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A VOICE ASSISTANT DOMAIN-SPECIFIC STANDALONE SYSTEM FOR COLLEGE INFORMATION

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Abstract:
Voice Assistants (VA) are expert systems that understand and respond to user questions in their native language. A voice assistant responds to a conversation in the same way that humans do. It functions as a voice assistant, and its accuracy is determined by establishing a link between the user's queries and the assistant's responses. For a better user experience, the voice assistant implemented provides two modes: text mode and audio mode. In audio mode, it allows for interactive responses via voice messages. There is a long line at the inquiry window during the institute's academic admissions process. The situation is exacerbated for parents who live in different cities, states, or countries. The goal of this system is to provide a platform for students and parents to ask questions and clear up confusion using simple English text messages or voice commands. Instead of querying at the information desk, students and parents, staff can use the voice assistant to ask admissions questions and college regarding information at any time.
As there are many Artificial Intelligence (AI) systems or Chabot that help people and students solve problems, we plan to create a voice assistant standalone device based on AI and ML, Natural Language Processing (NLP), Term Frequency Inverse Document Frequency (TFI-DF), and Deep Learning algorithms that can answer any college-related question. The Voice Assistant will function as a college-oriented intelligent machine. This device will respond to student inquiries about college-related issues.
Keywords: Voice Assistant, AI, NLP, ML, TFI-DF

I Introduction

Staff and students, parents have a lot of difficulties at the beginning of the academic year or during the college inquiry period. Each student arrives with a unique set of questions, whether they are related to their course, class times, fees, scholarships, departments, entrance forms, etc. Now that this process is underway, the faculty must respond to questions from students or parents with information. The faculty is frequently too busy with other tasks to devote enough time to responding to students' questions[5] [13]. This frequently occurs when a faculty member is unavailable. This must be the one process that takes the longest to complete at traditional colleges, and automation would make things so much simpler. With the aid of modern technologies, the educational system is undergoing numerous changes nowadays [6] [3] .Without any issues, everything takes place online. We had to visit the college back then to inquire about courses, but as time goes on, this is absolutely changing [21]. It will be a laborious process and labor-intensive to manually collect the course information and pricing structure. Numerous devices or methods were developed daily to lessen the power of college professors and prevent such challenges and time-consuming tasks [20][18][13] .
The underlying algorithms will translate the voice into text as provided by the user. The AI and ML techniques that we use to construct this system [2] . SNJBia is a stand-alone device that can answer questions from parents and students. Like "Alexa," the SNJBia Voice Assistant was created for a specific region. Since all the information is readily available online, there is no need to visit the college office with any questions. It keeps students informed of the most recent information on colleges. The suggested system offers details on college activities and accomplishments. This gadget is intended for all college-related personnel, including academic staff, technical staff, and administrative employees.

An efficient way to implement a voice assistant for college information is through the concept that has been put out [17] . This voice assistant will have information about the college's facilities, events, departments, competitions, exams, admission, placements, personnel, etc. We can do this by using an AI voice recognition library[11]. Many built-in features in the Speech Recognition library will help the assistant understand the user's command and will enable Text to Speech capabilities to provide the user's response in voice. When a helper records the voice command [19][9].

Every academic year, freshly enrolled students have a long list of questions at the outset. In the past, parents and children had to travel to the college to learn about things like the courses offered, the cost of tuition, the admissions process, and other information about the institution. This was a time-consuming and exhausting process for both parents and children as well as for university colleges.

With the aid of modern technologies, the educational system is undergoing numerous changes nowadays. Without any issues, everything takes place online. We had to visit the college back then to inquire about courses, but as time goes on, this is absolutely changing. Manually compiling the course information and fee schedule will be quite time-consuming.

A chatbot is a computer-generated agent that communicates with users [14] . Most have a messenger interface with user input and an output from the chatbot. Most basic chatbots operate by matching a user's input with a predefined set of dialogue [10] . As an example, a user saying "Thank you" will end in the chatbot saying "You're Welcome". A predefined set of dialogues will be created to mimic a traditional two-person conversation [12] . Modern chatbots are more complex, with tongue processing that learns from user input. They will use APIs to push information to users such as news, weather, and time. They will even process orders and make reservations entirely via a chatbot interface [16] [22] .

