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Article

DEVELOPMENT AND ACCEPTABILITY OF AN INTELLIGENT CHATBOT FOR STUDENT SERVICES IN EASTERN SAMAR STATE UNIVERSITY SALCEDO CAMPUS

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Abstract: Academic and student services at Eastern Samar State University–Salcedo Campus traditionally rely on manual processes. These methods frequently lead to response delays and restrict information availability outside of regular operating hours, hindering students' timely access to crucial campus data. This study aimed to design, develop, and evaluate an AI-driven, intelligent chatbot tailored to support student service automation at ESSU-SC, focusing on routine, front-facing queries such as enrollment steps, schedules, and general university policies. Employing a developmental research design, the system utilized Google Dialogflow for Natural Language Processing and integrated AWS services alongside OpenAI APIs to build a dynamic conversation workflow. System interfaces were deployed via official university web platforms and Facebook Messenger. A rigorous evaluation framework was executed across three sequential phases: a Benchmark Test, an Alpha Test, and a Beta Test using the ISO 9126 Quality Model, culminating in a System Usability Scale (SUS) evaluation. Evaluators included system design experts from the faculty, standard university students, and a visually impaired individual to verify accessibility features. The system demonstrated progressive quality enhancements across all metrics throughout the testing lifecycle. The initial Benchmark Test yielded a "Very Good" overall mean score of 3.68, which advanced to an "Excellent" rating of 4.76 during the Alpha Test phase following interface and architectural refinements. The real-world Beta Test achieved a mean score of 4.38 ("Very Good"), showcasing perfect efficiency scores (5.00) in real-time response times and data processing. Furthermore, the SUS yielded a final score of 78, confirming that the application is highly usable, practical, and effective as an inclusive, assistive communication tool. The study successfully validated that the intelligent chatbot efficiently bridges communication barriers, automates repetitive administrative inquiries, and improves service accessibility. Future recommendations include expanding the bot's scope to encompass all university services, introducing multi-language capabilities, and adding advanced accessibility features to support broader inclusion.

Keywords: Intelligent Chatbot, Student Services Automation, Dialogflow, ISO 9126, System Usability Scale (SUS), Eastern Samar State University

1. Introduction

1.1 Background of the Study

Eastern Samar State University (ESSU), particularly its Salcedo Campus, serves a diverse student community by providing a broad spectrum of academic programs and essential student services. These services, managed by the Student Services and Alumni Affairs office, encompass orientation programs, guidance counseling, scholarship

facilitation, health services, and support for student organizations, all aimed at fostering the academic and personal growth of students (Eastern Samar State University, 2024). Despite these efforts, the current manual systems for disseminating information and assisting students face significant limitations, such as delays in response and restricted availability beyond regular office hours. This insufficiency hampers students' timely access to pertinent information regarding academic offerings, events, and administrative procedures.

The evolution of digital technologies has introduced intelligent chatbots—automated software agents designed to simulate human-like interactions—which have emerged as promising tools to address such challenges within educational institutions. Chatbots, empowered by artificial intelligence (AI), offer continuous, real-time, and multilingual support, capable of managing multiple simultaneous inquiries effectively (ESSU Can-Avid Campus Chatbot Project, 2025). These attributes suggest that implementing a customized intelligent chatbot can transform student service delivery by automating routine inquiries, thus enhancing communication efficiency and accessibility.

Prior studies corroborate the beneficial role of AI-based chatbots in academic settings, highlighting their capacity to augment student engagement, provide personalized assistance, and alleviate administrative workload (Masula, G. T., Barrios, R. T. & Hilario, E. D., 2025; Vanichvasin, P., 2021). Furthermore, the integration of AI chatbots aligns with ESSU's mission to promote academic excellence and student-centered services by leveraging technological innovation to support learning and campus life.

Consequently, this study is justified by the identified need to improve the responsiveness and availability of student services at ESSU Salcedo Campus. It aims to design, develop, and evaluate an intelligent chatbot tailored to the specific requirements of the campus community, offering a robust digital solution to enhance student experience and institutional operational efficiency.

1.2 Statement of the Problem

This study will address the following:

- What specific challenges do ESSU-SC students encounter when accessing campus services?
- In what ways can a chatbot improve access and responsiveness to essential student services?
- What are the measurable impacts on accuracy and user satisfaction following the chatbot's deployment

1.3 Objectives

The study primarily aims to design, develop, and evaluate an intelligent chatbot to support student service automation for ESSU–Salcedo Campus.

Specifically, the study aims to:

- Assess current workflows and pain points in student service delivery.
- Create an AI-driven chatbot tailored to ESSU-SC's needs.
- Integrate and pilot the chatbot across primary student service functions.
- Evaluate system performance in terms of speed, accuracy, and user acceptance.

