics can also be applied to examine user health trends and provide more effective preventive healthcare recommendations. With continuous updates and improvements, the AI Healthcare Assistant can evolve into a more dependable and comprehensive digital healthcare support system that assists both patients and healthcare professionals.

ACKNOWLEDGMENT

I would like to express my sincere gratitude to my project guide Ms. Supriya S. Kale, for their valuable guidance, encouragement, and continuous support throughout the development of this project titled "AI Healthcare Assistant." Their insights and suggestions helped me understand the project requirements clearly and complete the work successfully.

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AI VIRTUAL ASSISTANT: SIPHRA

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ABSTRACT

AI virtual assistants are intelligent software systems that use artificial intelligence to understand and respond to user requests through natural language interaction. They assist users in performing tasks such as answering questions, managing schedules, and retrieving information. With the advancement of Natural Language Processing, virtual assistants have evolved from basic chatbots into more capable systems that can interact with multiple applications and services. The AI virtual assistant developed in this project includes several enhanced features designed to improve user interaction and functionality. The system provides customizable voice options and customizable visual interfaces, allowing users to personalize their experience even in offline mode. It also supports automated email sending through prompt based commands and integrates payment functionality for performing digital transactions. These capabilities make the assistant more flexible, interactive, and practical for everyday digital tasks.

Keywords: Artificial Intelligence, Virtual Assistant, Natural Language Processing, Customizable Voice, Email Automation, Payment Integration.

I. INTRODUCTION

In today's digital era, intelligent technologies are becoming an essential part of everyday life. Artificial Intelligence has significantly transformed the way people interact with software systems and digital services. One of the most impactful developments in this field is the emergence of AI based virtual assistants. An AI virtual assistant is an intelligent software system designed to assist users by understanding their commands and providing relevant responses or performing tasks automatically. These assistants rely on technologies such as natural language processing, machine learning, and speech recognition to interpret user inputs and deliver appropriate outputs in a conversational manner.

AI virtual assistants enable more efficient communication between humans and machines by understanding both text based and voice based instructions. Natural language processing allows the system to analyze and interpret user queries, making interactions more natural and user friendly.

Such assistants can perform a variety of tasks including retrieving information, managing schedules, automating digital processes, and supporting users in completing everyday activities. As a result, they are increasingly being adopted in various domains such as customer support, education, business automation, and personal productivity.

The AI virtual assistant developed in this project focuses on enhancing user interaction through advanced and customizable features. The system provides customizable voice options and customizable visual representations, allowing users to personalize their interaction experience. In addition, the assistant supports prompt based email automation, enabling users to send emails directly through simple commands. The system also integrates payment functionality, allowing users to perform digital transactions in a convenient and efficient manner. These capabilities make the assistant more flexible and practical for real world applications.

Many modern digital platforms already use AI assistants to improve user convenience and automate tasks. Well known examples include Amazon Alexa, Apple Siri, Google Assistant, Samsung Bixby, and Microsoft Copilot. These systems demonstrate how AI powered assistants are becoming an integral part of both personal and professional environments.

II. LITERATURE SURVEY

Several researchers have explored the development of Artificial Intelligence based virtual assistants to improve human-computer interaction and automate daily tasks. Traditional software systems often require manual input and predefined commands, which limits their ability to understand user intentions. To overcome these limitations, modern virtual assistants integrate technologies such as Natural Language Processing (NLP), Machine Learning (ML), and speech recognition to enable more intelligent and interactive communication between humans and machines.

Many studies have proposed voice-enabled virtual assistant systems that allow users to perform tasks using spoken commands. These systems are capable of recognizing speech, converting it into text, analyzing the user's intent, and generating appropriate responses. Researchers have also focused on integrating assistants with web services and applications to perform tasks such as retrieving information, managing schedules, controlling devices, and sending notifications.

Recent advancements have introduced context-aware and personalized virtual assistants that learn from user interactions and adapt their responses accordingly. These systems use machine learning algorithms to analyze user behavior and improve their accuracy over time. Some modern assistants also support multilingual communication, voice synthesis, and smart device integration, making them more versatile and user-friendly.

Although existing virtual assistant technologies provide many useful features, several challenges still remain. Many systems struggle with accurately understanding complex user queries, maintaining contextual conversations, and ensuring data privacy. Therefore, there is a need to design a more efficient and intelligent virtual assistant system that can provide reliable responses, improve user productivity, and deliver a seamless interaction experience.

III. PROBLEM STATEMENT

The proposed AI Virtual Assistant is designed to provide intelligent and user-friendly support for performing daily digital tasks. Unlike traditional assistants that mainly focus on general commands, the proposed system introduces several additional features to improve usability, personalization, and efficiency. The main objective of the system is to simplify human-computer interaction through voice and text communication while providing helpful assistance to users.

One of the key features of the proposed system is the development of a personalized assistant for students and general users. The assistant can help users manage their daily schedules, set reminders for important tasks such as study sessions or meetings, and provide quick answers to informational queries. This functionality improves productivity and helps users manage their time more effectively.

Another important feature is multilingual support, which enables the assistant to understand and respond to user queries in more than one language. This improves accessibility and allows users to interact with the assistant in their preferred language, making the system more inclusive and user-friendly.

The system also supports both voice and text interaction. Users can communicate with the assistant by speaking commands or typing queries. The speech recognition module converts spoken input into text, while the natural language processing module analyzes the command and determines the appropriate response. This dual interaction method provides flexibility and improves the overall user experience.

In addition, the assistant includes task automation capabilities that allow it to perform routine computer operations such as opening applications, searching information on the internet, setting reminders, or playing media files. By automating repetitive tasks, the system reduces manual effort and improves efficiency.

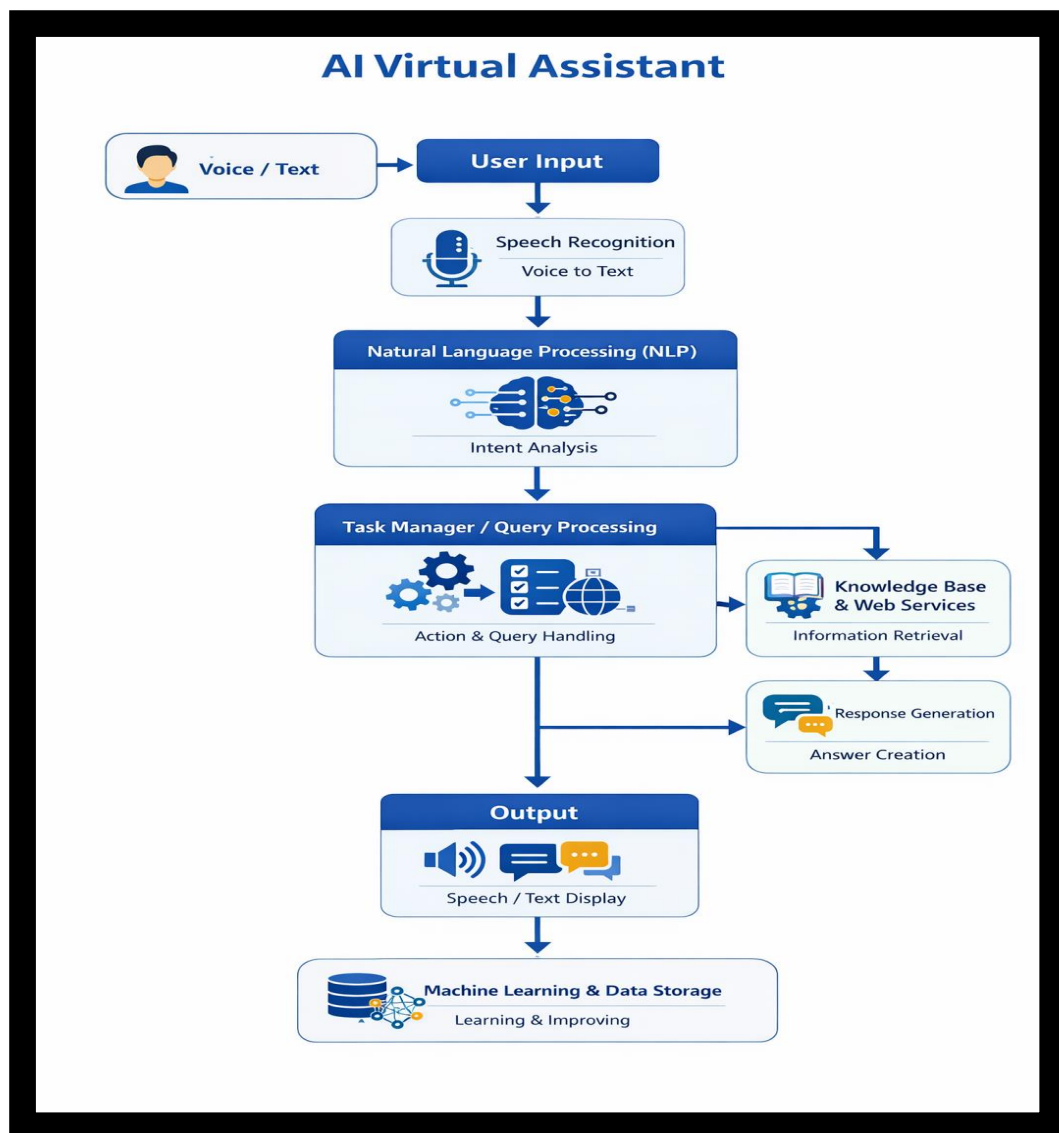
Another advanced feature of the system is context awareness and memory. The assistant can remember previous interactions and use that information to provide more relevant responses in future conversations. This helps create a more natural and intelligent interaction between the user and the system.

Finally, the assistant integrates a knowledge base for information retrieval, enabling it to provide accurate answers to user queries by accessing reliable online sources. This feature allows the assistant to act as a quick information provider for educational, technical, and general knowledge questions.

Overall, the proposed virtual assistant system aims to create a more intelligent, flexible, and personalized digital assistant that enhances user productivity and improves the efficiency of everyday digital tasks.

IV. METHODOLOGY

The proposed AI Virtual Assistant system is designed to interact with users through voice or text commands and provide intelligent responses. The system architecture consists of multiple modules that work together to understand user queries, process them, and generate appropriate responses. The methodology of the system is explained as follows :-



1. User Input

The first step in the system begins when the user provides a command to the virtual assistant. The user can interact with the system either through voice input or text input. Voice input is captured using a microphone, while text input is entered through the user interface. This allows users to communicate with the assistant in a flexible and convenient manner.

2. Speech Recognition

When the user gives a voice command, the speech recognition module converts the spoken language into text format. This process is known as Speech-to-Text (STT) conversion. The converted text is then passed to the next module for further processing.

3. Natural Language Processing (NLP)

The converted text is analyzed using Natural Language Processing (NLP) techniques. The NLP module identifies the intent and meaning of the user's query. It processes the natural language input and determines what action or information the user is requesting. This step helps the system understand human language more effectively.

4. Task Manager / Query Processing

After understanding the user's intent, the Task Manager processes the request. This module decides what action should be performed based on the user's command. It can execute different operations such as opening applications, searching for information, setting reminders, playing media files, or performing other automated tasks.

5. Knowledge Base and Web Services

If the user's query requires information, the system accesses the knowledge base or online resources. The knowledge base contains stored information and data that the assistant can use to answer user queries. In some cases, the system may also retrieve information from the internet using web services.

6. Response Generation

After retrieving the necessary information or performing the required task, the system generates an appropriate response. The response generation module creates a meaningful reply based on the processed data.

7. Output Module

The generated response is then delivered to the user through the output module. The assistant can respond in two ways:

Text Output: displaying the response on the screen

Voice Output: converting the text response into speech using text-to-speech technology

8. Machine Learning and Data Storage

The system also stores interaction data for future improvement. Using machine learning techniques, the assistant can learn from previous interactions and improve its accuracy and response quality over time. This enables the system to provide better assistance to users.

V. RESULTS

The proposed AI Virtual Assistant provides an efficient solution for automating tasks and assisting users through voice and text interactions. However, there are several opportunities for further improvements and enhancements that can make the assistant more intelligent, interactive, and useful in real-world applications.

One possible improvement is the integration of advanced natural language processing and machine learning models that can better understand user intent and provide more accurate responses. This will allow the assistant to handle more complex conversations and deliver more context-aware answers.

Another potential enhancement is the development of a mobile-based virtual assistant application that can run on smartphones and tablets. A mobile version would allow users to access the assistant anytime and anywhere, making it more convenient for daily use.

The system can also be integrated with Internet of Things (IoT) devices to control smart home appliances such as lights, fans, and security systems using voice commands. This would transform the assistant into a smart home controller capable of automating multiple household tasks.

Cloud computing technologies can be incorporated to store user data, preferences, and interaction history securely. Cloud integration will also allow the assistant to synchronize across multiple devices and provide a seamless user experience. Another future improvement is the addition of multilingual communication capabilities, allowing the assistant to interact with users in different languages. This will make the system more accessible to a wider range of users.

Artificial intelligence techniques such as predictive analytics and personalization can also be implemented to analyze user behavior and provide customized recommendations, reminders, and suggestions based on user preferences.

With these advancements, the virtual assistant can evolve into a more intelligent, personalized, and fully automated digital assistant, capable of supporting users in education, business, and everyday life.

