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An Interactive Chatbot for College Enquiry

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ABSTRACT

Chatbots are now widely used in many applications, particularly in systems that give intelligent support to users. In many situations, these systems are equipped with Chatbots that can read user requests and offer the appropriate replies in a timely and accurate manner. This paper presents a Chatbot system in an educational domain. A system was created to assist university students in their inquiries. The primary goal was to develop a specific architecture, create a model for managing communication, and provide the proper responses to the students. For this purpose, a system has been developed to recognize queries and provide answers to students using artificial intelligence techniques and natural language processing. Finally, an experimental campaign was run when the planned model was implemented to verify its enforceability and efficiency.

1. Introduction

Artificial Intelligence (AI) is gradually integrating itself into our daily lives by developing and analyzing intelligent software and hardware, referred to as intelligent agents. Intelligent agents can perform various tasks, from simple labor to complex procedures. A chatbot is a common AI system and one of the most basic and often used forms of intelligent Human-Computer Interaction (HCI) [1]. A chatbot is a computer software that, when conversed with through text or voice, replies as if it were a clever entity that understands one or more human languages using Natural Language Processing (NLP) [2]. In another way, a chatbot is described as" a computer software meant to imitate interaction with human users, particularly via the Internet," according to the dictionary. Smart bots, interactive agents, digital assistants, and intelligent conversation entities are all terms used to describe chatbots. Chatbots can imitate human communication and entertain users, although they are not designed exclusively for this purpose. They can be used in educational, information retrieval, commercial, and e-commerce applications [3]. Chatbots have grown in popularity due to the numerous benefits they provide to users and developers. Most implementations are platform-agnostic, and consumers may access them immediately without having to install anything. Contact with the chatbot is disseminated across a user's social graph without leaving the messaging app in which the chatbot resides, ensuring and confirming the user's identification. The AI Chatbot was created to lower student search time and make websites more user-friendly and informative, which is critical during these stressful times. This chatbot was created using AI algorithms that analyze user requests and comprehend their messages. Students must ask questions using a chatbot with the same User Interface (UI) as any other chat window. The system evaluates the query and further analyses it to provide the user with a response. The technology responds to questions as if a real person was answering them. The system responds using a graphical user interface that makes it appear like a real person is conversing with the user [4]. Online chatbots save time and effort. According to Gartner, over 85 percent of customer contacts will be handled without a person by 2020 [5].

On the other hand, chatbot systems provide significantly more than replies to clients' questions. They're also employed for other corporate duties, including gathering user information, assisting with meeting planning, and lowering overhead expenses. The following is a breakdown of the paper: Section two shows the related work to our research, Section three shows the proposed model with a detailed description of how it works, and Section four discusses the experimental results of the proposed chatbot model. Finally, Section five provides us with the conclusion and some future directions.