1.4 Significance of the Study

This study will be beneficial to the following:

Students. The study will provide rapid responses and accessible information at any time.

Public Relations Officer. The study will help reduce repetitive queries and provide more time for higher-level tasks.

Administration. The study will provide analytics for service improvement, reduced queues, and operational bottlenecks.

1.5 Scope and Limitations

The study will only encompass information on enrollment, class schedules, campus events, general FAQs, university policies, and contact details. Interfaces will be implemented via official web platforms and Facebook Messenger. However, the Chatbot will not provide confidential or personalized academic counseling in the early stages, and is also limited to front-facing, non-sensitive student services.

2. Review of Related Literature

2.1 Chatbot Technology in Education

Educational chatbots powered by NLP and machine learning (ML) are increasingly used for virtual assistants, FAQs, and administrative support. According to Smith et al. (2022), chatbots have improved information dissemination and service efficiency at several universities, reducing administrative workload and boosting student satisfaction.

2.2 Types, Architecture, and Platforms

Popular development platforms include Dialogflow, IBM Watson, and Rasa. Rule-based chatbots follow scripted answers, while AI-driven chatbots leverage NLP for dynamic, context-aware conversations, offering a human-like interface.

Research identifies major benefits such as scalable support, its availability, and cost efficiency. Challenges include understanding colloquial language, ensuring data privacy, and technical limitations for highly specialized or confidential inquiries.

2.3 Local and International Related Works

Several universities in the Philippines have implemented this technology. UP Diliman's chatbot "Iskobot" provides information on admissions and scholarships. Additionally, the De La Salle University–Green Archer Guide provides campus navigation and FAQ support. Lastly, in the international arena, consider including Georgia Tech's "Jill Watson" and Stanford's "AskSU" to expand the list.

However, few studies tailor chatbot content for Eastern Visayas institutions, addressing local language, cultural nuances, and unique administrative workflows.

3. Methodology

3.1 Research Design

This will employ the developmental research design focused on technology creation and evaluation. Methods include surveys, interviews, prototyping, and pilot testing.

3.2 Requirements Analysis

Surveys were administered to 200 ESSU-SC students and 20 staff to identify common queries, user expectations, and channel preferences. Also, interviews were conducted with administrators to clarify workflow integration points.

3.3 System Analysis and Design

Figure 1 depicts interfaces with the university website, Facebook Messenger, and internal databases. The system employs a serverless, event-driven Retrieval-Augmented Generation (RAG) architecture split into two discrete pipelines: an asynchronous knowledge ingestion phase and a synchronous, context-aware query resolution cycle. The entire ecosystem leverages a combination of Cloud Native Infrastructure (Amazon Web Services) and external Advanced Language Model APIs (OpenAI) to deliver scalable, dynamic, and contextually grounded responses to user inquiries.

