

DHVChat: A Web-Based Intelligent Chat Assistant for the Admissions Office using Natural Language Processing

Balagtas, Michael Joshua M.

College of Computing Studies

Don Honorio Ventura State University

Bacolor, Pampanga 2001 Philippines

(+63) 905 431 2885

balagtas michaeljoshua@gmail.com

Bernardo, Randylin B.

College of Computing Studies

Don Honorio Ventura State University

Bacolor, Pampanga 2001 Philippines

(+63) 951 420 9420

cs.randylinbernardo@gmail.com

Castillo, Jose Gabriel R.

College of Computing Studies

Don Honorio Ventura State University

Bacolor, Pampanga 2001 Philippines

(+63) 928 693 3915

gabrielcastillo8722564@gmail.com

Manalo, John Eric V.

College of Computing Studies

Don Honorio Ventura State University

Bacolor, Pampanga 2001 Philippines

(+63) 956 772 6081

johneric.v.manalo@gmail.com

Santos, Aljon S.

College of Computing Studies

Don Honorio Ventura State University

Bacolor, Pampanga 2001 Philippines

(+63) 956 507 5664

cs.aljonssantos@gmail.com

Sarcia, Kerby Mathew O.

College of Computing Studies

Don Honorio Ventura State University

Bacolor, Pampanga 2001 Philippines

(+63) 950 249 1943

Cs.kerbymathewosarcia@gmail.com

Mallari, Christian Samson

Don Honorio Ventura State University

Block 6 Lot 9 La Tierra Solana Phase

2 Macabacle Bacolor Pampanga

(+63) 917 451 7424

csmallari@dhvsu.edu.ph

ABSTRACT

This study explores the transformative impact of Artificial Intelligence (AI) and Natural Language Processing (NLP) in communication technologies, focusing on the development of DHVChat, an NLP-driven chat assistant for Don Honorio Ventura State University (DHVSU). DHVChat streamlines the admission inquiry process, aiming to lessen the workloads of the admission staff and enhance the efficiency and accessibility of the university's admission services. A quantitative research method was applied in which survey questionnaires using a 4-point Likert scale were utilized in the collection of data from purposively selected respondents. The respondents included prospective students, enrolled students, and admission staff of Don Honorio Ventura State University. Furthermore, the researchers utilized the iterative waterfall model as their software development method throughout the entirety of the system's development. Additionally, the system's evaluation was guided by the ISO/IEC 25010 Software Quality Model which revealed positive feedback from the respondents with a general average weighted mean of 3.45 (Strongly Agree), and 3.34 (Strongly Agree) on users' familiarity and comfortability with chatbots. Furthermore, comparative analysis between the developed system and existing inquiry methods highlighted an increase in user satisfaction, with the developed system's average weighted mean of 3.51 (Strongly Agree), compared to the existing inquiry method's average weighted mean of 2.06 (Disagree). Moreover, this study emphasizes the significance of AI-enhanced communication systems in higher education settings.

Keywords: *Natural Language Processing; chatbots; university admission; AI-enhanced communication systems.*

1. INTRODUCTION

The rise of Artificial Intelligence (AI) and its various subfields such as Natural Language Processing (NLP) has paved the way for innovative applications capable of providing human-like interactions. NLP algorithms and models have enabled machines to understand and interpret human language, and to generate responses in natural language. AI technologies have applied NLP in a wide range of use cases, from language analysis and translation to chatbots and virtual assistants. It appears that there are various benefits achieved with AI technologies, such as enhancing relationships with users and discovering new insights [1].

One of the most promising applications of NLP are chatbots, which are artificially intelligent programs designed to simulate human conversation through text or voice interactions. Chatbots are primarily used for information acquisition. It is a conversational agent that engages with users through natural language input. Chatbots can be referred to as software agents that pretend to be human entities [2].

The need for a college inquiry system often arises due to various reasons, which include the inaccessibility or slow load time of the college website, the division of information to different sources or departments, the high volume of inquiries or requests and the college's staff may not be able to respond in a timely manner, and a freshman's unfamiliarity with the college. In the study of Bhartiya, NLP techniques were applied to develop a University Counselling Auto-Reply Bot that is capable of providing answers to queries related to the field of engineering at the university [3].

The mentioned studies underscore the transformative influence of AI and NLP on communication technology. It highlights the pivotal role of chatbots in fostering interactive engagement, specifically in the realm of higher education. Moreover, the reference to the study by Bhartiya exemplifies a tangible implementation of NLP-driven

solutions to address challenges within the college admissions process. This illuminates the vast potential of AI-enhanced communication systems and their application to streamline complex processes within educational institutions.

The main focus of this paper is to develop a chat assistant for Don Honorio Ventura State University (DHVSU) using NLP techniques that can effectively respond to queries related to the university's office of admission.

2. PROJECT CONTEXT

Universities like Don Honorio Ventura State University face a common challenge in managing their admissions processes: the timely and efficient handling of inquiries from prospective students. The sheer volume of inquiries about admission application deadlines, program details, and requirements such as report cards, birth certificates, et cetera, often repetitive in nature, can overwhelm admissions staff, leading to delays in response time. The study's project context delves into the social environment surrounding the integration of an NLP-powered chat assistant, DHVChat, for the Don Honorio Ventura State University (DHVSU) admission office. The influence of AI, particularly NLP, signifies a paradigm shift in how individuals interact with technology. DHVChat, as an NLP-driven chat assistant, denotes how harnessing innovative solutions can address the evolving needs of students, prospective applicants, and admission staff.

Within the social fabric of higher education, the project seeks to foster an efficient communication medium by bridging the communication gap between students and the admission office. DHVChat, designed to understand and respond to natural language queries, fosters an accessible environment where individuals can effortlessly search for information, enhancing the accessibility of Don Honorio Ventura State University's admissions services.

DHVChat acknowledges the growing comfort and familiarity of students with digital interactions, particularly on chat platforms. DHVChat aligns with this preference, providing a user-friendly and familiar interface for students to inquire about admission-related information, contributing to the overall positive social experience within the said university.

The implementation of DHVChat extends beyond student interactions, providing benefits to Don Honorio Ventura State University's admission staff as well. By automating responses to frequently asked questions, DHVChat reduces the workload of the admission staff, enabling them to direct their attention toward more complicated and personalized aspects of student support. This empowerment not only increases staff productivity but also contributes to a positive work environment.

In essence, the project context revolves around the dynamic interplay between technology and the social environment at DHVSU. As DHVChat integrates seamlessly into the social environment of DHVSU, it prompts discussions on technological adaptability and the role of AI in shaping social interactions within academic institutions.

