

Cummins eCampus

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Abstract—educational institutions continue to rely on conventional communication mechanisms including physical notice boards manual enquiry counters and static websites resulting in information delays accessibility limitations and increased administrative burden this paper presents an ai-powered chatbot system developed for college information management that addresses these limitations through intelligent automation the proposed system integrates artificial intelligence ai natural language processing NLP and speech recognition technologies to process and respond to queries regarding academic schedules administrative procedures campus facilities and examination information the chatbot implements bilingual support English and Hindi with both text and voice-enabled interaction modalities accommodating diverse user preferences and accessibility requirements a hybrid architecture enables operation in online and limited offline modes using the Vosk speech recognition engine ensuring functionality during connectivity constraints the system is deployed as a cross-platform solution comprising a web-based interface and android mobile application providing ubiquitous access to institutional information experimental evaluation with 500 queries across 25 intent categories demonstrates.

I. INTRODUCTION

In contemporary academic environments effective information dissemination constitutes a fundamental requirement for institutional coordination and student success however many educational institutions continue to employ traditional communication mechanisms including physical notice boards manual enquiry counters and static websites for delivering critical information such as examination schedules academic calendars administrative procedures and campus announcements these conventional approaches exhibit inherent limitations information delays averaging 24-48 hours restricted accessibility for remote users increased administrative workload

consuming approximately 15-20 staff hours daily and frequent miscommunication due to human error cite1 cite3 the proliferation of digital technologies and artificial intelligence presents opportunities to address these challenges through intelligent automation conversational agents or chatbots have emerged as viable solutions for automated information dissemination across various domains including healthcare e-commerce and customer service cite2 within educational contexts chatbots offer the potential to provide instant accurate and personalized responses to student queries while reducing manual intervention this research proposes an ai-powered chatbot system specifically designed for college information management the primary contributions of this work include begin enumerate item development of a bilingual English and Hindi conversational agent supporting both text and voice-based interaction item integration of offline speech recognition capabilities using the Vosk engine for low-connectivity environments item implementation as cross-platform web and android applications ensuring ubiquitous access item comprehensive performance evaluation with quantitative metrics for accuracy response time and user satisfaction End enumerate the remainder of this paper is organized as follows section ii reviews related work in educational chatbot systems section iii describes the proposed system architecture and methodology section iv presents implementation details and the technologies employed section v discusses experimental results and performance evaluation section vi explores applications and implications section vii concludes the paper with future research directions.

II. LITERATURE SURVEY

It was clear to us, With the rapid advancement of Artificial Intelligence and Natural Language

Processing, chatbot technology has become an important tool for improving communication and information management in educational institutions. Several research studies have explored the development of chatbot systems to automate college enquiry services, provide academic assistance, and improve user interaction. Lalkot et al. proposed an interactive chatbot system for college enquiry that allows students to obtain information related to admissions, timetables, and administrative procedures through conversational interaction. The system uses Artificial Intelligence and Natural Language Processing techniques to Analyze user queries, detect intent, and generate appropriate responses from a predefined database. This approach helps reduce the workload of administrative staff and improves the efficiency of academic support services. Application / Paper Link: <https://www.ijraset.com/research-paper/an-interactive-chatbot-system-for-college-enquiry> Tarigan developed an NLP-based chatbot integrated with a university academic service system. The research highlights how conversational interfaces enable students to interact with academic service platforms in a more natural way. By integrating Natural Language Processing with the academic information system, the chatbot can provide quick responses and improve the digital transformation of university services. Application / Paper Link: <https://jurnal.geinrafflesia.com/index.php/JK/article/view/110> Another study by Jabitha and Swapna proposed a web-based college enquiry chatbot using Natural Language Processing techniques such as tokenization, lemmatization, and fuzzy matching. The chatbot retrieves information from a structured knowledge base and provides automated responses to users. The system also integrates text-to-speech functionality to improve accessibility and user experience. Application / Paper Link: <https://ijctjournal.org/college-enquiry-chatbot-nlp/> Debnath and Agarwal introduced a framework for implementing AI-integrated chatbot systems in educational institutions. Their research emphasized that chatbots can serve as virtual assistants for students by answering queries related to academic services and admission procedures. The study also highlighted the importance of combining knowledge bases with machine learning algorithms to improve chatbot performance. Application / Paper Link: <https://www.jsr.org/index.php/path/article/view/1063>