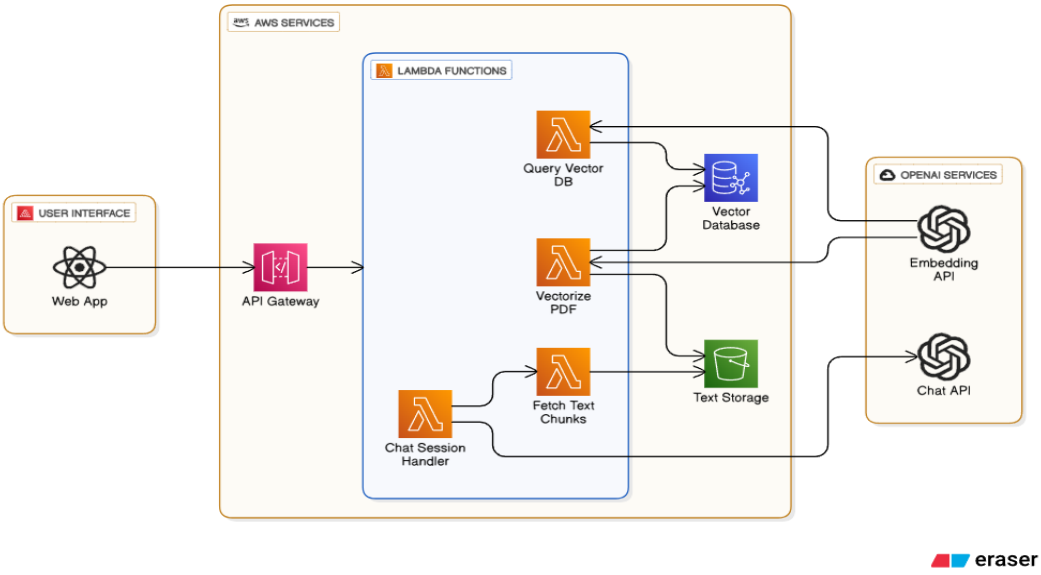

Figure 1. System Architecture

1. **The Ingestion and Indexing Pipeline**

Before the system can resolve complex domain-specific requests, unstructured institutional knowledge (such as university policy PDFs and enrollment schedules) must undergo vectorization and semantic indexing. When documents are uploaded, they trigger an isolated orchestration handler, the Vectorize PDF AWS Lambda function. This microservice systematically ingests the documentation, splits the text strings into standardized, optimal token lengths to prevent contextual degradation, and commits these raw text blocks to a secure data repository designated as Text Storage (Amazon S3). Simultaneously, these discrete text chunks are forwarded to the OpenAI Embedding API, which maps the textual semantic properties into high-dimensional vector arrays. The generated embedding coordinates are then routed back into the local environment and saved within a high-performance Vector Database. This database serves as a mathematical repository, indexing information by conceptual meaning rather than static keywords, which makes near-instantaneous semantic retrieval possible.

2. **The Conversational Inference Loop**

The end-to-end execution path for a live user prompt follows a highly coordinated synchronous workflow designed to inject relevant source information directly into the language model's context window, minimizing text hallucinations.

Request Entry and Dispatch. The process initiates at the user interface (Web App), where the user inputs a natural language query. The request is transmitted over HTTPS to an AWS API Gateway, which acts as the system's entry point, handling security throttling and routing the incoming payload to the primary backend compute node: the Chat Session Handler Lambda function.

Vector Query Transformation. To identify what institutional documentation relates to the user's question, the session handler offloads the string input to the Query Vector DB Lambda function. This service sends the user's prompt to the OpenAI Embedding API to convert the string payload into a matching high-dimensional vector representation.

Semantic Similarity Matching. The calculated question vector is subsequently matched against the pre-indexed repository inside the Vector Database using spatial similarity metrics (such as Cosine Similarity). The system instantly returns the unique mathematical addresses of the top-ranking, highly relevant knowledge blocks.

Context Retrieval and Extraction. Once the relevant block pointers are isolated, the system invokes the Fetch Text Chunks Lambda function. This function reads the matching raw textual information from the Text Storage target bucket, gathering verified source text to answer the query.

Response Synthesis. The Chat Session Handler aggregates the retrieved text segments alongside the user's original query into a unified context packet. This contextualized instruction set is dispatched directly to the OpenAI Chat API. By anchoring the response generated by the model to verified text files, the system produces a factually accurate, natural language answer that is passed back through the API Gateway to the interface.

3.3.2 Conversation Flow and Intents

Enrollment steps, class schedules, event calendar, FAQs, contact info, and feedback mechanism served as the core content of the chatbot. On the other hand, graceful error responses and escalation to human staff if needed.

3.3.3 Technology Stack

The technology was implemented in the Chat bubble on ESSU-SC website/Messenger bot. Google Dialogflow (NLP) was utilized as the backend, and pre-loaded datasets of university services will serve as the content of the chatbot.

3.4 Implementation

For the implementation phase, the following stages were conducted: Prototype conversational flows based on real FAQs, Program intents and entities in Dialogflow, and Integrate with web and Messenger using Dialogflow fulfillment.

3.5 Evaluation Procedure

Pilot Rollout to 30 students for two weeks was conducted. Data, specifically Chat logs, system response times, error rates, and CSAT (Customer Satisfaction Score) post-session surveys, will be collected from the Public Relations Office.

4. Results and Discussion

This chapter presents the results and discussion of the acceptance testing conducted to evaluate the overall functionality, performance, and user experience of the Chatbot. The acceptance testing consisted of three phases: the Benchmark Test, the Alpha Test, and the Beta Test. Each testing phase aimed to identify issues, gather user feedback, and verify whether the system met the intended requirements in terms of accuracy, usability, reliability, and accessibility by the users. This chapter also includes screenshots of the developed system and application.

4.1 Acceptance Testing

After the development phase of the system, the Chatbot underwent a series of acceptance tests to evaluate its quality, performance, and usability. These tests aimed to determine whether the requirements specified during the development stage were accomplished. After each testing phase, respondents provided feedback on whether the system met their expectations and identified any revisions or improvements needed for optimization.

The first test was conducted on September 29, 2025, known as the Benchmark Test. This evaluation focused on the system’s accuracy, security, Wi-Fi connectivity, and Firebase integration. The assessment was carried out using the ISO (International Organization for Standardization) 9126 Quality Model for External and Internal Quality Score Cards, which measure software attributes such as functionality, reliability, usability, efficiency, maintainability, and portability.

Next, the Alpha Test was conducted on October 8, 2025, using the same ISO-based scorecard. This phase primarily assessed the design, interface, and usability of the Chatbot after implementing the feedback gathered during the benchmark test. Finally, the Beta Test was carried out on October 9, 2025, which involved the complete integration and real-world evaluation of the chatbot to ensure its functionality and accessibility under actual usage conditions.

