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A Virtual Assistant using NLP Techniques

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A B S T R A C T

A chatbot is a computer program that makes conversation with the users through speech or text. The bot uses Natural Language Processing to understand the message sent by the user and it replies to the same based on the key value that matches. This project is an application that provides personal assistance to the college. With the help of this chatbot the user can easily access the data related to the college. The application is designed such that all the information regarding college and their services is accessible to the user by their voice commands or chat. The implemented system is a virtual assistant, a software that uses Artificial Intelligence (AI) that guides the users and also responds to user queries rationally. The application also helps the college students by solving their issues related to simple queries, and helps them round the clock. This project focuses on the development of Android applications for voice control (detection and analysis of matching commands, intelligent answers automatically) mobile device references, such as Speech-To-Text and Text-To-Speech technology. It makes advantage of IBM cloud's specified services.

Keywords: Array multiplier, Reversible Logic Gates, Garbage Outputs, Quantum Cost, Constant Inputs.

1. Introduction

A chatbot is a computer program that uses Natural Language Processing, a subset of AI to communicate or interact with users. It is a the next massive aspect of conversational services. They are virtual individuals that can discuss with any human being effectively. The usage of chatbot systems as a medium of conversation is very common for most of the companies, organizations and educational institutions these days. The main motive is to simulate human conversation through text or voice using Natural Language Processing (NLP). It can understand one or more human languages by using NLP. The structure of the bot integrates computational algorithms and language model to build casual chat which covers enormous NLP techniques.

Chatbots are being used is several industries these days for information delivery, performing tasks, weather prediction, flight reservations, answering educational queries, or product purchases. The bot is customized for the queries of the college and it also gives an overview of the college. A few examples for talking computer systems today are Apple's Siri, Google Voice Assistance by Google and other big companies. This concept first came into picture in 1960s. Conversational bots are lately relying on applying deep learning strategies. Chatbots have become popular lately as good-sized use of message offerings and advancement in NLU.

NLP

People communicate with each other through text and speech. Human way of exchanging information is called as Natural Language. Every day we share a large quality and quantity information in several languages. However, computers cannot decipher this information as its in natural language and computers understand and

communicate in 0s and 1s. The information delivered is valuable and can offer profitable bits of knowledge. Hence, we would like the computers to be able to understand it and respond intelligently and rationally.
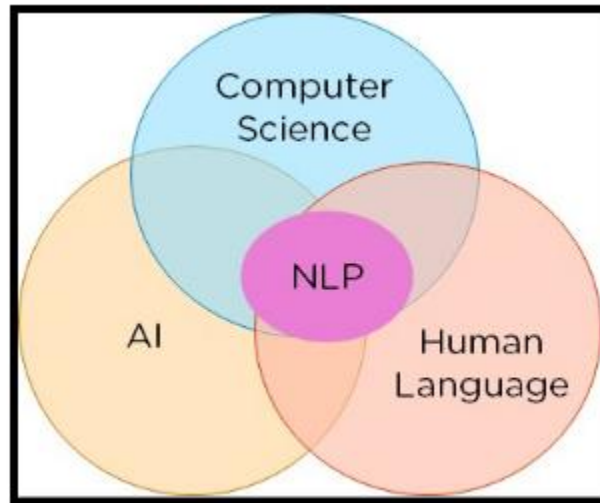

Figure 1: About NLP

Natural Language Processing or NLP refers to the branch of AI that provides the machines the power to read, understand and derive meaning from human languages. NLP has its roots to early 1950s. NLP combines the sector of linguistics and computing to decipher language structure and guidelines to form models which may comprehend, break down and separate significant details from text and speech. Natural Language Processing (NLP) is a subfield of computer science, linguistics, and AI that is concerned with interactions between computers and humans, especially how to program computers to process and analyze large amounts of natural data. We aim to obtain a computer capable of "understanding" the contents of message or document, including the contextual nuances of the language. It can extract information from the documents and categorize them. Most of the NLP techniques rely on machine learning techniques to derive the corresponding meaning from human language.