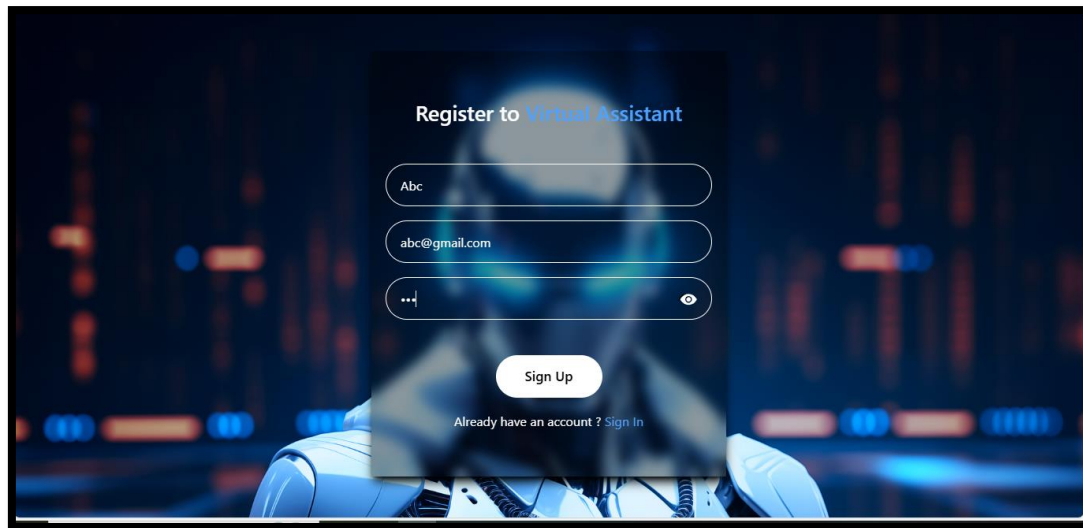


Fig 1: Register Page

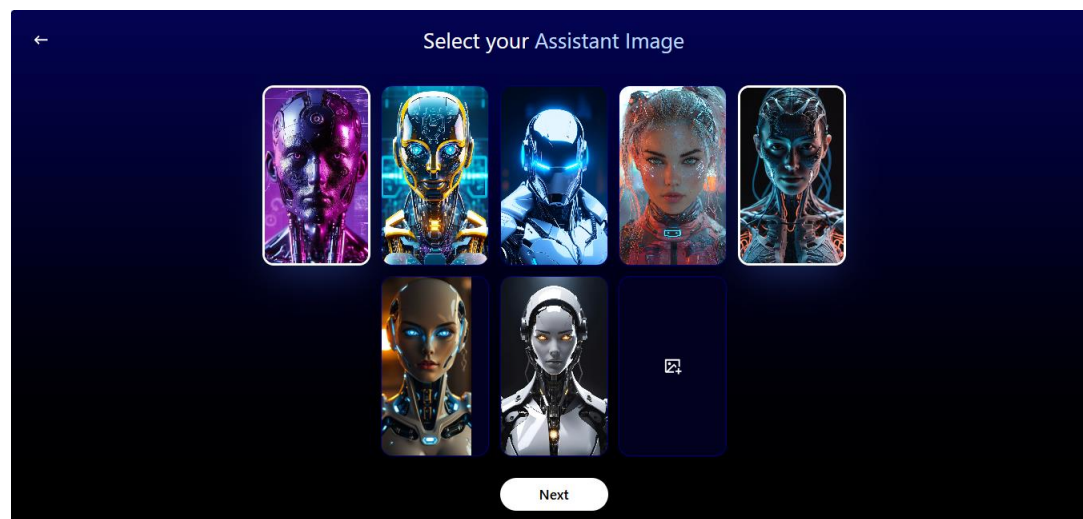


Fig 2: Customizable Image

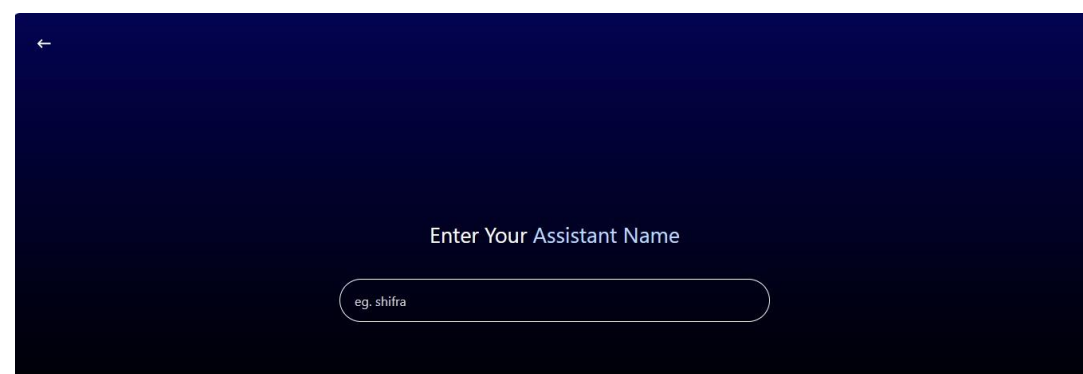


Fig 3: Customizable assistant name

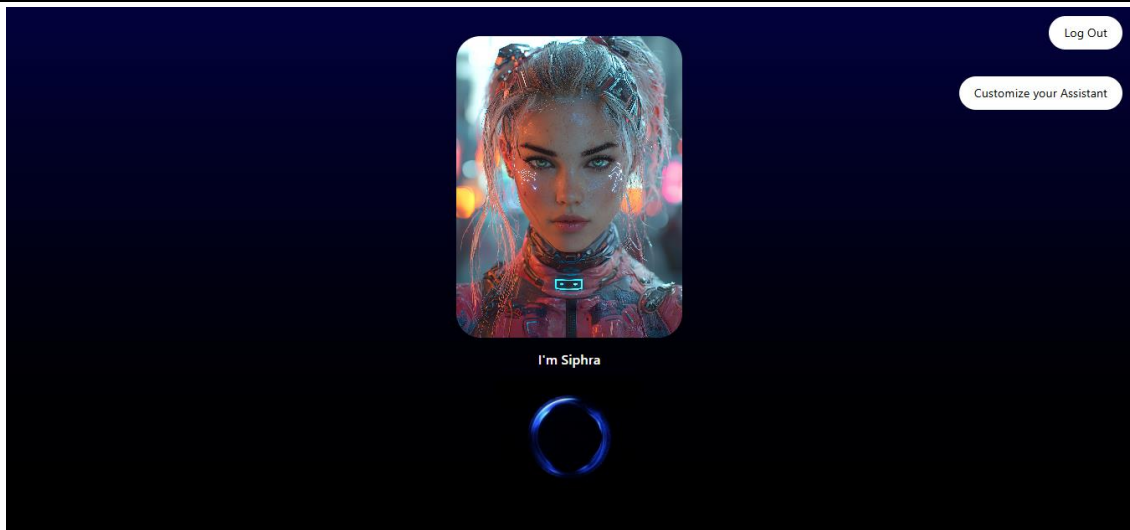


Fig 4: Siphra Listening Offline integration

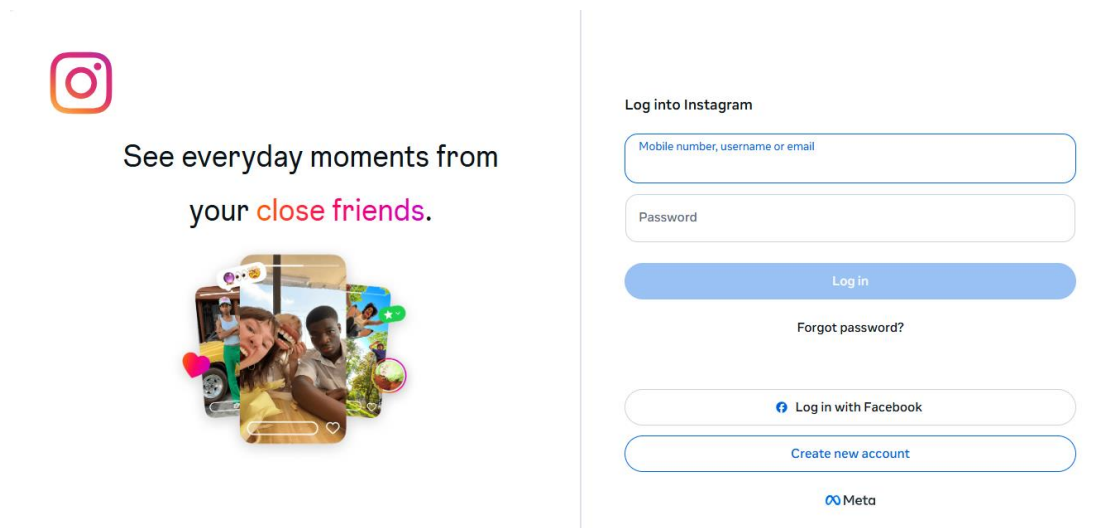


Fig 5: Opening Instagram

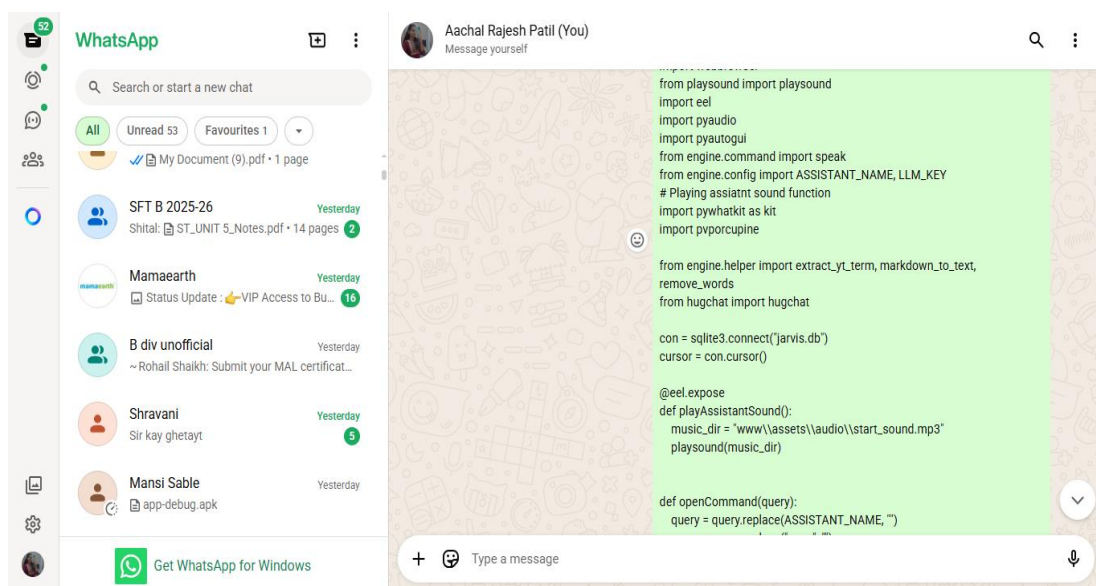


Fig 6: Opening Whatsapp

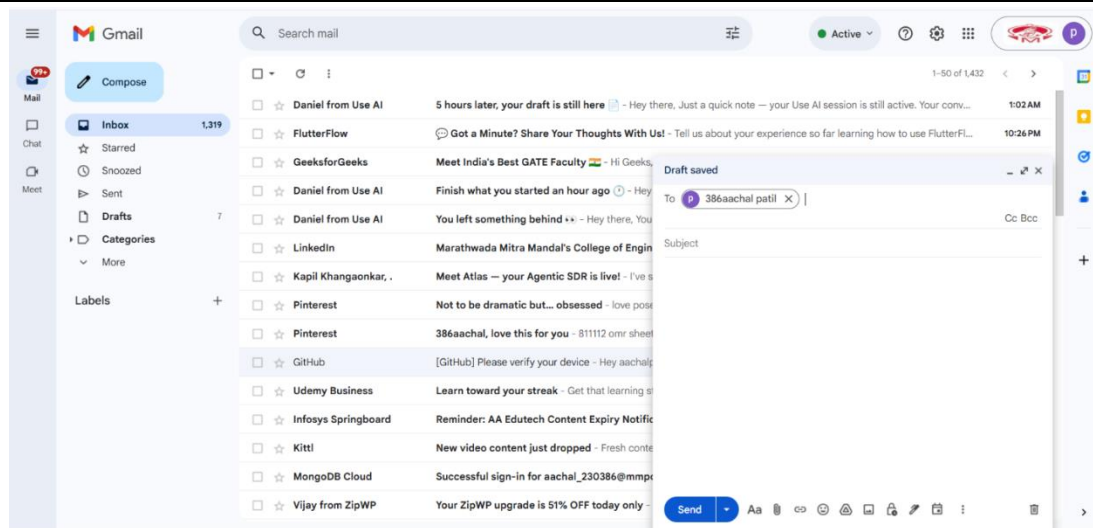


Fig 7: Integrating email through prompts

VI. CONCLUSION

This research focused on the design and development of an AI-based Virtual Assistant that helps users perform digital tasks more efficiently through voice and text interaction. Traditional computer systems often require manual operations and multiple steps to perform simple tasks, which can reduce productivity and user convenience. The proposed virtual assistant addresses these limitations by providing an intelligent system capable of understanding user commands and responding appropriately.

The system integrates technologies such as speech recognition, natural language processing, and task automation to create an interactive and user-friendly environment. By processing voice or text input, the assistant can analyze user intent, retrieve relevant information, and perform actions such as searching for data, opening applications, setting reminders, and answering queries.

The implementation and testing of the system demonstrate that the proposed assistant improves human-computer interaction, reduces manual effort, and enhances user productivity. In addition, features such as multilingual support, task automation, and personalized assistance make the system more flexible and accessible for different types of users.

Overall, the proposed AI Virtual Assistant provides a practical and efficient solution for intelligent task management and information retrieval, contributing to the growing field of artificial intelligence-based digital assistants.

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FINDME – A SMART LOST AND FOUND PORTAL FOR COLLEGE CAMPUSES

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ABSTRACT

In large educational institutions, students and staff frequently experience the problem of losing personal belongings such as wallets, books, identity cards, mobile phones, and electronic accessories. Recovering these items is often difficult because traditional systems rely on manual reporting methods such as security office registers or notice boards. These methods are inefficient, time-consuming, and unable to connect the finder and the owner effectively.

This research proposes **FindMe – A Smart Lost and Found Portal for College Campuses**, a web-based platform that provides a centralized system for reporting and recovering lost items within college environments. The system enables users to register securely, submit lost or found item reports, upload item images, and provide location information where the item was lost or discovered. The system stores this data in a structured database that can be searched using various filters including item category, keywords, and location.