The respondents during the testing phase included selected faculty members from the College of Computer Studies (CCS) of Eastern Samar State University – Salcedo Campus, chosen for their expertise in System Design. In addition, the students served as the main evaluators during the Beta Test. Their participation provided valuable insights into the system’s accessibility and overall usability for its intended users.

Scale	Code	Description
4.20 – 5.00	1	Excellent

3.40 – 4.19	2	Very Good
2.60 – 3.39	3	Good
1.80 – 2.59	4	Poor
1.00 – 1.79	5	Very Poor

Benchmark Test Results of the Chatbot for Real-Time Interaction with Android Devices

Functionality. Table 1 shows that the system's functionality obtained an overall mean of 3.75, interpreted as "Very Good." This implies that the developed Chatbot efficiently performs its intended purpose. The system also demonstrates dependable accuracy and secure data transmission, confirming that it successfully meets the user requirements for functionality.

Table 1

Benchmark Test Results on the Quality Attributes of the Chatbot in terms of Functionality

Criteria	**Mean**	**Interpretation**
The capability of the product to provide appropriate functions for specified tasks and user objectives.	4.0	Very Good
The capability of the software product to produce accurate and expected results.	3.0	Good
The capability of the system to interact with other specified systems, such as Android devices, through Bluetooth or Wi-Fi.	4.0	Very Good
The capability of the system to ensure user security and data privacy.	4.0	Very Good
Overall Mean	**3.75**	**Very Good**

Reliability. Table 2 indicates that the system's reliability achieved an overall mean score of 3.67, rated as "Very Good." This signifies that the tool performs reliably during continuous use and can handle occasional disconnections without causing major data loss or system failure. The results suggest that the Chatbot can sustain stable communication and recovery, essential for real-time interaction with the users.

Table 2

Benchmark Test Results on the Quality Attributes of the Chatbot in terms of Reliability

Criteria	**Mean**	**Interpretation**
The capability of the software to avoid failure as a result of software faults.	4.0	Very Good
The capability of the software to maintain its level of performance during faults or interruptions.	4.0	Very Good
The capability of the system to recover data directly affected by a failure.	3.0	Good
Overall Mean	**3.67**	**Very Good**

Efficiency. Table 3 reveals that the system obtained an overall mean of 3.33**,** interpreted as "Good." This means that the Chatbot effectively handles clients' queries in real time. However, slight latency may occur depending on the signal strength and data connection. Despite this, the efficiency level remains satisfactory and appropriate for its intended purpose.

Table 3 Benchmark Test Results on the Quality Attributes of the Chatbot in terms of Efficiency

Criteria	**Mean**	**Interpretation**
The system's ability to process and transmit Braille input efficiently under normal conditions.	3.0	Good

The software's capability to utilize resources effectively without excessive delay.	4.0	Very Good
The capability of the system to maintain smooth real-time performance with minimal latency.	3.0	Good
Overall Mean	**3.33**	**Good**

Maintainability. Table 4 presents the system's maintainability, which had an overall mean of 4.0**,** rated as "Very Good." This result indicates that the Chatbot be easily maintained and updated without disrupting performance. The modular programming design allows developers to identify and correct issues efficiently, ensuring the sustainability of the system for long-term use.

Table 4
Benchmark Test Results on the Quality Attributes of the Chatbot in terms of Maintainability

Criteria	Mean	Interpretation
The capability of the software to be diagnosed for failures or issues.	4.0	Very Good
The capability of the system to be modified and updated efficiently.	4.0	Very Good
The ability of the system to maintain stability after modifications.	4.0	Very Good
Overall Mean	**4.0**	**Very Good**

Portability. Table 5 shows that the system's portability received an overall mean score of 3.67, interpreted as "Very Good." This implies that the Chatbot can function effectively across different devices.

Table 5
Benchmark Test Results on the Quality Attributes of the Chatbot in terms of Portability

Criteria	Mean	Interpretation
The ability of the system to be installed and operated in various Android devices.	4.0	Very Good
The capability of the ESP32 to adapt to different network environments such as mobile data and Wi-Fi.	4.0	Very Good
The system's ability to operate across devices without requiring extensive setup.	3.0	Good
Overall Mean	**3.67**	**Very Good**

Usability. Table 6 displays the usability attribute gained an overall mean of 3.67, which is interpreted as "Very Good." This suggests that the interface is user-friendly and efficient for clients.

