Capstone Project Title

Chatbot: Respond to queries and book appointments using NLP and Deep learning.

Describe Your Project

My capstone project is to develop a chatbot that will respond to customer calls by deciding if the customer is trying to set up an appointment or has a question or query using NLP and then direct the customer respectively. The set of actions performed by my chat bot are:

- Decide if the customer is trying to set up an appointment or has a question or query or something else
- If operator is available, then redirect call or else take a message from the customer along with other details
- book appointments or cancel appointments by checking the appointments calendar using webservice call / Integrate with google calendar.
- Use of Natural language processing to be able to respond to customer and interpret customers request.
- In case of question send questions to appropriate person who can respond by voice or email and send the response back to customer.

Why I have Chosen This Project

My main area is Machine Learning and data analysis. I went across through many interesting projects like Action Recognition using drones etc. but I chose this project because of the area of the application of this project was on natural language processing and the demand of the project was high. A chat bot has not been made which can book appointments, thus it could automate the process of asking queries, booking appointments with doctors. It also aligns with my ambition to create something innovative in the field of Artificial Intelligence and Machine learning. Also, Amazon lex and Google Cloud Platform are new technologies and it would be the best opportunity for me to work on it.

What Problem(s) it solves.

It provides automation, management of appointment, queries. Responding to queries, booking appointments with doctors is not only limited to office hours but the user can book an appointment at any time. One can get a better response to queries by the doctors using chat bot and their problem can be solved more effectively. In fact, one can also respond to queries easily as well as conveniently using the chat bot and busy professionals such as doctors, whose schedules are hectic, can provide better response to patients/clients queries with much greater effect. Also, no receptionist would be required as the chat bot could automate the process of appointment management and ask the queries directly to the concerned doctors through the software conveniently.

Who will be the potential clients/customers/users/beneficiaries of the project? Describe appropriately.

This is being designed for doctor's offices to manage simple tasks and it will be able to provide round the clock support. Any doctor can respond to customer's queries conveniently and effectively using the chat bot over voice or email. The chat bot is applicable for a larger mass as it can be used in multiple domains of health care, lifestyle, law etc. Any profession where making appointments and responding to queries/questions of customers is to be done e.g.- Lawyers, Corporate offices, Banks, legal advisers, Chartered Accountants etc. can using our chatbot.

What will be the innovation in this project? *

Innovation in this case is handling office tasks using voice commands of busy professional doctors. Office tasks such as booking appointments and responding to queries using NLP and deep learning in automated chat bot is the novelty proposed by my project. This will replace traditional secretaries, instead chat bot can respond to customers effectively and efficiently than secretaries/receptionists. Hence, it would be also be bringing in efficiency and customer satisfaction as the whole process gets automated and fast.

How it will be different from similar existing solutions. *

No voice based automated appointment system is available right now, but chat bots have been created to solve other problems related to users and customer. Ex.

Domino's simplifies ordering pizza using Dialogflow's conversational technology: Domino's leveraged their 50+ years of customer service knowledge and Dialogflow's NLU capabilities to build both simple customer interactions and increasingly complex ordering scenarios. Anyone using a device with the Google Assistant built in, such as a Google Home can just say, 'Hey Google, talk to Domino's'.

KLM builds booking and packing bot 'BB' with Dialogflow: The airline's first project was a booking bot for Facebook Messenger, which they introduced in September 2017. KLM nicknamed it as 'BB,' for Blue Bot (blue being their signature color).

This chat bot is proposing the innovation of automating the whole process of booking appointments/resolving queries etc. Thus, it will replace the receptionist or assistants as this chat bot will be their new assistant.

What makes it challenging enough to be chosen to be done in four months (Aug-Nov)?

Firstly, processing natural language and extracting valuable information to understand commands of user such as booking appointments and resolving queries is a real challenging task. NLP integrated with deep learning model to understand user's concern and command by training and re-training the model will take time Also, technologies like Google Dialogflow and Amazon Lex are relatively new which increases the amount of work required to understand their working and build chat bot upon them. Challenge is to be able to handle different types of input and complete the actions in a user-friendly manner.