Recent research has also explored the use of AI-powered student assistance chatbots using Natural Language Processing and Machine Learning algorithms. These systems are capable of answering questions related to admissions, courses, examinations, fees, and placements. By learning from historical interactions, such chatbots can continuously improve their response accuracy and provide personalized assistance to students. Application / Paper Link: <https://www.ijraset.com/research-paper/ai-powered-student-assistance-chatbot-for-department-of-technical-education> Several studies have further emphasized that intelligent chatbot systems can significantly enhance student interaction and streamline the information retrieval process in academic institutions. Chatbots equipped with Natural Language Processing can analyze user queries, extract key information, and generate context-aware responses, thereby improving accessibility and communication efficiency within educational environments.

III. PROPOSED SYSTEM

The proposed system is designed to provide an intelligent and automated platform for delivering college-related information to students, faculty members, and visitors. The system integrates Artificial Intelligence (AI), Natural Language Processing (NLP), and speech recognition technologies to enable natural and efficient communication between users and the chatbot. The architecture of the system consists of several interconnected modules, including the User Interface Layer, Speech Recognition Module, Natural Language Processing Engine, Chatbot Processing Engine, Knowledge Base, Response Generation Module, and Admin Panel. These modules work together to process user queries and generate accurate responses in real time.

A. User Interface Layer

The User Interface Layer acts as the primary interaction point between the user and the chatbot system. This layer provides access through multiple platforms, including a web application and an Android mobile application. Users can interact with the system using either text-based chat or voice commands. The interface allows users to submit queries related to various college services such as admission procedures, examination schedules, scholarship information, training and placement activities, and campus

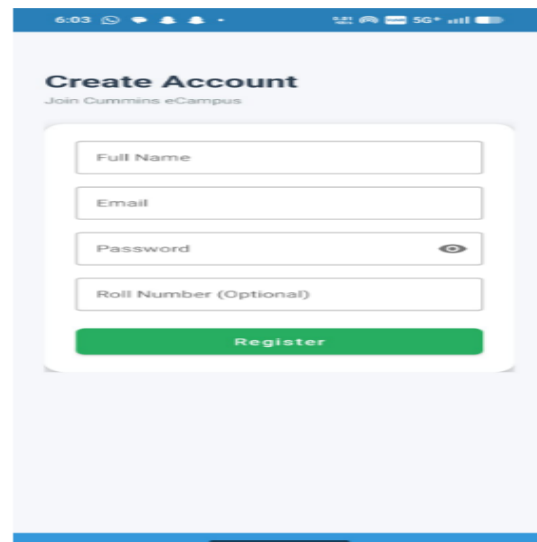
facilities. B. Speech Recognition Module The Speech Recognition Module enables the system to process voice-based user inputs. When a user submits a query through voice, this module converts the speech signal into textual data using a speech-to-text mechanism. This functionality improves accessibility and allows users to interact with the chatbot without typing queries. C. Natural Language Processing Engine The Natural Language Processing (NLP) engine plays a critical role in understanding user queries. The NLP module performs several operations including text preprocessing, tokenization, intent detection, and keyword extraction. By analyzing the input text, the system identifies the user's intent and determines the relevant information required to respond to the query. D. Chatbot Processing Engine The Chatbot Processing Engine is responsible for processing the interpreted user query and retrieving relevant information. This module communicates with the system's knowledge base to search for appropriate responses. The chatbot engine ensures that user queries are matched with the most relevant answers available in the database. E. Knowledge Base / Database The Knowledge Base stores institutional information required to answer user queries. This includes data related to: Academic schedules Examination timetables Admission procedures Scholarship information Training and placement activities Alumni details Campus facilities The chatbot retrieves information from this database to generate accurate responses. F. Response Generation Module Once the relevant data is retrieved, the Response Generation Module formats the output and delivers it to the user. Responses can be provided in text format or voice format using text-to-speech technology. This ensures that the system provides clear and understandable responses to users. G. Admin Panel The Admin Panel allows administrators to manage and update the chatbot knowledge base. Through this panel, administrators can add new information, modify existing data, and monitor user queries. The admin interface ensures that the chatbot database remains up-to-date and relevant.