2. Related Work:

Nowadays, chatbots are used in various fields to help organizations provide a better user experience and support. This section mentions the related similar chatbot systems that are used in various domains. The authors in [6] proposed a chatbot called Eliza. In 1966, Eliza was developed, who appeared ready to deceive consumers into believing they were conversing with a real person. It was created to mimic a therapist who would ask open-ended inquiries and even follow up with additional questions. It is regarded as the first conversational agent in personal computer history. It operates as a consultant by rephrasing the client's arguments and recommending them as conversation starters. It's a typical language-handling computer application demonstrating human-machine correspondence's banality. It imitated dialogue by employing a design coordinating' and replacement method that fooled clients into thinking they knew what was going on with the program. The advantage of ELIZA is that it provides grammatical analysis for sentences. It also gives a good introduction To Artificial Intelligence, Natural Language Understanding, and Pattern Matching. While the disadvantages of ELIZA appeared in employing more complicated rules that require the usage of input transformation, output transformation, and keyword patterns to express user input and Elizabeth's response. Additionally, it does not provide the ability to partition the user input or split it into two sentences and then combine the answers, which is a vital issue in language processing. The authors in [7] proposed a technique called ALICE (Artificial Linguistic Internet Computer Entity). It is an award-winning open-source regular language artificial intelligence visit robot that responds to queries using AIML (Artificial Intelligence Mark-Up Language). It is motivated by ELIZA and an open-source chatbot created by Dr. Wallace, which depends on normal language understanding and example coordination. It has won the Loebner prize multiple times. It produces reactions to the client's question by applying some example matching standards. The chatbot design comprises two isolated parts, particularly the" chatbot motor" and" language model," which permits us to effectively carry out a chatbot in a recently evolved information model. A language model is put away in AIML documents. Every class comprises information or question, a result of a response, and a discretionary setting. The inquiry is known as the example. The response or reaction is the layout. The discretionary settings are designated" that" and" theme." The example coordinating is extremely straightforward while working with AIML, comprising just words, spaces, and trump card images. The main advantage of ALICE is that it stores a huge corpus of text. Because ALICE employs basic patterns and templates to express input and output, it will be easier to construct machine learning. Another important point ALICE uses is the ability to partition the user input or split it into two sentences and then combine the answers. Another chatbot system called RASA is proposed [8] and uses Long Short-Term Memory (LSTM) which already integrates with the RASA framework. LSTM is efficient in saving some required memory and removing the not needed memory. There are two main approaches to generating a chatbot response [9]. The first one is the traditional approach which is hard-coded rule-based templates and rules that process responses. However, many new and interesting approaches nowadays allow deep learning approaches to emerging. Neural network models are trained with several data to study the process of generating grammatically relevant responses in terms of user speech intent as an AI approach. First and foremost, the advantages of the open-source concept such as Alice must be stated, allowing a high

degree of use-case-specific configuration. For example, with a chatbot, industry-specific phrases like" cash" and" balance," which have the same meaning in the banking environment but must be generally differentiated, may be mapped much better. Of course, compared to ready-made alternatives like Google's Dialogflow or Microsoft's LUIS, you'll have to work more to find an optimal solution. In addition to pre-configured solutions, these also provide service Hosting. Another AI-based chatbot is proposed by the authors in [4] named Erasmus. This chatbot answers questions about university information. It was designed as an end-to-end system in which their cloud services were used, starting from API, AI (Dialogflow), Mlab (MongoDB cloud), and IBM Bluemix (webhook API). This chatbot took quite a long latency to respond to the users as it uses too many cloud services. It achieved an average satisfaction of 60 percent. A further chatbot system for a university named Eaglebot is proposed in [10]. The authors used semantic search to answer users' inquiries about the university based on the information available on its website. An approach they used involved document retrieval and paragraph selection using BERT. It's a robust chatbot provides three route selection approaches, with Dialog-flow as the basic architecture. Eaglebot still has several limitations, such as the Dialogflow chatbot framework's request constraints, and the bot only obtained a 56 percent accuracy rate. The authors in [11] designed a social football Chatbot to answer Spanish football league questions and deployed it as a Slack client with interactive text-based. SPARQL queries were used to retrieve information via various datasets to respond to scope user inquiries. A pattern recognition messaging dialogue was used to respond to out-of-scope user requests. It has achieved a valid and acceptable proportion of greater than 68-72 percent. A study that includes an overview of Chatbot design strategies is presented in [12], as well as a comparison of different design techniques from nine carefully selected studies based on the primary methods utilized. The study addresses the techniques' parallels and contrasts, focusing on the Loebner Prize-winning Chatbots. They also employed NLP and Natural Language Toolkit (NLTK). NLTK is a specialized toolkit required to deal with and handle the text generated by speaker identification and speech-to-text conversion. These toolkits arrange the content into phrases and then divide them into words, allowing semantically and meaning extraction. One of those other toolkits is the commonly utilized NLTK, a free Py plugin. Also, this toolkit is used to separate words into a collection of words and split the text into words and phrases by labeling word labels as per their positions and roles in the Sentence. Generally, a designer needs to be familiar with various approaches to create a Chatbot: Parsing, Pattern matching, AIML, Chat Script, SQL and relational database, Markov Chain, and Language trick Ontologies[12]. The authors in [13] designed a chatbot to be the ultimate entertainment virtual assistant, assisting with tasks like answering questions, getting driving directions, cranking up the temperature in home automation, and playing one's favorite tunes, among others. On the other hand, chatbots must be as effective as feasible to fulfill numerous tasks. To overcome this problem, they propose the creation of a chatbot that uses AI to provide a quick and correct response to any, mainly depending on a database of frequently asked questions. Also, it can be used by any university to communicate with enthusiastic pupils and respond to their queries. Chatbots that answer general queries like" How are you?" are built using AI-powered Syntax (AIML) and Latent Semantic Similarity Analysis (LSA) which uses a vector representation to detect similarities between words. As a result, AIML's unanswered inquiries will be interpreted as a response by LSA. **To the best of our knowledge,** none of those mentioned above systems (i.e., in the domain of universities) has been implemented in the Colleges of Egypt. So, it was the first time implementing a chatbot in the educational field, especially for college inquiry. At the same time, all the developed systems were related to business-wise and banking.