3. PURPOSE AND DESCRIPTION

The project was conducted to develop and implement an intelligent chat assistant specifically tailored to the needs of the Don Honorio Ventura State University (DHVSU) admission office. The chat assistant serves as a reliable and efficient tool for addressing the queries and concerns of both current and prospective students. Leveraging its advanced natural language processing and machine learning capabilities, the chat assistant ensures that students receive prompt and accurate responses to their admission-related inquiries. The proposed system will have the following functionalities:

1. It can search and retrieve relevant information from a knowledge base to provide quick responses to common queries, reducing the need for repetitive manual responses.
2. The chat assistant maintains a comprehensive knowledge base of frequently asked questions (FAQs) and admission-related information.
3. The admission staff member and the super admin have the capability to add and update the knowledge base as needed.
4. The system can redirect unanswered questions to the admission staff.
5. Students can use the chat function with or without an account.
6. Students that are signed up to the system will be able to redirect their inquiry to the admission staff and will have the ability to access their query history, while guest users will have limited features.

4. STATEMENT OF THE PROBLEM

The study sought to develop a web-based chat assistant that can be used to inquire about non-confidential information about Don Honorio Ventura State University's admission which includes admission dates and schedules, course offerings, et cetera. This is to provide instant answers to inquirers and lessen the workload of the admission staff.

This study seeks to answer the following research questions:

1. How can the system be developed to provide accurate and up-to-date information about admission requirements, application deadlines, prerequisites, and program details?
2. How and what existing Natural Language Processing (NLP) models and tools will the developers use and integrate into the system that will help analyze and understand user queries in the proposed system to effectively and accurately respond to the queries of the users?
3. How do the users perceive the availability and reliability of the proposed system compared to traditional methods of seeking admission-related information?
4. How familiar and comfortable are the users with using a chatbot for gathering and requesting information?

5. OBJECTIVES OF THE STUDY

The general objective of the research project is to develop a web-based assistive chatbot designed to answer queries related to Don Honorio Ventura State University. Specifically, the research project aims to achieve the following objectives:

- To develop a user-friendly web-based intelligent chat assistant that can provide better online student inquiry services for the university admissions office.
- To test and integrate existing Artificial Intelligence (AI) models, tools, and APIs to be used by the proposed system for it to analyze and understand user queries effectively and to accurately respond to the queries of the users.
- To identify how users perceive the availability and reliability of the proposed system compared to the existing media in seeking admission-related information.
- To identify the target users' familiarity and comfortability with using a chatbot for gathering and requesting information.

6. SIGNIFICANCE OF THE STUDY

The research conducted in this thesis holds substantial significance for various stakeholders, including admission staff, prospective students, and the broader field of higher education. The study's findings and implications contribute significantly to several benefactors.

To the University Admission Staff of Don Honorio Ventura State University. The developed web-based system will help the admission staff by lessening their workloads, wherein the system will automatically answer inquiries from prospective and current students, especially during peak admission application periods.

To the Prospective Students. The developed web-based system will provide automated inquiry services for prospective students, which can help them receive instant responses regarding their inquiries, reducing long wait times.

To the Future Researchers. This study enables future researchers to use this as a related literature or background for their future research.

7. SCOPE AND LIMINATION

The proposed research project will be designed and developed using Don Honorio Ventura State University as the locale of the study, limiting the chatbot's response to only queries regarding the university's admission office.

The researchers will test and use APIs from existing Artificial Intelligence (AI) domains such as Meta, OpenAI, etc. in building the chat assistant's artificial mind. The researchers will also include the implementation of a customizable knowledge feeder to create or update events, dates, or any other information related to the said university's admission. Additionally, the researchers will include the feature to notify the querier through email when the admission staff submits an answer to their question that is not yet in the database to ensure complete delivery of answers to the users.

The chatbot will be initially set-up by the researchers to feed it with accurate data from reliable sources such as Don Honorio Ventura State University's website and Admission Office.

Furthermore, there are some limitations to this study. The creation of custom Artificial Intelligence models is outside the scope of this thesis due to funding and time limitations. Thus, the researchers had to use existing AI models.

The implementation of an Artificial Intelligence model in the system will also cost money in terms of push and/or pull requests or tokens that are used, or resources required to run the model; these models may also not always accurately understand user queries, specifically if they contain complicated language or are phrased unconventionally. Additionally, the chat assistant's abilities would be constrained by the data it can access and its capacity to process that data.

8. THEORETICAL BACKGROUND

University admission departments play a pivotal role in the higher education ecosystem by facilitating the enrollment of students. The process involves managing inquiries, processing applications, and providing essential information to prospective students. In recent years, the complexity and volume of tasks in these departments have increased significantly, necessitating innovative solutions to streamline operations.

Artificial Intelligence (AI) and Natural Language Processing (NLP) technologies have emerged as transformative tools across various industries. In the context of customer service and support, chatbots and virtual assistants have gained popularity for their ability to handle routine tasks efficiently, provide quick responses, and operate around the clock. These technologies offer immense

potential for universities seeking to enhance their admission services.

Implementing a web-based chat assistant for university admission can yield several advantages. Firstly, it can significantly reduce the workload of admission staff, allowing them to focus on more complex tasks. Secondly, it offers students immediate access to information, enhancing the overall user experience and potentially increasing application rates. Additionally, it can improve data accuracy and consistency in responses to inquiries.

9. METHODOLOGY

In this section of the thesis, the researchers will outline the methodologies used to achieve the objectives of the paper. The methodology encompasses various subsections, including the chosen research design, target locale and respondents, and research tools and instruments.

The study's methodology used quantitative research methods, allowing the researchers to collect statistical data on the usage and effectiveness of the proposed system. The researchers used a survey questionnaire to gather data from a sample of the respondents, the university students, which were analyzed using statistical techniques in order to compare the satisfaction in the existing media and in the proposed system and to identify the proposed system's effectiveness.

Focusing on the research methodology of the study, the quantitative method is particularly well-suited for this type of study, as it not only allows for a quantitative assessment of user satisfaction but also enables the identification of the proposed system's effectiveness based on numerical metrics.

The use of quantitative research provides a structured and objective approach, offering numerical insights that contribute to a robust evaluation of the web-based chat assistant. It allows for the generation of statistically significant findings, enhancing the overall reliability and validity of the study's conclusions regarding the impact and efficacy of the proposed system.

10. DESIGN AND TECHNIQUES

The thesis paper's research design is descriptive research since the proponents' aim was to describe the experience of the population in the chosen locale.

The researchers used the descriptive method to identify which problems with the existing methods of inquiring at the admissions office were needed to address and approach. This method was used to gather the information needed for the comparison of the respondent's satisfaction with the proposed system over the existing media for inquiring about the admission. The researchers used survey questionnaires, an unstructured interview, and evaluation of the existing medias to provide context on what concerns they were solving with the proposed system.

The questionnaire survey was targeted at the students to obtain their satisfaction rate and experience with the existing media, and their opinion about the development of a web-based chat assistant that they can use to ask questions about the admission process of the university. The evaluation survey, on the other hand, was used to gather data from both the university's admissions office staff and prospective students. The researchers also used a 4-point Likert's Scale in assessing the resulting web system to show its effectiveness. The proponents used the ISO/IEC 25010 (Software Quality Model) to evaluate the web-based system's functionalities. This provided the necessary guidelines to ensure the effectiveness of the system for the targeted users.

Furthermore, the researchers used the Iterative Waterfall Model throughout the development of the web-based system. This ensured a continuous flow of development, going through each stage, but with the ability to return to previous stages.