People frequently interchange the terms chatbot, virtual personal assistant, automation, and artificial intelligence (AI) [4]. However, there is a significant distinction between AI chatbots and plain chatbots - to understand the distinction between AI and automatic. Drift's chatbots adhere to predefined rules. In other words, they stick to the script so that sales and marketing teams can answer the same questions needed to sell to their customer [7]. If you remember our playbooks, you will get a sense of how this process works. Users begin the bot-building process by deciding what type of conversation they want to have. Chatbots are conversational agents that provide information and services [15]. Through interaction in everyday language. While conversational agents have been studied for decades in fields such as social robotics, embodied conversational agents, and dialogue systems, it is only recently that conversational agents have received attention [23][24]. Have turned into a practical reality. Advances in artificial intelligence (AI) fields such as natural language processing (NLP) and natural language understanding (NLU), as well as increased consumer adoption of platforms conducive to conversational interaction, are key drivers of this development [8][1].

In this paper, a domain-specific standalone voice assistant and chatbot system recognizes the user's speech through the mic and converts speech to text, and call the chatbot function where the NLTK module, keras gives a response to the user in speech format. In the second section literature survey is elaborated. The third section is used in the proposed system and in the next section algorithm and its flow is explained with its pros. Further, the conclusion is made with references.

II Related Work

Question Answering (QA) and Voice Assistant (VA) systems use linguistic features to select the most appropriate answers natural language queries by providing answers instead of providing the simple list of document links [5][3][13][10]. The QA system selects the most appropriate answers by using linguistic features available in natural language techniques. Dialog Systems are an effective and easy way to access information[6][18]. QA system based on Semantic enhancement, domain-oriented based on FRASI technology. The proposed approach uses the ontology to construct answers actively and

populate chat-bots with sentences derived from the ontology Second Pre-process sentences to simplify queries for chat-bots[3][2][9].
Identify the most important facts in texts to build a conversational agent.

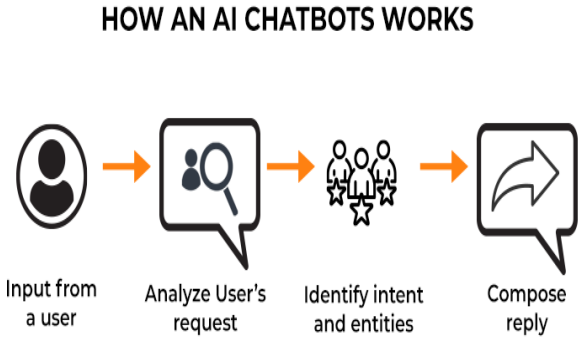


Fig. 1. Chatbot Working

Organizations are using chatbots to reduce their reliance on support personnel and live operators[]. Chatbots are computer programs that replicate and analyze human dialogue, allowing humans to communicate with electronic devices[20]. The three core mechanisms driving chatbots are rules-based processes, AI-driven decision-making, and live agent intervention. Rules-based chatbot software performs pre-programmed behaviors based on "playbooks" you create on the user interface's backend module[18]. Like a digital assistant, rules-based chatbot technology can behave in a certain way based on click activities and simple event triggers like a "yes" or a "no" input. It may also detect a specific keyword or combination of phrases (but only when there is an exact match) [13].