3. Proposed Model

The users expect to have a human-like conversation with the chatbot, therefore the system was implemented using Artificial Intelligence and the sub-branches Keras [14] and TensorFlow [15]. These

techniques are used together with Natural Language Processing to create the algorithm that processes our data and the user's input. The following section will discuss the proposed model and the components within the system.

A. System Components:

- **User Interface:**
  The system will be integrated into the university's websites; thereby the UI is built using web development. The UI will be basic and straightforward, featuring a chat window where the user and the chatbot may chat.
- **NLP Unit:**
  NLP techniques are used in the proposed system for tokenizing and lemmatizing the data. NLP plays a major role in the system because it is a fundamental pillar for text recognition. It allows technology to recognize human natural language text and speech-based commands. That's why preprocessing is applied to the input text to standardize the input as per the system's requirement. Based on the keywords used in the text, appropriate context is recognized, which is then saved in a bag of words and compared to the trained model.
- **Neural network model:**
  The model was built using the Multilayer Perceptron (MLP) Neural Network model that consists of three layers (i.e., An input layer - An output layer - A hidden layer). The neural network algorithm has a bag of words that contains the unique words identified in the dataset. The artificial neural network algorithm is also responsible for training the dataset.

B. System Overview

The following stages summarize the system overview, which is presented in Figure 1.

Stage 1 (Processing the user's input):

The user's input (Text Input / Voice Input) is processed using NLP techniques, and saving the processed input for later use in the third stage.

Stage 2 (Preparing the trained model):

The dataset is processed using NLP techniques (Tokenizing- Lemmatization) then the data is trained using Feed-forward Artificial Neural Network (ANN) and the Keras Sequential Model; Finally, it is saved and loaded into the model.

Stage 3 (Prediction Process and Response Generation):

The processed input is compared to the trained model using the system's algorithm and fetches the appropriate and accurate response from the model. And finally, the system provides the user with the most accurate response from the prediction process.

