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Smart Hospital Chatbot-Virtual Consultation and Appointment using NLP and Machine Learning

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Abstract: *Healthcare services face a huge challenge of supply-and-demand which you can fix when we create a digital platform. In the traditional healthcare system, patients would go to the hospitals, and they always have to wait for appointments and medical reports. Also, conversation between doctors and patients about their health status and daily lives is not fully remembered by the doctor as well as patients. So, to improve the doctor-patient interaction, we will design and implement a machine learning framework that contains a chatbot, voice transcription and other functionalities. The proposed Medical Chatbot can interact with the users, giving them a realistic experience of chatting with a medical Professional. Our motive is to show that the proposed medical chatbot could be a better alternative to many already existing chatbots in the domain of medicine. An Al enabled conversational UX can deliver personalized experiences to your patients for identifying the illness, scheduling doctor appointments, notifying caregivers about symptoms, monitoring the health status, updating the homecare assistant from time-to time and more. Also, the proposed system converts the voice to text first and then generates prescriptions automatically by extracting the keywords and provides the prescription in the desired format automatically. This system can also generate prescriptions efficiently with just the audio file of the conversation between the doctor and the patient through a phone call.*

I. INTRODUCTION

A chatbot or conversational agent is software that can communicate with a human by using natural language. One of the essential tasks in artificial intelligence and natural language processing is the modelling of conversation. Since the beginning of artificial intelligence, it's been the hardest challenge to create a good chatbot. Although chat bots can perform many tasks, the primary function they have to play is to understand the utterances of humans and to respond to them appropriately. In the past, simple statistical methods or handwritten templates and rules were used for the constructions of chatbot architectures. With the increasing learning capabilities, end-to-end neural networks have taken the place of these models in around 2015. Especially now, the encoder-decoder recurrent model is dominant in the modelling of conversations. This architecture is taken from the neural machine translation domain, and it performed very well there. Until now, plenty of features and variations have been introduced that have remarkably enhanced the conversational capabilities of chatbots.

The chatbot is also known as chatter robots, are software agents that stimulate human conversation via text or voice messages. One of the 1st and main goals of Chatbot has always been to resemble an intelligent human and make it hard for others to understand their real nature. In order to understand the user input and provide a meaningful response, the chatbot uses artificial intelligence and deep learning methods. Moreover, they interact with humans, using natural language, different applications of Chat-bots such as medical chatbots, call centers, etc. A chatbot could help doctors, nurses, patients or their families. Better Organization of patient information, medication management, helping in emergencies or with first aid, offering a solution for superficial medical issues these are all possible situations for chatbots to step in and reduce the burden on medical professionals.

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II. LITERATURE SURVEY

Flora Amato [1] paper was based on the concept of the Deep machine learning and Artificial intelligence; it allows the application to interact with patient in a manner that doctor does. For creating such powerful application researcher has used Watson conversation service which is designed and trained by the blue mix platform.

PriyasankariM [2] proposed an idea in which it uses user dialogue. User dialogue is a linear design that proceeds from symptom extraction to symptom mapping, where it defines the corresponding symptom then diagnosis the patient where it's a major or minor disease.

Table 1:

Sr. No	Paper Name	Author Name	Year	Outline	Advantages
1	A Medical-History-Based Potential Disease Prediction Algorithm	Wenxing et al	IEEE Access/ 2019	This paper proposed novel deep-learning based hybrid recommendation algorithms, which predicts possible disease based on the patient's medical history and provides a reference to patients and doctors	1) It considers both, high-order relations as well as low order combinations of disease among disease features. 2)Improved comprehensiveness compared to previous system.
2	Designing Disease Prediction Model Using Machine Learning Approach	Dahiwade D., Patle, G., & Meshram, E.	IEEE Xplore/ 2019	Proposed general disease prediction. In which the living habits of person and checkup information consider for the accurate prediction It also computes the risk associated with general disease	1) low time consumption 2) minimal cost possible 3) The accuracy of disease prediction is 84.5%
3	Explainable Learning for Disease Risk Prediction Based on Comorbidity Networks	Xu, Z., Zhang, J., Zhang. Q., & Yip. P.S.F.	IEEE/ 2019	Proposed a comorbidity network involved end-to-end trained disease risk prediction model. The prediction performances are demonstrated by using real case study.	1)Comfortably the incorporates comorbidity network into a Bayesian framework 2)Exhibits superior prediction performance
4	Design And Implementing Heart Disease Prediction Using Naïve Bayesian	Repaka, A.N., Ravikanti, S.D., & Franklin, R.G.	IEEE/ 2019	This paper focused on heart disease diagnosis by considering previous data and information. To achieve this SHDP (Smart Heart Disease Prediction) was built via Navies Bayesian in order to predict risk factors.	1) Accuracy is 89.77% in spite of reducing the attributes. 2) The performance of AES is highly secured compared to previous encrypting algorithm.
5	Chatbot for Disease Prediction and Treatment Recommendation using Machine Learning	Mathew, R.B., Varghese,S .,Joy, S.E., & Alex,S.S.	IEEE/ 2019	This paper explained a medical chatbot which can be used to replace the conventional method of disease diagnosis and treatment	1) This system helps in reducing of daily check-ups 2) It identifies the symptoms and gives proper diagnosis.