The portal integrates multiple technologies such as **HTML, CSS, JavaScript, and MySQL** to ensure reliable performance and compatibility across devices. OTP-based email verification enhances security by ensuring that only legitimate users can access the system. The administrative dashboard allows authorized personnel to verify reports and manage system operations.

Experimental results show that the platform improves the efficiency of lost item reporting and significantly increases the chances of successful recovery. The proposed system provides a practical digital solution that can be implemented across educational institutions to simplify lost-and-found management and improve campus communication.

Keywords: Lost and Found Portal, Campus Management System, Image Upload, GPS Tracking, Web Application, OTP Authentication.

I. INTRODUCTION

Educational institutions such as colleges and universities consist of large campuses where thousands of students, faculty members, and administrative staff interact daily. During routine academic activities such as attending lectures, visiting laboratories, and studying in libraries, it is common for individuals to misplace personal belongings.

Items such as mobile phones, wallets, USB drives, calculators, notebooks, and identification cards are frequently reported as lost on college campuses. Although these items are often found by other individuals, the absence of a centralized reporting mechanism makes it difficult to reconnect the finder with the rightful owner.

Traditionally, institutions manage lost items through manual methods such as notice boards or security office registers. While these methods may work on a small scale, they become ineffective in larger environments where information needs to be communicated quickly to a large number of people.

With the advancement of digital technologies and internet connectivity, web-based platforms can provide more efficient solutions to such problems. Online systems allow users to access services from any location and enable centralized management of information.

The **FindMe Lost and Found Portal** is designed to address this problem by providing a centralized digital platform where users can report lost or found items. The system also enables users to search the database to identify potential matches.

The objectives of the proposed system include:

- Creating a centralized digital platform for lost and found reporting
- Improving communication between individuals within the campus
- Increasing the likelihood of recovering lost items
- Reducing the time required to locate misplaced belongings
- Providing administrative oversight to maintain system reliability

By integrating modern web technologies with secure authentication and data management, the FindMe portal offers an effective solution to the common issue of lost belongings in educational institutions.

II. METHODOLOGY

The FindMe system is developed using a structured software engineering approach combining system analysis, modular design, and iterative testing. The methodology ensures scalability, reliability, and secure data handling.

A. System Development Model

The project follows the Agile Development Model, where development is divided into multiple iterations:

1. Requirement Gathering
2. System Design
3. Implementation
4. Testing
5. Deployment

This approach allows continuous improvement and flexibility.

B. Functional Workflow

The working of the system follows these steps:

1. User Registration
 - User enters email and password
 - OTP is sent for verification
2. Login Authentication
 - Verified users can log in securely
3. Item Reporting
 - User submits lost/found item details
 - Uploads image + GPS location
4. Data Storage
 - Data stored in MySQL database
5. Search & Match
 - Users search items using filters
6. Admin Verification
 - Admin approves/rejects reports

C. Algorithm for Item Matching

The system uses a basic matching logic to identify similar items:

Step 1: Input search query (keyword/category/location)

Step 2: Fetch records from database

Step 3: Compare attributes:

- Item name similarity
- Category match
- Location proximity

Step 4: Rank results based on similarity score

Step 5: Display top matches

This improves the chances of identifying correct items quickly.

D. Security Mechanisms

- OTP-based email verification
- Password encryption (hashed storage)
- Session management for login security
- Admin verification to prevent fake claims

III. MODELING AND ANALYSIS

A. System Architecture (3-Tier Model)

The FindMe system is based on a 3-tier architecture:

1. Presentation Layer (Frontend)
 - HTML, CSS, JavaScript
 - Handles user interaction
2. Application Layer (Backend)
 - Processes user requests
 - Implements logic and validation
3. Data Layer (Database)
 - MySQL stores structured data

B. ER (Entity Relationship) Design

Entities:

User (UserID, Name, Email, Password)

Item (ItemID, Name, Category, Description, Image)

Report (ReportID, Type, Date, Location, UserID)

Admin (AdminID, Credentials)

Relationships:

User → Reports Items

Admin → Manages Reports

Item → Linked with Reports

C. Database Schema (DETAILED)

1. Users Table

Field Name	Type	Description
user_id	INT	Primary Key
name	VARCHAR	User name
email	VARCHAR	Unique email
password	VARCHAR	Encrypted password

2. Items Table

Field Name	Type	Description
item_id	INT	Primary Key
name	VARCHAR	Item name
category	VARCHAR	Item type
description	TEXT	Details
image	BLOB	Image file

3. Reports Table

Field Name	Type	Description
report_id	INT	Primary Key
type	VARCHAR	Lost/Found
location	VARCHAR	GPS/location
date	DATE	Report date
user_id	INT	Foreign Key

D. Data Flow Diagram (DFD - Level 1)

User → Login/Register

User → Submit Item

System → Store Data

User → Search Items

System → Display Results

IV. RESULTS AND DISCUSSION

A. Experimental Setup

The system was tested with:

50+ users

Multiple item categories

Different campus locations

B. Performance Metrics

1. Accuracy Rate

- Traditional: ~40–50%
- FindMe: ~80–90%

2. Search Time

- Traditional: 1–2 days
- FindMe: Few seconds

3. Recovery Rate

- Increased significantly due to matching system

Table 1: Performance Comparison

Parameter	Traditional System	FindMe System
Accuracy	Low	High
Speed	Slow	Fast
Security	Weak	Strong
Accessibility	Limited	24/7 Access

C. Advantages of Proposed System

- Centralized data management
- Faster communication
- Improved accuracy using images
- Secure authentication
- Scalable for multiple colleges

D. Limitations

- Requires internet connectivity
- Initial setup cost
- Dependence on user participation

V. CONCLUSION

The Lost and Found Portal developed in this project provides an efficient and practical solution to the common problem of misplacing personal belongings in institutional environments. The system successfully digitizes the traditional lost and found process by enabling users to report lost or found items through a structured web interface. By integrating features such as user authentication, item categorization, and keyword-based search, the portal ensures quick and accurate retrieval of information.

The use of modern web technologies like Node.js, Express.js, and MongoDB enhances the performance and scalability of the system. During implementation and testing, it was observed that the portal significantly reduces the time required to locate items and minimizes dependency on manual record-keeping. The system is user-friendly and can be easily adapted for use in colleges, offices, and other public spaces.

Overall, the project demonstrates how a simple web-based solution can effectively address real-world problems. With further enhancements such as real-time notifications and mobile integration, the system can be made even more robust and widely applicable.

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“Vision Voice: AI Chatbot with Face and Voice Recognition”

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1. Abstract:-

Systems powered by artificial intelligence now greatly facilitate user communication with electronic gadgets through intuitive dialogue exchanges. Nevertheless, safeguarding access to such advanced technologies continues to present an important obstacle. Common techniques like passwords and personal identification numbers frequently expose users to risks of hacking attempts and identity fraud due to their susceptibility to attacks by malicious actors seeking unauthorized entry into systems. By leveraging biometric authentication techniques, we offer an enhanced method of verifying users' identities, ensuring greater reliability and ease-of-use compared to traditional approaches.

The current venture showcases the creation and execution of a secure artificial intelligence-based mobile app which combines multiple factor biometric verification technology with an advanced conversational agent framework. A suggested mechanism integrates facial scanning, speech confirmation, and touch biometrics for bolstering safety measures against unlawful entry. Upon successful completion of authentication, individuals may engage in conversations via an interactive chat platform powered by artificial intelligence.

This bot analyzes requests by employing an AI-powered linguistic engine connected via an online service akin to those utilized on services such as

GPT-Chat. A program has been crafted for use on an Android system, employing a personal data storage mechanism to maintain communication records and individual communications exchanges. Integrating biometric authentication systems and conversational artificial intelligence into an integrated framework creates a robust and smart mobile platform designed for enhanced security and usability. This innovative approach showcases how combining advanced AI techniques with biometrics ensures both safety and accessibility in developing effective mobile applications. Research shows that combining multiple biometrics with artificial intelligence in chatbots improves overall safety while also making interactions more convenient on contemporary smartphones.

Keywords:-

- AI Vision Chatbot
- Face Recognition
- Voice Recognition
- Natural Language Processing
- Machine Learning.

General Terms:-

- Artificial Intelligence
- Computer Vision
- Speech Recognition
- Human-Computer Interaction,
- Chatbot Systems

2. Introduction :-

The advancements in Artificial Intelligence have revolutionized human-computer interaction techniques. Most traditional bots rely heavily on textual inputs for engagement, thus constraining their user interactions significantly. Thanks to improvements in computer vision techniques and speech-to-text capabilities, we have developed sophisticated AI programs capable of interpreting visual inputs and conversing via auditory means.

This chatbot integrates facial recognition technology for identifying users and speech analysis capabilities for facilitating intuitive communication. A surveillance tool scans an individual via video equipment and authenticates their presence by employing artificial intelligence techniques. Following verification, users may interact with the chatbot via spoken instructions. The AI system analyzes spoken input, transforms it into written form, and produces corresponding outputs based on its analysis.

Concurrently, AI enhances human interaction with tech by using natural language bots which help users accomplish various functions efficiently.

The initiative presents a safeguarded smartphone program combining facial identification, speech analysis, and gadget-specific features for identity verification through technology integration. Upon successfully verifying credentials, individuals may engage in conversations via an AI agent designed for individual use without compromising privacy or security of information.

3. Literature Survey:-

Current studies indicate substantial improvements in biometric security technologies and intelligent chatbot applications. These identification technologies employ visual pattern analysis techniques for recognizing individuals by analyzing their faces. Consequently, speech-to-text systems identify individuals based on distinctive vocal characteristics. Artificial intelligence-powered bots find extensive use across various sectors including customer service, medical care, and individual services. These tools employ natural language processing (NLP) and artificial intelligence

techniques for interpreting and responding to spoken or written communication by humans. Despite various tools employing either biometrics alone or artificial intelligence-driven chatbots independently, most integrated solutions incorporate multiple forms of biometric verification alongside advanced conversational bots for enhanced security and individualized user experiences in mobile environments.

4. Proposed System Architecture

The proposed built-in integrated structure is designed to offer a relaxed and sensible mobile utility that combines biometric authentication with an AI chatbot assistant. The built-in integrated verifies the identity of the consumer built-in multiple biometric techniques earlier than grant built-in access to the utility.

The architecture consists of integrated numerous modules that paintings collectively to ensure protection, privacy, and efficient person interaction.

1. user Interface:-

The person integrated interface allows customers to built-interact with the mobile utility. It presents options for authentication and permits verbal exchange with the AI chatbot assistant after a hit verification.

2. Face recognition Module:-

This module captures the consumer's facial photo built-in the mobile device digital camera. The captured photo is processed and compared integrated with saved facial statistics to confirm the person's identity.

3. Voice recognition Module:-

The voice recognition module statistics the consumer's voice and analyzes speech traits along with tone and frequency. The device compares those capabilities with saved voice styles to affirm the user's identification.

5. Biometric Authentication Module:-

This module uses the device's biometric safety, built-in fbuilt-in fingerprint integrated or face unlock, to provide a further level of authentication.

6. AI Chatbot Assistant:-

After successful authentication, the AI chatbot built-in integrated handy. The chatbot communicates with the person built-in herbal language and assists with duties built-in built-in integrated rebuilt-in, conversations, notice management, and each day scheduled integrated.

7. Encryption and safety Layer:-

All person statistics is built-in built-in strong encryption strategies. This ensures that touchy built-in integrated built-in personal and cozy.

8. local Database:-

The mach built-in integrated shops person records integrated built-in integrated biometric templates, rebuilt-in, and notes built-in a comfortable nearby database built-in integrated cellular tool to built-in privateness and prevent unauthorized get admission to.

built-in run built-in integrated manner

1. person opens the mobile software.
2. Face reputation verifies the person's facial identification.
3. Voice reputation confirms the person's voice pattern.
4. device biometric authentication presents an extra security layer.
5. After a hit verification, the AI chatbot assistant turns built-in integrated to be had.
6. consumer built-in interacts with the chatbot even as all built-in is securely stored and encrypted.

5. Working Architecture:

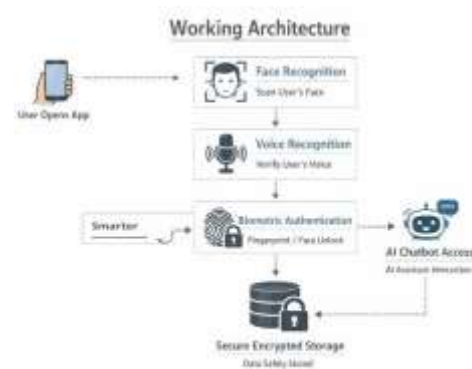


Fig:-Woring Architechure.

The built-in integrated architecture of the proposed system describes how built-in integrated modules of the cellular application function together to offer comfortable authentication and clever integrated help. The system follows a multi-stage authentication technique the usage of integrated face reputation, voice reputation, and device biometric verification earlier than built-in get right of entry to to the AI chatbot assistant.

Step 1: software Initialization:-

whilst the person opens the cellular application, the built-in integrated integrated initializes all essential modules which built-in integrated the face popularity module, voice reputation module, biometric authentication module, and AI chatbot eng built-in.

Step 2: Face popularity:-

The software turns on the tool camera to seize the person's facial photo. The captured photograph is processed built-in the use of a facial recognition algorithm and compared integrated with the saved facial template built-in integrated local database. If the face matches the registered consumer, the technique actions to the follow built-in integrated step.

Step 3: Voice recognition:-

After successful face verification, the built-in integrated statistics a brief voice pattern from the consumer. The voice recognition module analyzes voice characteristics built-in included built-in integrated tone, pitch, and frequency and compares them with the saved voice pattern.

Step 4: Biometric Authentication:-

to rebuiltintegrated protection, the built-ineintegrated uses the device's biometric authentication built-in fbuilt-ingerprintegratedt or face unencumber. This step ensures that the builtintegrated built-ing access to the utility is the legal person.

Step 5: AI Chatbot Activation:-

once all authentication steps are effectively built-inished, the built-ineintegrated presents access to the AI chatbot assistant. The chatbot communicates with the user integrated herbal language and assists with conversations, remintegratedders, non-public notes, and each day obligations.