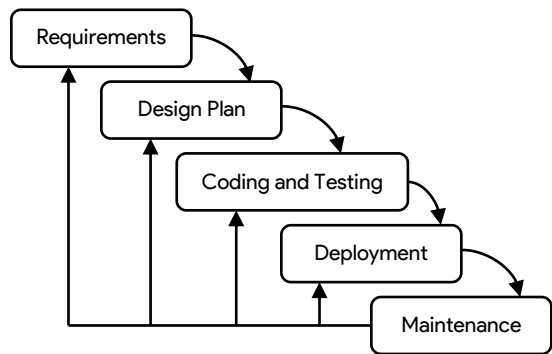


Figure 1: Iterative Waterfall Model Diagram

Requirements Definition

During the requirements definition stage of the development life cycle, the researchers engaged in a collaborative ideation process to identify potential system requirements. Some of the generated ideas included incorporating statistical features into the staff user interface, adopting a tabular format for knowledge storage as opposed to a list, among others.

Design Plan

Progressing through subsequent phases, in the design planning stage, the researchers conducted a thorough exploration of existing Artificial Intelligence models on the web that could be leveraged by the proposed system. These models were then evaluated, leading to the selection of the most suitable one for integration. Subsequently, attention was directed towards the exploration of both frontend and backend aspects of the system.

Coding and Testing

Moving into the coding and testing phase of the development methodology, the developer initiated the coding of the backend, subjecting it to testing using PostMan. This was followed by the coding of the frontend wherein the developer and the user interface designer coordinated to finish the visual aspect of the system. Each revision of the user interface design was also quickly reflected in the frontend.

Deployment

During the deployment phase, the development team deployed both the frontend and backend of the app using onRender. The developer prioritized the deployment of the backend since it has many configurations, such as setting all environment variables, such as OpenAI's API token, database URL, and frontend URL. The developer then proceeded to deploy the frontend configuring the environment variable to the URL address of the deployed backend service.

Maintenance

In the maintenance phase of the development methodology, the researchers diligently sought out potential bugs and system breakages. Simultaneously, the developers undertook updates to enhance the user interface and ensured the seamless functionality of all system features. Additionally, quality assurance testing of the system was conducted during this phase by the remaining researchers.

10.1 DEVELOPMENT TIMELINE

The figure below shows the timeline for the development of the proposed web-based system, adhering to the iterative waterfall model which undergone 2 iterations in the development process.

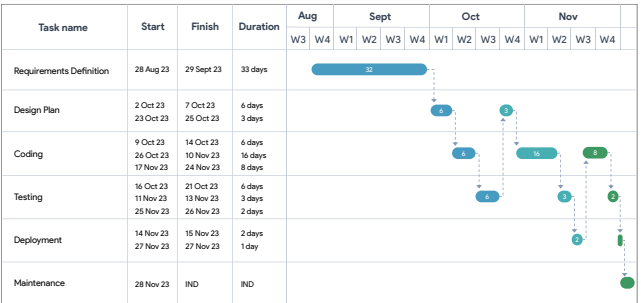


Figure 2: Gantt Chart

The initial requirements definition phase spanned 33 days, which started on August 28, 2023, and ended on September 29, 2023. Subsequently, the design plan phase unfolded from October 2, 2023, to October 7, 2023. The coding phase followed from October 9, 2023, to October 14, 2023, leading into the testing phase from October 16, 2023, to October 21, 2023.

Following the testing phase, an iteration occurred, returning to the design plan phase from October 23, 2023, to October 25, 2023. This was succeeded by the coding phase, spanning from October 26, 2023, to November 10, 2023. The subsequent testing phase was initialized from November 11, 2023, to November 13, 2023. The system was then deployed on November 14, 2023, until the following day.

Post-deployment, another iteration transpired, reverting to the coding phase from November 17, 2023, to November 24, 2023. A brief system testing occurred from November 25, 2023, to November 26, 2023. The day after, a quick deployment was made which only lasted for a day. After the final system deployment, the maintenance phase commenced on November 28, 2023.

10.2 System Architecture

10.2.1 Natural Language Processing (NLP) Engine

- The NLP engine will be the core component of the chat assistant, responsible for understanding and processing user queries.
- It will utilize machine learning algorithms and techniques to extract intent, entities, and context from user input.
- AI frameworks can be utilized to implement the NLP engine.
- The system's NLP will use supervised learning wherein it is trained on a labeled dataset, where each input is paired with the corresponding output. The model maps input data to the correct output by generalizing patterns from the labeled examples.

10.2.2 Backend Services

- Backend services will handle the logic and data processing required to generate responses.
- They will interact with various data sources, APIs, and databases to retrieve and provide information.

10.2.3 Front-End System

- The front-end of the application will be developed using ReactJS.
- It will utilize a responsive design to ensure compatibility across different devices.

- The user interface will be intuitive with easy navigation.

10.2.4 Knowledge Base

- A knowledge base will be maintained, containing information related to admission requirements, programs, deadlines, etc.
- Regular updates to the knowledge base will ensure accurate and up-to-date information is provided to users.

10.3 System Modules

10.3.1 Authentication Module

- Verifies the identity of users attempting to access the system.
- Involves the use of credentials, such as emails and passwords.
- Determines the level of access and permissions that should be granted based on the user's role or privileges.
- Prevents access from unauthorized users

10.3.2 AI Module

- Used to understand and interpret human language.
- Used for analyzing the knowledge base.

10.3.3 API Module

- Calls the services of the OpenAI and the system's API.

10.3.4 Validation Module

- Validates information input by the user.

10.3.5 Component UI Module

- Manages the reusable parts of the user interface.

10.3.6 User Module

- Takes care of the tasks or functions that each type of user can do.
- The system will have 4 different types of users; the super admin, the staff, the inquiring student (with account), and a guest inquirer.

10.3.7 Conversation Module

- Takes care of the communication between the user and the Artificial Intelligence model.

10.3.8 Knowledge Module

- Takes care of the management (creating, reading, updating, and deleting of information) on the system's knowledge base.

10.3.9 Inquiry Module

- Takes care of the rerouting of the user's question if it is not yet on the knowledge base of the system.

10.3.9.1 Routing Module

- Takes care of the system's navigation (routing).

10.4 Natural Language Processing Text Embedding

Artificial Intelligence encompasses various subfields, and one of them is Natural Language Processing (NLP), which focuses on the interaction between computers and human languages. The primary goal of NLP is to understand, interpret, and generate human-like text. To achieve this, a fundamental process known as Text Embedding is applied, wherein words undergo transformation into numerical interpretations. This involves representing words or sentences as numerical vectors in a continuous vector space. These

embeddings form the basis for tasks like sentiment analysis, document clustering, machine translation, and others, significantly contributing to the enhancement of machines' natural language understanding capabilities.