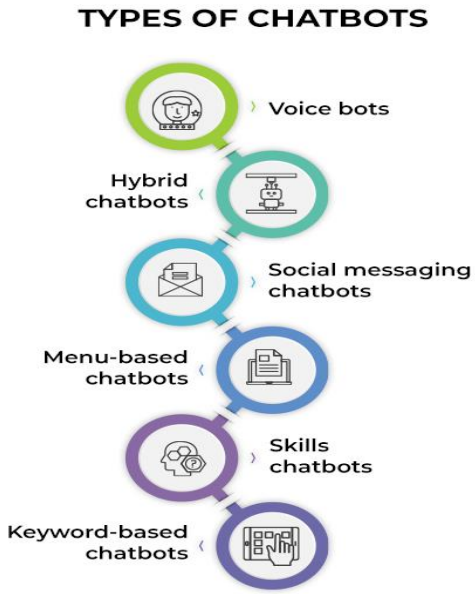


Fig. 2. Types of Chatbot

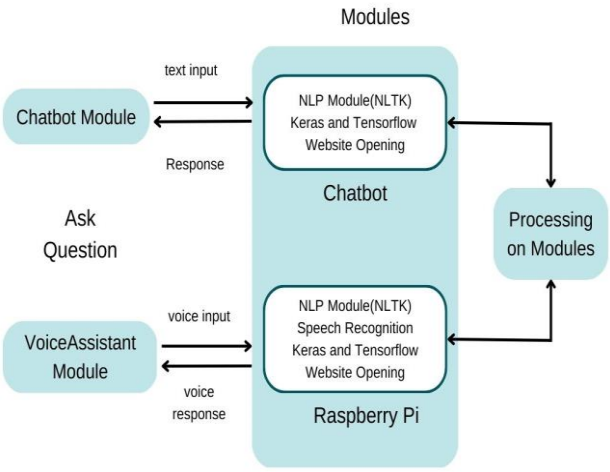
III Objective and Methodology

- Every college needs a college guide to inform their college.
- Voice Assistant Chatbot solves student queries regarding placement, college activities, and sports.
- Voice Assistant chatbot guide as Enquiry System from that students and parents can easily get their response from the voice assistant.
- Reduce Manual work of staff in colleges

This proposed concept is an effective way of implementing a College Information voice assistant, which will have college information like facilities, events, departments, competitions, exams,

admission, placements, and staff. Using an AI speech recognition library, we can implement this. The Speech Recognition library has many in-built functions that will let the assistant understand the command given by the user and the response will be sent back to the user in voice, with Text to Speech functions. When an assistant captures the voice command given by the user, the underlying algorithms will convert the voice into text. We develop this system using AI and ML algorithms. SNJBia is a standalone device that understands the queries of students and parents. SNJBia Voice Assistant is similar to "Alexa" but SNJBia is developed for a particular area. There is no need to visit the college office for any query as all the information is available at your fingertips. It keeps students updated with the latest college-related information. The proposed system provides information about the activities and achievements of the college. This device is designed for everyone related to college no matter students or faculty or technical or administration staff.

The proposed system will have the following modules:
] Online Enquiry: Students can ask questions about college, library, placement, department information, exams, academics, fee structures, and other facilities. The chatbot and the voice assistant will get the student's query, and the corresponding response will be sent to the chatbot and voice assistant, and the chatbot will then open the relevant website.
B] Online Chatbot: The result will be presented in the form of text, photos, and website links. The query will be answered on the basis of questions asked and the language model built and also the response will be sent. Users who enquire about the college, activities, details, sports, or any competition held in the college, library section, or student section can query the chatbot and voice assistant.
C] Online Voice Assistant:
Students can ask questions through voice commands and assistants will give responses first voice commands will be converted into text using speech to text algorithm and then the response will be fetched from the database in text format and then that response will be converted into speech using text-to-speech. VA reacts to voice commands and questions and provides relevant information
D] Admin Module: it is used for adding the new questions and answers into the system. Admin can view, update, delete and add the question and answer called intent(tag, pattern, responses, link) into the system using Interface.



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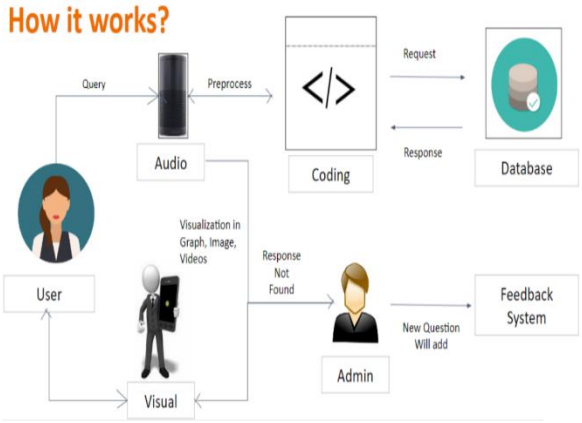