Table 6
Benchmark Test Results on the Quality Attributes of the Chatbot in terms of Usability

Criteria	Mean	Interpretation
The capability of the user to understand and operate the system.	4.0	Very Good
The capability of the system to support easy learning for new users.	4.0	Very Good
The capability of the system to be visually and functionally appealing to users.	3.0	Good
Overall Mean	**3.67**	**Very Good**

Benchmark Summary. Table 7 summarizes the overall evaluation of the Chatbot during the Benchmark Test conducted on September 29, 2025. The system achieved an overall mean score of 3.68, which is interpreted as "Very Good."

Among the six quality attributes**,** Maintainability obtained the highest mean score of 4.00, indicating that the system can be easily updated, debugged, and improved without compromising its performance. This suggests that the system's modular design and clear code structure allow for effective troubleshooting and enhancement when needed.

The attributes Functionality**,** Reliability**,** Portability, and Usability all received ratings of "Very Good"**,** which implies that the Chatbot successfully met the expected standards of performance and dependability. These results indicate that the system operates efficiently across different Android devices, maintains stable communication, and provides an accessible interface suitable for the users.

Meanwhile**,** Efficiency obtained a slightly lower mean rating of 3.33, interpreted as "Good." This reflects minor performance limitations such as processing delay or slower Wi-Fi connection response. Nonetheless, the device remains effective in performing real-time communication.

Overall, the results of the benchmark test demonstrate that the Chatbot is a well-developed and reliable system, meeting the ISO 9126 quality standards in most areas. The findings confirm that the system is ready for further evaluation under the Alpha and Beta Testing phases, focusing on refining its performance, user experience, and communication efficiency.

Table 7
Summary of the Benchmark Test for the Chatbot for Real-Time Interaction with Android Devices

Criteria	**Mean**	**Interpretation**
Functionality	3.75	Very Good
Reliability	3.67	Very Good
Efficiency	3.33	Good
Maintainability	4.00	Very Good
Portability	3.67	Very Good
Usability	3.67	Very Good
Overall Mean	**3.68**	**Very Good**

Alpha Test Results of the Chatbot Evaluated by a Faculty Members

Functionality. Table 8 presents the evaluation results for the system's functionality. It obtained an overall mean of 4.75, interpreted as Excellent. This indicates that the application provides the appropriate functions and user objectives with a high degree of accuracy and reliability. The system's ability to operate seamlessly with other integrated components demonstrates its improved interoperability and performance.

Table 8
Alpha Test Results on the Quality Attributes of the Chatbot in terms of Functionality

Criteria	**Mean**	**Interpretation**
Suitability	5.0	Excellent
Accuracy	5.0	Excellent
Interoperability	5.0	Excellent
Security	4.0	Very Good
Overall Mean	**4.75**	**Excellent**

Reliability. Table 9 shows the reliability test results of the system. It achieved an overall mean of 4.33, which is interpreted as Very Good. This suggests that the system can perform consistently and maintain performance even in the presence of faults or minor system failures. The high score for fault tolerance indicates that the app is capable of sustaining data integrity and maintaining stable communication between the Chatbot and the user.

Table 9
Alpha Test Results on the Quality Attributes of the Chatbot in terms of Reliability

Criteria	Mean	Interpretation
Maturity	4.0	Very Good
Fault Tolerance	5.0	Excellent
Recoverability	4.0	Very Good
Overall Mean	**4.33**	**Very Good**

Efficiency. Table 10 shows that the system achieved an overall mean of 5.0, interpreted as Excellent. This indicates that the system performs its operations efficiently with optimal response times and minimal resource usage. The integration of Firebase and Wi-Fi connectivity contributed to the improved data synchronization and overall performance speed of the application.

Table 10
Alpha Test Results on the Quality Attributes of the Chatbot in terms of Efficiency

Criteria	Mean	Interpretation
Time Behavior	5.0	Excellent
Resource Utilization	5.0	Excellent
Overall Mean	**5.0**	**Excellent**

Maintainability. Table 11 presents the maintainability attribute results, with an overall mean of 4.75, interpreted as Excellent. The system demonstrates high adaptability and can be easily diagnosed, modified, and tested without significant risk of errors. This reflects a well-structured and organized code design, allowing developers to make future improvements efficiently.

Table 11
Alpha Test Results on the Quality Attributes of the Chatbot in terms of Maintainability

Criteria	Mean	Interpretation
Analyzability	4.0	Very Good
Changeability	5.0	Excellent
Stability	5.0	Excellent
Testability	5.0	Excellent
Overall Mean	**4.75**	**Excellent**

Portability. Table 12 shows that the system attained a perfect overall mean of 5.0, rated as Excellent**.** This confirms that the Chatbot can be easily installed and adapted across various mobile devices. The system's lightweight design and simple installation process enhance its portability and scalability.