LITERATURE SURVEY

The world has been experiencing a era of revolution in 21st century and its digitizing with new technologies and innovations. And one of the best existing examples is "The Chatbot". A chatbot is a computer program designed to interact with users via textual or auditory methods using artificial intelligence.

It can also be called as a Personal digital Assistant. And now we are living in the era where everything is available via Internet. We will get all sort of data and information by searching over the web. This can also be possible by typing for chatbots that are invented. Depending on the way they are developed, the bots can be classified as Command-based bots and smart bots. Command-based bots are manually programmed by a developer based on key words or with help user inputs. Its functionality is limited as they are not using the cognitive services to program the bots. Smart chatbots depend on Artificial Intelligence for interacting with users. Smart bots predict the response message based on the context and preceding message, rather than going through the predefined response. E-introduction of cloud-platform that can be used to develop the chatbot. Microsoft Azure bot service, Chat fuel, IBM Watson, Heroku, Kore, AWS lambda, and other cloud platforms are available.

RESEARCH AREA

IBM Watson mainly deals with the domain of Artificial Intelligence, which is very useful in predicting future outcomes and optimization of users time. The goal of Watson is to bring the cognitive computing to users and can be used as service as software cloud delivery model. It makes use of Natural Language Understanding which helps to Analyze and understand key insights from the data by extracting entities, sentiment, emotions, keywords and semantics. It is one of the most important Natural Language Processing tools that gives information retrieval via question answering. Watson guides with decision-making in any domains such as Weather, healthcare, insurance, banking etc

METHODOLOGY

The proposed system is a domain specific bot for the college and institutions of educational environment. The system is a virtual assistant, a software that uses Artificial Intelligence to guide the users and takes actions to effectively understand user queries and respond to them rationally. This application can help the college students by solving their issues related to query, and helps them round the clock. This project is focusing on the Android development over the voice control (recognition and analyze corresponding commands, gives intelligent responses automatically) mobile device references ranging from Text-To-Speech, Speech-To-Text technology.

Beginning with the app design, it will be implemented using Android Studio. The application is developed using XML and Java programming. XML is used for UI development and Java for the application functionality. XML provides a standard means for accessing information, making data use and presentation easier for applications and devices of all kinds. IBM Watson is used for backend development.
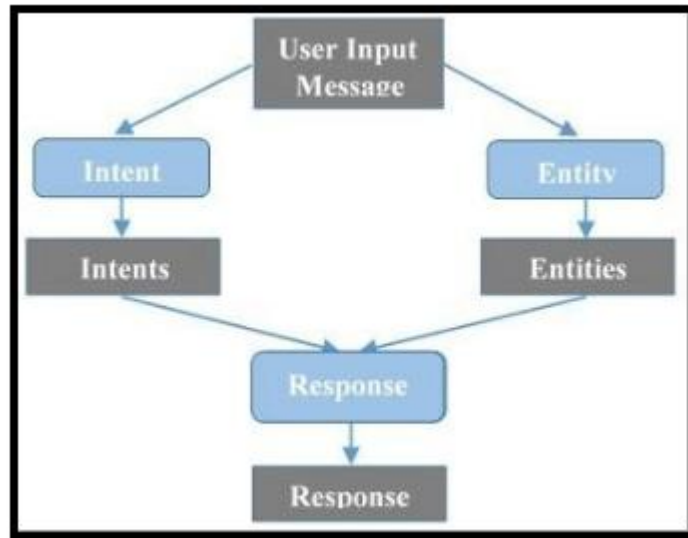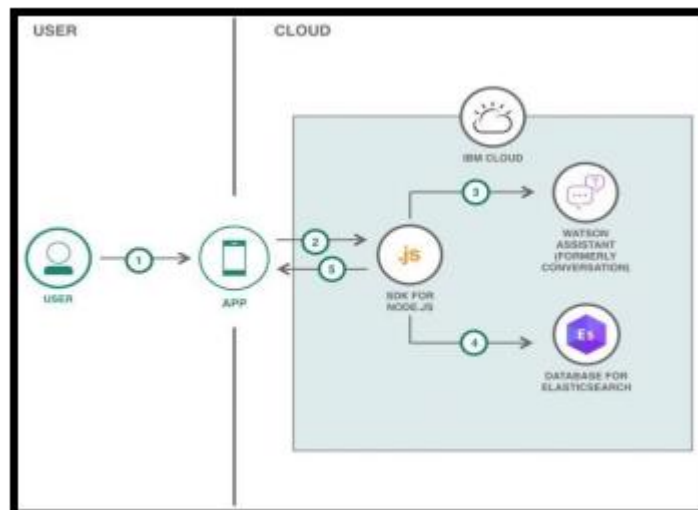

