

Enhancing College Chat Bot Assistant with the Help of Richer Human Computer Interaction and Speech Recognition

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Abstract: Chat bots are the expert systems that understands and responds to the query asked by users in their own language. Chat bot responds in conversation just like how a human interact with each other. It works as a virtual assistant and its accuracy is determined by finding correlation between user's queries and answers provided by chat bots. Implemented Chat bot provides two modes like text mode and audio mode for better user experience. In audio mode it facilitates an interactive way of answering through voice messages. During Institute's Academic Admission procedure there is a huge queue at the enquiry window. Situation is even more difficult for the parents who reside in different cities, states, and countries. The goal of this system is to provide a platform for student and parents to ask queries and clear doubts through simple English language text messages or audio commands. Students and parents will amalgamate with bot instead of making queue at enquiry desk to ask queries related to admission procedure.

Keyword: Chat Bot, College bots, Interactive bots, Dialogue based bots, NLP, Text based bots

I. Introduction

After 12th or completion of diploma students are going to take admission to the engineering. Before taking admission, they faced many problems. Students and their parents are concerned about various queries related to admission. Students get confused when selecting a good engineering college. They are selecting colleges based on various parameters like fees, last year cutoff of admission procedure. So some students contact me via e-mail or make phone calls. Result is an unnecessary crowd for enquiry. Admission department also faces problems solving repeated queries of students. And the college admission department required extra manpower and money to serve all the queries.

The implemented chatbot will solve queries of the users, provide information to users as they require, improve quality of service time and make customers happy by providing smart solutions. It also improves productivity by providing 24/7 service, reduces crowd at help desk and also reduces human efforts. Students can interact with chatbot on the web via laptop or smartphones. Students ask miscellaneous queries regarding admission details in natural language and both can respond to their queries with correct answers. Proposed application is accessible to customers easily and gives response to users anywhere anytime. Chatbot not only gives response but also self-learn and improve itself in order to improve the quality of service.

II. Related Work

Over the past one decade's chat bots gained a lot of attention in almost every online domain, e.g. e commerce platform, travel sites, government sites, College websites, company's website, online ticket booking site etc. Authors Bayu Setiaji and Ferry Wahyu Wibowo[2] implemented a chatbot based on pattern matching using relational databases. They have also used normalization of spell check after checking of spelling to increase the accuracy.

In paper [1] authors Karthick Sowndarajan, R John Victor and S Manikandan uses Natural language processing to make an android based chat application using java language. They have removed words appearing at the starting and at the end using stemming process after preprocessing. Preprocessing is used to remove special characters and numbers. After stemming processing, remaining words are matched with the keywords that are stored in dictionary.

Dungeon Lee, Kyo-Joong Oh and Ho-Jin Choi [5] designed and implemented an artificial intelligence based chatbot (referring as college bot) application for college website, which provides the answer of all the college related queries. Authors have user facebook like user interface to make it more interactive.

Authors Borah B., Pathak D., Sarmah P., Som B., Nandi S. have done extensive survey on text based chat bots. Their focus are on chat bots based on artificial intelligence and natural language process based chat bots. They have beautifully listed down the problems in implementation of text based chatbots for various types of application.

AM Rahman, Abdullah Al Mamun, Alma Islam discuss about promising domains of chatbot applications in detail along with general architecture of interactive bots. Their work mainly focus on various existing API's available for implementation of chat bots.

Chabot also called interactive agent is a software which interacts with human via textual or auditory methods. Programs like chat bot are smart and designed in such a way that they could work like conversational partner of human being. Dialog driven systems included in various fields like information acquisition and customer service uses these type of smart bot. Simple chat bot systems scan keyword within input, and give response with similar pattern or matching keyword while some chatbot uses NLP(Natural Language Processing).

Guruswami Hiremath developed a text based chatbot for education system [10]. Preprocessing, tokenization and pattern matching used in this paper is pretty much similar as used by Bayu Setiaji and Ferry Wahyu Wibowo [2]. Author Guruswami Hiremath used machine learning and NLP for template matching.