10.5 Cost Benefit

Implementing Artificial Intelligence models in a system comes with a cost one way or another, some models use subscription-based services while others use credit-based services; though some models are free, running these models in a system requires high computing powers which could significantly add to the overall cost of the system. Thus, together with the results of the students' evaluation of the Artificial Intelligence models, and its affordable pricing, the researchers decided to employ the GPT 3.5-Turbo Model by OpenAI as the proposed system's Artificial Intelligence component. This model proposes a cost of \$0.0010 per 1000 input tokens and \$0.0020 per 1000 output tokens which converts to ₱0.056 per 1000 input tokens and ₱0.11 per 1000 output tokens in the local currency. 1000 tokens is about 750 words, thus the final simplified rate could be translated into about ₱0.00007467 per word sent to the model and ₱0.0001467 per word received by the model [22].

From the gathered data on the system's average sent and received tokens from user inquiries, the researchers recorded an average of 714 input tokens used per inquiry and an average of 91 output tokens used per inquiry. These data paired with the gathered data from an unstructured interview done at the admissions office of the Don Honorio Ventura State University wherein it is mentioned that the average received inquiries in a semester by the staff were around 26,000 inquiries per semester, it could be calculated that the average cost of input tokens used per semester is ₱779.69 and the average cost of output tokens used per semester is ₱195.20 which totals to ₱904.89 of average cost per semester.

10.6 ISO/IEC 25010 or Software Quality Model

The researchers applied the ISO/IEC 25010 standard to ensure the quality and effectiveness of the proposed system. The ISO/IEC 25010 provided a structured framework for evaluating and addressing key software quality characteristics, such as functionality, usability, reliability, security, maintainability, and portability. Adhering to these standards helped ensure that the proposed system contributed positively to the admission inquiry services, enhancing the overall user experience of both the prospective students and university admission staffs when inquiring about the university admissions, and answering questions from the inquirers, respectively. However, the researchers eliminated the maintainability characteristic to the survey questionnaire due to the respondents not having enough qualification to evaluate said characteristic of the proposed system.

11. RESPONDENTS OF THE STUDY

The target respondents for this study were primarily prospective students considering Don Honorio Ventura State University as their university of choice, along with enrolled students and the staff of the admissions office. The sampling technique that the researchers used is purposive sampling, as this allows them to select respondents based on the required set of characteristics needed for the study. Consequently, the set of respondents that the researchers involved in the study consists of prospective students, enrolled students, and staff of the admissions office.

The surveys were conducted using two distinct methods: online and face-to-face interactions. This dual approach was employed to expedite the data collection process and obtain a more comprehensive set of information. Conducting the survey online

allowed for widespread distribution, reaching audiences that were otherwise unreachable by the researchers. Simultaneously, the face-to-face method ensured a more personal and direct engagement with respondents, potentially yielding more profound insights on the surveys. This combined strategy maximized the advantages of both online and traditional survey methods, enhancing the overall efficiency of data gathering.

In the pre-study survey, only the students answered the questionnaires; they were instructed to use the existing media utilized by the admissions office for seeking information and addressing concerns, and then were surveyed about their satisfaction and experience with it. In the evaluation of the system, the researchers provided evaluation survey forms and allowed all sets of respondents use their developed web-based system.

12. RESEARCH TOOLS AND INSTRUMENTS

The instruments used in the study were pre-survey questionnaires and evaluation survey forms to seek for improvement signs of the satisfaction of students to the proposed system. The researchers will use the ISO/IEC 25010 (Software Quality Model) to evaluate the web-based system's functionalities. This will provide the necessary guidelines to ensure the user-friendliness and efficiency of the system for the targeted users.

The researchers formatted the questionnaires with a Likert Scale wherein the respondents specified their level of agreement with each of the given statements. Defining a Likert Scale, it is a rating scale that is used to measure opinions, attitudes, or behaviors which consists of statements or questions that is followed by a series of four or more answer statements [23].

Additionally, the researchers conducted an interview or consultation with the admission staff to receive feedback and determine if the proposed system was acceptable enough to be used by the remaining respondents.

13. STATISTICAL TREATMENT OF THE DATA

Statistical treatment of the data involves the application of statistical methods and techniques to analyze and interpret the data collected from the data gathering of the researchers. This process is critical for drawing meaningful conclusions, and addressing research questions. Thus, the researchers used the following statistical tools:

4-Point Likert Scale

The researchers used 4-point Likert scale to assess the level of agreement expressed by respondents toward a specific statement. This scale consists of four points that do not include a neutral option:

(1) Strongly Disagree, (2) Disagree, (3) Agree, and (4) Strongly Agree.

Weighted Mean

The weighted mean serves as a useful tool for summarizing extensive datasets. It is computed by adding all the numbers within a set and dividing the sum by the total number of members in the set. The researchers used weighted means to calculate the average value for each statement.

Where:

WM = weighted mean

WV = weighted value

N = number of respondents

Σ = summation symbol

$$WM = \frac{\Sigma WV}{N}$$

Table 1. Weighted mean with corresponding descriptive rating

Weighted Mean	Descriptive Rating
1.00 – 1.75	Strongly Disagree
1.76 – 2.50	Disagree
2.51 – 3.25	Agree
3.26 – 4.00	Strongly Agree

Table 1 shows the weighted mean values with their assigned descriptive ratings. A weighted mean of 1.00 to 1.75 (inclusive) has a descriptive rating of "Strongly Disagree", a weighted mean of 1.76 to 2.50 (inclusive) has a descriptive rating of "Disagree", a weighted mean of 2.51 to 3.25 (inclusive) has a descriptive rating of "Agree", and a weighted mean of 3.26 to 4.00 (inclusive) has a descriptive rating of "Strongly Agree".

14. RESULTS AND DISCUSSION

With the Artificial Intelligence (AI) aspect of the system, the researchers made an evaluation form for the students to test the performance of the four (4) Artificial Intelligence models based on their responses' correctness, speed, friendliness and engagement to the conversation. This will help the researchers choose the best model to be implemented for the proposed system.

Table 2. DialoGPT Response Evaluation

DialoGPT's Response Evaluation	WM	DR
The Artificial Intelligence model answered the prompts correctly.	1.49	Strongly Disagree
The Artificial Intelligence model responded to the prompts within a reasonable amount of time.	2.39	Disagree
The Artificial Intelligence model's answers were friendly.	1.70	Strongly Disagree
The Artificial Intelligence model's answers were engaging.	1.51	Strongly Disagree
Average Weighted Mean	1.77	Disagree

Table 2 presents the evaluation results for the DialoGPT's responses to the user prompts. The calculated average weighted mean of 1.77, with the descriptive rating of "Disagree," concludes that the researchers find the responses of the model to be underqualified for the proposed system's needs.

Table 3. DeBERTaV3 Response Evaluation

DeBERTaV3's Response Evaluation	WM	DR
The Artificial Intelligence model answered the prompts correctly.	2.01	Disagree
The Artificial Intelligence model responded to the prompts within a reasonable amount of time.	2.54	Agree
The Artificial Intelligence model's answers were friendly.	1.71	Strongly Disagree
The Artificial Intelligence model's answers were engaging.	1.65	Strongly Disagree
Average Weighted Mean	1.98	Disagree

Table 3 presents the evaluation results for the DeBERTaV3's responses to the user prompts. The calculated average weighted mean of 1.98, with the descriptive rating of "Disagree," concludes

that the researchers find the responses of the model to be underqualified for the proposed system's needs.

