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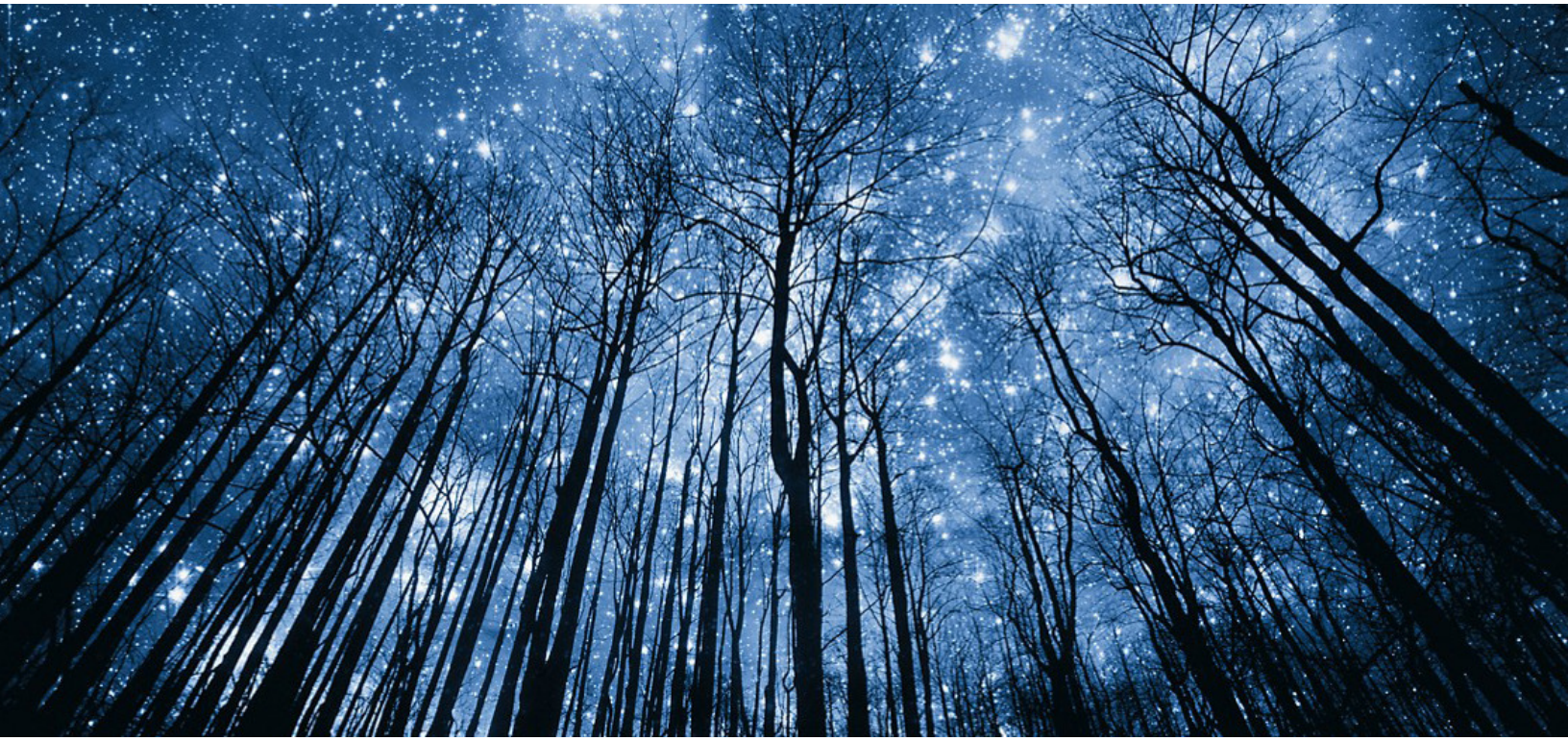
TECH-INDUCED EASY PRESCRIPTION



Shri Vishnu S

Associate Sales Engineer Analyst
Dell Technologies
Shri_vishnu_s@dell.com

Krithika Jagannath

Krithika Jagannath
Associate Sales Engineer Analyst
Dell Technologies
Krithika_jagannath@dell.com

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Introduction

The global spread of Novel Coronavirus poses a serious threat to millions of individuals around the world. Annual conferences of various sizes, as well as small group meetings, have migrated to the Internet. Though the new 'virtual' format presents various significant technical and organizational obstacles, it also presents opportunity.