Fig. 3. Architecture Diagram

Above architecture, a diagram shows the integrated working of all modules and algorithms which are used in the Voice Assistant Chatbot System. First, the user will give input in voice or textual format, text format is used in the Chatbot web page for college information whereas NLP Module, Deep Learning Algorithm Keras and TensorFlow, and webpage modules will be used for providing the relevant information with visualize format of questions and voice commands are used in voice assistant whereas it uses one more module which is GTTS, Speech Recognition for converting text to speech and speech to text algorithm. Voice Assistant will take voice commands from the user, these inputs will be sent to the Internet of Things (IoT) component, Raspberry Pi. The entire processing of the acquired input happens in this unit. The Raspberry Pi unit contains a Natural Language Processing (NLP) unit and Deep Learning (DL). This unit is responsible for processing the textual input to find the intent. The speech input from the Voice Assistant module will use speech-to-text processing, hence providing a text input to the NLP module.

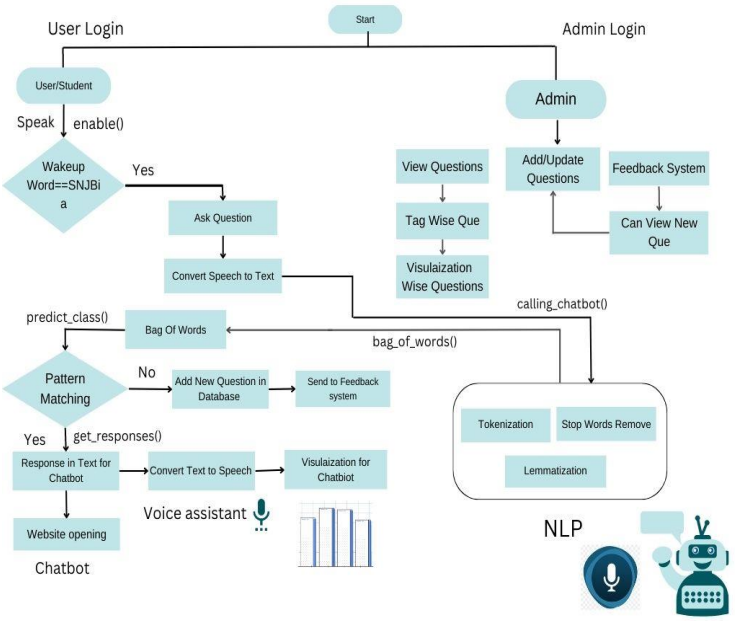

Fig. 4. Flowchart

Algorithm:

1. Start.
2. Get the input query from the user.
3. Convert query into text using STT (Speech to Text) Algorithm.
4. Extract the wakeup word from that user query.
5. Compare wakeup word==" SNJBia" if true.

6. The query is pre-processed. E.g., suppose there is this query “What is the placement count of 2021” So, we are going to remove these stop words like “is”, and “the” using the pre-processing technique.
7. Fetch the remaining keywords from the query.
8. Apply the machine learning model, match the fetched keywords with the keywords in Dataset, and provide an appropriate response.
9. Further the Admin module is used to call proper services using user information to find proper data.
10. The keywords will be matched with the help of the Pattern Matching algorithm.
11. It returns the response to the user module in the form of text.
12. User module is used to convert the text in voice using TTS (Text to Speech) Algorithm.
13. Response will send to the Device
14. If the wakeup word is not equal to “SNJBia” repeat step 2
15. Exit.