Table 4. NLLB and Llama2 Response Evaluation

NLLB and Llama2's Response Evaluation	WM	DR
The Artificial Intelligence model answered the prompts correctly.	3.22	Agree
The Artificial Intelligence model responded to the prompts within a reasonable amount of time.	2.81	Agree
The Artificial Intelligence model's answers were friendly.	3.08	Agree
The Artificial Intelligence model's answers were engaging.	3.08	Agree
Average Weighted Mean	3.05	Agree

Table 4 presents the evaluation results for the NLLB and Llama2's responses to the user prompts. The calculated average weighted mean of 3.05, with the descriptive rating of "Agree," concludes that the researchers find the responses of the model to be qualified for the proposed system's needs.

Table 5. GPT 3.5-Turbo Response Evaluation

GPT 3.5-Turbo's Response Evaluation	WM	DR
The Artificial Intelligence model answered the prompts correctly.	3.77	Strongly Agree
The Artificial Intelligence model responded to the prompts within a reasonable amount of time.	3.42	Strongly Agree
The Artificial Intelligence model's answers were friendly.	3.66	Strongly Agree
The Artificial Intelligence model's answers were engaging.	3.68	Strongly Agree
Average Weighted Mean	3.63	Strongly Agree

Table 5 presents the evaluation results for the GPT 3.5-Turbo's responses to the user prompts. The calculated average weighted mean of 3.63, with the descriptive rating of "Strongly Agree," concludes that the researchers find the responses of the model to be qualified for the proposed system's needs.

14.1 AI Model's Evaluation Summary

Table 6. AI Model's Evaluation Summary

AI Model	AWM	DR
DialoGPT	1.77	Disagree
DeBERTaV3	1.98	Disagree
NLLB and Llama2	3.05	Agree
GPT 3.5 Turbo	3.63	Strongly Agree

Table 6 presents the summarized results of the AI models' evaluation. DialoGPT and DeBERTaV3 having low average weighted means make them underqualified for the proposed system's needs. On the other hand, NLLB and Llama2, and GPT 3.5-Turbo having both a descriptive rating of "Agree" and

"Strongly Agree" respectively, qualify them for the system's needs. However, the researchers decided to use the GPT 3.5-Turbo Model which has the highest average weighted mean of 3.63. Additionally, the GPT 3.5-Turbo model is the cheapest choice that the researchers can manage, with a the rate of ₱0.056 per 1000 input tokens and ₱0.11 per 1000 output tokens. According to OpenAI (2023), 1000 tokens is about 750 words; thus, the final simplified rate could be translated into about ₱0.000075 per word sent and ₱0.00015 per word received.

14.2 Pre-study Questionnaire for the Students of Don Honorio Ventura Statue University

To analyze and draw conclusions about the difficulties encountered in the existing admission inquiry services of the university, the researchers distributed a survey questionnaire to the students of Don Honorio Ventura State University.

14.2.1 Respondent's Satisfaction Evaluation for Existing Inquiry Services of the University Admission

To evaluate the reliability and availability of the existing inquiry services of the university's admission department, the researchers created a self-structured evaluation form. This form aimed to identify challenges that the proponents could then address using the proposed system.

Table 7. Respondent's Satisfaction in Existing Inquiry Services

Existing Inquiry Services User Satisfaction	WM	DR
The existing admission inquiry services (email, Facebook page messenger, over-the-phone contact) respond to my inquiries within a reasonable timeframe.	2.02	Disagree
Simple questions are effectively and promptly answered when I use the existing admission inquiry services.	2.13	Disagree
The admission inquiry services are available during convenient hours for me.	1.85	Disagree
The admission inquiry services provide information about requirements, dates, deadlines, and general information.	2.25	Disagree
Overall, I am satisfied with the quality of service provided by the existing admission inquiry services.	2.07	Disagree
AWM	2.06	Disagree

Table 7 displays the weighted mean and descriptive rating reflecting the satisfaction levels of the students with the current admission inquiry services. The calculated average weighted mean of 2.06 indicates that the students generally perceive the existing admission inquiry services as unsatisfactory.

14.2.2 Respondent's Familiarity to Chatbots Survey

To evaluate the respondents' familiarity and comfortability with chatbots, the researchers distributed a survey questionnaire to the students of Don Honorio Ventura State University.

Table 8. Respondent's Familiarity and Comfortability to Chatbots

Familiarity & Comfortability to Chatbot	WM	DR
---	----	----

I feel more comfortable using conversational (chat) method of inquiring instead of sending an email or talking over the phone.	3.35	Strongly Agree
I find using a chat-based method for inquiries more convenient than sending an email or making a phone call.	3.37	Strongly Agree
I feel that chat-based methods are more suitable for my communication style and preferences.	3.35	Strongly Agree
I am familiar with the concept of a chatbot.	3.24	Agree
I find Chatbot-based inquiry methods more suitable for quick, straightforward questions.	3.35	Strongly Agree
I am interested in using a chatbot to get answers to my inquiries related to the university admission.	3.36	Strongly Agree
AWM	3.34	Strongly Agree

Table 8 presents the survey findings regarding the respondents' familiarity with chatbots. The calculated average weighted mean of 3.34 suggests that the respondents strongly agree that they feel more comfortable and prefer using chat-based methods for inquiring. Additionally, the respondents agreed to show interest in using a chatbot for inquiring about the university's admission.

14.3 Proposed System Evaluation

To assess the compliance of the proposed system with established standards, the researchers distributed a survey questionnaire to the respondents, aligned with the ISO/IEC 25010 Software Quality Model.

14.3.1 Student's Evaluation of the Proposed Web-Based System

Table 9. Students' Functionality Evaluation of the Proposed System

FUNCTIONALITY	WM	DR
The system allows the user to input and send their inquiry to the system.	3.59	Strongly Agree
The chat assistant is able to understand the inquiries posed by the user.	3.44	Strongly Agree
The chat assistant is able to provide answers to all inquiries posed by the user.	3.39	Strongly Agree
All of the system's functions work as intended.	3.56	Strongly Agree
Average Weighted Mean	3.5	Strongly Agree

Table 9 presents the evaluation results for the proposed system's functionality. The calculated average weighted mean of 3.5, coupled with the descriptive rating of "Strongly Agree," suggests that the students at Don Honorio Ventura State University find the proposed system to be functional and capable of performing all its intended functions.

Table 10. Students' Efficiency Evaluation of the Proposed System

EFFICIENCY	WM	DR
------------	----	----

The chat assistant can answer the inquiries in a reasonable amount of time.	3.26	Strongly Agree
The chat assistant is capable of quickly fetching from its knowledge base.	3.39	Strongly Agree
Average Weighted Mean	3.33	Strongly Agree

Table 10 presents the evaluation results for the proposed system's efficiency. The calculated average weighted mean of 3.33, with the descriptive rating of "Strongly Agree," suggests that the students at Don Honorio Ventura State University find the proposed system to be efficient and capable of using its resources effectively.