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Benilda Eleonor [3] the paper introduces a Pharmabot: A Paediatric Generic Medicine Consultant Chatbot Pharmabot, which conversational chatbot that is designed to prescribe, suggest and give information on generic medicines for children. Human machine as a technology integrates different areas and the computational. The researchers used descriptive method in the study. The researchers use left and Right Parsing Algorithm. hash identifies the block and all its contents which is always unique like a fingerprint. The hash is calculated once the hash block is created and after that changing anything inside block will cause to change the hash. Tobias Kowatsch [4] says that in past year's text based chatbots are made. They are working on few diseases only. They are making application mobile coach in which they using mobile chat app in which patients can communicate with doctor. Doctor will be chatting with them daily and suggest them how to maintain their health. They can give them advices and suggestions. They are fetching data from Google & doctor.

III. REQUIREMENT ANALYSIS

The main goal of our project is to provide a digital platform for easy doctor patient interaction and also gather as many doctors as possible on these platforms. This is enforced by developing a system which is capable of gathering all the related information about doctors as well as patients. Our problem can be defined as, Using Computer Vision and Machine Learning to predict the output of chatbots to the users to help them or guide them for booking appointments and their queries related to certain diseases. Software requirement is a functional or non-functional need to be implemented in the system. Functional means providing particular service to the user. In empathic diary we have provided following functional requirements to user. Firstly, Doctor has to be registered on the application then under that specific doctor many patients can be appointed and the verification done by the admin. And there is no such a specific limit for registration of doctor or patient.

After that all the process takes place like appointment booking, chatting with chatbot and voice transcription, also if a patient gets admitted then at the time of discharge the bill gets generated. For that we use SVM model for the classification purpose. Software requirements can also be non-functional, it can be a performance requirement. For example, the accuracy of chatbots should be maintained. Our model provides 82 accuracy and it can be further improved using various pre-processing techniques. The Functional requirements are concerned with the functionality of the system. We are providing user friendly web application for user interaction. Risk is expectation of loss, a potential problem that may or may not occur in the future. It is generally caused due to lack of information, control or time. A possibility of suffering from loss in software development process is called a software risk. Loss can be anything, increase in production cost, development of poor-quality software, not being able to complete the project on time. Software risk exists because the future is uncertain and there are many known and unknown things that cannot be incorporated in the project plan.

IV. DETAILS OF MODULE

The implementation of the application could be divided into three main stages or modules, namely:

- Dataset Collection and mapping of data
- Implementation of SVM on the data
- Development of the Graphical User Interface

This module comprised a collection of available datasets with required permissions, segregating the required diseases, and pre-processing the selected symptoms. Details of available datasets can be found in the next section. Out of the available datasets, Dataset for healthcare systems were chosen as they met the required criteria. Disease detection was then performed on these symptoms using the SVM from ML which gives about 99 accuracies in the detection of Disease.

A support vector machine (SVM) is a supervised machine learning model that uses classification algorithms for two-group classification problems. After giving an SVM model sets of labelled training data for each category, they're able to categorize new text. The objective of a Linear SVC (Support Vector Classifier) is to fit to the data you provide, returning a "best fit" hyperplane that divides, or categorizes, your data. From there, after getting the hyperplane, you can then feed some features to your classifier to see what the "predicted" class is.

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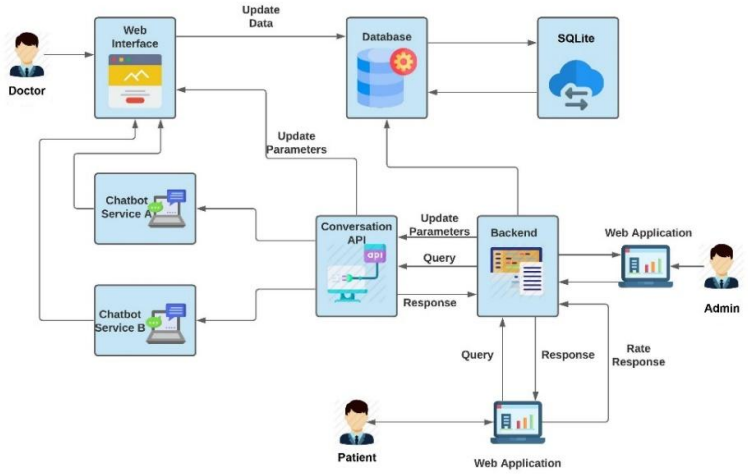