Using our app, one may virtually reach out to patients and consult with them. Adverse drug effects are a leading cause of death worldwide, with tens of thousands of people dying each year due to medication or prescription errors. Indecipherable handwriting, drug interactions, and ambiguous drug names impact a caregiver's administration of the incorrect substance or dosage to patients. Voice-based e-prescription, that allow prescription information to be recorded as a voice and then heard by voice response rather than in the doctor's handwriting, may avoid some of these flaws. This project presents a design and implementation of a voice-based E-Prescription along with the ability to book appointments using the IVR system as the main idea.

This application helps doctors generate patient prescriptions using voice commands and send the same as an SMS for people who do not have the facility of a smartphone or as a PDF to the patients over social media. Additionally, the application has features that enable doctors to access patient records and send messages. Patients can book appointments based on doctor's availability on our app or using the Interactive Voice Response system.

Abstract

COVID-19 has made face-to-face meetings difficult if not impossible. People in remote areas have difficulty traveling to a clinic. Now, most provider/patient consultations are done online or over the phone, which can result in miscommunication of the medicines prescribed. Also, if the patient forgets the medicine name or dosage, he /she contact the doctor again. Our idea mainly focuses on eliminating these errors and helping doctors generate E-prescriptions by voice commands and send the same to the patient as SMS/PDF with the audio version of the E-prescription. We are not only targeting the people with smartphones but also the people without smartphones and who are technologically challenged using the IVR technology. In this way we can reach out to a broader set of people and help the society.

Literature Survey

Attributes	Tata health	E-sanjeevini	Proposed System (Voice Based E-Prescription)
E-Prescription generation (by Voice/manual)	Manual	Manual	Voice
Appointments	Yes	Yes	Yes
IVR Service	No	No	Yes
Prescription sending format	In App	Link	SMS / Social Media App/ In App
Access to E-prescriptions and audio prescriptions	E-prescription	E-prescription	E-prescription and audio prescription
Video Call	Yes	Yes	No
Link to the App	https://www.tatahealth.com/	https://esanjeevaniopd.in/	In Progress

Table 1

Attributes	Tele Arogya	Board Of Doctors	Proposed System (Voice Based E-Prescription)
E-Prescription generation (by Voice/manual)	Manual	Manual	Voice
Appointments	Yes	Yes	Yes
IVR Service	No	No	Yes
Prescription sending format	In App	In App	SMS / Social Media App/ In App
Access to E-prescriptions and audio prescriptions	E-prescription	E-prescription	E-prescription and audio prescription
Video Call	Yes	Yes	No
Link to the App	https://telearogya.com/	https://boardofdoctors.com/	In Progress

Table 2

For the Literature Survey, Tata health, E-sanjeevini, Tele Arogya and Board of Doctors are taken into consideration. All the compared applications are up and running. In these applications, the prescription generation is manual unlike the proposed system. All the applications have an option to book appointments online, but the proposed system not only offers the option to book consultations online but also an option for the non-smartphone users to book consultations via the IVR service. This IVR service is unique to our proposed system. All of these applications generate E-prescription, but the proposed system not only generates E-prescription, but also generated audio prescriptions and these are stored in the application itself, which can be accessible to the patients with smartphone or without smartphone. The non-smartphone users can fetch their audio prescriptions via the IVR service. Most of the mentioned applications have video consulting which is not the provided option in the proposed system.

Finally, after comparing the related work it can be told that the existing systems offer consultation facilities, but it limits its facilities to only high-end devices such as smartphone/PC users. In the proposed system, all the users will have to go through a onetime registration process, which helps the system maintain patients' profiles as well as classify smartphone and basic cell phone users.