Figure 2: Architecture of the Bot

Figure 3: Chat bot for the Mobile App

With the IBM Watson Conversation service, we can create chatbot application that combines cognitive approaches to build and train a chatbot using entities and intents and construct dialog to simulate conversation. The International Business Machine (IBM) named its digital assistant as IBM Watson chatbot which is a rule- based AI bot developed by IBM under its DeepQA project.

Working of IBM Watson

Here we are making use of three services from IBM Cloud for the application. They are as follows:

Watson Assistant: Watson is an IBM supercomputer that combines artificial intelligence (AI) and sophisticated analytical software for optimal performance as a "question and answering" machine.

Speech to Text: Watson Speech to Text (STT) easily converts audio and voice into written text.

Text to Speech: Watson Text to Speech (TTS) converts the written text into natural-sounding audio in a variety of languages and voices.

Watson assistant powered by IBM, helps us to build a powerful AI based bot assistant for our app. The back end is integrated with the front end using the API keys and service URLs which is provided by the Watson services of the IBM cloud.

The Watson assistant is customized for this particular application mainly using Intents and Entities. They are the building blocks of natural language understanding.

Dialog skill understands and interprets the user input, then directs the flow of the conversation accordingly.

Figure 4: Watson Assistant Architecture Overview

Watson Entity Recognition

Entities are the interesting parts of user utterances, few common phrases or names or dates. The Watson assistant already provides system entities for date, time, etc. It also lets us define our own entities with synonyms, it uses fuzzy matching and also to define pattern-based entities.

Entities are prefixed with "@" and they are concepts or objects that matter to the tasks your assistant can perform.

The entities are defined based on the context of user utterance. This is done by annotating the in the intent examples. Watson uses these annotations to learn how to identify entity values and can also match new values that have not been explicitly annotated. The entity values are not limited to those created or specified in the list. The use of contextual entities is demonstrated below.
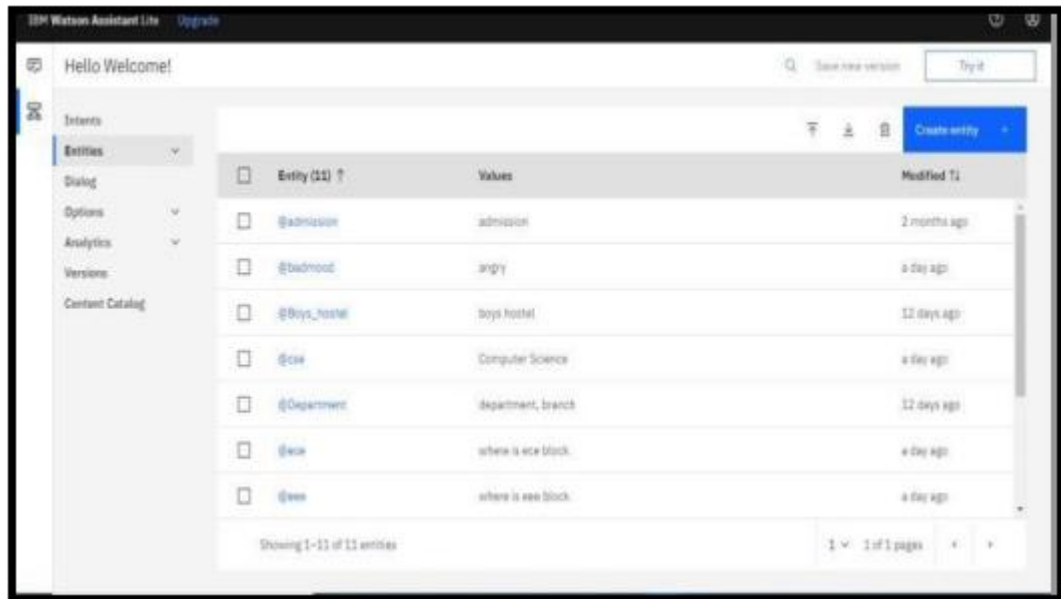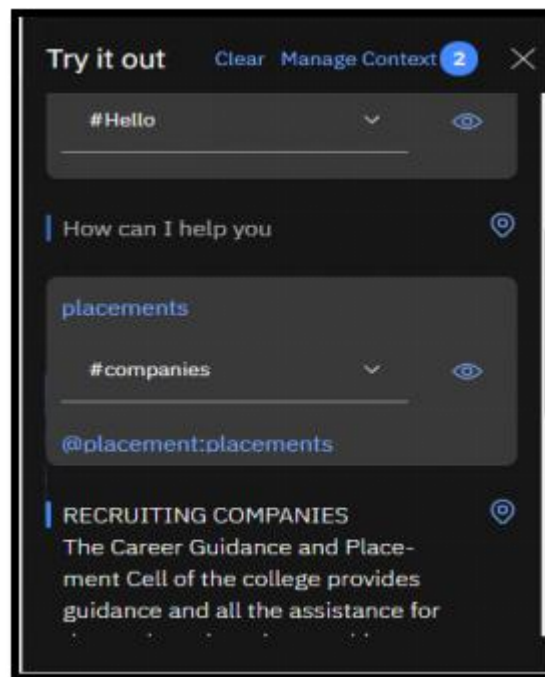
Figure 5: Entities created in Watson

