

Voice Prescription for Patients Using Natural Language Processing

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Abstract: *In India, most of the hospitals and clinics still provide handwritten prescriptions. The readability of such prescriptions is a big issue as an error in understanding the prescription by a chemist may lead to wrong medication. Also, typing the prescription is very tedious task. It also consumes a good amount of time. How can this waiting time be reduced? We cannot reduce the time of interaction between the doctor and the patient. So, to reduce the turn-around time, we may look at the time taken to make medicine prescriptions. The doctor may have to write it manually or feed it in the electronic prescription system through his computer. This process takes considerable amount of time. If it can be automated, then significant amount of time will be saved especially at government hospitals where each doctor has to examine a large number of patients. Leveraging the technology of machine learning or deep learning, this task can be performed automatically. This prescription can be easily read by the patient and thus will be beneficial for further consultation and understanding.*

Keywords: *Deep Learning, Machine Learning*

1. Introduction

In medical science field, many applications are available for medicine prescription. But they have some or other limitation on it. The doctors have to write or type the prescription for patients which is a time-consuming task. In some places, the physicians give handwritten prescriptions which is not easily readable. This may also lead to some human errors. To address these problems, we have designed a mobile application that will help the doctors to create a voice-based prescription and is easy to use.

Voice technology is the best and the most convenient as it can be easily integrated with other devices and powered by artificial intelligence. Its implementation can be acknowledged as a major shift happened in the digital world recently. Voice technology along with Natural Language Processing (NLP) has made human interaction easier and faster.

NLP is defined as the automatic manipulation of natural language, like speech and text, by software. It helps machines process and understand the human language in any given context. It makes it possible for computers to hear speech and interpret it.

2. Related Work

In 2014 [1], Randhir Jagannath Patil and Dr. S.A.Pardeshi had presented a paper on voice recognition based medicine prescription application. They have focused on the interaction between humans and computers. They have used Automatic Speech Recognition (ASR) through MFCC and DTW and also filter extraction for analysis of speech signal. These applications are based on different platforms like Windows, Android, etc. They have implemented everything on MATLAB and the ASR through MFCC-DTW gives accuracy up to 90% and speed up to 2.60 seconds.

In 2017 [2], Boza-Quispe, G., Montalvan-Figueroa, J., Rosales-Huamani, J., & Puente-Mansilla, F. presented research paper. It presents an interface for speech to extract domain-specific information from a tourism semantic website. They have used Google Cloud Speech API which performs Speech to Text conversions. This API Google service uses deep learning neural network algorithm that provides high accuracy in speech recognition. As hardware, they have Raspberry Pi and a web server. As a result, they have presented response time for different speech queries where they have three stages that are website server, the response time of Google Cloud Platform, and a constant latency time.

In [3], Ikhu-Omoregbe N. A. and Azeta A. A. have presented a design and implementation of a Voice-based Mobile Prescription Application. In this, they have specified that this system could eliminate prescription error occurred due to doctor's handwriting and also reduced death due to wrong medications. This system enables a user to access records anywhere just by dialing telephone numbers and connect a patient to an e-prescription available on a web server. They have used VoiceXML technology which useful for speech recognition and touch-tone applications. This is a real-time, error-free, and time-efficient system.

In August 2019 [4], Jitendra Mahatpure, Dr. Mahesh Motwani, and Dr. Piyush Kumar Shukla have presented a new healthcare system which would change the way of storing as well as processing health records. This system would generate an electronic prescription using speech recognition and NLP. The use of traditional Electronic Health Record System (EHR) is a bit tedious and to ease this they have to digitalize the system. A computer webcam or mobile camera will recognize the patient through a QR code and then orally prescribed input will convert to text. The patient's health record can be only accessed by a QR code present on a patient's smartphone. They have used technologies like Blockchain network, Python Django, React for various modules. This proposed system is cost and time-efficient.

In October 2020 [5], Mohammed Abrar Ahmed and Tirumala Shravika had proposed a speech perception mobile application that would intake voice responses than medical scripts. They have used Google's Speech API which enables a user to communicate with the internet. This application will allow a doctor to enter the patient's details, symptoms and will be able to prescribe medicines over voice, and then it will get converted to text and will generate a pdf file. The doctor can send that to the patient through Email or WhatsApp. This will also decrease the usage of paper.

3. Proposed System

Our proposed system is a mobile application that is built on an android studio. This has a registration for new users i.e., doctor and a login system for each existing user.

Every registration will store data in a database. Every time the user will log in to the system, it will check for user id and password in the database. When a doctor has to add a new patient's data, he will just click one button and the application will record the speech with the help of Google Speech API as a recognizer and fill the form containing various categories such as patient details, diagnosis, medication, etc. [5] Here, the Speech-to-Text API enables developers to convert audio into text.

After conversion system will ask for editing if required and then, that prescription will get converted to PDF using APW library which is already present in Android Studio. After the successful creation of a PDF file, this will be sent to the patient through the mail, or WhatsApp message to the number and mail id provided by the patient. And, it will also get stored in the respective patient's database.

The figure below is the block diagram for the system architecture. There are 4 Modules in this system.