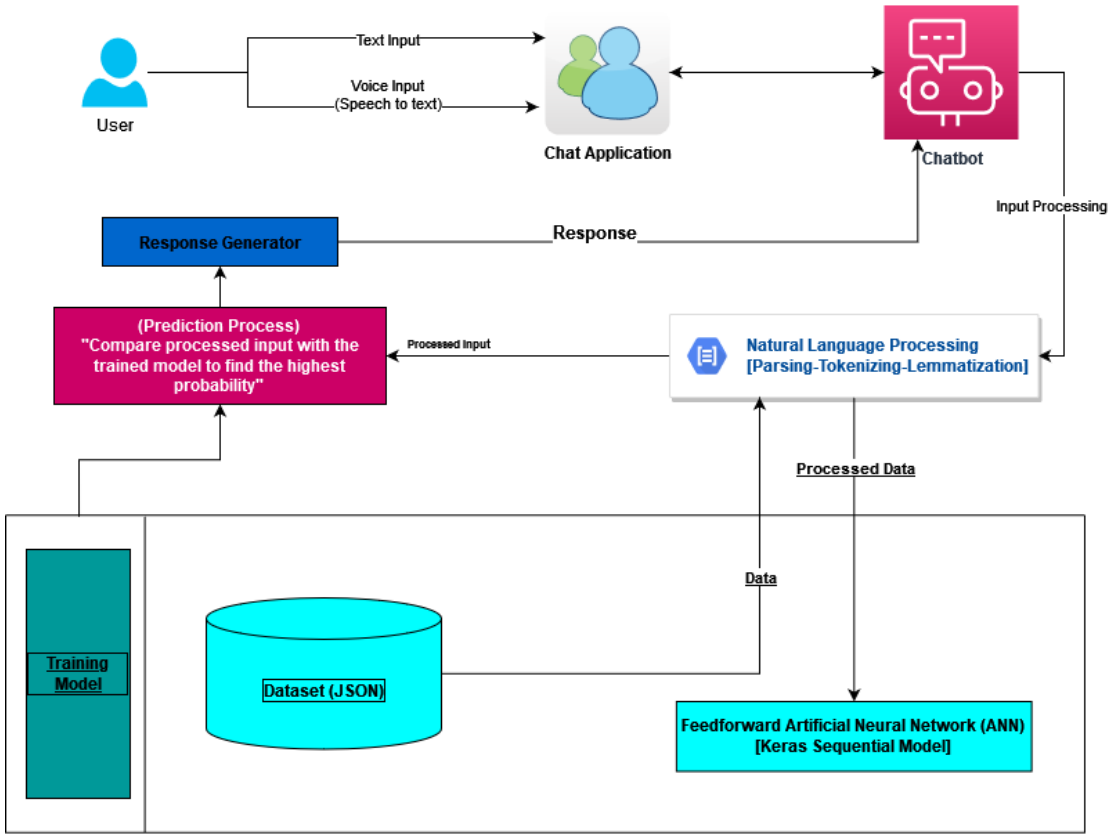

Fig. 1. Proposed System Overview

4. Results

This college inquiry system can be used in any university or for any educational domain as long as it contains a dataset related to that university, either a JSON file or a CSV file, as shown in Figures 2 and 3. The dataset contains many Tags and response samples, which are used to train the chatbot. The JSON file was chosen because it is well-organized and expressed in plain language that humans can readily comprehend. We began extracting data from the university website after writing a large amount of data to maintain our current data. This step will improve our chatbot's ability to answer users' inquiries quickly. The dataset can include as many tags as necessary, containing several patterns to be compared to the user's input. To test the efficiency of the proposed chatbot system, we have experimented on Misr International University (MIU) as a case study. The team members collect the dataset with the help of certain departments in the university and the information available on the university's website. The following sub-sections present detailed results.

```
{"tag": "VisitAdmissionOffice",
"patterns": ["Can we apply by visiting the Admissions Office in person?"],
"responses": ["In our recent developments to reduce waiting time and digitalize our procedures, students can only apply online.
"context": [""]
},
{"tag": "TanseekPortal",
"patterns": ["Can the applicant choose MIU on the government Tanseek portal?"],
"responses": ["Yes, if the subjects taken and scored received qualify the candidate to join MIU."],
"context": [""]
},
{"tag": "ReschedulePlacementExam",
"patterns": ["Can the applicant reschedule the MIU Placement Exam?"],
"responses": ["Yes, applicants can change the exam date using the username and password of their MIU account, which is sent to
"context": [""]
},
{"tag": "ApplicationFees",
"patterns": ["What are the required fees for the application?", "What is the application fees?", "What are the fees for the pla
"responses": ["A nonrefundable amount of 1350 Egyptian pounds has to be paid online with a MasterCard / Visa credit card to boo
"context": [""]
},
{"tag": "ApplicationInfo",
"patterns": ["What if applicants did not receive a confirmation email after submission of the online application?", "When do i
"responses": ["Make sure that the email you registered in the application is correct. If the applicant is sure the correct emai
"context": [""]
},
{"tag": "ChangeEmail",
"patterns": ["How can applicants change their registered email?"],
"responses": ["The applicant can simply send us a request through the Admission Office active email (admdocuments@miuegypt.edu.
"context": [""]
},
```