IV. STEPS INVOLVED IN SYSTEM WORKING

The proposed system consists of two interconnected mobile applications designed to improve the accessibility of academic information within the

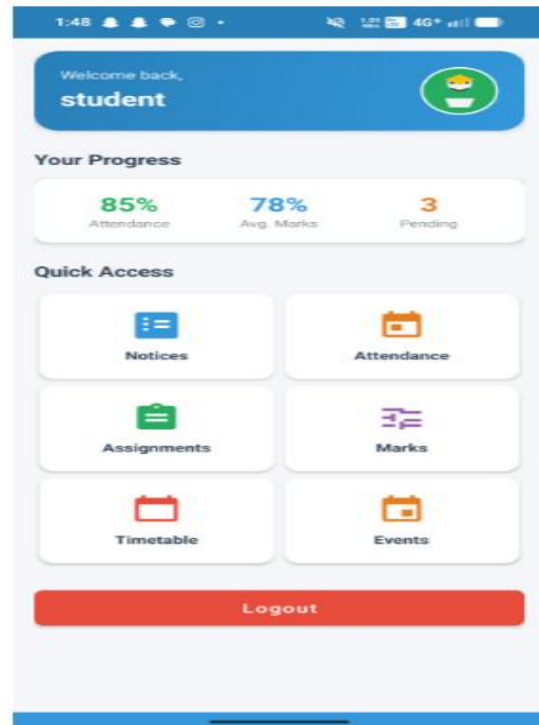
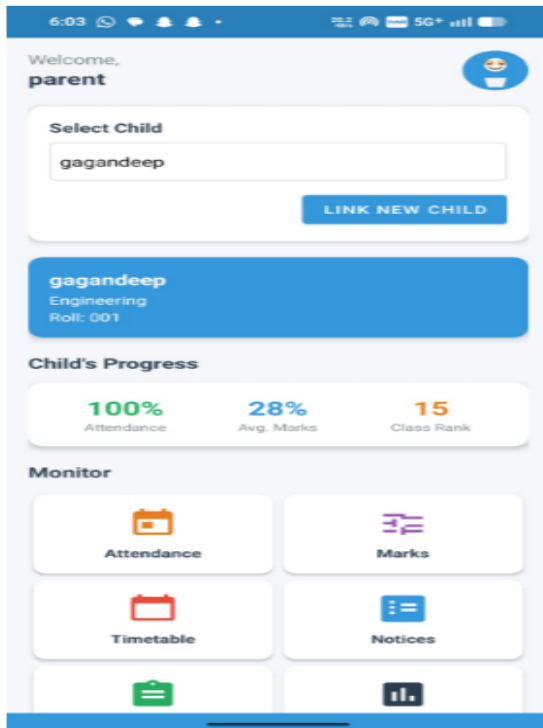
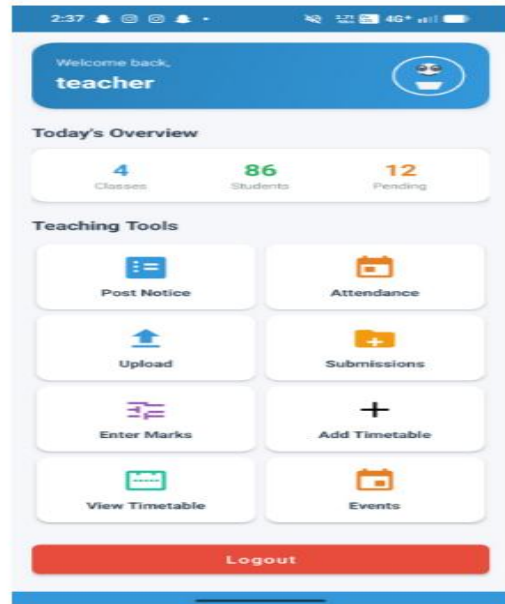
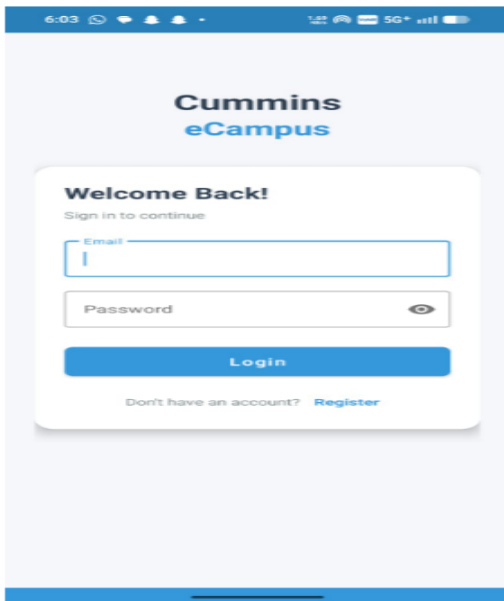
institution. The first application, Cummins eCampus, functions as a centralized digital platform that provides students with institutional resources and academic updates. The second application, Cummins AI eCampus, incorporates an Artificial Intelligence-based chatbot that enables users to obtain information through conversational interaction. Together, these applications create a comprehensive information management ecosystem that allows students and faculty members to quickly retrieve academic and administrative information. A. Working of Cummins eCampus Application The Cummins eCampus application operates as a digital gateway through which students can access various services provided by the institution. The working of this application involves several sequential steps that enable efficient delivery of information.