Table 12
Alpha Test Results on the Quality Attributes of the Chatbot in terms of Portability

Criteria	Mean	Interpretation
Adaptability	5.0	Excellent
Installability	5.0	Excellent
Replaceability	5.0	Excellent
Overall Mean	**5.0**	**Excellent**

Usability. Table 13 presents the usability results, showing an overall mean of 4.75, interpreted as Excellent. The high scores indicate that the system is easy to understand, learn, and operate, with a user-friendly interface that allows smooth interaction between the user and the application. The slightly lower rating for attractiveness reflects users' adjustments that could further enhance the user experience.

Table 13
Alpha Test Results on the Quality Attributes of the Chatbot in terms of Usability

Criteria	Mean	Interpretation
Understandability	5.0	Excellent
Learnability	5.0	Excellent
Operability	5.0	Excellent
Attractiveness	4.0	Very Good
Overall Mean	**4.75**	**Excellent**

Alpha Test Summary. Table 14 summarizes the evaluation of the Chatbot during the Alpha Test, which was conducted on October 8, 2025. The system achieved an overall mean score of 4.76, which falls under the "Excellent" interpretation. This result indicates a significant improvement from the Benchmark Test phase, demonstrating that the modifications and enhancements implemented were effective in refining the system's performance and user experience.

Among all six quality attributes, Efficiency and Portability obtained the highest mean score of 5.00, both rated as "Excellent." This signifies that the system can process information efficiently and transmit data between the Chatbot and the clients with minimal delay. Furthermore, it can be easily installed and operated across multiple Android devices without compatibility issues, highlighting its adaptability and lightweight design.

The attributes Functionality**,** Maintainability, and Usability also earned "Excellent" ratings, with mean scores of 4.75 each. These results confirm that the system performs its intended tasks accurately, is user-friendly, and can be maintained or updated easily when modifications are necessary. The positive feedback on the application's user interface demonstrates that the adjustments made after the Benchmark Test successfully improved the visual layout and accessibility of the program. On the other hand, the Reliability attribute received a mean rating of 4.33, interpreted as "Very Good." This suggests that while the system performs consistently under normal operating conditions, there remains a minor potential for further enhancement in ensuring continuous operation under unstable network connectivity.

Overall, the Alpha Test results prove that the Chatbot effectively met its functional and usability standards after refinement. The application performed smoothly during testing, showing its readiness for real-world validation in the upcoming Beta Test phase with an actual clientele.

Table 14
Summary of the Alpha Test for the Chatbot

Criteria	Mean	Interpretation
Functionality	4.75	Excellent
Reliability	4.33	Very Good
Efficiency	5.00	Excellent
Maintainability	4.75	Excellent
Portability	5.00	Excellent
Usability	4.75	Excellent
Overall Mean	**4.76**	**Excellent**

Beta Test Results of the Chatbot Evaluated by Students

Functionality. Table 15 presents the functionality results, showing an overall mean of 4.5, interpreted as Excellent. The results indicate that the Chatbot performs its primary functions efficiently, allowing text transmission and conversion between the Chatbot and the users. The system provides accurate responses, secure data transfer, and reliable interoperability through Firebase.

Table 15 Beta Test Results on the Quality Attributes of the Chatbot in terms of Functionality

Criteria	Mean	Interpretation
Suitability	4.0	Very Good
Accuracy	5.0	Excellent
Interoperability	5.0	Excellent
Security	4.0	Very Good
Overall Mean	**4.5**	**Excellent**

Reliability. Table 16 shows the reliability attribute obtained an overall mean of 3.67, interpreted as Very Good. The system was able to maintain a consistent level of performance throughout the testing. Although minor connection interruptions occurred due to varying Wi-Fi signal strength, the device successfully recovered communication after reconnection.

Table 16 Beta Test Results on the Quality Attributes of the Chatbot in terms of Reliability

Criteria	Mean	Interpretation
Maturity	4.0	Very Good
Fault Tolerance	3.0	Good
Recoverability	4.0	Very Good
Overall Mean	**3.67**	**Very Good**

Efficiency. Table 17 presents the efficiency results, where the system achieved an overall mean of 5.0, interpreted as Excellent. This demonstrates that the Chatbot communicates smoothly and quickly in real-time. The response time between input and output was minimal, ensuring the device operates effectively without noticeable delay.

Table 17 Beta Test Results on the Quality Attributes of the Chatbot in terms of Efficiency

Criteria	Mean	Interpretation
Time Behavior	5.0	Excellent
Resource Utilization	5.0	Excellent
Overall Mean	**5.0**	**Excellent**

Maintainability. Table 18 obtained an overall mean of 4.25, interpreted as Very Good. This result suggests that the system can be easily analyzed, modified, and tested for further enhancement. Although stability received a lower rating of 3.0 due to occasional communication lags during Wi-Fi disconnection, the tool remains reliable and maintainable overall.