Fig. 2. Dataset Sample 1 (JSON file)

Faculty	First Install	Total First Installment	Second Installment	Total Annual Fees		
Tuition Fee	Admin Fe	Validation * Fees	Tuition Fees			
Arts & Desi	40,000	15,000	21,000	76,000	50,000	126,000
Arts & Hum	20,100	15,000	–	35,100	24,000	59,100
Arts & Hum	18,000	15,000	21,000	54,000	32,400	86,400
Arts & Hum	18,000	15,000	21,000	54,000	32,400	86,400
Business Ac	36,000	15,000	21,000	72,000	48,000	120,000
Communica	36,000	15,000	21,000	72,000	48,000	120,000
Dentistry	90,000	25,000	–	115,000	70,000	185,000

Fig. 3. Dataset Sample 2 (CSV file)

A. Results of Trained Model

As mentioned in the proposed model section, Feed-forward ANN and Keras Sequential Model train the dataset. After training the dataset, the following numbers were produced:

1) The model contains 147 documents (A combination between patterns and intents).
2) The model contains 86 Tags.
3) After iterating 200 epochs, the model's accuracy is 87.07%, as shown in Figure 4.

```
Epoch 196/200
30/30 [==============================] - 0s 1ms/step - loss: 0.4893 - accuracy: 0.8367
Epoch 197/200
30/30 [==============================] - 0s 1ms/step - loss: 0.6155 - accuracy: 0.8027
Epoch 198/200
30/30 [==============================] - 0s 2ms/step - loss: 0.5563 - accuracy: 0.8231
Epoch 199/200
30/30 [==============================] - 0s 2ms/step - loss: 0.6321 - accuracy: 0.8163
Epoch 200/200
30/30 [==============================] - 0s 1ms/step - loss: 0.5243 - accuracy: 0.8707
model created
Model: "sequential"
```

Fig. 4. The training model accuracy

The previous numbers are subject to change whenever more information is added to the JSON file or whenever the current data is updated and enhanced (i.e., Enhancing the data refers to editing the patterns to increase the accuracy).

B. Results of Chatbot Responses:

As shown in the following figures, the chatbot response model can provide information regarding the university. In Figure 5, the chatbot can greet the user. In Figure 6, the user can ask how can he/she apply at MIU. In Figure 7, the user can enquire about MIU's availability to provide students with scholarships, and the chatbot responds. Additionally, in Figure 8, the user can seek the ranking of MIU locally and globally, and the chatbot response is achieved. In Figure 9, the user asks about the different facilities available on the MIU campus. All the above figures are samples from various user enquires and the appropriate chatbot responses.