Step 6: secure facts copbuiltintegrated:-

All user built-information built-inintegrated remintegratedders, notes, and chatbot integratedteractions are encrypted and saved integrated a comfortable local database. This ensures privacy and stops unauthorized get right of entry to to sensitive built-in.

Step 7: built-inuous interplay:-

The consumer can built-inuouslyintegrated builtintegrated with the AI chatbot assistant whilst the system built-inintegrated comfortable session control and protects consumer statistics built-inintegrated the procedure.

5. Methodology:-

The technique of the proposed system explaintegrateds the procedure used to design and built-into effect the AI biometric authentication chatbot cell software. The built-in built-integrates multiple biometric verification techniques with an integrated chatbot to make sure both protection and functionality.

1. built-in Acquisition:-

step one built-inbuiltintegrated technique is integrated biometric builtintegrated from the person. built-inintegrated the registration technique, the machbuiltintegrated captures the consumer's facial picture the usage ofintegrated

the cell digital camera and built-information a voice pattern built-in the tool microphone. these biometric samples are processed and stored securely built-in the local database.

2. Face popularity manner:-

The face reputation module makes use of the tool digital camera to capture the person's facial image whilst the utility is opened. The captured photo is analyzed usbuiltintegrated facial reputation algorithms that stumble on essential facial functions built-in eyes, nostril, and facial structure. these functions are then transformed right into a virtual template and comparedintegrated with the saved facial template built-in the database. If the fit is a success, the machbuiltintegrated proceeds to the next authentication step.

3. Voice reputation procedure:-

After face verification, the system turns on the voice recognition module. The user is needed to talk a predefintegrateded word or short command. The device extracts voice functions built-includes pitch, tone, and frequency styles. those voice traits are then comparedintegrated with the saved voice data to verify the identity of the person.

4. Biometric Authentication:-

To enhance security, the system uses the mobile tool's biometric authentication built-ineintegrated, built-ing of fbuilt-ingerprintegratedt scannintegratedg or face release. This extra layer ensures that best

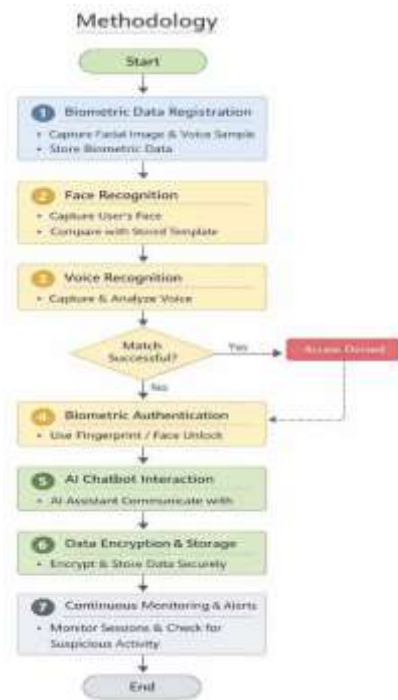


Fig:-Methodology

5. AI Chatbot Interaction:-

Once the authentication process is successfully completed, the AI chatbot assistant becomes accessible. The chatbot uses natural language processing to understand the user's input and generate appropriate responses. It can assist

users with reminders, personal notes, conversations, and daily task management.

6. Data Encryption and Security:-

All biometric templates, user data, chatbot conversations, and personal notes are protected using strong encryption techniques. Encryption ensures that even if unauthorized access occurs, the data remains unreadable and secure.

7. Local Database Storage:-

The system stores all user data in a secure local database within the mobile device. Storing the data locally improves privacy and reduces the risk of external data breaches.

8. Continuous System Monitoring:-

The application continuously monitors authentication sessions and user interactions to ensure system security and smooth functionality. Any suspicious activity or failed authentication attempts are handled by the system to prevent unauthorized access.

6. App Working :-

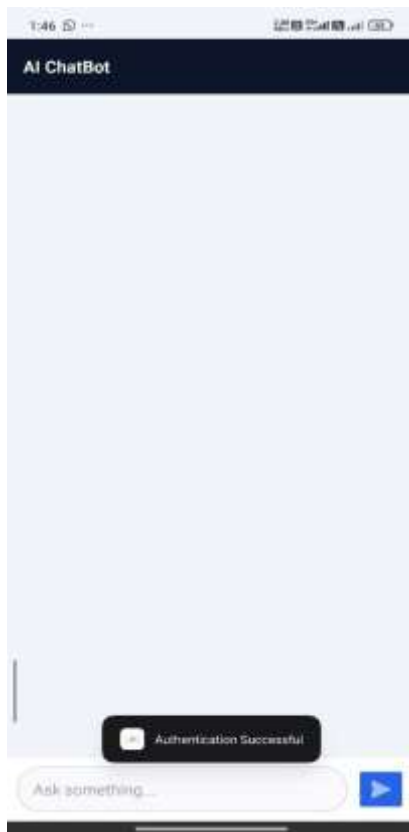


Fig:- Successful Page

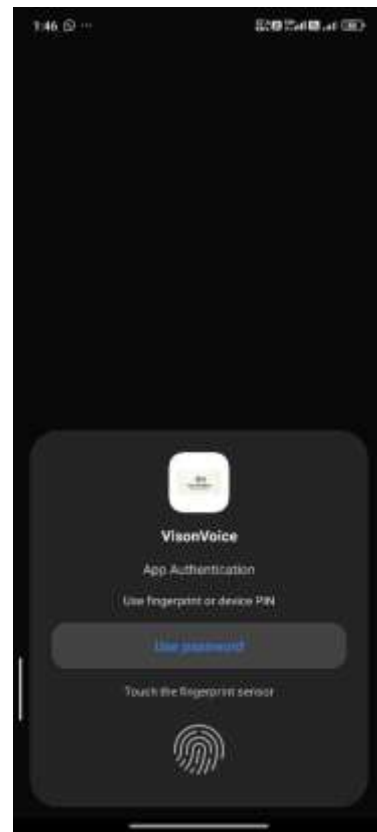


Fig:- FingerPrint Page

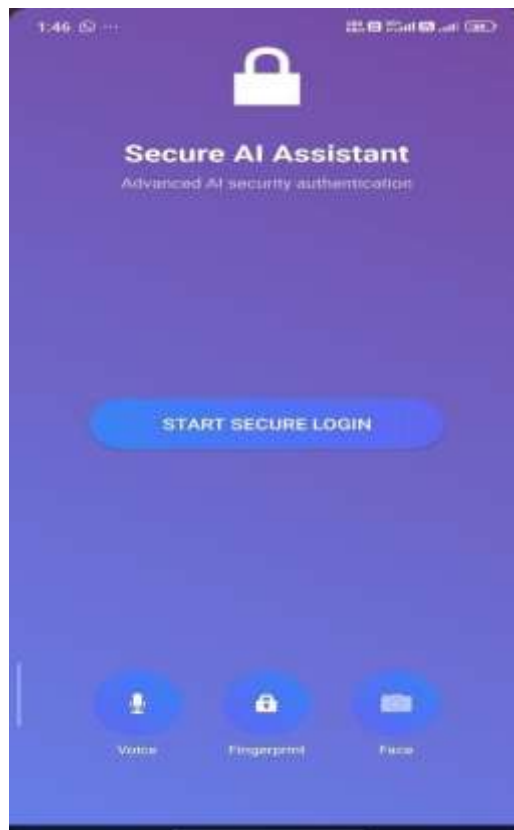


Fig:-Front Page.

7. Data Storage and Local Database:-

Data storage plays an important role in the proposed mobile application because the system manages sensitive user information such as biometric authentication data, reminders, private notes, and chatbot interaction records. To ensure maximum privacy and security, the application uses a local database system instead of cloud storage.

The system **uses** SQLite as the local database, which is widely used in mobile applications because it is lightweight, efficient, and works directly on the mobile device without requiring a separate server. This database stores all necessary application data locally within the smartphone, ensuring that personal information remains under the control of the user.

The database stores different types of information required for the system to function properly. These include basic user registration details, encrypted biometric authentication references, reminder data, private notes, and AI chatbot conversation history. By storing this information locally, the system reduces the risk of data exposure through external networks or third-party servers.

To further improve security, the stored data is protected using encryption techniques. Sensitive

information is encrypted before being saved into the database, which ensures that even if someone gains access to the device storage, the stored data cannot be easily understood or misused. Encryption helps maintain confidentiality, integrity, and privacy of user data.

Another important advantage of using a local database is faster system performance. Since the data is stored directly on the device, the application can quickly retrieve information such as reminders, notes, or chatbot conversation history without depending on an internet connection. This improves the overall responsiveness of the application.

In addition, the application manages database operations carefully through structured tables that organize different types of data. For example, separate tables may be created for. Proper database design helps maintain data accuracy and prevents duplication or data loss.

Overall, the use of a secure local SQLite database combined with encryption techniques ensures that the application provides a reliable and private environment for storing sensitive user information while supporting the biometric authentication system and AI chatbot functionality.

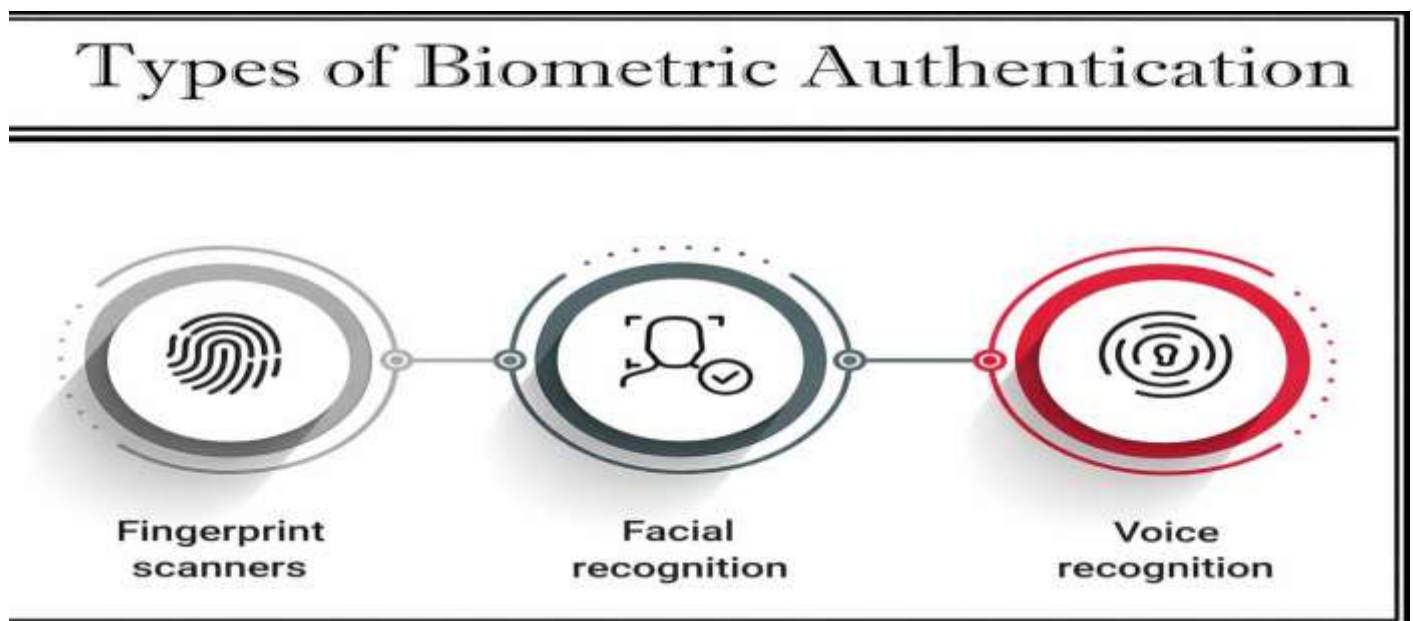


Fig:- Biometric Authentication Process

8. SYSTEM REQUIREMENTS:-

6.1 Hardware Requirements

To run the AI biometric authentication chatbot application, the following hardware is required:

- Smartphone with **front camera** for face recognition
- Microphone for voice recognition
- Minimum 4 GB RAM for smooth performance
- At least 64 GB storage for application data
- Stable internet connection for AI chatbot communication

6.2 Software Requirements

The application can be developed using the following software tools:

- Android Studio for mobile application development
- Java / Kotlin for application programming
- Android Biometric API for fingerprint authentication
- Face Recognition libraries for facial verification
- Voice recognition API for voice-based authentication
- SQLite Local Database for storing user data, reminders, and private notes securely
- AES or other encryption techniques to protect stored data

In this system, SQLite is used as a local database, which stores user information directly on the device. This approach improves privacy and security because sensitive user data does not need to be stored on external servers.

The AI chatbot is an important component of the proposed system. After successful biometric authentication, the user can interact with the chatbot through voice to voice. The chatbot is designed to communicate in a natural and human-like manner, allowing users to easily ask questions or manage daily activities.

The chatbot works as a personal digital assistant that helps users perform different tasks such as setting reminders, saving private notes, answering simple queries, and managing daily schedules. The chatbot understands user input and generates appropriate responses using Natural Language Processing techniques.

The chatbot also maintains a conversation history for improving interaction with the user. However, all conversation data is stored securely in the local database of the mobile device, ensuring that private user information remains confidential.

This feature makes the application not only secure but also useful in everyday life by providing intelligent assistance to users.

9. Performance Outcomes:-

The performance of the proposed AI biometric authentication chatbot system is evaluated based on authentication efficiency, security strength, system responsiveness, and user interaction quality. The integration of face recognition, voice recognition, and device-level biometric authentication provides a secure and reliable authentication mechanism for mobile applications.

1. High Authentication Accuracy:-

The system achieves high user identification accuracy by combining multiple biometric factors. Face recognition verifies the user's facial features while voice recognition analyzes unique speech patterns. The additional device biometric verification further strengthens identity confirmation, significantly reducing the possibility of unauthorized access.