Figure 6: Contextual Entity Recognition

Watson Intent Detection

Intents are categories that identify what the users' intentions are; they are the frontline of any chatbot. They accurately classify the user utterance according to an intent which is of utmost importance. They are basically trying to understand the user intentions.

Intents are prefixed with "#", they are the goals user is trying to accomplish. We can train the Watson Assistant to detect intents by providing some user examples ie., like what the users would probably say (also sometimes

to express the intent or goal (also known as "user utterances"). Various parameters can be set in each dialog node and intent scores are the most prevalent metric for determining relevance. The New Intent detection model combines the Traditional Machine Learning, Transfer learning, and Deep Learning Techniques.

Every time a new feature is updated, the Watson assistant has to do the training. With enhanced detection we can improve the assistant's ability to classify what users say with the right intent, more often. Less training of data is required, which is more convenient for the bot customization.
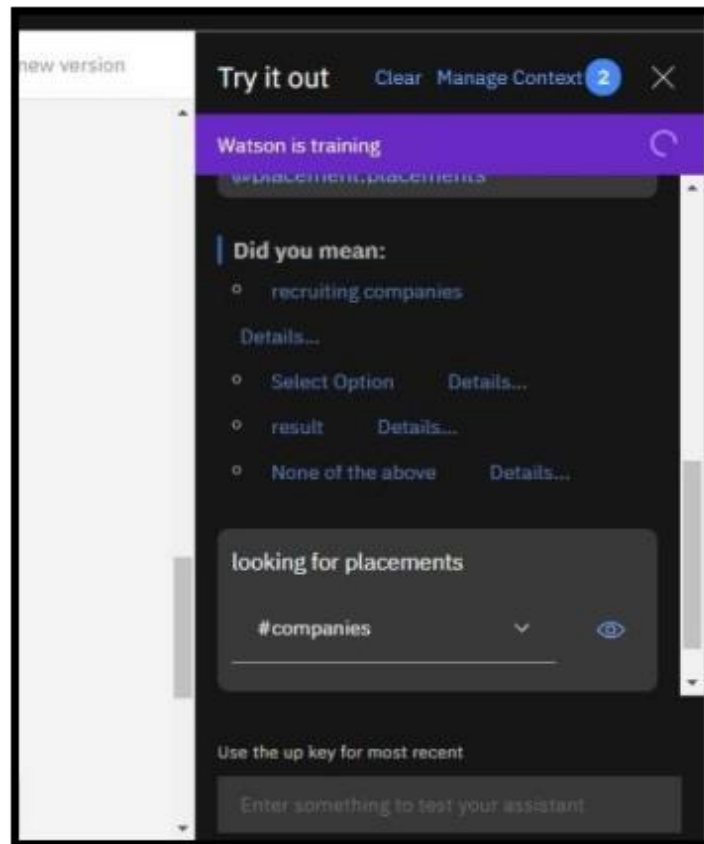