Table 11. Students' Compatibility Evaluation of the Proposed System

COMPATIBILITY	WM	DR
The chat assistant can be used on different operating systems without compromising the experience.	3.51	Strongly Agree
Average Weighted Mean	3.51	Strongly Agree

Table 11 presents the evaluation results for the proposed system's compatibility. The calculated average weighted mean of 3.51, with the descriptive rating of "Strongly Agree," suggests that the students at Don Honorio Ventura State University find the proposed system to be widely compatible and can be opened using other operating systems.

Table 12. Students' Usability Evaluation of the Proposed System

USABILITY	WM	DR
The chat assistant is easy to use and navigate.	3.66	Strongly Agree
The chat assistant displayed no visual glitches and errors.	3.56	Strongly Agree
The system's layout was rendered correctly based on the device used.	3.56	Strongly Agree
Average Weighted Mean	3.59	Strongly Agree

Table 12 presents the evaluation results for the proposed system's usability. The calculated average weighted mean of 3.59, with the descriptive rating of "Strongly Agree," suggests that the students at Don Honorio Ventura State University find the proposed system to be usable and operable.

Table 13. Students' Reliability Evaluation of the Proposed System

RELIABILITY	WM	DR
The chat assistant is able to provide reliable information about the university admission based on its knowledge base.	3.48	Strongly Agree
The chat assistant can answer inquiries about the university admission.	3.54	Strongly Agree
The chat assistant can be accessed any time.	3.55	Strongly Agree
Average Weighted Mean	3.52	Strongly Agree

Table 13 presents the evaluation results for the proposed system's reliability. The calculated average weighted mean of 3.52, with the descriptive rating of "Strongly Agree," suggests that the students at Don Honorio Ventura State University find the proposed system to be reliable and can be accessed anytime.

Table 14. Students' Security Evaluation of the Proposed System

SECURITY	WM	DR
The information that is collected can only be accessed by authorized personnels.	3.45	Strongly Agree
The system can verify if a user is registered to access the system.	3.57	Strongly Agree
Average Weighted Mean	3.51	Strongly Agree

Table 14 presents the evaluation results for the proposed system's security. The calculated average weighted mean of 3.51, with the descriptive rating of "Strongly Agree," suggests that the students at Don Honorio Ventura State University find the proposed system to be secure and does protect users' personal data.

Table 15. Students' Portability Evaluation of the Proposed System

PORTABILITY	WM	DR
The system can be accessed on different devices without problems.	3.58	Strongly Agree
Average Weighted Mean	3.58	Strongly Agree

Table 15 presents the evaluation results for the proposed system's portability. The calculated average weighted mean of 3.58, with the descriptive rating of "Strongly Agree," suggests that the students at Don Honorio Ventura State University find the proposed system to be accessible on multiple devices and platforms.

14.3.2 Admission Staff's Evaluation of the Proposed Web-Based System

Table 16. Admission Staff's Functionality Evaluation of the Proposed System

FUNCTIONALITY	WM	DR
The system allows the user to input and send their inquiry to the system.	4	Strongly Agree
The chat assistant is able to understand the inquiries posed by the user.	4	Strongly Agree
The chat assistant is able to provide answers to all inquiries posed by the user.	3.5	Strongly Agree
All of the system's functions work as intended.	3.83	Strongly Agree
Average Weighted Mean	3.83	Strongly Agree

Table 16 presents the evaluation results for the proposed system's functionality. The calculated average weighted mean of 3.83, coupled with the descriptive rating of "Strongly Agree," suggests that the admission staff at Don Honorio Ventura State University find the proposed system to be functional and capable of performing all its intended functions.

Table 17. Admission Staff's Efficiency Evaluation of the Proposed System

EFFICIENCY	WM	DR
The chat assistant can answer the inquiries in a reasonable amount of time.	4	Strongly Agree
The chat assistant is capable of quickly fetching from its knowledge base.	4	Strongly Agree
Average Weighted Mean	4	Strongly Agree

Table 17 presents the evaluation results for the proposed system's efficiency. The calculated average weighted mean of 4, with the descriptive rating of "Strongly Agree," suggests that the admission staff at Don Honorio Ventura State University find the proposed system to be efficient and capable of using its resources effectively.

Table 18. Admission Staff's Compatibility Evaluation of the Proposed System

COMPATIBILITY	WM	DR
The chat assistant can be used on different operating systems without compromising the experience.	3.33	Strongly Agree
Average Weighted Mean	3.33	Strongly Agree

Table 18 presents the evaluation results for the proposed system's compatibility. The calculated average weighted mean of 3.33, with the descriptive rating of "Strongly Agree," suggests that the admission staff at Don Honorio Ventura State University find the proposed system to be widely compatible and can be opened using other operating systems.

Table 19. Admission Staff's Usability Evaluation of the Proposed System

USABILITY	WM	DR
The chat assistant is easy to use and navigate.	3.67	Strongly Agree
The chat assistant displayed no visual glitches and errors.	3.83	Strongly Agree
The system's layout was rendered correctly based on the device used.	4	Strongly Agree
Average Weighted Mean	3.83	Strongly Agree

Table 19 presents the evaluation results for the proposed system's usability. The calculated average weighted mean of 3.83, with the descriptive rating of "Strongly Agree," suggests that the admission staff at Don Honorio Ventura State University find the proposed system to be usable and operable.

Table 20. Admission Staff's Reliability Evaluation of the Proposed System

RELIABILITY	WM	DR
The chat assistant is able to provide reliable information about the university admission based on its knowledge base.	3.33	Strongly Agree
The chat assistant can answer inquiries about the university admission.	3.17	Agree
The chat assistant can be accessed any time.	3.35	Strongly Agree
Average Weighted Mean	3.33	Strongly Agree

Table 20 presents the evaluation results for the proposed system's reliability. The calculated average weighted mean of 3.33, with the descriptive rating of "Strongly Agree," suggests that the admission staff at Don Honorio Ventura State University find the proposed system to be reliable and can be accessed anytime.

Table 21. Admission Staff's Security Evaluation of the Proposed System

SECURITY	WM	DR
The information that is collected can only be accessed by authorized personnels.	3.67	Strongly Agree
The system can verify if a user is registered to access the system.	3.83	Strongly Agree
Average Weighted Mean	3.75	Strongly Agree

Table 21 presents the evaluation results for the proposed system's security. The calculated average weighted mean of 3.75, with the descriptive rating of "Strongly Agree," suggests that the admission staff at Don Honorio Ventura State University find the proposed system to be secure and does protect users' personal data.

Table 22. Admission Staff's Portability Evaluation of the Proposed System

PORTABILITY	WM	DR
The system can be accessed on different devices without problems.	3.5	Strongly Agree
Average Weighted Mean	3.5	Strongly Agree

Table 22 presents the evaluation results for the proposed system's portability. The calculated average weighted mean of 3.5, with the descriptive rating of "Strongly Agree," suggests that the admission staff at Don Honorio Ventura State University find the proposed system to be accessible on multiple devices and platforms.

