

Chat Kolumbano: Interactive Assistant for School Inquiries

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ABSTRACT

Saint Columban College, like many educational institutions, faces challenges in efficiently managing inquiries from students, parents, faculty, alumni, and visitors. Traditionally, staff are expected to be well-versed in the institution's processes and background to provide accurate information. However, this dependency on human personnel poses risks, especially when staff become unavailable or resign. To address this issue, the study proposes Chat Kolumbano, an intelligent chatbot assistant designed to streamline inquiry management. The system leverages advanced technologies such as Large Language Models (LLMs), semantic indexing, and Natural Language Processing (NLP) to provide real-time, accurate, and contextually relevant responses. This innovation aims to reduce administrative burden while enhancing user experience and information accessibility within the school environment.

Key words: Large Language Models (LLMs), Natural Language Processing (NLP), inquiry management, chatbot, educational technology

1. INTRODUCTION

Educational institutions face significant challenges in efficiently managing inquiries from students, parents, and faculty. From navigating admissions processes to addressing common academic and administrative concerns, school personnel are often overwhelmed by the sheer volume and variety of questions. These inefficiencies can result in delayed responses, reduced user satisfaction, and increased workloads for staff [1][2].

To address these issues, Chat Kolumbano was developed—an intelligent chatbot assistant designed to improve the way inquiries are managed in educational settings. By automating responses to frequently asked questions, the system reduces the burden on administrative teams while ensuring timely and accurate delivery of information to users.

Recent advancements in generative artificial intelligence (AI), particularly large language models (LLMs) such as ChatGPT and Claude, are transforming how information is accessed and processed in academic environments [3][4]. These models can assist with tasks like content generation, language translation, and information retrieval, making them powerful tools for both learners and educators [5]. In schools, AI-powered chatbots offer immediate, 24/7 support, helping streamline student services and enhance user engagement [6][7].

However, the integration of such technologies into education must be done with care. Concerns around data privacy, academic integrity, and ethical use have prompted the development of guidelines to govern their application in schools [8][9]. By implementing tools like Chat Kolumbano in a transparent and purpose-driven manner, institutions can embrace innovation while upholding trust and responsibility [10].

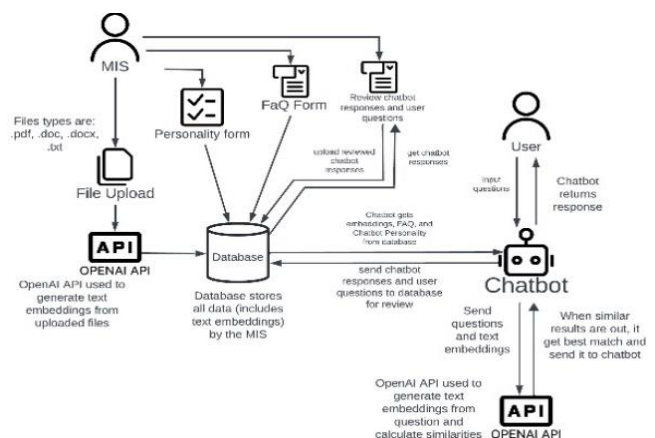


Figure 1: Product Perspective

From a product perspective, Figure 1 presents the system enabling efficient user interactions by combining OpenAI's capabilities with a centralized database. MIS uploads the documents, sets chatbot personalities, and manages FAQs,

which are processed into embeddings for accurate query matching. User queries are handled by the chatbot, leveraging the OpenAI API to retrieve the best responses. A feedback loop allows MIS to review and refine responses, ensuring continuous improvement and adaptability to user needs.

2. METHODOLOGY

The project adopted the Waterfall model, a traditional software development methodology characterized by its structured and sequential phases. This model is particularly suited for projects with clearly defined and stable requirements, such as Chat Kolumbano, where each phase must be completed before progressing to the next [11]. The development process followed these phases: Requirements Specification, Planning, Design, Implementation, Testing, Deployment, and Maintenance. This linear approach ensured a disciplined project workflow, minimized ambiguity, and allowed the team to manage scope, time, and resources effectively [12].

3. RESULTS

Following the structured approach outlined in the Methodology section, the results of each development phase are detailed below.

3.1 Requirements Specification

In the initial phase, the team conducted comprehensive requirements gathering through consultations with key stakeholders, including the school administration, staff, and project adviser. These discussions helped identify the specific needs and expectations regarding the chatbot's functionality. Emphasis was placed on aligning system features with the nature of user inquiries typically received by the school. This phase ensured that the chatbot would be responsive, relevant, and useful in real-world scenarios.