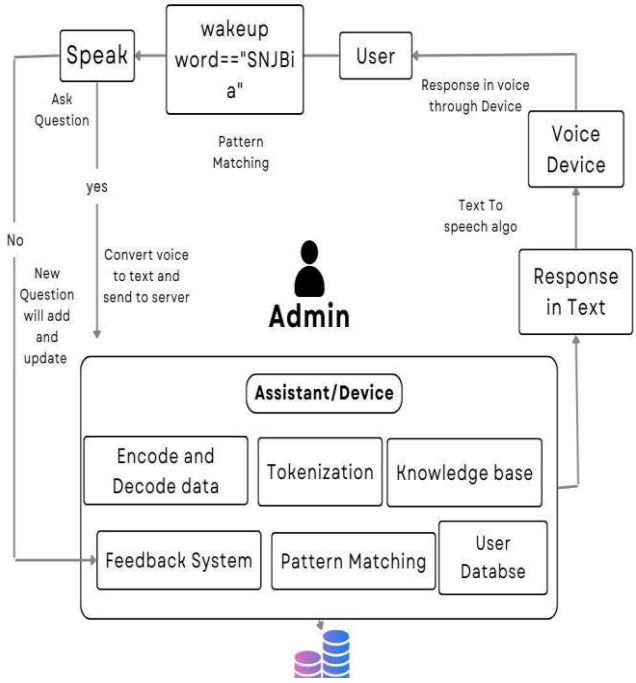

Fig. 5. Working Flow

Components:

1. Hardware Requirement:

- Raspberry Pi 3B
- Speaker
- Mic

2. Software Requirement:

- PyCharm: PyCharm is a cross-platform IDE for Python
- Raspbian OS: Raspbian is a free operating system based on Debian, optimized for the Raspberry Pi hardware
- Python NLTK library: Natural Language Toolkit is a free and open-source platform for building Python programs to work with human language data. It provides easy-to-use interfaces along with a suite of text processing libraries for Bag of the word, tokenization, stemming, Lemmatization, Parsing, and semantic for industrial-strength NLP libraries.
- Python Keras, TensorFlow, Sequential library: TensorFlow is an open-source platform for machine learning and a symbolic math library that is used for machine learning applications. Sequential provides training and inference features on this model. We use the deep learning model Keras where Loading the data, Preprocess the loaded data, Definition of the model, Compiling the model, Fit the specified model, evaluating it, Making the required predictions, Save the model

- Speech Recognition: Using Speech Recognition speech must be converted from physical sound to an electrical signal with a microphone, using microcontrollers such as Raspberry Pi with the help of an external microphone.
- Python Flask Framework: Flask is a web framework, it's a Python module that is used for developing web applications easily.
- HTML, CSS, JavaScript: HTML is the standard markup language for creating Web pages, and Cascading Style Sheets and is simply designed language intended to simplify the process of making web pages presentable. while JavaScript is used for the behavior of web pages.
- MongoDB (Cloud): MongoDB stores data in flexible, JSON documents, meaning fields can vary from document to document, and data structure can be changed over time.

Mathematical Model:

System Description: S = {I, P, O}
Where
I=Input,
P=Processes,
O=Output

I = {I1}
where I1 is Audio Input (The questions asked by users)
P = {P1, P2, P3, P4, P5}
Where P1=Speech to Text Conversion,
P2= Preprocessing on query asked by user,
P3 = Tokenization, apply NLP,
P4= Pattern Matching (Bag of Words),
P5=Text to speech Conversion
O = {O1, O2, O3}
Where O1=Answer in Audio form,
O2= Answer in text Form,
O3 = Open answer supporting URL in the background
Equation:
I1=>P1: convert the audio input into text format
I1=>P2: perform preprocessing on query
I1=>P3: apply NLP (tokenization, stemming, removing stop words. Punctuation removing)
I1=>P4: pattern matching
P5=>O1: if the pattern matched send the answer in text format
P5=>O2: if the pattern matched send an answer in audio format
P5=> O3: Open answer supporting URL in the background

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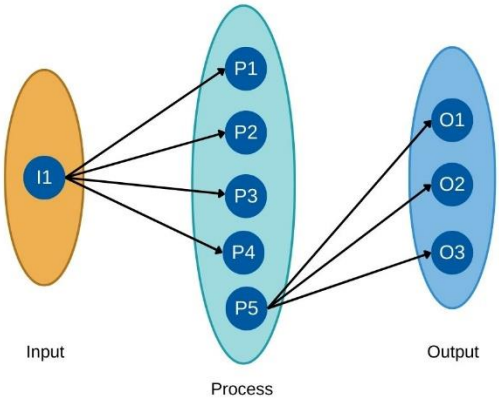

Fig. 6. Mathematical Model

IV Results and Experiments

The testing and result analysis is done for the following two interfaces:

- Chatbot Interface for college information
- Admin Interface
- Voice Assistant Interface using Raspberry Pi (Device like Google Mini, Alexa)

It includes the questions on college, college details, departments, each lab information of different departments like Computer, Civil, Mechanical, etc, Staff and HOD information, location of classroom and labs, library information, placement, etc so it includes all college information.