14.3.3 Proposed System Grand and Overall Mean

Table 23. Grand and Overall Mean of the Evaluation of the Proposed System

Characteristic	Students		Admission Staffs	
	AWM	DR	AWM	DR
Functionality	3.11	Agree	3.83	Strongly Agree
Efficiency	3.38	Strongly Agree	4	Strongly Agree
Compatibility	3.13	Agree	3.33	Strongly Agree
Usability	2.94	Agree	3.83	Strongly Agree
Reliability	3.27	Strongly Agree	3.33	Strongly Agree
Security	3.48	Strongly Agree	3.75	Strongly Agree
Portability	3.42	Strongly Agree	3.5	Strongly Agree
Overall Mean	3.25	Agree	3.65	Strongly Agree

Table 23 presents the summarized results of the proposed system evaluation. With the calculated overall means of the proposed system, it could be concluded that the students of Don Honorio Ventura State University agree with the proposed system based on the calculated overall mean of 3.25, while the admission staff of Don Honorio Ventura State University have shown strong agreement with the proposed system based on the calculated overall mean of 3.65.

14.4 Post-study Survey Questionnaire for the Students of Don Honorio Ventura State University

To have a better grasp of the comparison between the respondents' satisfaction of the existing and proposed system, the researchers distributed a self-made evaluation form that was included in the system evaluation survey questionnaire to the students of Don Honorio Ventura State University.

14.4.1 Respondent's Satisfaction Evaluation for the Proposed System

To evaluate the reliability and availability of the proposed system, the researchers created a self-structured evaluation form that is parallel to the satisfaction evaluation of the existing inquiry services that was included in the pre-survey that the researchers devised.

Table 24. Respondent's Satisfaction Evaluation for the Proposed System

User Satisfaction	WM	DR
The proposed web-based chat assistant system (DHVChat) responds to my inquiries within a reasonable timeframe.	3.45	Strongly Agree
Simple questions are effectively and promptly answered when I use the proposed web-based chat assistant system.	3.59	Strongly Agree
The proposed web-based chat assistant is available during convenient hours for me.	3.55	Strongly Agree
The proposed web-based chat assistant system can provide information about requirements, dates, deadlines, and general information.	3.44	Strongly Agree
Overall, I am satisfied with the quality of service provided by the proposed web-based chat assistant.	3.53	Strongly Agree
Average Weighted Mean	3.51	Strongly Agree

Table 24 presents the weighted mean and descriptive rating of the students' satisfaction of the proposed system. The calculated average weighted mean of 3.51, with the descriptive rating of "Strongly Agree," suggests that the students at Don Honorio Ventura State University find the services offered by the proposed system very satisfactory.

15. SUMMARY

The primary concern identified in this study revolves around the constrained accessibility of the current inquiry services provided by the admissions office to its end-users, coupled with the increased workload for admission staff in addressing repetitive queries posed by students. The researchers' main concern is creating a web-based

system that the existing or prospective students of Don Honorio Ventura State University can use to easily pose questions about the university admission without getting ignored or having to wait an unreasonable amount of time for such simple questions. To gather the requisite data and insights for the study, the researchers plan to address specific questions outlined in the study's statement of the problem.

One of the specific questions in the statement of the problem that the researchers are interested in knowing was the students' familiarity and comfortability with using chatbots for gathering and requesting information. From the survey that the researchers collected, it shows that in terms of familiarity with chatbots, 37.7% of the respondents strongly agree, 50.9% agree, 8.5% disagree, and 2.9% strongly disagree. It can be concluded that the majority of the students of Don Honorio Ventura State University agree that they are familiar with chatbots. The students also strongly agree that they feel more comfortable with using conversational method of inquiring than talking over the phone or sending an email. Additionally, 94.3% of the students have shown interest in using a chatbot to get answers for their inquiries related to the university admission.

The researchers have also showed interest in the respondents' satisfaction of the existing inquiry services provided by the admissions office (i.e., Facebook page messenger, email, contact number) to which the respondents have shown unsatisfactory remarks based on the results of pre-study survey that the researchers collected with an average weighted mean of 2.06 with the corresponding descriptive rating of "Disagree". With these data, it can be concluded that having a dedicated chat assistant for the students to use for inquiring about the university admission will be of significant help to them, especially for the ones with social anxieties. In light of these considerations, it is reasonable to suggest that the proposed system will be valuable and helpful for the respondents.

The assessment of the proposed system's performance revealed its functionality, efficiency, compatibility, usability, reliability, security, and portability. Students have shown a strong agreement on the system's efficiency (average weighted mean: 3.38), reliability (average weighted mean: 3.27), security (average weighted mean: 3.48), and portability (average weighted mean: 3.42). They also expressed agreement on its functionality (average weighted mean: 3.11), compatibility (average weighted mean: 3.13), and usability (average weighted mean: 2.94). On the other hand, the admission staffs have shown a strong agreement in terms of functionality with an average weighted mean of 3.83, efficiency with an average weighted mean of 4, compatibility with an average weighted mean of 3.33, usability with an average weighted mean of 3.83, reliability with an average weighted mean of 3.33, security with an average weighted mean of 3.75, and portability with an average weighted mean of 3.5.

Additionally, the researchers examined the post-study survey that assessed the satisfaction of students with the proposed system, which yielded an average weighted mean of 3.51 with a descriptive rating of "strongly agree," in contrast to the pre-study survey evaluating the current methods of inquiring about university admission, which registered an average weighted mean of 2.06 with a descriptive rating of "disagree," it becomes evident that the students exhibit higher satisfaction with the proposed system compared to the existing inquiry services.

16. CONCLUSION

The research entitled "DHVChat: A Web-Based Intelligent Chat Assistant for the Admissions Office Using Natural Language Processing" aimed to provide a quick way of inquiring about the

university admission of Don Honorio Ventura State University and to lessen the workloads of the admission staff when it comes to repetitive and simple questions posed by the students. The researchers developed a web-based assistive chatbot designed to answer queries related to Don Honorio Ventura State University. Drawing from the study's results, it can be deduced that the proposed system effectively fulfills its intended purpose as a user-friendly chat assistant for university admission.

17. RECOMMENDATIONS

To bring improvements to the web-based chat assistant system, the researchers advise expanding the scope of the study and welcome the idea of developing an AI model that the system can use free of charge, which will bring real customization to the chat assistant and better integration and restrictions to the system. On the other hand, if time and resources are still limited, the researchers suggest the use of a better tier of the selected AI model of this research, the GPT-4 Model or better if there are newer models in the current time.

The researchers also recommend expanding the reach of the chat assistant, as the chat assistant is currently limited to the admission department of Don Honorio Ventura State University.

The researchers advise future programmers and researchers to explore different Artificial Intelligent models that could bring better control and accuracy to the chat assistant's responses.

With the positive results of the study, the researchers recommend that the system be implemented by the Don Honorio Ventura State University Admissions Office.

18. ACKNOWLEDGMENT

The completion of this study could not have been possible without the unwavering support and guidance of individuals and institutions who have played a pivotal role in our academic journey. The researchers would like to express their heartfelt gratitude to each of them for their contributions.