How it reflects and uses the knowledge gained as part of your UG curriculum covered in the last three years?

The knowledge gained in our UG curriculum and implemented in this course is Data Structures, Machine Learning, Deep Learning, Natural Language Processing, Discrete Mathematical Structures etc. Since it is an integrated project, various stages of the project reflect various courses and knowledge outcomes of our curriculum. For instance, Software Engineering helps to think the type of approach we need to give to the project for it to be agile. Amazon Lex and Google Dialogflow being new technologies require overall implementation and understanding of the courses taught in our UG curriculum.

How you will measure the success/outcome/quality of your project

Since chat bot is a live project, success of the project cannot be measured quantitatively. Rather test cases can be made which would cover every aspect of my project. Features such as booking an appointment, cancelling an appointment, handling queries/questions of customers and getting them answered through the chat bot would be the factor that decides the success and outcome of my project. These features can be tested, and the results of the project can be measured by entering dummy customer's queries/questions and getting response to them.

Resources required for the project and the feasibility of their availability as per the plans *

Login credentials of any one of the chat bot building platforms – Google DialogFlow (Google Cloud Platform) or Amazon Lex (Amazon Web Services) is required, since they are chargeable, to build and train the chat bot. Training using NLP and deep learning model may require processing power of a PC as training a model takes a lot of processing power.

Short-term and long-term planning with detailed and logical steps and timelines

The project would be divided in 4 phases:

1. Planning the NLP and deep learning model architecture, techniques and concepts to be used, research and finalizing the model.
2. Coding, applying the model, training the model, implementing various features of booking/cancelling appointments, integrating the chat bot with Google Calendar API and web service call.
3. Make chat bot efficient and able to respond to customer's questions/queries by sending them to appropriate person who can respond to it by voice or email.
4. Debugging, testing the chat bot and final deployment of it on web.

First phase requires 15-20 days as research work needs to be read, consulted to decide the type of model architecture and techniques to be used.

Second phase requires 1 month because of the coding, training, integrating of Google Calendar API and web service call, and testing the model.

Third phase would require 1.5 month to make chat bot able to respond to customer's queries and help the doctors respond through voice/mail.

Fourth phase would be completed at the end of fourth month with the testing and deployment of the final prototype of my chat bot.

Short term plan for the project currently is to read about Google DialogFlow documents, tutorials and videos related to my project thoroughly in order to get the intuition and approach to the build the project in next 15 days.

Evidence/literature/research/survey etc. in support of the hypothesis or idea to be successful. (Local/National/International Context)

- **Ticketmaster's bot using DialogFlow to provide faster services for ticket buyers.**

  https://dialogflow.com/case-studies/ticketmaster/

  Founded in 1976, Ticketmaster sell more than 500 million tickets annually in 29 different countries. In recognizing the ever-increasing accuracy and power of natural language processing, Ticketmaster turned to Dialogflow's technology to provide efficient and more personalized services for ticket buyers and users. While Ticketmaster continues refining the system, the company feels that they've created something that does sound pretty close to human. The Ticketmaster team continues to improve the user journey using Dialogflow. "Once we know users better, we can make better recommendations for events that might interest them and help them purchase tickets effortlessly" says the CEO.

- **KLM builds booking and packing bot 'BB' with Dialogflow**

  https://dialogflow.com/case-studies/klm/

  The airline's first project was a booking bot for Facebook Messenger, which they introduced in September 2017. KLM nicknamed it as 'BB,' for Blue Bot (blue being their signature color). BB's personality is female, helpful, friendly, and professional. She's also a bit edgy, and occasionally even cracks a joke. If you want to make a booking through Messenger, BB will ask you for your destination, when you want to fly, etc. The bot shows you the options, and you can purchase, fill out your personal details, and get your booking confirmation, all right there on the conversational app. A human agent can easily take over, if she is unable to answer, by connecting BB with KLM's CRM system.