But all of the above proposed bots lacked filling the gap between how a real human would interact and how a bot would respond for the same user queries thus users having an unpleasant experience. Natural Language Understanding is a key aspect in chat bots by which they can understand a human error while having a conversion and can try to correct them and extract meaning out of those incorrect sentences. Thus, while using these techniques, it has been attempted to work on giving users a pleasant experience while interacting with bots.

III. Architecture

Interaction between chat bot and user is defined by process of chatbot design. The chatbot designer defines overall interaction, chatbot personality and the questions that will be asked by users. Dedicated chatbot design tools is used by designers to speed up the process that allow team collaboration, immediate preview and video export. User testing is important part of chatbot design.

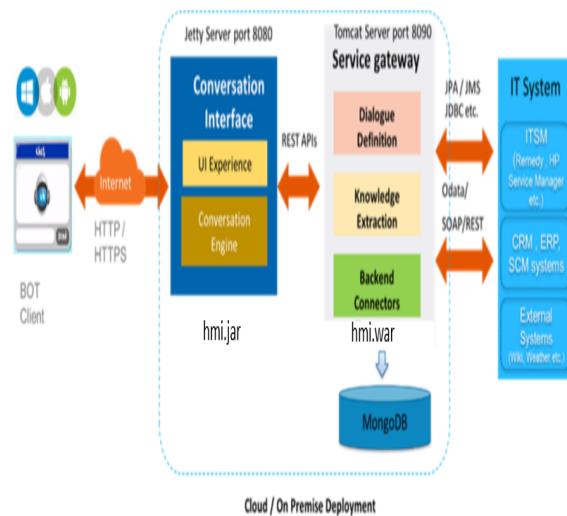


Figure 1: Architecture

3.1. BOT Client

User can interact with the system with the help of GUI. He/she will enter the query or doubt in text box provided. Once the query is submitted, that request will be further handled by conversation interface (hmi.jar).

3.2. Conversational Interfaces

Conversational interfaces are platforms that can have conversation like a real human. Generally, users use Graphical user interfaces (GUI) to give commands to the computer. The computer then interprets the meaning of that command and perform the desired action. In case of Conversational interfaces the user can communicate with computer in their natural language instead of giving command or using GUI. For this to be possible, there is use of Natural Language Processing (NLP) so that the computer will be able to understand the meaning of the input given by the user and perform the task accordingly. Due to the ambiguous nature of languages it is difficult for computer to always

understand the correct meaning of the input given by human, which is known as Natural Language Understanding (NLU).

With the help of Natural Language Understanding it is possible for conversational interfaces to understand the correct meaning of the query which contains spelling mistakes, wrong grammar, etc. For example, if a user asks "What is intake of Computer Engineering?" After this the user asks "Who is HOD", the search will carry forward the context of Computer Engineering and provide the appropriate response.

3.3. Service Gateway

3.3.1 Dialogue Definition

Computer System which is intended to converse with a human is called a Dialog Definition.

Phases in a dialogue system are:

The user with the help of systems microphone asks queries in plain English. With the help of Automatic Speech Recognizer (ASR) input is converted into plain text.

Natural language understanding unit (NLU) is used for analyzing the converted text.

The dialog manager is responsible for analyzing the semantic information. The history and state of the dialog is kept by dialog manager itself.

The task managers have knowledge of specific task domain, which is contacted by the dialog manager.

Output generator is used by dialog manager to produce output.

At the last step, the output is rendered with the help of an output renderer and displayed as response to the user.

3.3.2 Knowledge Extraction

Structured relational database or XML and documents are used for creation of Knowledge extraction.

3.3.3 Backend Connectors and Database

MongoDB is used at the backend which is a cross-platform document oriented database. MongoDB is a NoSQL database. It uses JSON-like documents with schemata.

3.3.4 Representational State Transfer (REST API)

RESTful web services is used which allows requesting systems to access and manipulate textual representations of web resources by using a uniform and predefined set of stateless operations.