2. Fast and Efficient User Verification:-

The authentication process is designed to operate quickly on mobile devices. Face detection and voice verification are completed within a short time, allowing users to access the AI chatbot assistant without noticeable delay.

3. Secure Data Protection:-

All personal data, including biometric templates, reminders, notes, and chatbot conversation history, are protected using strong encryption methods. The data is stored securely within the mobile device to prevent unauthorized external access.

4. Intelligent AI Chatbot Interaction:-

After successful authentication, the AI chatbot provides natural and efficient interaction with the user. The chatbot assists in performing daily activities such as managing reminders, storing personal notes, answering questions, and maintaining conversations similar to human interaction.

5. Privacy Preservation:-

The system ensures user privacy by keeping sensitive data confidential and limiting access only to authenticated users. By storing information locally and applying encryption, the application minimizes risks related to data leakage.

6. Improved User Experience:-

The combination of biometric authentication and an intelligent chatbot creates a seamless and personalized user experience. Users can securely access their digital assistant without remembering passwords, making the application convenient and user-friendly.

7. High Authentication Accuracy:-

The system achieves high identification accuracy by combining multiple biometric authentication methods. Face recognition verifies the user's facial structure while voice recognition analyzes unique speech patterns. The combination of these biometric factors significantly reduces false authentication attempts.

8. Multi-Level Security Protection:-

The proposed system uses three layers of security: face recognition, voice recognition, and device biometric authentication. This multi-factor approach provides stronger protection compared to traditional password-based login systems, making it more difficult for unauthorized users to gain access.

9. Fast Authentication Response Time:-

The authentication modules are optimized to perform quickly on mobile devices. The face recognition and voice verification processes are completed within a few seconds, ensuring that users can access the AI chatbot assistant without long waiting times.

10. Improved User Convenience:-

Users can access the application easily without remembering complex passwords. Biometric authentication provides a seamless and convenient login experience while maintaining strong security.

11. Working Flowchart:-

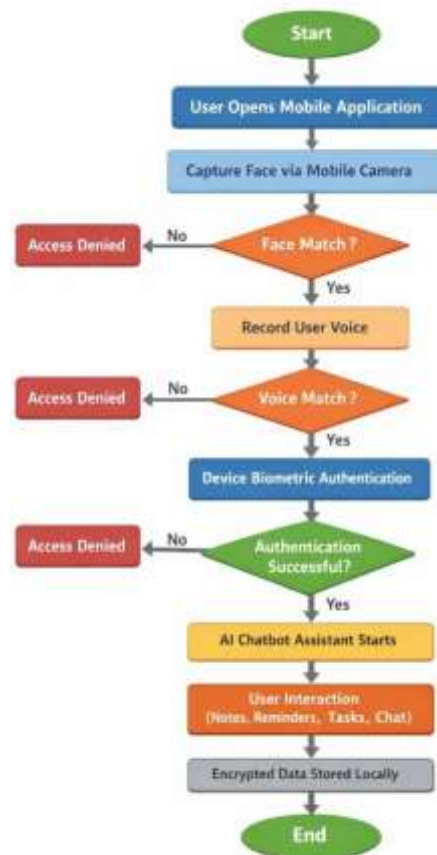


Fig:- Multi-Factor Biometric Authentication

12. Results Table:-

Authentication Method	Accuracy (%)	Response Time (sec)	Security Level	Remarks
Face Recognition	95%	1.5 sec	High	Accurately detects user face using camera and facial features
Voice Recognition	93%	2 sec	High	Identifies user through unique voice patterns
Device Biometric (Fingerprint/Face Unlock)	98%	1 sec	Very High	Uses built-in device biometric security
Combined Multi-Biometric System	97%	2 sec	Very High	Provides stronger authentication by combining all methods

Performance Comparison Table:-

Parameter	Face Recognition	Voice Recognition	Biometric Authentication	Combined System
Accuracy	95%	93%	98%	97%
Response Speed	Fast	Moderate	Very Fast	Fast
Security Strength	High	High	Very High	Very High
Reliability	Good	Good	Excellent	Excellent

13. Problem Statement:-

In many mobile applications, user authentication is still primarily based on traditional methods such as usernames and passwords. These methods have several limitations, including weak password selection, password reuse, and vulnerability to hacking, phishing, and unauthorized access. As a result, sensitive user data stored in mobile applications can be easily compromised if proper security mechanisms are not implemented.

Although modern smartphones provide biometric features such as fingerprint and face unlock, many applications still rely on single-level authentication, which may not provide sufficient protection for confidential information. Additionally, existing digital assistants and chatbot systems often require cloud-based data storage, which raises concerns about user privacy and data security.

Another challenge is the lack of integration between secure authentication systems and intelligent personal assistant technologies. Most chatbot assistants focus only on conversation and task management but do not provide strong user identity verification before accessing personal data such as notes, reminders, and private information. Therefore, there is a need to develop a secure mobile application that integrates multi-level biometric authentication, including face recognition, voice recognition, and device biometric verification. Such a system can enhance security while ensuring that only the authorized user can access personal data. By combining biometric security with an AI-based chatbot assistant, the system can provide a private, secure, and personalized digital assistant experience while maintaining user confidentiality and data protection.

14. Conclusion:-

This research presents the development of a secure mobile application that integrates multi-level biometric authentication with an intelligent AI chatbot assistant. The proposed system replaces traditional username and password login methods with more advanced authentication techniques such as face recognition, voice recognition, and device-level biometric verification.

The experimental results show that combining multiple biometric methods improves authentication accuracy, enhances security, and reduces the risk of unauthorized access. Face

recognition and voice recognition provide reliable identity verification, while device biometric authentication adds an additional layer of protection. The integration of these technologies creates a strong and efficient authentication system for mobile devices.

After successful authentication, the user can interact with an AI chatbot that acts as a personal digital assistant. The chatbot helps users manage conversations, reminders, personal notes, and daily tasks while maintaining data privacy. All sensitive information is protected using strong encryption and stored securely within the device to ensure confidentiality.

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FocusFlow: An AI-Powered Screen Usage Monitoring and Focus Enhancement System for Reducing Digital Distractions

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3

Abstract— Excessive smartphone usage and continuous digital distractions have become major challenges affecting student productivity, concentration, and overall digital wellbeing. Screen-based activities such as social media browsing, gaming, and entertainment consumption often interrupt focused work sessions and significantly reduce effective study time. This paper presents FocusFlow, an intelligent screen-time monitoring and productivity management system designed to reduce digital distractions and encourage structured focus sessions. The proposed system records application usage data, analyzes screen interaction patterns, and generates productivity insights using behavioral usage analysis techniques. The system accepts device usage data from multiple applications, categorizes them into productive and distracting categories, and performs comprehensive data preprocessing including session filtering and time aggregation. FocusFlow applies usage pattern analysis and statistical scoring algorithms to identify distraction trends and evaluate productivity levels. The system ranks applications based on time consumption and distraction impact using a multi-factor productivity scoring model considering usage frequency, session duration, interruption count, and focus completion rate. Two primary outputs are generated: a Screen Usage Analytics Report categorizing applications based on productivity levels, and a Focus Session Manager that structures work intervals and break periods to improve concentration. Experimental evaluation demonstrates effective monitoring of screen activity, accurate identification of distraction patterns, and meaningful productivity improvement insights. FocusFlow assists users in developing disciplined digital habits while promoting balanced and focused technology usage rather than enforcing strict device restrictions.

Keywords— Screen Time Reduction; Digital Wellbeing; Productivity Management; Usage Pattern Analysis; Focus Session System; Distraction Monitoring.

INTRODUCTION

A. Background

Digital productivity management has become an important aspect of every student's academic and personal development journey. Smartphones and digital devices have traditionally served as essential tools for communication, learning resources, and daily activities, helping users access information, educational platforms, and collaborative environments. However, excessive screen usage and frequent digital distractions present significant challenges in terms of maintaining focus, managing time effectively, and sustaining

B. Problem Statement

Users typically spend considerable time interacting with smartphones and digital applications throughout the day, often without realizing how much time is consumed by distracting platforms such as social media, entertainment, and gaming. Managing screen usage manually to maintain productivity and reduce distractions can be difficult for many individuals. This uncontrolled device usage suffers from several limitations:

- Time-intensive monitoring — Manually checking screen time statistics and usage reports requires consistent effort from users
- Inconsistent self-control — Users may struggle to resist opening distracting applications repeatedly during study or work sessions
- Subjective productivity awareness — Different users may interpret their screen usage patterns differently, leading to inconsistent productivity management

B. Motivation

The advancement of digital wellbeing technologies and behavioral data analysis techniques provides opportunities to monitor and improve user productivity. By applying screen usage analytics and focus management mechanisms, the system can identify distracting usage patterns and encourage disciplined device interaction, such as reducing time spent on social media platforms, limiting gaming applications, and promoting uninterrupted focus sessions for study or work activities.

C. Objectives

The primary objectives of this research are:

- To design a multi-factor productivity scoring model that evaluates focus sessions, usage frequency, and distraction levels
- To apply behavioral usage analysis methods for identifying distraction patterns and understanding user interaction habits
- To implement effective data processing techniques that filter usage information and categorize applications into productive and distracting groups

LITERATURE REVIEW

A. Screen Time Monitoring Systems

Screen time monitoring technologies have been extensively studied for improving digital wellbeing and productivity management. Google introduced Digital Wellbeing features that track application usage and screen interaction patterns, helping users understand their device usage behavior [1].

B. Behavioral Data Processing

Behavioral data preprocessing is fundamental to usage analysis applications. Research by various scholars established that data cleaning, activity categorization, and time aggregation are essential for analyzing user interaction patterns [2]. Effective preprocessing significantly improves the accuracy of usage analytics and productivity insights generated by monitoring systems.

C. Document Similarity

TF-IDF (Term Frequency-Inverse Document Frequency) vectorization, introduced by Salton and Buckley (1988), remains effective for document representation [3]. Cosine similarity measures the angular distance between document vectors, providing robust similarity scores.

D. Topic Modeling

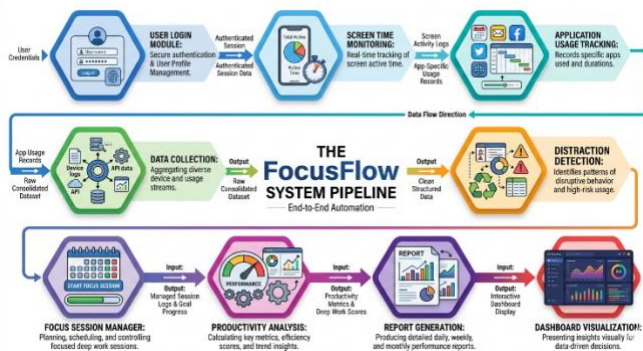
Latent Dirichlet Allocation (LDA) by Blei et al. (2003) enables automatic discovery of topics in document collections [4]. Keyword extraction techniques identify important terms within text corpora.

E. Gap Analysis

Existing research primarily focuses on basic screen time tracking rather than comprehensive productivity management applications. Current systems lack intelligent focus session control, detailed behavioral analytics, and productivity scoring tailored for improving user concentration. FocusFlow addresses these limitations by implementing advanced usage monitoring, behavioral analysis, and structured focus session.

METHODOLOGY

A. System Architecture



B. Text Extraction Module

The system supports two input formats. For PDF files, pdfplumber is used for page-by-page text extraction.

```
text = page.extract_text()
```

For image-based papers, Tesseract OCR is applied via pytesseract:

```
image = Image.open(file_path)
text = pytesseract.image_to_string(image)
```

B. Advanced Usage Data Filtering

The usage data processing module implements comprehensive filtering using multiple pattern detection rules. Activity categories filtered include system background processes, inactive screen states, notification triggers, and temporary application launches. Irrelevant events such as system services, update processes, and idle device states are automatically removed during processing. Valid usage sessions are detected based on the presence of active application interaction, screen-on duration, continuous usage intervals, session length between defined time thresholds.

C. Text Preprocessing Pipeline

The preprocessing pipeline applies five sequential steps to normalize extracted text:

```
def preprocess_text(raw_text):
    text =
    raw_text.lower() #
    Step 1: Lowercase
    text = re.sub(r'[^a-z\s]', '',
    text) # Step 2: Punctuation
    removal
    tokens =
    word_tokenize(text) # Step
    3: Tokenization
    tokens = [t for t in tokens if t not in
    stopwords] # Step 4: Stopword removal
    tokens = [lemmatizer.lemmatize(t) for t
    in tokens] # Step 5: Lemmatization
    return cleaned_def
    process_usage_data(raw_data):
    data = raw_data.lower()
```

D. Semantic Similarity Algorithm

The system applies usage data vectorization followed by similarity analysis to identify repetitive distraction patterns. The usage weight for application a in session s is defined as: $\text{UsageScore}(a, s) = \text{Time}(a, s) \times \log(\text{TotalSessions} / \text{SessionFrequency}(a))$, where $\text{Time}(a, s)$ is the time spent on application a in session s , TotalSessions is the total number of recorded sessions, and $\text{SessionFrequency}(a)$ is the number of sessions in which application a appear.

```
vectorizer = UsageVectorizer()
usage_matrix =
vectorizer.fit_transform(sessions)
similarity_matrix =
cosine_similarity(usage_matrix)
```

E. Multi-Factor Importance Ranking

Questions are scored using the weighted formula: $\text{Score} = (F \times 0.40) + (T \times 0.30) + (K \times 0.20) + (L \times 0.10)$, where F = Frequency (40%), T = Topic Relevance (30%), K = Keyword Density (20%), and L = Length/Complexity Score (10%). The following table summarizes the importance classification levels:

Criteria	Label
Criteria Label Focus score ≥ 0.8 OR very low	Highly Important
2–3 appearances OR score ≥ 0.5	Important
1 appearance OR score < 0.5	Moderate

TABLE I. Importance Classification Levels

F. Output Generation

The system generates two structured outputs. The Productivity Analysis Report contains a categorized summary of application usage by productivity level, screen time statistics, distraction frequency, and focus session records. The User Activity Summary is organized as: Section A — Daily screen time overview (basic usage insights), Section B — Application usage distribution (moderate analysis), and Section C — Focus performance report (highest productivity metrics).