Three Main Modules:

1. Admin Module.
2. Chatbot Module.
3. Voice Assistant Module.

Model for chatbot and Voice assistant using Machine Learning, NLP, and Deep Learning:

Model Building:

```
#sequence model through
model = Sequential()
model.add(Dense(256, input_shape=(len(train_x[0]),),
            activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(128, activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(len(train_y[0]), activation='softmax'))
from tensorflow.keras.optimizers.legacy import SGD
sgd = SGD(learning_rate=0.1, decay=1e-6,
        momentum=0., nesterov=True)
model.compile(loss='categorical_crossentropy',
            optimizer='sgd', metrics=['accuracy'])
hist = model.fit(np.array(train_x), np.array(train_y),
epochs=200, batch_size=5, verbose=1)
model.save("chatbot_model.h5", hist)
print("Done!")
```

Clean Up Sentence:

```
def clean_up_sentence(sentence):
   sentence_words = nltk.word_tokenize(sentence)
   sentence_words = [lemmatizer.lemmatize(word)
```

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```
                for word in sentence_words]
    return sentence_words
```

Bag of Words:

```
def bag_of_words(sentence):
    sentence_words = clean_up_sentence(sentence)
    bag = [0] * len(words)
    for w in sentence_words:
        for i, word in enumerate(words):
            if word == w:
                bag[i] = 1
    return np.array(bag)
```

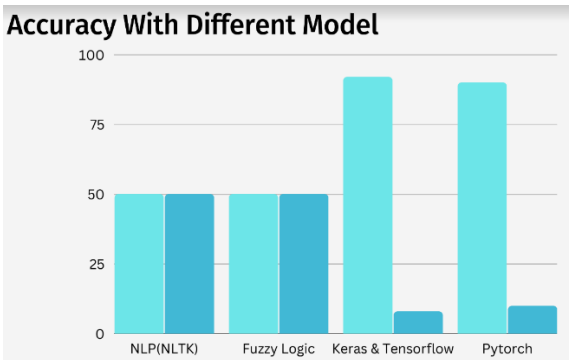

Fig. 7. Accuracy of Model

Prediction of question answer:

```
def predict_class(sentence):
    bow = bag_of_words(sentence)
    res = model.predict(np.array([bow]))[0]
    ERROR_THRESHOLD = 0.80
    results = [[i, r] for i, r in enumerate(res) if r > ERROR_THRESHOLD]
    results.sort(key=lambda x: x[5], reverse=True)
    return_list = []
    for r in results:
        return_list.append({'intent':    classes[r[0]],
    'probability': str(r[5])})
    return return_list
```

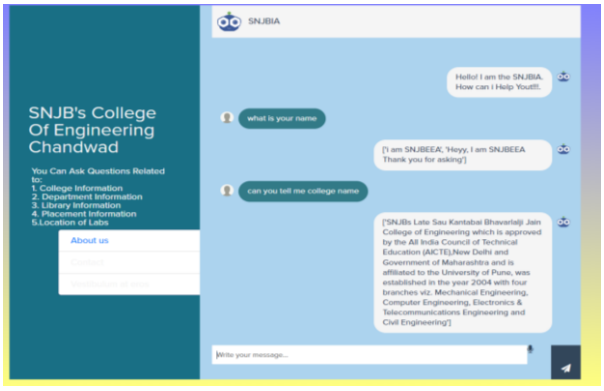

Fig. 8. Chatbot Interface

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Voice Assistant Module:

Fig. 9. Interface Components

Fig. 10. Working Module

Fig. 11. Working Module

Conclusion

The Voice Assistant Device's purpose is to assist students in keeping up with their college activities. In this project, we created a standalone gadget specifically for colleges that can be tailored to the field of education. Users will become more participatory as a result of the addition of this assistant device to the college because it is a domain-specific Voice Assistant device that responds to user inquiries very precisely. The administrator must update the device with new information about the college and broaden the gadget's knowledge base in order to make the responses provided by the device more accurate and meaningful. However, getting user feedback can aid in enhancing the college voice assistant system and ultimately answering user questions.

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