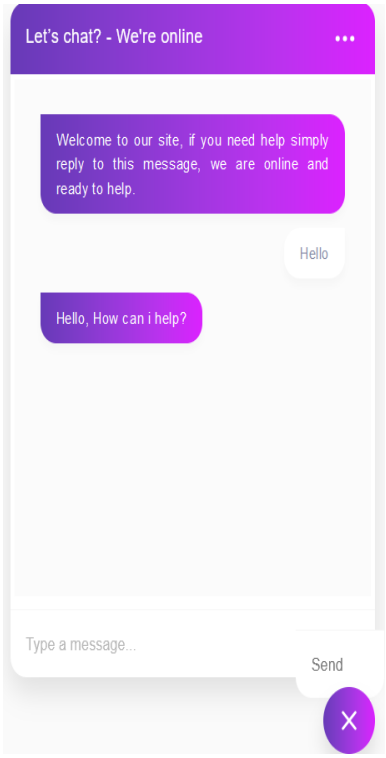

Fig. 5. Chatbot Response Sample 1

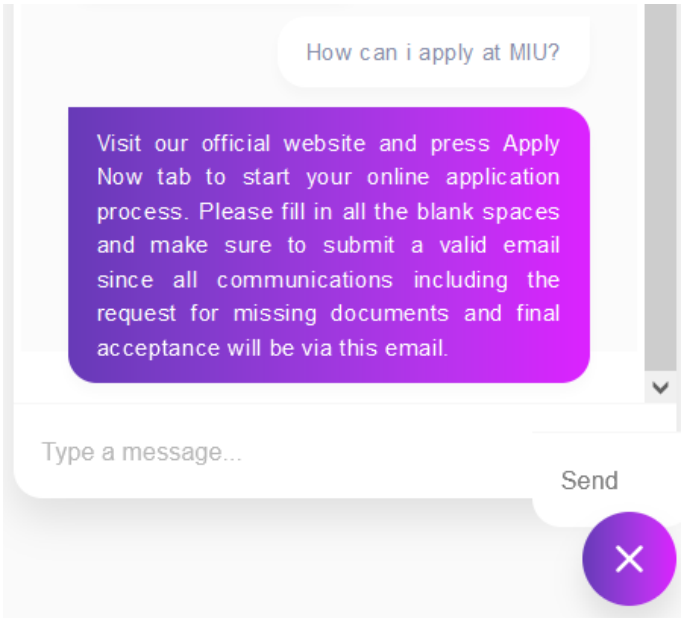

Fig. 6. Chatbot Response Sample 2

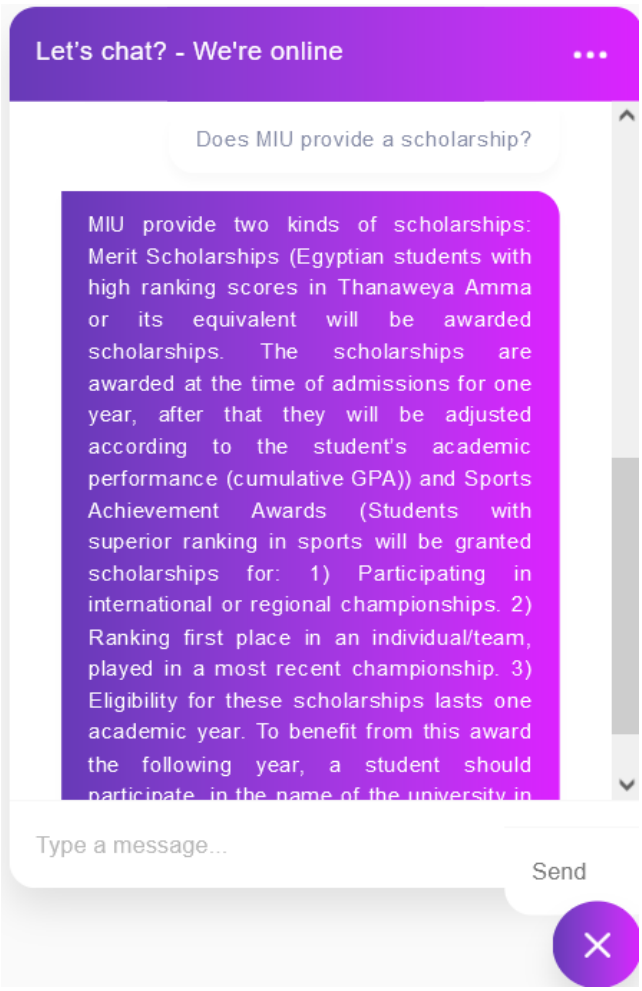

Fig. 7. Chatbot Response Sample 3

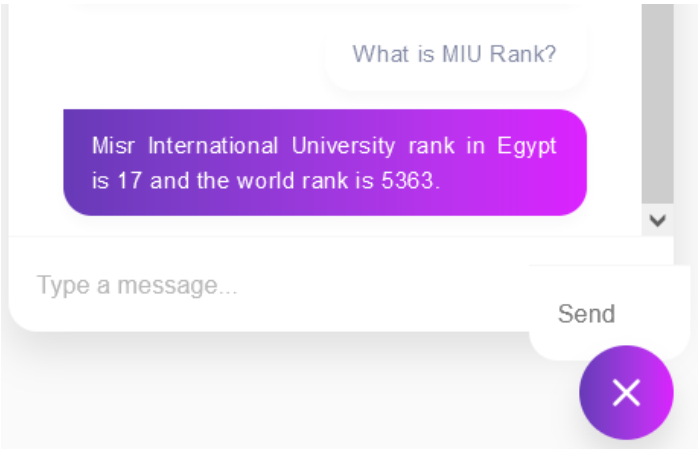

Fig. 8. Chatbot Response Sample 4

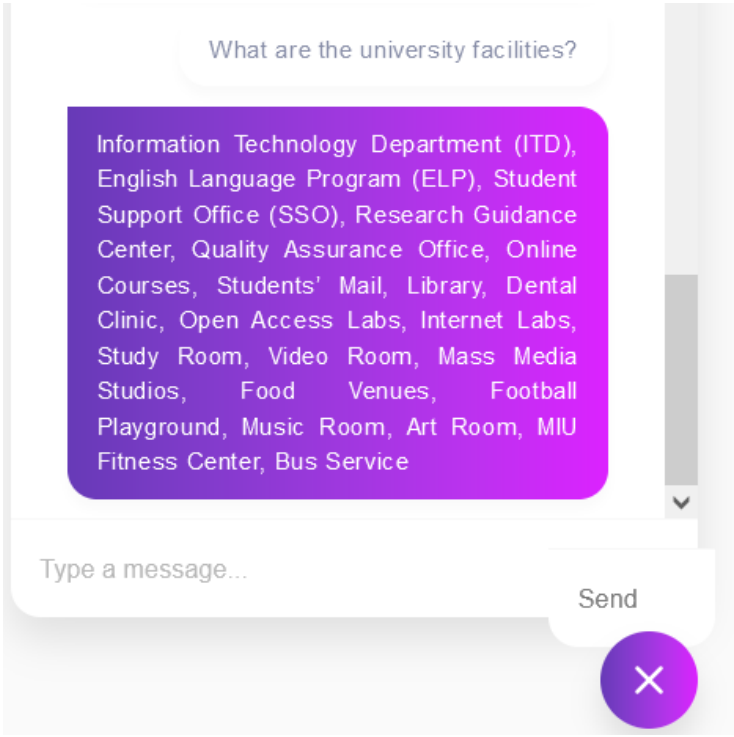

Fig. 9. Chatbot Response Sample 5

6. Conclusion And Future Direction

This paper proposed an interactive, user-friendly chatbot system for college inquiry where questions from college students and employees are encouraged to be submitted. It's often impossible to get all of the data into a single interface without the headaches of filling out multiple forms and windows. The college chatbot aims to eliminate this by providing a standardized and user-friendly interface. Students and instructors can use this interface to get answers to their inquiries in a natural language. The chatbot searches quickly and efficiently for answers to their questions and provides them with relevant connections. In the future, other algorithms, such as AIML-based bots, could be utilized. It is possible to conduct searches using voice. Users will be expected to supply voice input and written output from the system. We can apply the chatbot in other domains, such as medicine, forensics, sports, and so on, after it has been effectively implemented in the collegiate domain. It will be beneficial in many fields since we can swiftly obtain crucial information without having to arrange it.

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