System design and implementation

Once the user is registered, he/she can

• Book appointments

• View prescriptions

• Hear the audio version of the prescription

The method is to process an audio file of a prescription and reach out to people with smartphones or those with basic cell phones.

The system has 2 major entities:

Converting the audio file to Text format and sending it as PDF/SMS to the patient

A prescription is sent to the patient by transcribing the audio instructions given by the doctor and formatting that into an SMS body. The border condition with respect to the number of characters in a single SMS is also addressed.

Storing the audio file of prescription in the database

The audio file can be played either on the application or through the IVR system. In IVR technology people interact with an application through prerecorded voice messages with dual-tone multi-frequency signaling (DTMF) input using a keypad. IVR system interacts with callers, gathers some essential information, and routes calls to the appropriate agents. In this use case, the IVR system helps users book appointments, playing recorded prescriptions in the database.

Resulting Improvements

While the proposed system helps a lot of people with basic cell phones, it also helps people with hearing aids who might not have heard some important details during the consultation.

In this model, there are 5 main components:

1. Patient

2. Doctor

3. Appointments

4. Consultation

5. Slot Booking

1) Patient

Patient participant object has the following attributes:

• Patient ID

• Name

• Age

• Mobile

• Email

• Gender(optional)

2) Doctor

The features of the Doctor participant object are:

• Doctor ID

• Name

• Phone Number

• Email

• Role

• Signature

3) Appointments

Appointment has the following attributes:

• Booking ID

• Booking Date

• Start Time

• End Time

4) Consultations

Appointment has the following attributes:

• Consultation ID

• Booking ID

• Consultation Date and Time

• Pdf of the prescription

• Audio of the prescription

5) Slot Booking

Slot Booking has the following attributes:

• Slot Number

• Slot Start Time

• Slot End Time

• If the slot is booked or not

The patient first registers on the application, irrespective of the phone used. Once registered, the patient can book slots based on their convenience and slots for when the doctor is available. After the conversation between the patient and doctor, the doctor ends the call and creates an e-prescription using voice commands. Then, the generated prescription is updated in the patient's database which the patient can access anytime through the application. For the non-smartphone users, the audio prescription can be listened to using the IVR service and a SMS of the same is sent to his mobile.

The IVR system

Interactive Voice Response (IVR) is basically an automated phone system which allows incoming callers to access information via a voice response system of previously recorded messages without having to speak to a person or an agent. Additionally, menu options can be accessed via keypad selection or speech recognition through which calls can be routed to a specific department or a particular specialist.

Figure A depicts how the IVR system works in this application.

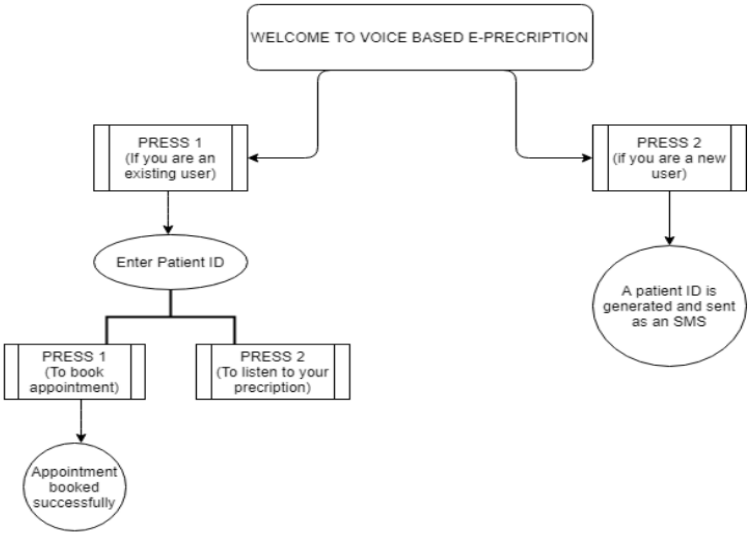

Figure A: IVR Flow

As seen in this proposed system, the doctor can generate a prescription with voice commands. This flow is shown in Figure B.