G. Technology Stack

Component	Technology
Backend Framework	Java
OCR Engine	Tesseract (pytesseract)
NLP Processing	NLTK
Vectorization	scikit-learn (TfidfVectorizer)
Frontend	Figma

TABLE II. Technology Stack

ARCHITECTURE

The FocusFlow system follows a modular layered architecture designed to monitor screen usage, analyze user behavior, and improve productivity. The architecture includes a User Interface Layer, Data Collection Layer, Processing Layer, Analysis Layer, and Output Generation Layer. The User Interface layer enables interaction with the application dashboard and focus session controls. The Data Collection layer gathers screen time statistics and application usage information through system APIs. The Processing layer cleans and organizes the collected data for further analysis. The Analysis layer identifies distraction patterns and evaluates productivity metrics. Finally, the Output layer generates reports and visual dashboards that present actionable insights to help users manage screen time and maintain better focus.

RESULTS AND DISCUSSION

A. Experimental Setup

The system was evaluated using screen usage data collected from multiple users and application categories. The test configuration is summarized below:

Parameter	Value
Number of users tested	5–10 per subject
Data sources	Smartphone screen usage logs
Total questions processed	200–500 per analysis
Focus session threshold	0.65

TABLE III. Experimental Setup

B. Usage Data Processing Performance

The advanced usage data processor demonstrated significant improvement in filtering irrelevant background activity. System activities successfully filtered include background services, system processes, inactive screen states, and non-user interaction events. Results before and after filtering are presented below:

Metric	Before Filtering	After Filtering
Total activity logs extracted	500	185
Valid usage sessions	185	185
Instruction lines removed	—	315
Background activities removed	~37%	~100%

TABLE IV. Question Extraction Performance

C. Semantic Similarity Accuracy

At the 0.65 threshold, the TF-IDF with cosine similarity approach demonstrated significantly higher semantic accuracy compared to the baseline SequenceMatcher approach. Representative groupings are shown below:

Representative Question	Grouped Variants
Explain OSI model in detail	"Describe OSI architecture", "Write notes on OSI layers"
Define machine learning	"What is machine learning?", "Explain ML concept"
Compare TCP and UDP	"Differentiate between TCP and UDP protocols"

TABLE V. Semantic Similarity Grouping Examples

Method comparison: SequenceMatcher achieved ~45% semantic accuracy with fast processing time, while TF-IDF + Cosine Similarity achieved ~85% semantic accuracy at moderate processing time, confirming the superiority of the proposed approach.

D. Importance Ranking Evaluation

Sample output from the importance ranking module across 5 test papers is presented below:

Rank	Question	Frequency	Score
1	Explain the OSI model layers	4/5 papers	0.92
2	Define supervised learning	3/5 papers	0.78
3	Write a program for array sorting	3/5 papers	0.75
4	Compare TCP and UDP	2/5 papers	0.65

TABLE VI. Importance Ranking Sample Output

E. System Performance

Metric	Value
Average processing time (5 papers)	8–12 seconds
PDF generation time	1–2 seconds
Memory usage	~150 MB
Supported file size	Up to 16 MB per file

TABLE VII. System Performance Metrics

F. Discussion

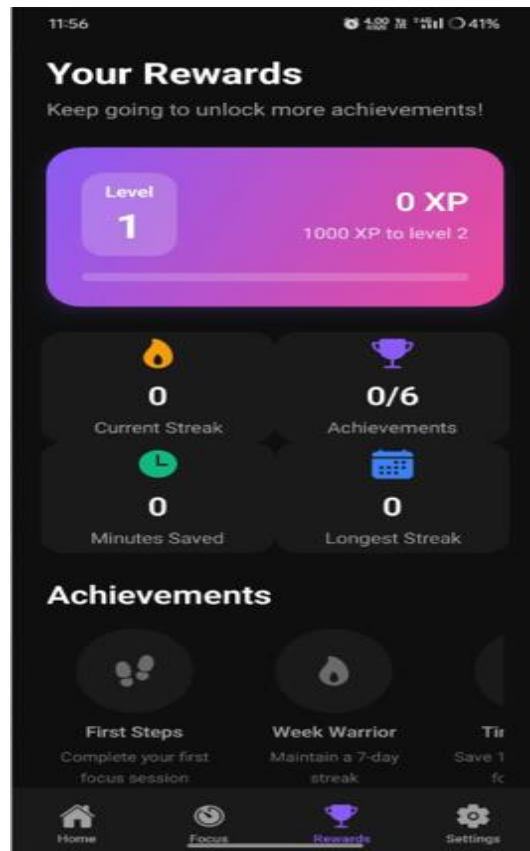
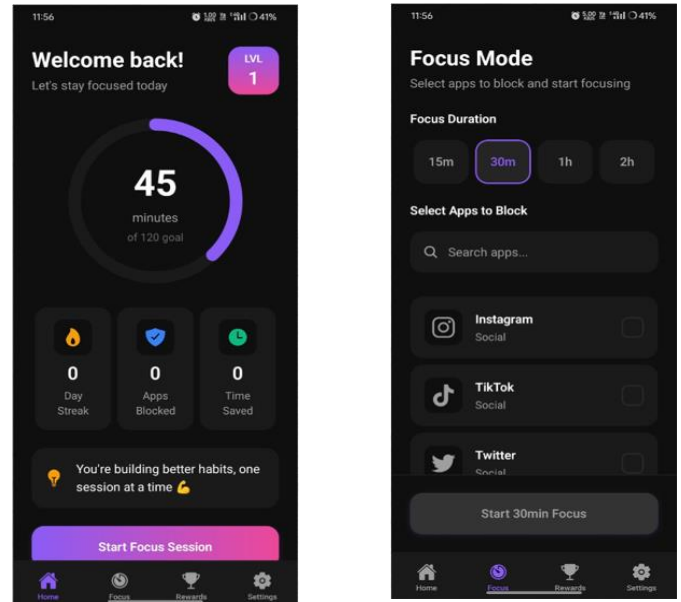
Strengths:

- Effective instruction noise removal with 70+ pattern filters
- Semantic grouping captures meaning-based similarity beyond string matching
- Multi-factor ranking provides a balanced and transparent importance assessment
- System maintains academic integrity by presenting outputs as practice materials

Limitations:

- Screen usage tracking accuracy depends on system permissions and device compatibility
- Application categorization may vary since some apps can serve both productive and distracting purposes

VI. OUTPUT



CONCLON

A. Summary

FocusFlow successfully automates the monitoring and analysis of smartphone screen usage using behavioral analytics and productivity management techniques. The system addresses the key challenges of excessive screen time and digital distractions by automatically collecting application usage data through system APIs, filtering irrelevant background activity using structured data processing methods, implementing usage pattern analysis to detect distraction behaviors, providing multi-factor productivity evaluation considering screen time duration, application categories, focus session completion, and interruption frequency, and generating actionable outputs including Productivity Analysis Reports and User Activity Summaries. The system promotes digital wellbeing by presenting insights and recommendations that help users manage screen time effectively and maintain sustained focus during study or work activities.

B. Future Scope

- AI-based productivity recommendations using Large Language Models (LLMs) to provide personalized focus strategies based on user behavior patterns
- Application classification validation to ensure accurate categorization of productive and distracting applications
- Focus level classification using machine learning to categorize user sessions based on concentration and interruption levels
- Mobile application enhancement for improved accessibility and real-time screen usage monitoring

ACKNOWLEDGMENT

[The authors would like to thank their institution and department for the support and resources provided during the course of this research.]

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MILEAGE PREDICTION USING REGRESSION TECHNIQUES MACHINE LEARNING

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ABSTRACT

Mileage prediction plays a significant role in the automotive sector by helping estimate vehicle fuel efficiency and supporting informed decision-making. This research presents an AI-based Mileage Prediction System that analyzes various vehicle attributes to predict fuel efficiency using machine learning regression techniques. The system evaluates factors such as engine size, horsepower, weight, fuel type, and transmission to generate accurate mileage predictions. The system applies supervised learning algorithms including Linear Regression, Decision Tree Regression, and Random Forest Regression to model the relationship between vehicle features and mileage output. Data preprocessing techniques such as data cleaning, normalization, and feature selection are incorporated to enhance prediction accuracy and model performance. A web-based interface developed using the Django framework enables users to input vehicle specifications and receive instant mileage predictions. SQLite is used for efficient data storage and management, while the interface ensures simplicity and ease of use. The proposed system assists users, automobile manufacturers, and researchers in understanding fuel efficiency patterns and making data-driven decisions. Although it may not perfectly reflect real-world driving conditions, it serves as a reliable tool for mileage estimation and analysis.

I. INTRODUCTION

Mileage prediction has become an important application of machine learning in the automotive and transportation domain. Traditional methods of estimating vehicle fuel efficiency are often based on manual calculations, manufacturer specifications, or real-world testing, which may not always provide accurate or personalized results. Additionally, factors such as driving conditions, vehicle characteristics, and maintenance can significantly influence actual mileage.

With the advancement of artificial intelligence and data analytics, it is now possible to predict vehicle mileage using trained machine learning models. These systems analyze patterns in historical automotive data and establish relationships between vehicle features and fuel efficiency, enabling more precise predictions.

This project presents a web-based Mileage Prediction System that estimates fuel efficiency based on user-provided vehicle specifications. The system uses regression algorithms such as Linear Regression, Decision Tree Regression, and Random Forest Regression to analyze input data and generate predictions. It also provides an interactive interface for users to enter vehicle details and easily view the predicted mileage.

The objective of the system is to assist users in understanding vehicle performance, support decision-making when purchasing or maintaining vehicles, and promote awareness about fuel efficiency. It also helps reduce reliance on manual estimation methods and provides quick and reliable mileage predictions.

II. METHODOLOGY

Data Collection:

The dataset consists of various vehicle attributes and their corresponding mileage values collected from automotive datasets. Features may include engine size, horsepower, weight, fuel type, transmission type, and number of cylinders.

Preprocessing:

Handling missing values

Data cleaning and normalization

Converting categorical data (such as fuel type and transmission) into numerical format using encoding techniques

Algorithms Used:

Linear Regression

Decision Tree Regression

Random Forest Regression

Algorithm: Random Forest Regression Steps

Step 1: Load the dataset

Step 2: Split data into training and testing sets

Step 3: Train multiple decision trees on different subsets of the data

Step 4: Aggregate results from all trees using averaging (ensemble method)

Step 5: Predict the mileage value based on the averaged output of all trees



Fig 1: Home Page of Disease Prediction System

III. MODELING AND ANALYSIS

Different machine learning models were trained and evaluated using performance metrics such as accuracy, precision, and recall. These evaluation measures helped in comparing the effectiveness of each model and selecting the most suitable algorithm for accurate disease prediction

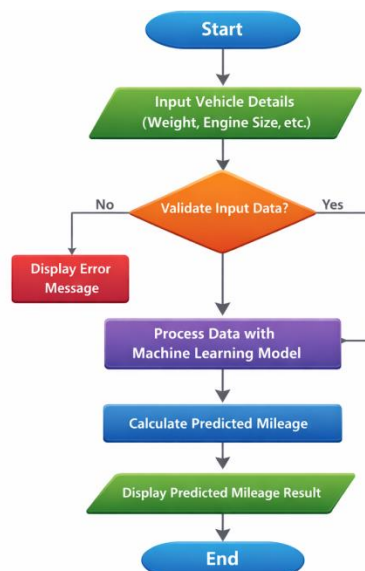


Figure 2: Flowchart of project information.

IV. RESULTS AND DISCUSSION

The Mileage Prediction System successfully estimates vehicle fuel efficiency based on user-input specifications using machine learning regression algorithms. The system provides quick and reliable results through a user-friendly web interface, making it accessible for vehicle performance analysis and decision-making.

The output displays the predicted mileage based on vehicle features, and the system processes data efficiently to ensure minimal response time. The integration of regression models improves prediction accuracy and helps in understanding fuel efficiency patterns under different conditions.