- i. Login/Registration of a user
- ii. Adding a patient's details, symptoms & prescribing medicines
- iii. Generating PDF
- iv. Sending PDF through the mail or WhatsApp text

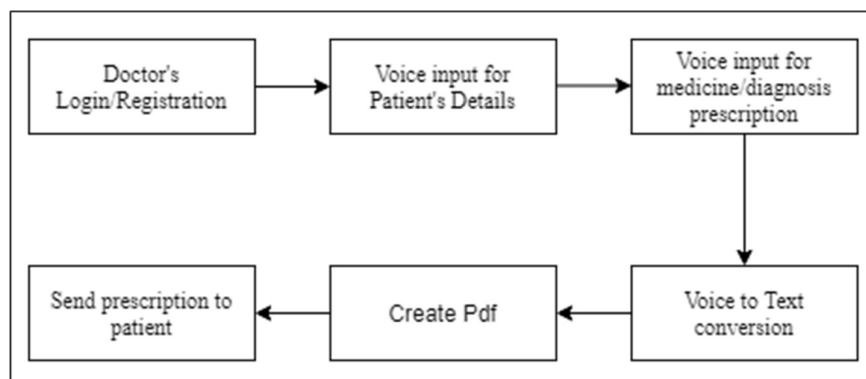


Figure 3.1 Block Diagram of Proposed System

4. Experimental Results

This project provides an efficient way to reduce the time consumed in typing or writing the prescriptions. Thus, it is a better alternative to the handwritten or typed electronic prescriptions.

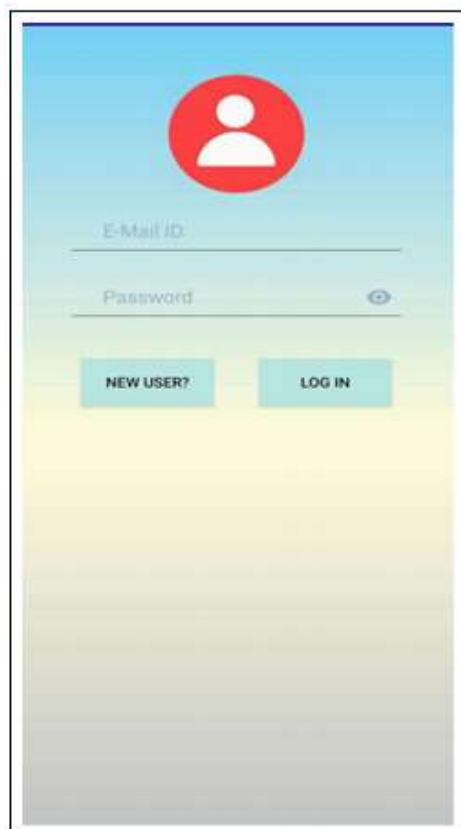


Figure 4.1 User Login

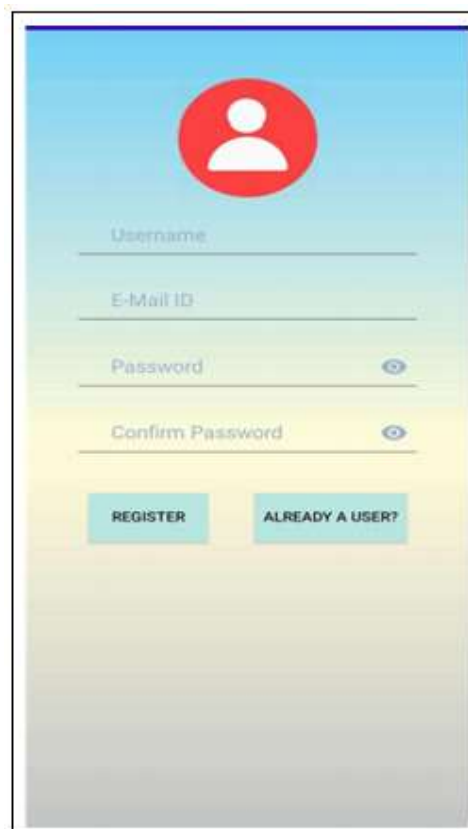


Figure 4.2 Registration Page

Figure 4.1 and figure 4.2 shows user login and registration page. The home page as shown in figure 4.3 has the options for creating new prescription and checking the patient history. This application also stores all the previously generated prescriptions in the form of a PDF file. Thus, there is also a past prescription option through which doctors can see the PDFs of the past prescriptions.



Figure 4.3 Home Page



Figure 4.4 Voice Input

Figure 4.4 shows the voice input given by doctors which will be used for creating the prescription. After the prescription is confirmed by the doctor, it will be sent to patient on his/her email id.

This step towards automation significantly reduces the work of the doctor and the patient. It would be cost saving in healthcare centres across the world especially in developing countries where treatment processes are usually cumbersome and paper based.

5. Conclusion and Future work

This application have a login system for the physician. The voice input gets converted into the text form. Then, PDF document is created. It is then electronically sent to the patient. This system would help the physicians to prescribe medicines to the patients with less efforts.

In future, we would like to enhance the security aspects of the prescription by incorporating the doctor's digital signature to prove its authenticity and the prescription can be made password protected to avoid any misuse.

6. Acknowledgements

We owe our deepest gratitude and regards towards the ones who offered their valuable guidance in the hour of need. We thank our guide Ms. Tina D'abreo for her guidance and precious insights. Her useful comments and feedbacks during the discussions we had and the encouragement to question every technical detail that we came across while completing this project helped us to a great extent.

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