- **Domino's simplifies ordering pizza using Dialogflow's conversational technology**

  https://dialogflow.com/case-studies/dominos/

  Domino's leveraged their 50+ years of customer service knowledge and Dialogflow's NLU capabilities to build both simple customer interactions and increasingly complex ordering scenarios. Anyone using a phone device with the Google Assistant, such as a Google Home can just say, 'Hey Google, talk to Domino's' and you're able to order right with us".

These are the products released by companies in order to cater needs of their customers effectively and conveniently. Similarly, this project also aims to use Google DialogFlow to implement a chat bot to help doctors to respond to their patient's needs and replace traditional receptionists by automating the process of booking/cancelling appointments and responding to queries by providing round the clock support.

Risk Analysis (What are the factors which pose risk of failure of your project and risk of not completing your project by deadline) *

Industry research tells that speech recognition has reached 95% accuracy. Human speech isn't 100% accurate, it's unrealistic to expect chatbots to ever reach that level, and the chat bot could be exposed easily. But, the current level of speech recognition and NLP is good enough for business use of the project application.

Understanding natural language and responding to it automatically is never an easy task for the chat bot as Natural language understanding (NLU) is difficult and sometimes not even feasible. But determining set of actions which the chat bot can perform and limiting the NLU part to the application of the chat bot reduces the problem.

Give Names of Three Persons with whom you have discussed the details of the project and what was their reaction/suggestion. *

I've discussed the details of my project with the following people:

1. Professor K.K. Biswas, Bennett University (CSE) - He is my mentor for this project. We discussed about the details, planning, scope and application of the project. He guided and motivated me to pursue it as my capstone project because of the demand of the application.
2. Professor Sridhar Swaminathan, Bennett University (CSE) - Being profound in the area of deep learning, I went to him to discuss about the feasibility and deploy ability of my project. Sridhar sir said me to take this project as it sounded interesting and new technologies would be used in it.
3. Anubhav Anand, Student (B.Tech CSE Sem 7), Bennett University – Being my friend and also a machine learning enthusiast, I discussed with him about my project. He told me about the different scope of applications of my project, how it would positively affect my technical skills and knowledge.

List Three Projects with their Brief that you have done in the First year, Second year and Third year of your B.Tech Degree. Also list your teammates in each Project. *

Online Charity System:

Teammates: Anubhav Anand, Deepak Sharma, Navnidhi Sharma, Riya Mishra

The project was based on the idea of charity for poor. My SQL database was used to save items information, the project was on java and JRE Desktop Application was deployed which was connected to SQL using JDBC drivers. The software had admin system to control the inputs given by user. It also had mail notification system.

Digital Notice Board

Teammates: Deepak Sharma, Rishabh Mehrotra, Nishant Verma

It was a remote Desktop application based on Java and JAVA UI development tools which showed announcements, events and deadlines to students. Teachers could login and add/edit the various announcements, events etc. using the tables in My SQL which were linked through JDBC drivers.

GP Fuzzy for classification of Breast Cancer using wbc dataset

Teammates: Deepak Sharma, Rishabh Mehrotra, Chandraneil Basa

The project was done under the mentoring of Dr. Arpit Bharadwaj. I used genetic programming algorithm and fuzzy logic to get better accuracy and better f1 score on Wisconsin breast cancer dataset.

List down the Ethics, Privacy, Moral and Legal issues related with the project *

Threats that a chatbot could pose include spoofing/impersonating someone else, tampering of data, and data theft. Since system is supposed to chat with patient , private information of patient could be recorded by someone which could pose a serious legal issue to the organization and to the privacy of the patient. A system can also become vulnerable and open to attacks when it is not well maintained, has poor coding, lacks protection, is open sourced or due to human errors. Threats are often one-off events such as malware attacks or distributed denial of service (DDoS) attacks. Vulnerabilities are long term issues that need to be addressed regularly.

Being alone, i can efficiently implement the chat bot using Google's DialogFlow. Also, my mentor Dr. K.K. Biswas motivated me to do it alone as this project can be done individually. Processing voice recognition, natural language understanding, extracting valuable information from code, booking/cancelling appointments or solving queries according to users's statement can be done by putting in individual work. This was the reason i am doing this project solo as no team is required to implement it.