First and foremost, they would like to express their most grateful sentiments to their thesis advisor, Mr. Christian S. Mallari, for his guidance, encouragement, constructive criticism, and for sharing his expertise throughout the process. The researchers are truly grateful for his dedication to their academic success. In addition, they would also like to express their most grateful sentiments to their panelists, Mr. Philip I. Doctor, Mr. Earl Lawrence B. Pelayo, Ms. Angelica S. Dagal, and Mr. Edgar B. David, for their valuable feedback, suggestions, and insights that helped in improving this study. They have challenged the researchers to think critically and creatively, and they appreciate their time and effort.

Furthermore, the researchers are also sincerely grateful to the Don Honorio Ventura State University Office of Admissions, - led by Mr. Richard Briones, for providing the necessary information and supporting them. The office staff has always been approachable and dedicated to assisting them. They are particularly grateful to Mr. Jerome De Leon for his assistance and accommodation.

Finally, the researchers would like to acknowledge their family, friends, and instructors for the unwavering support and belief in their abilities. They are deeply grateful to all of those who have contributed to the success of this thesis. Your hard work, dedication, and support are greatly appreciated.

19. REFERENCES

Deloitte. (2020). Thriving in the Era of Pervasive AI. WSJ. <https://deloitte.wsj.com/articles/thriving-in-the-era-of-pervasive-ai-01595358164>

- Lalwani, T., Bhalotia, S., Pal, A., Rathod, V., & Bisen, S. (2018). Implementation of a Chatbot System using AI and NLP. *ScienceDirect*. <https://doi.org/10.2139/ssrn.3531782>
- Bhartiya, N., Jangid, N., Jannu, S., Shukla, P., & Chapaneri, R. (2019). Artificial Neural Network Based University Chatbot System. <https://doi.org/10.1109/ibssc47189.2019.8973095>
- Santoso, H. A., Winarsih, N. a. S., Mulyanto, E., Saraswati, G. W., Sukmana, S. E., Rustad, S., Rohman, M. S., Nugraha, A., & Firdausillah, F. (2018). Dinus Intelligent Assistance (DINA) Chatbot for University Admission Services. In 2018 International Seminar on Application for Technology of Information and Communication. <https://doi.org/10.1109/isemantic.2018.8549797>
- Oguntosin, V., & Olomo, A. (2021). Development of an E-Commerce Chatbot for a University Shopping Mall. *Applied Computational Intelligence and Soft Computing*, 2021, 1–14. <https://doi.org/10.1155/2021/6630326>
- Kasthuri, E., Balaji, S. (2023). Natural language processing and deep learning chatbot using long short term memory algorithm. *Social Science Research Network*. <https://www.sciencedirect.com/science/article/pii/S221478532103056X>
- Adamopoulou, E. (2020). Chatbots: History, technology, and applications. <https://www.semanticscholar.org/paper/Chatbots%3A-History%2C-technology%2C-and-applications-Adamopoulou-Moussiades/5154ee5b479e6b27474bf6d2803b7655672a03e5>
- Chopra, A., Prashar, A., Sain, C. (2019). Natural Language Processing. *CiteSeerX*. <https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=eace1d14e266a5cd44fe781a874c662928602fd>
- Hirschberg, J., Manning, C. (2019). Advances in natural language processing. <https://www.science.org/doi/abs/10.1126/science.aaa8685>
- Jung, S. (2019). Semantic vector learning for natural language understanding. *Computer Speech & Language*, 56, 130–145. <https://doi.org/10.1016/j.csl.2018.12.008>
- Perera, R. (2019). Recent Advances in Natural Language Generation: A Survey and Classification of the Empirical Literature. <https://openrepository.aut.ac.nz/handle/10292/10691>
- Bresnick, P. (2021, February 22). Universities Using AI-Enabled Chatbots to Foster Student Relationships. *Fierce Education*. <https://www.fierceeducation.com/best-practices/universities-using-ai-enabled-chatbots-to-foster-student-relationships>
- Sandu, R. (2020). Adoption of AI-Chatbots to Enhance Student Learning Experience in Higher Education in India. *ResearchGate*. https://www.researchgate.net/publication/338868551_Adoption_of_AI-Chatbots_to_Enhance_Student_Learning_Experience_in_Higher_Education_in_India
- Singh, R. (2021). AI and Chatbots in Education: What Does The Future Hold? *Medium*. <https://chatbotsmagazine.com/ai-and-chatbots-in-education-what-does-the-futurehold-9772f5c13960>
- Serrano, J., Belegal, J. A., Cañas-Llamas, A., & Almodiel, M. C. (2021). Ask Iska and IskOU: Analysis of UPOU's Chatbot for Information Support Services. *ResearchGate*. https://www.researchgate.net/publication/357826481_Ask_Iska_and_IskOU_Analysis_of_UPOU's_Chatbot_for_Information_Support_Services
- Dibitonto, M., Leszczynska, K., Tazzi, F., & Medaglia, C. M. (2018). Chatbot in a Campus Environment: Design of LiSA, a Virtual Assistant to Help Students in Their University Life. In *Lecture Notes in Computer Science* (pp. 103–116). Springer Science+Business Media. https://doi.org/10.1007/978-3-319-91250-9_9
- Patel, N., Parikh, D. A., Patel, D. P., & Patel, R. M. (2019). AI and Web-Based Human-Like Interactive University Chatbot (UNIBOT). In 2019 3rd International conference on Electronics, Communication and Aerospace Technology (ICECA). <https://doi.org/10.1109/iceca.2019.8822176>
- Santoso, H. A., Winarsih, N. a. S., Mulyanto, E., Saraswati, G. W., Sukmana, S. E., Rustad, S., Rohman, M. S., Nugraha, A., & Firdausillah, F. (2018). Dinus Intelligent Assistance (DINA) Chatbot for University Admission Services. In 2018 International Seminar on Application for Technology of Information and Communication. <https://doi.org/10.1109/isemantic.2018.8549797>
- Hien, H. T., Cuong, P. V., Nam, L. N. H., Nhung, H. L. T. K., & Viet, T. L. (2018). Intelligent Assistants in Higher-Education Environments: The FIT-EBot, a Chatbot for Administrative and Learning Support. <https://doi.org/10.1145/3287921.3287937>
- Bringula, R. P., Jose, J. K. L., Lardizabal, A. T., & Lizaso, J. R. D. (2023). Predictors of Usability of a Mobile Intelligent Agent Information Provider for College Students. *International Journal of Mobile Human Computer Interaction*, 15(1), 1–19. <https://doi.org/10.4018/ijmhci.322457>
- Shanmugam, R., Jena, S. R., & Gaur, V. (2020). College Information Chat-Bot System Based on Natural Language Processing. *Xi'an Dianzi Keji Daxue Xuebao*, 14(5). <https://doi.org/10.37896/jxu14.5/086>
- OpenAI, (2023). OpenAI Pricing. <https://openai.com/pricing>
- Bhandari, P., Nikolopoulou, K., (2023). What Is a Likert Scale? | Guide & Examples. <https://www.scribbr.com/methodology/likert-scale/>