3.2 Planning

This phase involved laying a strong foundation for the project by defining its scope, objectives, and deliverables. A project roadmap was created to streamline development and ensure adherence to time constraints. To optimize productivity, tasks were distributed among team members based on individual strengths and availability. The planning stage also included the formulation of a resource management strategy, which addressed manpower, scheduling, and budget allocation. This strategic planning ensured that the project remained within financial limits and progressed efficiently.

3.3 Designing

a. Technical Specification

Chat Kolumbano comprises several key components. First is the web portal, where the MIS can manage the chatbot like

adding training data, managing training data, and looking at chat logs and correcting the chatbot. The second one is the plugin, where it can be dynamically added to any of the school's websites and users of those websites can easily access and use them where they can message the chatbot for inquiries.

The following tech serves as the foundation of the platform:

- HTML
- CSS
- JavaScript
- Firebase
- NextJS
- Visual Studio Code
- OpenAI

b. Use Case Diagram

A use case diagram illustrates the functional requirements and user interactions with a system from the perspective of its end users. Its primary aim is to provide a straightforward, high-level summary of how users interact with the system.

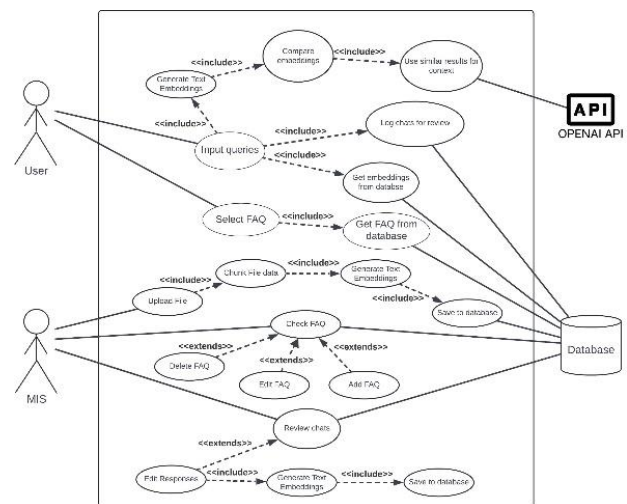


Figure 2: Use Case Diagram

Figure 2 illustrates the system's use case model, detailing the interactions between the users and the system. It highlights key functionalities such as generating text embeddings, managing FAQs, integrating with the OpenAI API, and leveraging Firebase Realtime Database for real-time updates and efficient data handling.

c. Interface Design

The interface design describes the production of the view of the user. It involves organizing visually appealing elements such as buttons, navigation menus and input fields. The goal of this phase ensures that the general user of the project has an easy experience of navigating the menus of Chat Kolumbano.

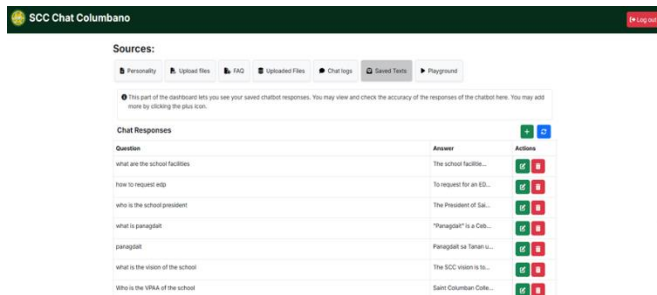


Figure 3: System dashboard

Figure 3 shows the System dashboard which offers a way to manage the chatbot of Chat Kolumbano. This ensures that the chatbot is managed easily and can be corrected if any of its responses are not accurate to the corresponding questions made by the visitor of the school.

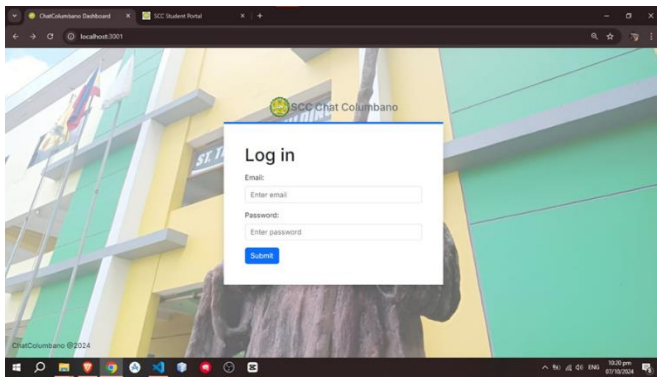


Figure 4: Account Login

Figure 4 shows the Login Page which serves as the gateway to the Chat Kolumbano dashboard, providing secure access to the database of the chatbot. Robust security measures ensure your information remains protected for a safe and enjoyable experience.