RESTful systems are fast and reliable in terms of performance and have ability to grow.

IV. PROPOSED SYSTEM

A. Classification of Questions

Questions submitted by user through web application can be divided into two parts either it is FAQ question or it is transactional question.

Frequently Asked Questions [FAQ] are the commonly listed questions and answers, asked in some context. BOT can answer these types of questions without asking any further question. For example: Where the college is located? Answer for this question is address of college and this question does not required any clarification or additional question.

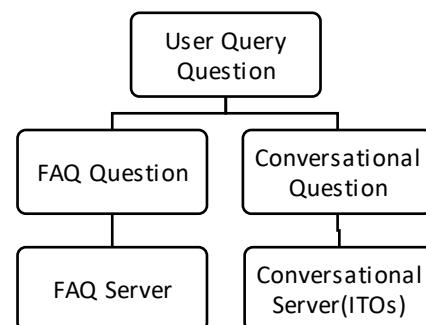


Figure2: Classification of Question

Conversational Questions: In conversational questions slots are filled based on the Abstract Question Descriptor. BOT may asked fallback

question or clarify question in the case if slot is not filled.

Figure2: Classification of Question

B. Dialog Definition File (DDF)

Dialog Definition File (DDF) consists of Global Flags for defining Dialog behavior. It consists of different tasks that BOT needs performs. Some task are reserved and they are used for special purposes.

- Cancel task: Cancelling current task. User explicitly want to cancel the task.
- Help task : Providing help to user in case there are consecutive failed attempts in answering ITO
- Handover task: Coming out of current task and to handover the chat from bot to human respectively
- Exit task: If user says (bye, exit or bye bye) this task will get final confirmation from user before logout.

C. Flags to define Dialog Definition:

- startTaskName -This specify the initial task to be executed by BOT. Initial task may be other than "start" but after execution the initial task BOT will return to start task.
- globalLanguage –This specifies the BOT language. This has to be in ISO language code.
- useSODA(System Of Dialogue Act) –Each utterance will be classified using Max Entropy Classifier to find whether user is seeking the information or Providing information or issuing the defined command (e.g. switch ON, Switch OFF)
- allowSwitchTasks–if set to true it will allow sub-dialogues from other tasks , if set to false only sub-dialogues of same task will be executed. (e.g. for trip.xmlDDF use case - User can only answer questions specific to getTripInformationand will not allowed to switch to getWeatherInformationtask)
- allowOverAnswering- if set to true the user is allowed to provide more than the information that has been asked for (but at least the current question).
- allowCorrection-if set to true user can change a value of an already asked question

- useIntentEngine–if set to true , the intent will be identified using internal intent engine trained separately (see appendix -3), else will use BOW (Bag Of Words) specified in <selector> part of dialogue definition file.
- failureAttempts–is an integer number which is number of consecutive attempts that will be allowed to user to answer specific ITO. In case he/she fails to answer, he/she will be redirected to "helpTask"

```
<startTaskName>start</startTaskName>
<globalLanguage>en</globalLanguage>
<useSODA>true</useSODA>
<allowSwitchTasks>true</allowSwitchTasks>
<allowOverAnswering>true</allowOverAnswering>
<allowDifferentQuestion>true</allowDifferentQuestion>
<allowCorrection>false</allowCorrection>
<useIntentEngine>true</useIntentEngine>
<failureAttempts>2</failureAttempts>
```

Figure3: Flags to define Dialog Definition

D. DDF-Task definition:

Task definition consist of unique task name as an intent. The intent are map to all the possible utterances using bag of word model after removal of stopwords.

In Information Transfer Entity (ITOs) the slots are filled on the basis of AQD (Abstract Question Descriptor). A fallback question may be asked by the BOT to the user if slot is not filled and if required flag is true. Clarify question is used in case if user fails to provide correct answer.

E. DDF-Action

DDF-action supports REST api. The API result will be always stored in the result variable and accessed using #result.

V.USER INTERFACE

User interface design (UI) is the design of user interfaces for BOT so that user usability can be maximized as well as user experience. Making user's interaction simple and efficient is the goal of user interface design.