1. Application Initialization When the user launches the Cummins eCampus application, the system loads the primary interface and establishes a connection with the institutional database server. This step ensures that the application can retrieve updated information related to academic and administrative activities.
2. User Authentication Process To access personalized information, users must authenticate themselves through the login interface. The system requires the user to provide valid credentials such as a registered username and password. The entered credentials are verified by the backend server, and once validated, the user is granted access to the application dashboard.



3. Dashboard and Navigation Module After successful authentication, the user is redirected to the dashboard of the application. The dashboard acts as a central interface that organizes different sections of the application. Through this interface, users can navigate to multiple modules such as academic information, placement activities, scholarship updates, and campus announcements.

4. Academic Information Retrieval Within the academic module, the application provides information related to subjects, course schedules, examination timetables, and academic calendars. When a user selects a specific option, the application sends a request to the backend database, retrieves the required information, and displays it on the user interface.



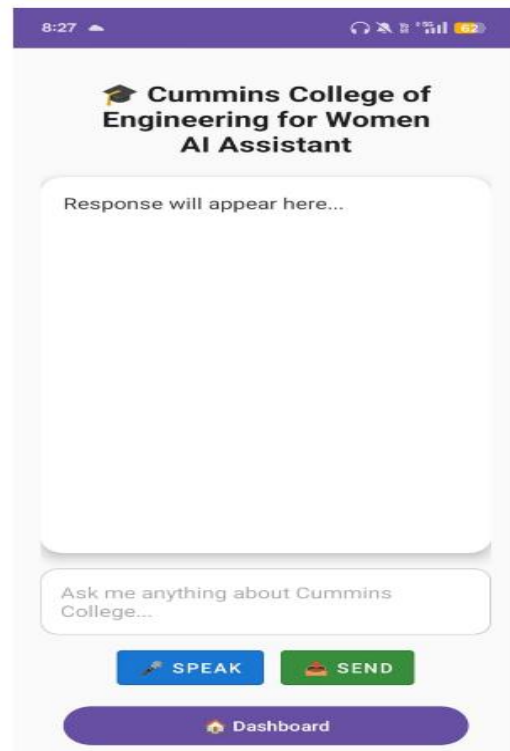
5. **Training and Placement Services** The training and placement module enables students to stay informed about internship opportunities, company recruitment drives, and placement announcements. The system periodically updates this information by synchronizing with the placement database maintained by the institution.
6. **Scholarship and Student Support Information** Another important feature of the application is the scholarship module. This module provides details regarding available government and private scholarships, eligibility requirements, and application procedures. Students can access this information without visiting administrative offices.
7. **Notification and Announcement System** The application continuously monitors institutional updates and displays notifications to users. These notifications may include information related to examination updates, academic events, workshops, or administrative announcements.

This feature ensures that students remain informed about important activities occurring within the institution. Through these modules, the Cummins eCampus application serves as a comprehensive platform for accessing institutional services and academic information.

B. Working of Cummins AI eCampus Chatbot Application The Cummins AI eCampus application introduces an intelligent chatbot system that assists users in retrieving information through natural language communication. The chatbot utilizes Artificial Intelligence and Natural Language Processing techniques to understand user queries and provide relevant responses.