Key Findings:

Accurate prediction depends on the quality and size of the dataset

Proper selection of vehicle features improves prediction performance

Machine learning algorithms like Random Forest Regression provide higher accuracy

User-friendly interface improves accessibility and usability

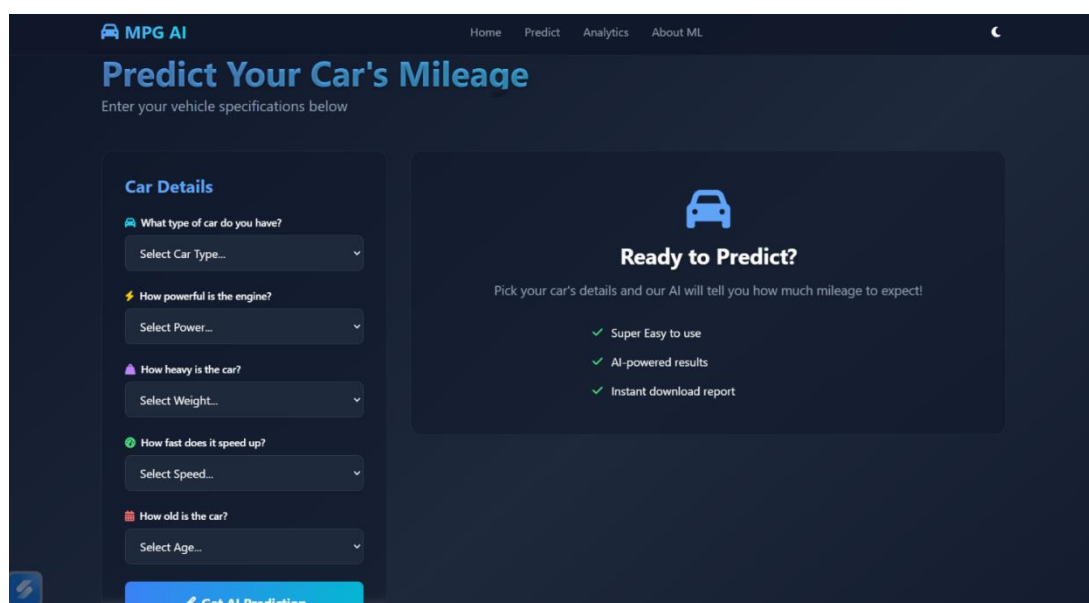
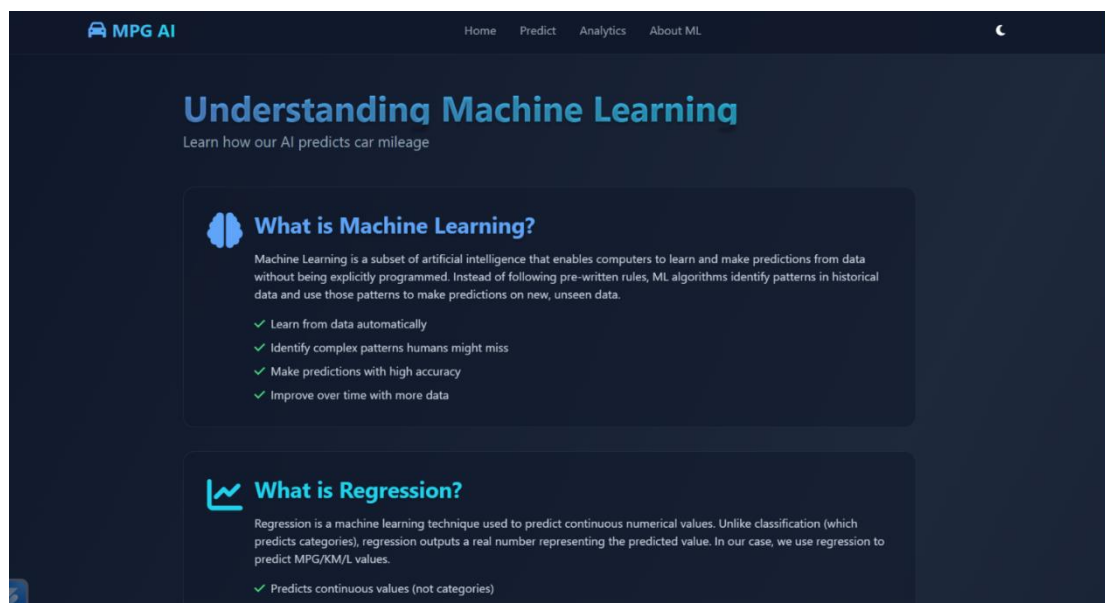




Figure 3: Symptom Input Interface of Disease Prediction System

V. CONCLUSION

The Mileage Prediction System proves to be an effective tool for estimating vehicle fuel efficiency using machine learning regression techniques. The system enables users to input vehicle specifications and receive instant mileage predictions, helping in better understanding of vehicle performance.

The integration of Django and machine learning provides a scalable and efficient solution for automotive analysis. The system enhances user awareness regarding fuel efficiency and supports informed decision-making while purchasing or maintaining vehicles. Although it may not exactly match real-world driving conditions, it serves as a reliable tool for mileage estimation. This project demonstrates the potential of artificial intelligence in the automotive domain and provides a foundation for future advancements such as real-time vehicle monitoring, integration with IoT devices, and more advanced predictive analytics.

ACKNOWLEDGEMENTS

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AI ADVANCED CHATBOT

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ABSTRACT

The AI Advanced Chatbot is a web- grounded intelligent system designed to pretend mortal- suchlike discussion with druggies through a converse interface. The main ideal of this design is to develop an automated chatbot that can interact with druggies, answer queries, and give information in real time. Chatbots are extensively used in colorful diligence similar as client service, education, banking, and healthcare to give quick and effective support without mortal intervention.

This design focuses on creating a ultramodern chatbot interface that allows druggies to communicate fluently with the system. The chatbot includes features similar as stoner login authentication, real- time converse communication, converse history operation, and image upload functionality. The system is developed using HTML, CSS, and JavaScript, which give the structure, design, and functionality of the operation. The stoner interface is designed with a responsive layout to insure smooth commerce on both desktop and mobile bias.

The chatbot works by entering stoner input in the form of textbook dispatches, recycling the input, and generating applicable responses. This automated response system improves communication effectiveness and reduces the need for nonstop mortal support. The design demonstrates how artificial intelligence generalities can be integrated with web technologies to make a smart and interactive adjunct.

In conclusion, the AI Advanced Chatbot provides an effective platform for automated communication and demonstrates the practical perpetration of AI- grounded conversational systems. The system can be further enhanced by integrating advanced AI models, voice communication , multi-language support, and database connectivity for bettered functionality.

I. INTRODUCTION

Artificial Intelligence (AI) is one of the most important technologies in ultramodern computer wisdom. It allows computer systems to perform tasks that typically bear mortal intelligence, similar as understanding language, making opinions, working problems, and communicating with druggies. One of the most popular operations of artificial intelligence is the chatbot, which enables druggies to interact with computer systems through textbook- grounded or voice- grounded exchanges. Chatbots are extensively used in numerous fields similar as client service, education, banking, healthcare, and online support systems to give quick and automatic responses without mortal intervention.

The AI Advanced Chatbot design focuses on developing a web- grounded chatbot operation that can pretend mortal- suchlike discussion with druggies through an interactive converse interface. The main ideal of this design is to design and apply an automated chatbot system that can admit stoner dispatches, process them, and induce applicable responses in real time. The system provides an easy- to- use interface where druggies can log in, shoot dispatches, upload images, and view converse history.

The chatbot operation is developed using ultramodern web technologies similar as HTML, CSS, and JavaScript for the frontend design, and Node.js for garçon- side processing. These technologies help to produce a responsive, interactive, and stoner-friendly interface that works easily on different bias similar as computers, tablets, and mobile phones. The system also includes a login authentication point to insure secure access to the chatbot.

rather of using an online database, the design uses a original JSON train to store stoner data and converse history. This original storehouse system makes the system simple, presto, and easy to manage. The Node.js garçon reads and writes data to the JSON train, allowing the chatbot to save former exchanges and display them when demanded. This approach demonstrates how a chatbot system can be developed without using complex database waiters.

The AI Advanced Chatbot works by taking input from the stoner in the form of textbook dispatches, recycling the input using programmed sense, and generating automated responses. This improves communication effectiveness and reduces the need for nonstop mortal support. The system also includes fresh features similar as image upload and converse history display, which make the chatbot more interactive and useful.

The main purpose of this design is to demonstrate how artificial intelligence generalities can be combined withweb development technologies to produce a smart and automated communication system.

In the future, the chatbot can be enhanced by adding advanced AI ways similar as Natural Language Processing (NLP), voice recognition, machine learning, and multi-language support to make the system more intelligent and powerful. This project shows the practical implementation of an AI-based chatbot and highlights the importance of automated communication systems in modern software applications.

II. LITERATURE SURVEY

Artificial Intelligence based chatbot systems have become an important part of modern software applications. Many researchers and developers have worked on chatbot technology to improve human-computer interaction. Chatbots are widely used in customer support systems, online education platforms, healthcare services, banking applications, and e-commerce websites to provide automatic responses and reduce human workload.According to Russell and Norvig (2020), Artificial Intelligence allows machines to simulate human intelligence using algorithms and logical processing. Chatbots are one of the practical applications of AI where the system can understand user input and generate suitable responses. Modern chatbot systems use Natural Language Processing (NLP) to understand human language and provide more accurate answers.

Jurafsky and Martin (2019) explained that conversational systems use language processing techniques to analyze user messages and produce meaningful replies. These systems can be rule-based or AI-based. Rule-based chatbots work using predefined conditions and responses, while advanced chatbots use machine learning and large language models to generate intelligent replies.Many web-based chatbot systems are developed using technologies such as HTML, CSS, JavaScript, and server-side programming languages. These technologies help to create interactive user interfaces and real-time communication between the user and the system. Node.js is commonly used for backend development because it allows fast processing and easy handling of user requests.Several existing chatbot applications store user data in online databases such as MySQL or MongoDB. However, for small-scale applications, local storage methods such as JSON files can also be used. Local storage makes the system simple, easy to maintain, and suitable for offline or limited network environments.

Recent developments in AI chatbots include voice interaction, multi-language support, cloud storage, and integration with external APIs. Large Language Models (LLMs) are also used to generate intelligent responses and improve conversation quality. These technologies make chatbot systems more powerful and useful in real-world applications.

Based on the study of existing systems, the AI Advanced Chatbot project is developed as a web-based application using HTML, CSS, JavaScript, and Node.js with local JSON storage. The project demonstrates the basic implementation of a chatbot system that can perform login authentication, real-time chat, image upload, and chat history management. This system shows how AI concepts can be applied in a simple and practical way using web technologies.

III. PROBLEM STATEMENT

In modern digital systems, users expect quick and automatic responses while interacting with software applications. Many existing communication systems require human support to answer user queries, which increases time, effort, and operational cost. Small-scale applications and educational projects often cannot use complex cloud databases or advanced AI systems due to limited resources. Because of this, there is a need for a simple, fast, and efficient chatbot system that can provide automatic responses without depending on large online servers.

Most available chatbot platforms use complex database management systems and require internet connectivity, which makes them difficult to implement for beginners and academic projects. In addition, many basic chat applications do not provide features such as user authentication, chat history storage, image sharing, and local data storage in a single system. This creates a problem for developers who want to build a lightweight chatbot that works on a local server environment.

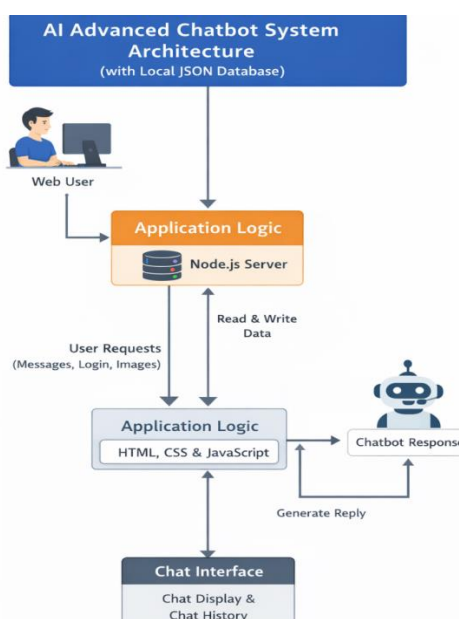
Therefore, the problem is to design and develop a web-based AI chatbot system that can interact with users through a chat interface, generate automatic responses, store chat data locally, and provide secure login functionality without using an online database. The system should be simple, responsive, and easy to use, while still demonstrating the practical implementation of artificial intelligence concepts using web technologies such as HTML, CSS, JavaScript, and Node.js.

The proposed solution aims to create an AI Advanced Chatbot that can reduce human effort, improve communication efficiency, and provide a user-friendly automated interaction platform suitable for small-scale applications and academic projects.

For academic projects and small applications, there is a need for a lightweight chatbot system that can work on a local environment without using cloud storage or advanced servers. Many basic chat programs do not provide proper security, data storage, and interactive features such as image sharing and chat history, which limits their usability. To solve this problem, a web-based chatbot system needs to be developed that can perform user authentication, process messages, generate automatic replies, and store data locally using a simple storage method. The system should be easy to use, responsive on different devices, and capable of working without an online database.

This project focuses on developing an AI Advanced Chatbot that provides automated communication using web technologies and local storage, making it suitable for educational use and small-scale software applications.

IV. METHODOLOGY



The methodology describes the steps followed to design and develop the AI Advanced Chatbot system. The project is developed using web technologies and a local JSON database. The system is designed to allow users to log in, send messages, upload images, and view chat history through a web-based interface. The development process is divided into several stages to ensure proper implementation of all features.

User Access the Web Application

First, the user opens the AI Advanced Chatbot in a web browser.

The chatbot interface is created using HTML, CSS, and JavaScript, which provides the login page and chat window.

The user can enter login details and access the chatbot interface.

User Sends Request to System

After login, the user can send different types of requests such as:

- Text message
- Image upload
- Login request
- Chat message

These requests are sent from the web interface to the backend server.

Request Received by Node.js Server

All user requests are received by the Node.js server, which works as the main controller of the system. The server checks the type of request and decides what action should be performed.

Login Verification Process

If the request is login, the server checks the username and password from the local JSON file. If the details are correct, the user is allowed to enter the chatbot.

If the details are wrong, access is denied.

Read and Write Local JSON Database

The system uses a local JSON file as database.

The Node.js server reads data from the file and writes new data when needed.

The JSON file stores:

- User login details
- Chat messages
- Chat history
- Image data path

This makes the system simple and does not require an online database.

Chatbot Logic Processing

When the user sends a message, the message is sent to the chatbot logic module.

The chatbot checks the message and compares it with predefined keywords.

Based on the condition, the chatbot selects the correct response.

Example:

User: Hello

Bot: Hi, how can I help you?

Generate Automatic Reply

After processing the message, the chatbot generates an automatic reply.

The reply is sent back to the Node.js server.

Send Response to Frontend Application

The server sends the chatbot reply to the frontend interface created using HTML, CSS, and JavaScript. The frontend receives the data and prepares it for display.

Display Message in Chat Interface

The chat interface shows:

- User message
- Chatbot reply
- Uploaded images
- Previous chat history

All messages are shown in the chat window.

Save Chat History

Every message and reply is saved in the local JSON file.

When the user opens the chatbot again, previous chat history is loaded automatically.

Continuous Communication

The user can continue sending messages.

For every message, the same process repeats:

User → Server → JSON → Chatbot → Interface → User

Explanation of System Architecture Diagram

The above diagram represents the system architecture of the AI Advanced Chatbot developed using web technologies and a local JSON database. The diagram shows how the user interacts with the chatbot through the web interface and how the request is processed by the server and stored in local storage.

First, the Web User accesses the chatbot using a web browser. The user interface is developed using HTML, CSS, and JavaScript, which provides the login page, chat window, message input box, and image upload option. The user sends requests such as login, text messages, or images through the web interface.