Figure 7: Watson is Training

Once a new intent is upgraded, the Watson needs to undergo training. It helps the assistant to improve its ability and classify what the users say with right intent more often. Rigorous testing is needed as the dialog nodes have conditions set on not only the intent detected but also records the score of intent. These are used as thresholds to determine which node is to be invoked.

The model also checks for ambiguity, and increases the intent score for the correct intent each time. It an evolving model when analyzed overall.
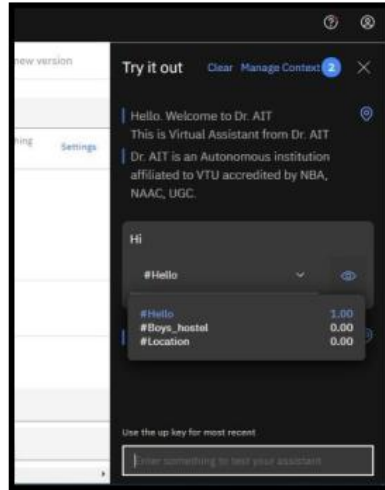
Figure 8: Intent detection and score of intent

Watson Dialogue Development

Watson Natural Language Understanding is a product that runs in the cloud. It uses deep learning to extract metadata entities, keywords, categories, sentiment, emotion, relationships, and syntax are all extracted from text. Dialogue building is a simple task of creating nodes and defining suitable responses and including suitable user intentions and entities based on the requirements.
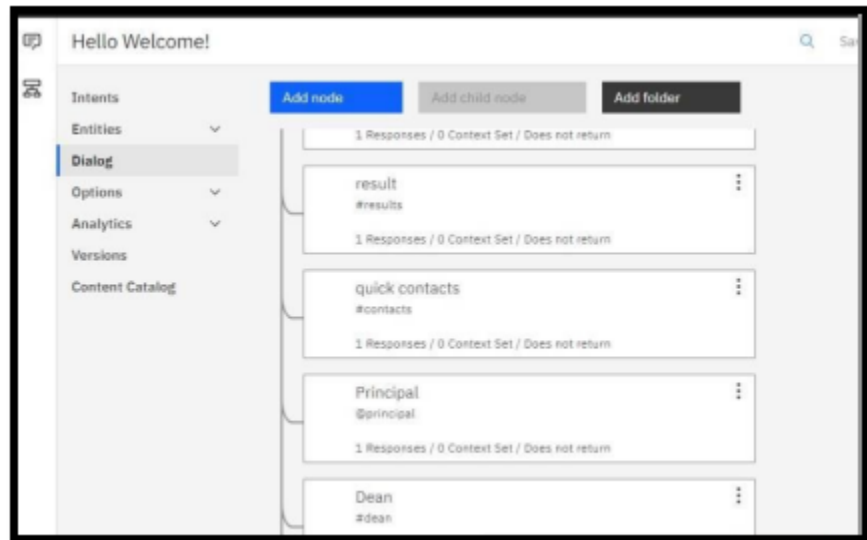

Figure 9: Watson Dialogue Building

 To conclude in overall, the building blocks of the Watson assistant indirectly make use of many NLP and NLU algorithms like Named Entity Recognition, Aspect Mining, Dialogue Act (DA) Recognition, Bayesian Approaches to DA Models, Non-Bayesian Approaches to DA Models, Intent Identification, Information Extraction, Statistical Methods for Information Extraction etc and many more to successfully obtain a well pre- trained and customizable assistant.