Figure 5: Chatbox

Figure 5 shows the Chatbox which offers a way for users to ask a question for the school in which those questions will be

recorded in the chatlogs in the Admin Dashboard. Asking questions here will prompt the user with a response from the chatbot providing them with the information they need.

3.4 Development Implementation

The development phase of the chatbot project, Chat Kolumbano, focused on building an intelligent and responsive Q&A system powered by OpenAI's language models. The process began with setting up the core application using the Next.js framework, chosen for its flexibility, performance, and ease of integration with both frontend and backend logic.

The development process utilized HTML, CSS, JavaScript, NextJS, and Firebase to build a dynamic, responsive, and user-friendly platform. These technologies ensured seamless access and interaction for artists, organizers, and visitors.

Designed to streamline school inquiries, and manage information dissemination, the chatbot helps by delivering prompt and accurate responses to inquiries, Chat Kolumbano aims to alleviate the workload on administrative staff and reduce response times for users.

By implementing Chat Kolumbano to the school's current website, it offers a versatile and portable information desk that can be used anywhere from within or outside the school. It will improve the way outsiders and current students of the campus inquire about the school.

3.5 Testing

The Testing Phase of Chat Kolumbano focused on ensuring accurate, efficient, and reliable chatbot performance. Various testing methods were applied to verify both backend logic and frontend user experience.

Unit testing was performed on key backend functions, including user input handling, prompt formatting, and OpenAI API communication, using mock API calls to reduce costs. Integration testing verified the full chat flow, including data handling, error management, and Firebase Realtime Database connection for chat history.

Manual testing on multiple devices and browsers assessed usability, layout consistency, and input behavior. Issues like duplicate submissions, delays, and UI freezes were addressed.

Edge case testing focused on scenarios like unclear questions and repeated prompts, ensuring the chatbot handled them smoothly with appropriate fallback responses.

User acceptance testing (UAT) involved real-world feedback, helping identify usability issues and guide final adjustments.

Overall, the Testing Phase ensured Chat Kolumbano met functional requirements, provided a smooth user experience, and remained stable, preparing it for deployment.

3.6 Deployment

The Deployment Phase of Chat Kolumbano focused on preparing the chatbot for a smooth and stable launch. This involved setting up the necessary infrastructure and ensuring everything was configured for optimal performance.

The deployment also included database configuration for Firebase Realtime Database, ensuring proper data storage and retrieval for chat histories. Security measures, such as API key protection and user authentication, were also implemented to safeguard user data.

Additional testing was performed to validate the system's stability and compatibility within its operational environment. Special attention was given to user onboarding, system configuration, and addressing any final adjustments.

3.7 System Evaluation and Maintenance Considerations

To test the functionality of our system, we divided it into two parts, the Dashboard functional testing and the Chatbot functional testing with the acceptance level of 79%.

The first chart displays the results of the dashboard functional testing where in it has pass and fail conditions. It has a score of 88% passed in the main dashboard and it has a score of 92% in the Login.

The second chart displays the results of the chatbot functional testing where it also has the pass and fail conditions. It has a score of 83% in [The user can send messages to chatbot], the second part [The chatbot lets the user know it is processing the sent message] has a score of 84%, and the last part [The chatbot successfully responded to the user.] has a score of 96%.

The third chart displays the overall non-functional test of the system where Functional stability has a rating of 97%, Reliability rating of 98%, Portability rating of 97%, Usability rating of 98%, Efficiency rating at 98%, Compatibility rating at 98%, and Maintainability rating of 98%

These results validate the system's readiness for deployment and its capability to support a wide range of users effectively.

In terms of maintenance, the project was designed with scalability and adaptability in mind. Future updates, bug fixes, and enhancements can be implemented efficiently due to the modular structure of the system and its use of modern web development frameworks. The integration with Firebase also ensures real-time database updates and simplified backend management. A maintenance protocol will be established to monitor performance metrics, manage security updates, and respond promptly to user feedback, ensuring long-term sustainability and continued user satisfaction.

4. CONCLUSION

In conclusion, Chat Kolumbano offers a reliable and efficient solution for managing inquiries in educational institutions. Leveraging advanced technologies like LLMs and NLP, it delivers accurate, real-time responses while streamlining administrative processes. Testing results highlight its strong functionality, with high success rates in dashboard and chatbot features, and exceptional performance in stability, usability, and efficiency. Chat Kolumbano effectively addresses user needs, reduces workloads, and enhances communication, making it a valuable tool for educational environments.

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