Table 18 Beta Test Results on the Quality Attributes of the Chatbot in terms of Maintainability

Criteria	Mean	Interpretation
Analyzability	4.0	Very Good

Changeability	5.0	Excellent
Stability	3.0	Good
Testability	5.0	Excellent
Overall Mean	**4.25**	**Very Good**

Portability. Table 19 presents the results for portability, which attained an overall mean of 4.33, interpreted as Very Good. This shows that the system is easy to install and adaptable to multiple Android devices. However, the replaceability score was slightly lower due to the need for a stable 2.4GHz Wi-Fi or 4G network connection.

Table 19 Beta Test Results on the Quality Attributes of the Chatbot in terms of Portability

Criteria	**Mean**	**Interpretation**
Adaptability	5.0	Excellent
Installability	5.0	Excellent
Replaceability	3.0	Good
Overall Mean	**4.33**	**Very Good**

Usability. Table 20 shows that the system's usability gained an overall mean of 4.5, interpreted as Excellent. The user found the device understandable and easy to learn after short guidance. Thus, the system was still rated highly for its accessibility.

Table 20 Beta Test Results on the Quality Attributes of the Chatbot in terms of Usability

Criteria	**Mean**	**Interpretation**
Understandability	4.0	Very Good
Learnability	5.0	Excellent
Operability	5.0	Excellent
Attractiveness	4.0	Very Good
Overall Mean	**4.5**	**Excellent**

Beta Test Summary. Table 21 summarizes the findings of the Beta Test conducted on October 9, 2025, for the Chatbot for Real-Time Interaction with clients. The system achieved an overall mean score of 4.38, which is interpreted as Very Good. This indicates that the system is effective, functional, and suitable for real-world use, especially for clients.

The highest ratings were obtained under Efficiency, with a perfect mean score of 5.0, signifying the system's excellent performance in terms of response time and data processing speed. Functionality and Usability followed closely with mean scores of 4.5 each, indicating that the system performs its core features accurately and provides an accessible interface for the user.

Reliability, Maintainability, and Portability were all rated as Very Good, with mean scores ranging from 3.67 to 4.33. Minor concerns noted during testing include occasional signal delay. Despite these limitations, the system was still found to be dependable, portable, and easy to maintain.

Overall, the Beta Test validated that the Chatbot is highly functional, efficient, and user-friendly. The visually impaired evaluator confirmed that the device is beneficial for communication purposes, especially once familiar with the Braille alphabet. These results indicate that the system meets its intended objectives and is ready for potential deployment as an assistive communication tool for the clients.

Table 21 Summary of the Beta Test for the Chatbot for Real-Time Interaction with Android Devices

Criteria	Mean	Interpretation
Functionality	4.5	Excellent
Reliability	3.67	Very Good
Efficiency	5.0	Excellent
Maintainability	4.25	Very Good
Portability	4.33	Very Good
Usability	4.5	Excellent
Overall Mean	**4.38**	**Very Good**

System Usability Test

After the acceptance testing, the System Usability Test (SUS**)** was conducted to evaluate whether the developed application conforms to usability standards and is ready for implementation. The test aimed to determine how effectively the system allows users to accomplish their intended communication goals.

The respondent used the System Usability Scale (SUS) developed by the Digital Equipment Corporation (1986)**,** which measures how well a product enables users to complete tasks effectively and efficiently. The SUS has been proven to be a reliable and robust tool that correlates well with other usability measures. It is generally administered after respondent have used the application being evaluated, but before any debriefing or discussion takes place.

To compute the SUS score, the inputs from each of the ten statements are added together. Each item has a score contribution ranging from 0 to 4. For positive items (1, 3, 5, 7, and 9), the score contribution is the scale position minus one. For negative items (2, 4, 6, 8, and 10), the contribution is five minus the scale position. The total sum is then multiplied by 2.5 to yield the final SUS value. A SUS score of 68 or higher is considered above average, indicating good usability, while a score below 68 suggests areas for improvement.

The System Usability Test for the Chatbot was conducted in October 2025 at Salcedo, Eastern Samar, with the participation of the students in the university. The evaluation measured the respondent's satisfaction, ease of use, and confidence when using the system.

System Usability Test Results of the Chatbot

Table 22 presents the summary of results for the System Usability Test of the Chatbot. It shows the respondents' overall evaluation of the 10 usability criteria. The system obtained a total SUS score of 78**,** which indicates that the developed application is highly usable and ready for practical use by the clients and supporting users.