1. **User Query Submission** The interaction begins when a user enters a query in the chatbot interface. The system allows users to communicate with the chatbot using either typed text or voice input. This flexible interaction method improves accessibility for different users.
2. **Input Processing** If the query is submitted through voice input, the application activates the speech recognition module to convert spoken words into textual form. This step allows the chatbot to process voice queries in the same manner as typed queries.
3. **Query Analysis and Natural Language Understanding** Once the input is converted into

text, the chatbot analyzes the query using Natural Language Processing techniques. The system examines the structure of the sentence and identifies key terms that indicate the user's request. For example, if the user asks about examination schedules, the chatbot detects keywords related to examinations and interprets the intent of the query accordingly.



4. **Intent Classification** After analyzing the query, the chatbot categorizes the request into predefined informational domains such as admissions, academic schedules, placements, scholarships, or campus services. This classification helps the system determine the most relevant information source.
5. **Knowledge Base Search** Once the query category is identified, the chatbot searches the institutional knowledge base to locate the information corresponding to the user's request. The knowledge base contains structured data related to different institutional services and academic activities.
6. **Response Generation** After retrieving the required information, the chatbot formulates an appropriate response. The response is structured in a clear and conversational format so that the user can easily understand the provided information.

7. Response Delivery The generated response is delivered to the user through the chatbot interface. If the application supports voice output, the response may also be converted into speech using a text-to-speech module.

Through these steps, the AI chatbot enables users to access institutional information quickly without navigating multiple application menus.

The integration of the Cummins eCampus application with the Cummins AI chatbot creates a hybrid information access system. While the eCampus application allows users to manually browse different information modules, the AI chatbot provides an intelligent conversational interface for retrieving the same information. This integrated approach enhances user experience by offering two complementary methods of accessing institutional resources. Students who prefer structured navigation can explore the application modules, while users who prefer conversational interaction can obtain information directly through the chatbot.

V. TOOLS AND TECHNOLOGIES USED

The development of the proposed AI-powered Cummins eCampus system requires the integration of multiple software tools, programming frameworks, and cloud technologies. These technologies enable efficient development of both the mobile application and the intelligent chatbot system.

A. Android Studio Android Studio is the primary Integrated Development Environment (IDE) used for developing the mobile applications. It provides a comprehensive environment for designing user interfaces, writing application logic, debugging code, and testing the application on emulators and physical devices. The platform supports various development tools that simplify the process of building scalable Android applications.

B. Java Programming Language The application logic of the system is developed using the Java programming language. Java provides a robust and platform-independent environment for developing Android applications. It supports object-oriented programming concepts which help in creating modular and maintainable code.

C. Firebase Cloud Platform The system utilizes Firebase as a cloud-based backend service for managing application data and authentication. Firebase provides real-time database functionality, which allows the application to synchronize data instantly across multiple users.

D. Natural Language Processing (NLP) Natural Language Processing techniques are used in the AI chatbot application to understand and process user queries. NLP enables the chatbot to analyze the structure and meaning of sentences entered by users.

E. Speech Recognition Technology The chatbot application also incorporates speech recognition technology to allow users to interact with the system through voice commands. This technology converts spoken language into text so that the chatbot can process the query using Natural Language Processing algorithms. This feature improves accessibility and enhances the user experience by enabling hands-free interaction.

F. Application Programming Interfaces (APIs) Application Programming Interfaces are used to enable communication between different components of the system. APIs allow the mobile application to interact with external services such as chatbot engines, databases, and notification services.

G. Cloud Database A structured cloud database is used to store institutional information such as academic schedules, scholarship details, placement updates, and campus announcements. The database ensures that information remains organized and easily accessible by both the application modules and the AI chatbot.

H. User Interface Design Tools User interface design tools are used to create an intuitive and user-friendly application layout. Proper UI design ensures that users can easily navigate through the application and access required information without complexity.

VI. RESULTS AND DISCUSSION

The proposed AI-powered Cummins eCampus system was developed to simplify access to institutional information and reduce the time required for students to obtain academic and administrative details. The

system integrates a mobile application platform with an Artificial Intelligence based chatbot to provide a more efficient and interactive information retrieval mechanism.

A. Implementation Results The developed system was successfully implemented as two Android-based mobile applications: the Cummins eCampus application and the Cummins AI eCampus chatbot application. Both applications were tested on Android devices to evaluate their functionality, performance, and usability. The Cummins eCampus application provides students with access to several academic services such as training and placement information, scholarship details, academic announcements, and institutional updates. The interface allows users to navigate through different modules and retrieve the required information quickly. The Cummins AI eCampus chatbot application enables users to interact with the system using natural language queries. The chatbot processes the user's query using Natural Language Processing techniques and retrieves relevant responses from the knowledge base. This conversational interface significantly improves the user experience by allowing students to obtain information without manually browsing through multiple sections of the application.