RESULT

After the complete implementation of the methodology of the IBM Watson assistant, the Watson services are integrated and the application can be executed on mobile devices. And we have obtained the following results. Here are some of sample use cases which we obtained, they are as follows:

Figure 10: Bot Introduction-Simple greeting by the bot.
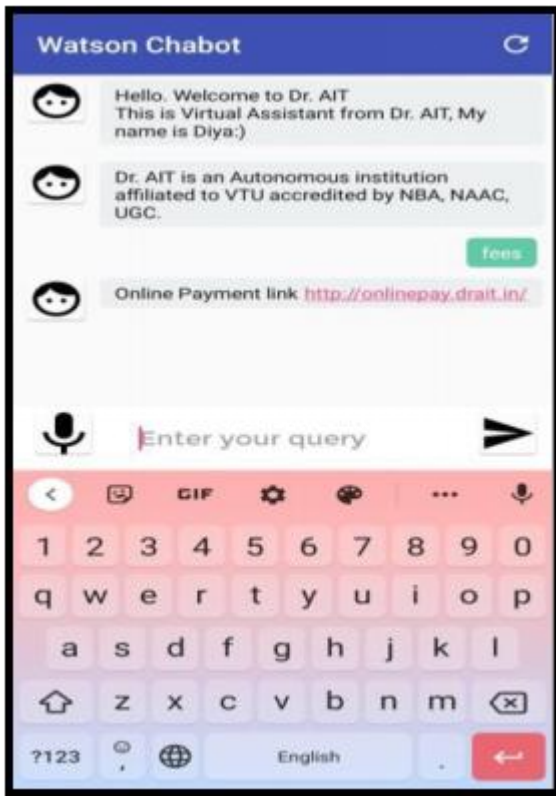

Figure 11: Mood analysis and reply.

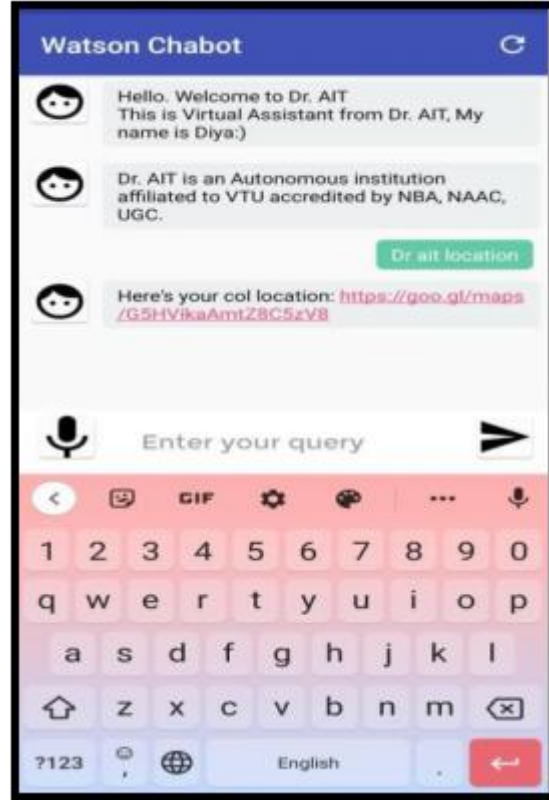**Figure 12:** Fee structure Information - User query regarding Fee structure.

Figure 13: Direction - User request for directions.

VI . CONCLUSION AND FUTURE WORK

Future enhancement: We can have integrations to different chat applications and also maintain session history and much more based on the evolution of the IBM Watson.

WhatsApp is popular among mobile users all over the world. And WhatsApp integration would work with the same dialog skill that the assistant uses for all your other channels. The user would send the voice or text message in the WhatsApp application. The message is redirected to the Watson Assistant. The Assistant chatbot detects the intent and replies with a response which is redirected to the user to able to view the same on WhatsApp.

When conversing with an assistant on chat-bot or on an internet site, users sometimes accidentally close their tabs, or refresh the page, or move to a completely new page on the web site. And without session history, end users would lose their connection to the assistant and would have to start their interaction from scratch.

And after including Session History, the users can resume their chat without being interrupted. This quickly leads to more comprehensive changes.

VII. ACKNOWLEDGEMENT

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Create a conversational voice bot using WhatsApp and Watson services

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