Table 22 Summary of the System Usability Test Results on the Chatbot for Real-Time Interaction with Android Devices

Criteria	Mean	SUS Score
I think that I would like to use this system frequently.	4.5	3.5
I found the system unnecessarily complex.	2.0	4.0
I thought the system was easy to use.	4.5	3.5
I think that I would need the support of a technical person to use this system.	2.0	3.0
I found the various functions in this system were well integrated.	4.5	3.5
I thought there was too much inconsistency in this system.	2.0	4.0
I would imagine that most people would learn to use this system quickly.	4.5	3.5

I found the system very cumbersome to use.	2.0	4.0
I felt very confident using the system.	4.5	3.5
I needed to learn a lot of things before I could get going with this system.	2.0	4.0
Total SUS Score	34.0	
Over-all SUS Score	**78**	

Screenshots

Figures 2 and 3 present screenshots of the chatbot, where the user prompts a query, and the Chatbot automatically responds.

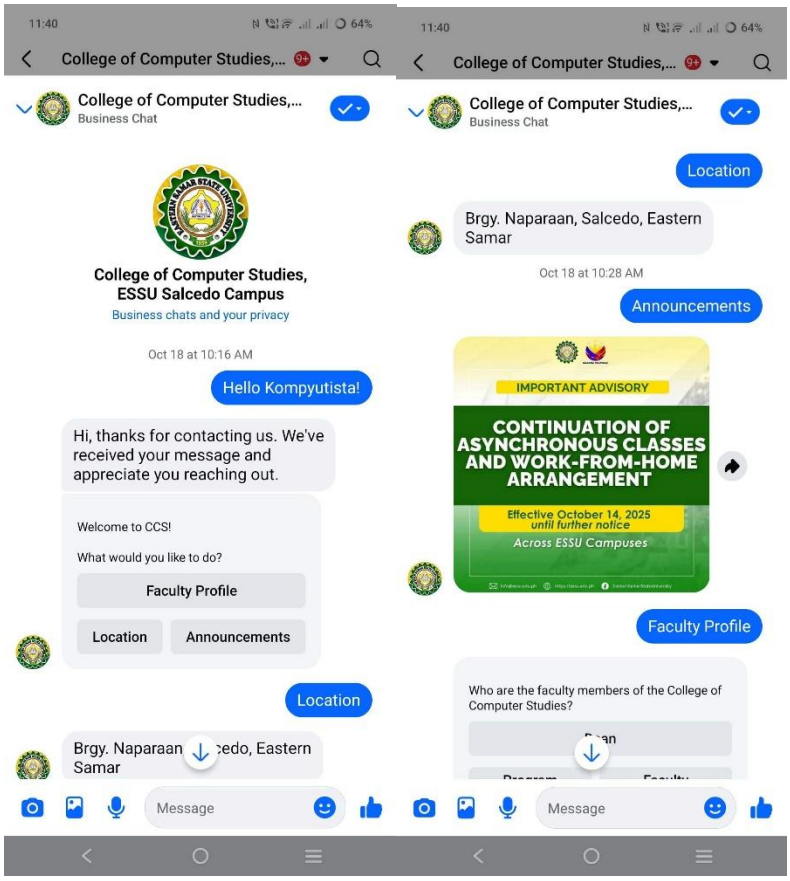

Figure 2 -3. Screenshots of the Chatbot

5. Summary, Conclusions and Recommendations

This chapter presents the summary, conclusions, and recommendations.

Summary

This study aimed to use a chatbot to assist clients in knowing the various services offered by the university. The system utilized Firebase technology to enable real-time sending and receiving of messages between the device and the Android application. The development process followed a structured approach consisting of design, coding, testing, and evaluation phases. The system underwent three stages of acceptance testing: Benchmark Test, Alpha Test, and Beta Test. The Benchmark Test focused on evaluating the system's accuracy, security, and Wi-Fi integration. The Alpha Test assessed improvements in design and usability, while the Beta Test evaluated the full system performance

with the users. Additionally, a System Usability Test (SUS) was conducted, resulting in a total SUS score of 78, indicating that the application is highly usable and ready for practical implementation.

Overall, the system successfully achieved its objectives of providing an accessible, functional, and affordable communication tool that combines software and cloud integration to promote inclusivity for all users.

6. Conclusions

Based on the results of the development and evaluation phases, it can be concluded that the Chatbot effectively bridges communication barriers for users by providing a real-time and accessible means of message exchange through automatic feedback. The integration of Firebase technology ensured secure, synchronized, and stable data transmission between the Chatbot and the users using Wi-Fi or mobile data connectivity. Meanwhile, the system's performance across the Benchmark, Alpha, and Beta tests demonstrated that it met the essential software quality standards in functionality, reliability, and usability. The overall SUS score of 78 further confirmed that the system is highly usable and ready for practical application. Therefore, the Chatbot can be considered a successful prototype that meaningfully contributes to assistive technology solutions for clients at the university.

Recommendations

Based on the findings and conclusions, the following recommendations are presented:

1. Future improvements may include expanding support for multiple languages to make the system more adaptable and globally applicable.
2. The implementation of additional accessibility options is also suggested to enhance user interaction.
3. Include all Services offered by the university.

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