User can interact with BOT and ask queries using three different ways.

A. Keyboard Interface

User can ask queries by giving text input through keyboard. User type their query in the provided textbox and hit submit button to submit query to BOT.

B. Card Interface

With the help of card interface user can give input to the BOT by selecting values of the cards. Card interface provide option to the user to select particular card and submit query.

C. Speech Recognition

Speech recognition gives BOT ability to

Figure3: Flags to define Dialog Definition

recognize words and sentences in spoken language and convert them to a machine-readable format. Speech recognition is used when user

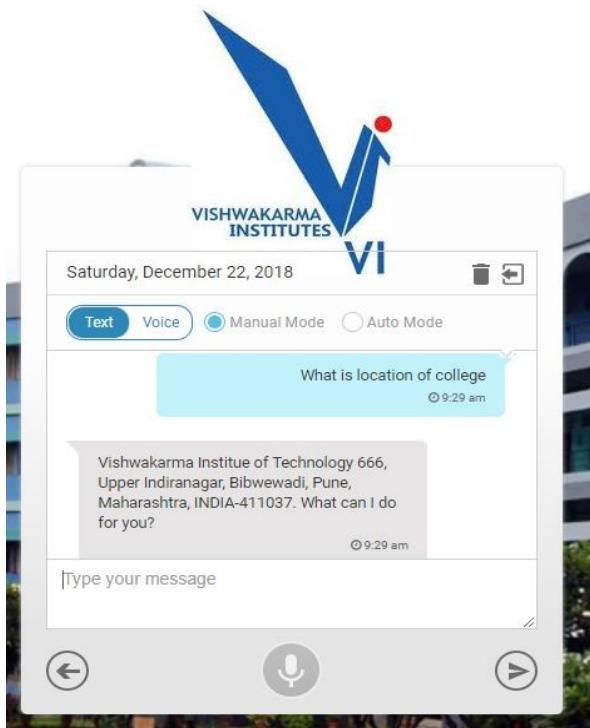


Figure4: Screenshot of BOT while interacting with User Interface.

gives input through microphone of system, such as voice commands (e.g. "What is address of college") as shown in figure 4. The bot reply query by providing address of location.

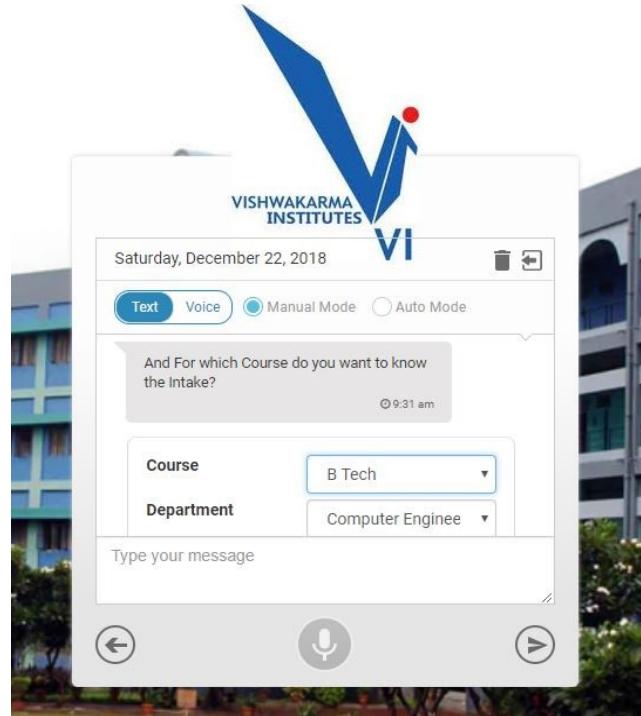


Figure 5: Screenshot of BOT while interacting with Card Interface

Figure 5 is a snippet of a query of a user enquiring about courses and intake. In General a variety of course are offered by a college so bot provides card interface to user to avoid the ambiguity of fees of different courses. After that user can provide extra inputs by selected course type and department from dropdown option to or by typing message to bot. This is a transactional type of question where bot require more information to reply back to the user. Therefore bot provide a card interface for more user details. So Chabot is offering to choose a type of course

D. Voice Commands

1) Manual Mode: In manual mode user will have to interact with BOT for every voice command. User will input a command the BOT gives reply and stops. Again if the user wants to ask new question he should again press the voice command button.