Figure 4.1: System Architecture

V. DEVELOPMENT OF GUI

In development of GUI html was used. SQLite database was used to store details. In the database three classes Admin, Patient and Doctor are created. Patient class has patient details such as username, email, password. Admin class contains details i.e., patients and doctors in hospital along with User id. User first has to register then details will be stored in the user object. After Approved from admin, doctor and patient are able to use the system. Admin handling all information of patient and doctor. Chatbot is used to predict disease and to solve queries of patients. For selecting symptoms options are provided. Various Symptoms are given. By giving Audio file prescription is generated.

Figures must be numbered using Arabic numerals. Figure captions must be in 8 pt. Regular font. Captions of a single line (e.g., Fig. 2) must be cantered whereas multi-line captions must be justified (e.g., Figure 1). Captions with figure numbers must be placed after their associated figures, as shown in Figure 1.

VI. IMPLEMENTATION

The implementation of the application could be divided into three main stages ormodules, namely:

- Dataset Collection and mapping of data
- Implementation of SVM on the data
- Development of the Graphical User Interface

Datasets: There are a number of datasets recording various diseases Common cold, itching, fatigue, fever, weakness, nausea along with additional symptoms such as coughing, sneezing, nausea, stiffness, etc. The Dataset contains 400+ diseases and also various question and answers related to those diseases.

Tools and Technology Used:

Software's Used:

- Django
- OpenCV
- Programming language: Python is used as programming language for CNN model development as well asfor webapp development.

Tools:

- Numpy, Pandas, Scikit- learn, Django, Django markdown-deux, pillow, OpenCV-python