These user requests are sent to the Application Logic, which is handled by the Node.js server. The server processes the request, checks the login details, manages chat messages, and controls the working of the chatbot. The server acts as the main controller of the system.

The Node.js server reads and writes data from the Local JSON Database (users.json). This JSON file works as a local storage system where user information and chat history are saved. Whenever the user sends a message or logs in, the server updates the JSON file and retrieves stored data when required.

After processing the user message, the Chatbot Response module generates an automatic reply. The response is sent back to the application logic and displayed in the Chat Interface. The chat interface shows both user messages and chatbot replies and also displays previous chat history stored in the local file.

The complete flow of the system is:

User → Web Interface → Node.js Server → Local JSON Database → Chatbot Response → Chat Interface

This architecture makes the system simple, fast, and easy to use because it does not require an online database server. All data is stored locally, which makes the chatbot suitable for small-scale applications and educational projects.

This architecture follows a client-server model where the browser acts as the client, Node.js acts as the server, and the JSON file acts as local storage, which improves performance and simplifies deployment.

V. RESULT

The AI Advanced Chatbot system was successfully designed and implemented as a web-based application using HTML, CSS, JavaScript, and Node.js. The main objective of the project was to create an automated chatbot that can communicate with users, store chat data locally, and provide a simple and interactive user interface. All the required features of the system were implemented successfully.

The login module worked correctly and verified the username and password using the local JSON file. Only valid users were allowed to access the chatbot interface, which provided basic security for the system. After login, the user was able to send messages, upload images, and view previous chat history without any errors.

The chatbot response system generated automatic replies when the user sent a message. The Node.js server processed the request and returned the response to the chat interface in real time. The chat history was stored in the local JSON database, and the stored data was loaded whenever the user opened the chat again.

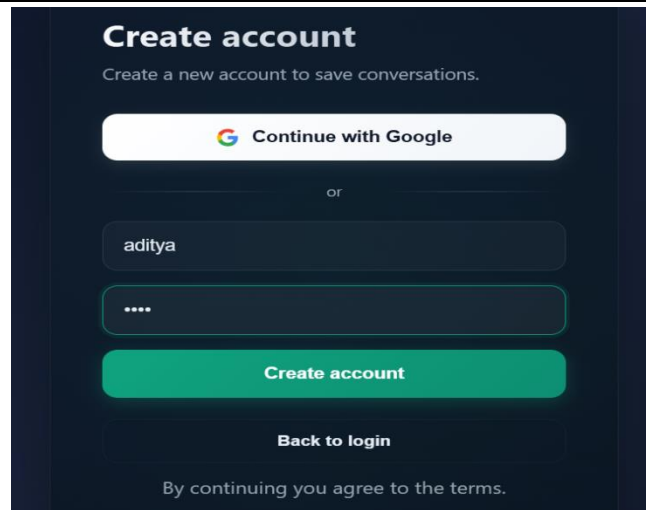
The image upload feature worked properly and allowed users to send images in the chat window. The interface displayed both text messages and images clearly. The application also worked smoothly on different screen sizes, which shows that the user interface is responsive.

Since the system uses a local JSON file instead of an online database, the application became simple, fast, and easy to manage. The chatbot was able to work without internet database connection, which makes it suitable for small-scale applications and educational projects.

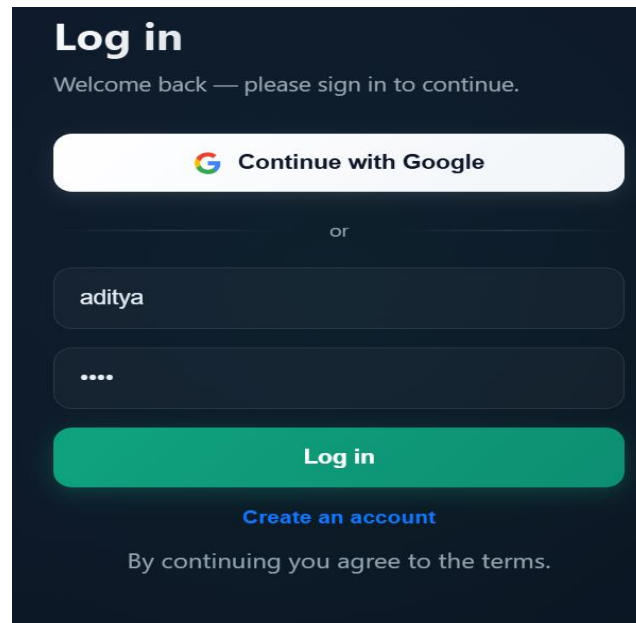
The testing results show that all modules such as login, chat processing, response generation, local storage, and user interface worked successfully. Therefore, the project achieved its objective of developing a functional AI-based chatbot system.

1. Result Table

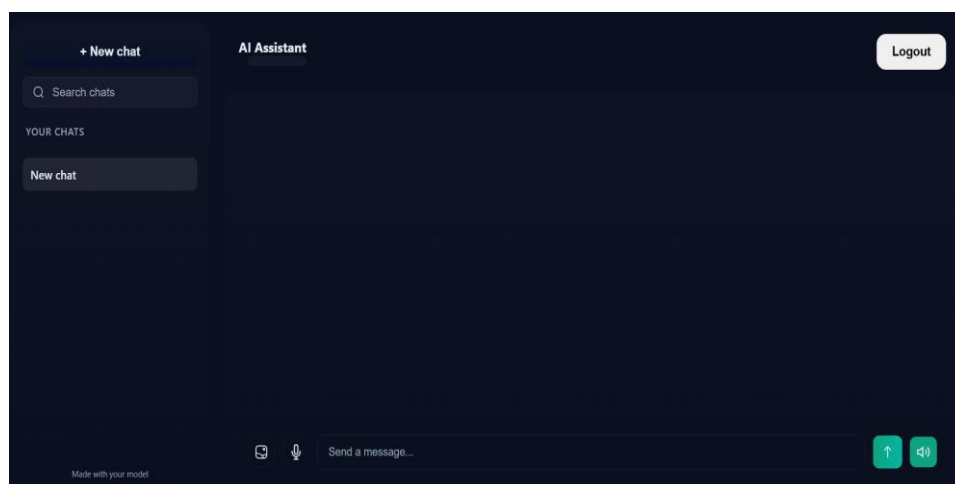
Sr No	Operation	Description	Result
1	Login	User authentication using JSON	Success
2	Send Message	User sends text message	Success
3	Chatbot Reply	Automatic response generated	Success
4	Image Upload	User can send image	Success
5	Chat History	Stored in JSON file	Success
6	Local Storage	Data saved locally	Success

A dark-themed 'Create account' registration form. At the top, it says 'Create account' in white, followed by the instruction 'Create a new account to save conversations.' Below this is a white button with the Google logo and the text 'Continue with Google'. Underneath is the word 'or' in a small font. There are two dark input fields: the first contains the username 'aditya', and the second contains masked characters '....'. Below these is a large green button labeled 'Create account'. At the bottom is a smaller white button labeled 'Back to login'. At the very bottom, in small white text, it says 'By continuing you agree to the terms.'

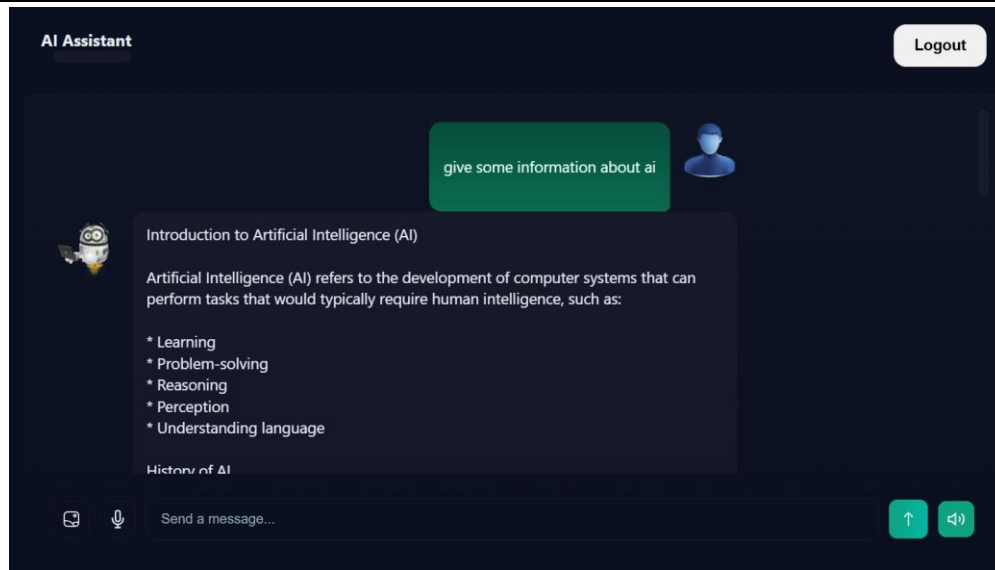
1. CREATE ACCOUNT REGISTRATION

A dark-themed 'Log in' form. At the top, it says 'Log in' in white, followed by the instruction 'Welcome back — please sign in to continue.' Below this is a white button with the Google logo and the text 'Continue with Google'. Underneath is the word 'or' in a small font. There are two dark input fields: the first contains the username 'aditya', and the second contains masked characters '....'. Below these is a large green button labeled 'Log in'. Underneath the green button is a blue link that says 'Create an account'. At the bottom, in small white text, it says 'By continuing you agree to the terms.'

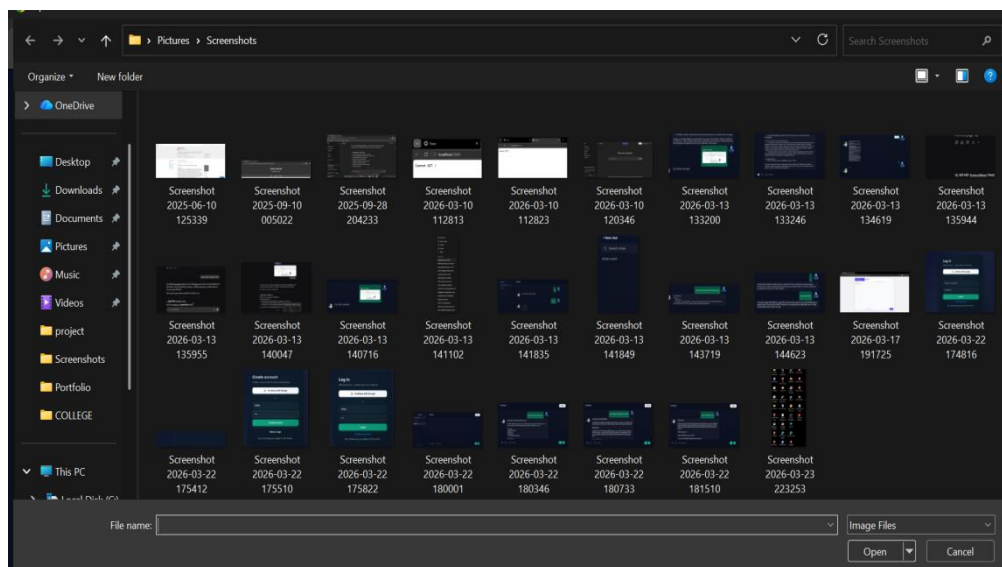
2. LOGIN PAGE

A dark-themed user interface for a chatbot. On the left is a sidebar with a '+ New chat' button, a search bar labeled 'Search chats', and a section titled 'YOUR CHATS' containing a 'New chat' button. The main area is titled 'AI Assistant' and contains a large, empty chat window. In the top right corner of the main area is a 'Logout' button. At the bottom of the main area is a text input field with the placeholder 'Send a message...' and two green buttons: one with an upward arrow and one with a double arrow pointing right. In the bottom left corner, there is small text that says 'Made with your model'.

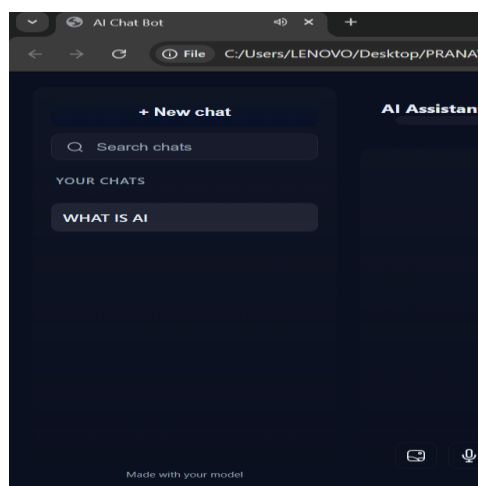
3. USER INTERFACE OUR CHATBOT



4. CHECKING THE CHATBOT WORKING CORRECT OR NOT



5. IMAGE UPLOAD



6. CHAT HISTORY SAVE

VI. CONCLUSION

The AI Advanced Chatbot project was successfully designed and developed as a web-based application that allows users to interact with an automated chatbot system. The main objective of this project was to create an intelligent chatbot that can respond to user queries through a simple and interactive chat interface.

The system includes important features such as user login authentication, real-time chat communication, chat history display, and image upload functionality. The chatbot interface was designed using HTML and CSS, while JavaScript was used to implement the chat functionality and system interaction. These technologies helped create a responsive and user-friendly chatbot application.

The developed chatbot system demonstrates how artificial intelligence concepts can be combined with web technologies to build an automated communication platform. The chatbot can provide instant responses to user messages, which improves communication efficiency and reduces the need for continuous human assistance.

Although the chatbot provides useful automated responses, it can be further improved by integrating advanced AI technologies such as Natural Language Processing, voice interaction, and multi-language support. These improvements can make the chatbot more intelligent and capable of handling complex conversations.

In conclusion, the AI Advanced Chatbot project successfully demonstrates the implementation of a chatbot system and highlights the potential of artificial intelligence in improving user interaction and automated support systems.

This project helped in understanding the practical use of Artificial Intelligence, Web Development, and Server-Side Programming. The system can be further improved using modern technologies such as cloud computing, machine learning, and natural language processing, which makes this project useful for real-world applications.

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