B. System Performance The performance of the proposed system was evaluated based on the following criteria:

- 1. Response Time** The chatbot system demonstrated fast response times when processing user queries. Most queries were processed and answered within a few seconds, ensuring a smooth and responsive user interaction.
- 2. Information Accessibility** The mobile application significantly improved the accessibility of institutional information. Students were able to obtain details related to placements, scholarships, and academic updates directly from their smartphones without visiting administrative offices.
- 3. User Interaction** The integration of the AI chatbot improved user interaction by enabling conversational communication with the system. Users could simply type or speak their questions and receive relevant answers instantly.
- 4. System Reliability** During testing, the system maintained stable performance with minimal

errors. The backend database successfully handled information retrieval requests from both the mobile application modules and the chatbot system.

C. Discussion The experimental implementation of the proposed system demonstrates the effectiveness of integrating a mobile information platform with Artificial Intelligence technologies. The Cummins eCampus application provides structured access to institutional information, while the AI chatbot simplifies the information retrieval process through natural language interaction. Compared to traditional information systems where students rely on manual searches or administrative assistance, the proposed system offers a faster and more convenient solution. The AI chatbot reduces the effort required to locate specific information and enhances overall user satisfaction. Additionally, the system can be easily expanded by updating the knowledge base and integrating additional institutional services. This flexibility makes the platform suitable for long-term deployment within educational institutions. The results indicate that the proposed system can effectively improve communication between students and institutional services while reducing the workload on administrative departments.

VII. APPLICATIONS

The proposed AI-powered eCampus system can be applied in various academic and institutional environments to improve the accessibility and management of information. The integration of a mobile application platform with an intelligent chatbot enables users to obtain academic and administrative information efficiently.

A. Educational Institutions The system can be implemented in schools, colleges, and universities to provide students with a centralized platform for accessing academic information. Students can retrieve details related to course schedules, examination timetables, placement updates, and institutional announcements directly through the mobile application.

B. Student Information Assistance The AI chatbot integrated into the system can serve as a virtual

assistant for students. It can answer frequently asked questions regarding admissions, scholarships, campus facilities, and academic procedures. This reduces the need for students to visit administrative offices for basic information.

C. Training and Placement Support The system can assist training and placement departments by providing students with updated information about internship opportunities, recruitment drives, and placement notifications. This helps students remain informed about career opportunities and improves communication between students and placement coordinators.

D. Scholarship Information Management The application can also be used to manage and distribute information related to scholarships. Students can easily access details about government and private scholarships, eligibility criteria, and application procedures.

E. Smart Campus Environment By integrating Artificial Intelligence and mobile technologies, the system contributes to the development of a smart campus environment. Institutions can use the platform to improve digital communication, automate information delivery, and enhance overall administrative efficiency.

F. 24/7 Information Access Unlike traditional administrative services that operate during limited working hours, the proposed system allows students to access information at any time. The AI chatbot ensures continuous availability of institutional support.

VIII. CONCLUSIONS

This paper presented the design and implementation of an AI-powered eCampus system that aims to simplify the process of accessing institutional information for students and faculty members. The proposed system integrates a mobile application platform with an intelligent chatbot to provide quick and efficient access to academic and administrative services. The Cummins eCampus application offers a centralized platform where users can obtain information related to academic schedules, training and placement activities, scholarship opportunities, and campus

announcements. This reduces the dependency on manual information systems and improves communication between students and institutional departments. In addition to the mobile application, the Cummins AI eCampus chatbot provides a conversational interface that enables users to retrieve information using natural language queries. By utilizing Natural Language Processing techniques, the chatbot can understand user requests and provide relevant responses in a short time. This feature enhances the overall usability of the system and makes information retrieval more convenient. The implementation results demonstrate that the proposed system successfully improves the accessibility of institutional information while reducing the workload on administrative staff. The integration of mobile technology and Artificial Intelligence creates a more efficient and interactive platform for academic information management. Overall, the proposed system contributes to the development of a digital and intelligent campus environment, where students can easily access essential information through both structured navigation and conversational interaction.

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