Coding Style Format: Python 3.6.3

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VII. OUTCOMES

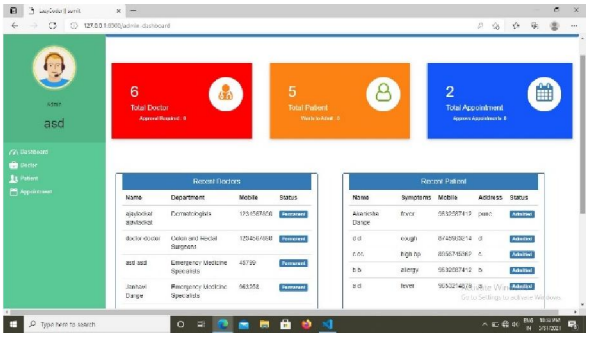

Figure 1: Login Page

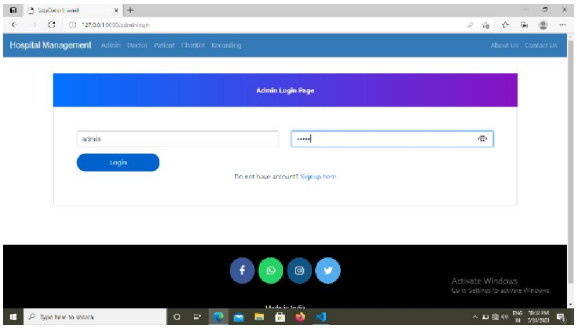

Figure 2: Dashboard

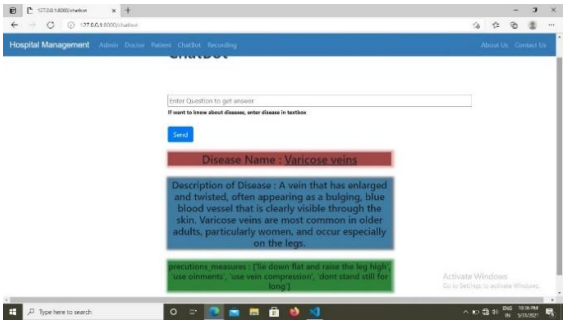

Figure 3: Billing receipt-1

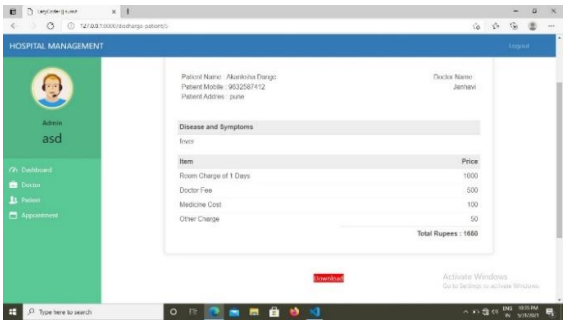

Figure 4: Chatbot Interaction-1

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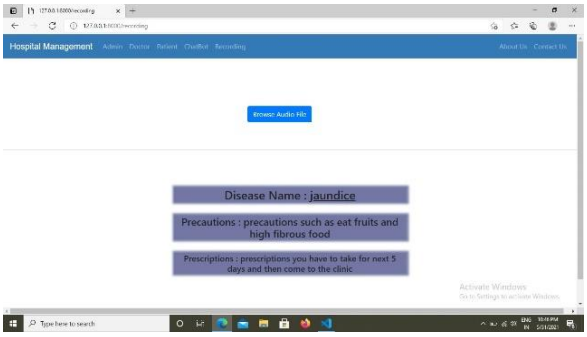

Figure 5: Chatbot Structure

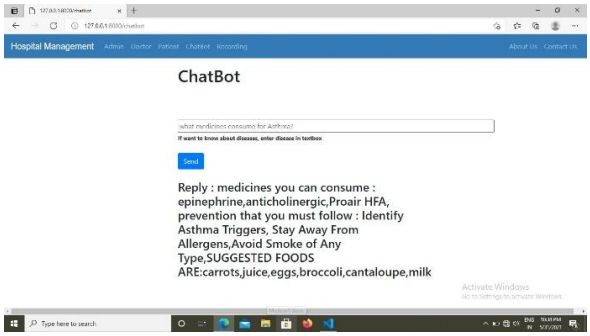

Figure 6: Voice Transcription-1

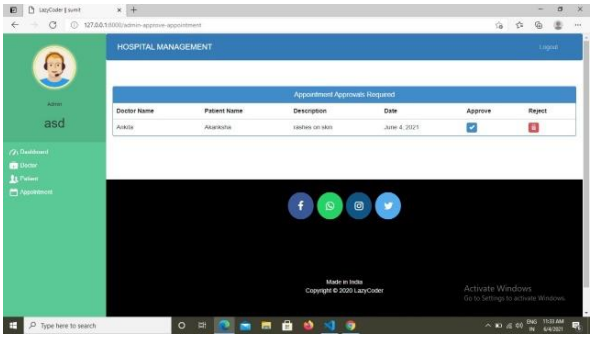

Figure 7: Appointment -1

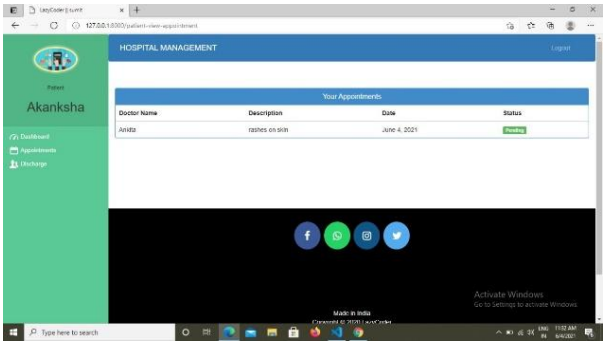

Figure 8: Appointment -1

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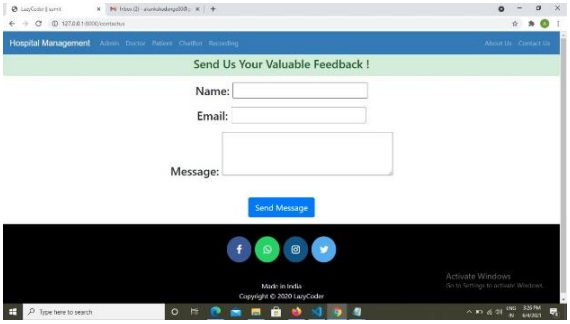

Figure 9: Feedback-1

VIII. CONCLUSION

This project helped us to gain a deeper understanding of NLP systems, their design and their working. We were able to associate the concepts of Natural language processing and understanding by means of implementing the chatbot from scratch. We also gained a lot of insight into the Django framework and its configuration. Also, we were learned the new algorithms like GTTS string matching Lastly, the symptom checker, disease prediction part has been demonstrated by using SVM classifier as that required a lot of development. Our motive was to show that the proposed medical chatbot could be a better alternative to many already existing chatbots in the domain of medicine. An Al-enabled conversational UX can deliver personalized experiences to your patients for identifying the illness, scheduling doctor appointments. As a matter of fact, we have pretty much achieved this motive.

Also, we implemented a module which converts the voice to text first and then generates prescriptions automatically by extracting the keywords and provides the prescription in the desired format automatically. By testing we come to know that this system gives the accurate result. As we are using a large dataset which will ensure robust performance.

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