2) Auto Mode: Auto mode is like a real conversation UI. When auto mode is on user can have a back-to-back conversation with BOT like he is talking to a

real human being. The BOT uses Text-to-speech to answer the question through speakers.

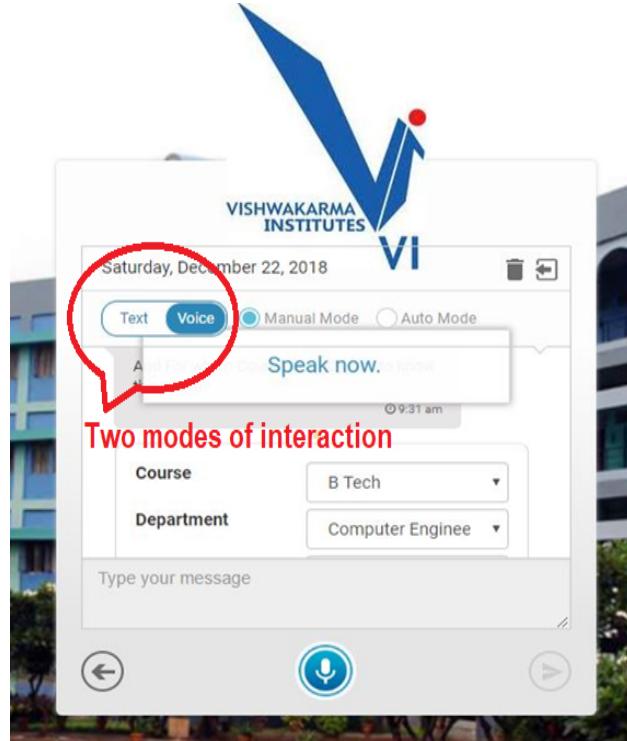


Figure 6: Screenshot of BOT while listening to Speech Commands

As shown in figure 6, user is trying to interact with bot with speech command mode so voice option is highlighted in output screen shot. User will ask question and speech recognition model of Chatbot will try to extract information via audio received from users.

V1. Hardware and Software Requirements

Below steps describe the deployment of Chat BOT on windows machine.

Required configuration of Windows machine:

- RAM 8GB Minimum
- 64 bit processor

Following software are required for implementation of chat bot:

- 1) Scikit-learn pip3
- 2) Numpy module

- 3) Install scipy module
- 4) NLTK packages
- 5) Flask module

VI. CONCLUSION

Chat bot can be used by any College and Universities on their website so that external stakeholders can ask their queries anytime. And it would be very much effective to simplify the admission process as well as this chatbot is not only providing college information but also able to answer queries related to state wise cut off, Categories wise off, gender specific cut offs and shift wise cut offs.

User can provide the feedback by pressing like and dislike buttons based on the replied received to their query. This data is stored in backend and can be viewed by Administrator for analyzing the type of questions asked and improvement of answer if required.

To check the accuracy of chatbot, same query has been asked in different form by changing the wordings of sentences and appending various especial characters and irrelevant words.

VII. Future Scope

Chat bots are ever green area of research of interest in field of computer science. Bots still sometimes cannot understand what is asked if there are any glitches in input due to human spoken language, like a grammar error or a context error.

Misinterpretation of any commands may be because of misspelling can be further improved with the help of Powerful Natural Language Processing [NLP] techniques. Improvement can be done till the BOT passed Turing test.

Accuracy of BOT for recognizing a particular query for different contexts in which user of asking can be improved, so that the User can get a more realistic feel like talking to a real counselling person. At later stages this bot can be implemented in local language and multilingual as well.

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