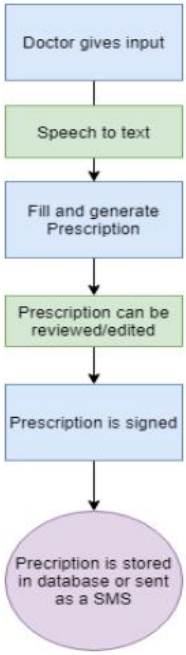

Figure B: Prescription generation flow

The doctor starts the process of this application by hovering over the textbox provided and starts dictating the prescription. The application uses Google Speech API as a recognizer to record the speech in real time and fills the prescription with several categories such as diagnosis, medication, time medication is to be given, dosage, and any necessary instructions. A PDF document of the E-prescription will be saved which is accessible to the patients via the application or via the IVR system (audio prescription).

Tools and Technologies

The tools and technologies used to build this application are:

Adobe XD: Adobe Experience Design is another name for this. It's a user experience design tool for online and mobile apps that's built on vectors. This is used to provide a more user-friendly interface.

React JS: Mostly used to manage the view layer for mobile and web apps, this an open-source JavaScript framework is primarily used to create single-page applications.

Node JS: This is primarily used to run JavaScript code outside of a browser. Another advantage is that it allows developers to utilize JavaScript to create command-line tools and server-side scripting. This aids in production of dynamic web pages before they are transmitted to the user's web browser. It is a back end, cross-platform JavaScript runtime environment that is open source.

MySQL: MySQL is a database management system that is used for a variety of applications, including e-commerce, data warehousing, and logging.

Postman: A client for an API, Postman simplifies sharing, testing, creating, and documenting APIs for developers like us. This is accomplished by sending and receiving simple and complicated HTTP/s queries, as well as reading their answers resulting in a less time-consuming effort and a more efficient approach.

Google speech to text API: The Google Speech API, also known as Cloud Speech-to-Text, is a complex tool that converts voice to text using Google's machine learning technology. Speech-to-text is performed in this application while producing prescriptions, which is one of the key features.

Webkit speech recognition API: The Speech Recognition Event is sent by the recognition service module. Web Speech API's Speech Recognition interface is simply a controller for the available recognition service.

Twilio: This is a global messaging API that can send and receive MMS, OTT, and SMS messages. It simply makes use of intelligent sending characteristics to ensure that messages reach end users consistently, no matter where they are, with minimal procedure and faults.

The proposed system uses Adobe XD to design the user interface (UI); React JS and Bootstrap to build the front end and Node js and MySQL for the back end. Testing is done on Postman. The entire application is deployed on AWS. Some of the APIs are Google Speech-to-Text API and also Webkit Speech Recognition API. For sending SMS through the IVR, Twilio SMS is used.

Results

Given the Covid-19 pandemic, most patient/doctor consultations are done online/over a phone call increasing the chances of miscommunication. Our idea mainly focuses on eliminating these problems and helping doctors generate E-prescription by voice commands and send the same to the patient as SMS/PDF.

In this proposed system, formatted prescriptions are generated based on voice commands from the doctor. The prescription is accessible to the patient via the application for smartphone users and as an SMS for non-smartphone users. The audio version of the prescription will also be available in the application.

A brief of the project

- Voice instructions allow doctors to write standardized prescriptions.
- Doctors can read prescriptions if their reference is present in the doctor’s array of prescription objects.
- Patients can either book the appointment using the IVR module or the app itself.
- A patient can access his audio prescriptions via the IVR module or the application itself.
- A patient can read and access the prescriptions as they are accessible via PDF/SMS.

Advantages of the proposed system

• Save time and energy by just speaking to the application rather than writing it on a sheet of paper.
• Save paper by generating digital prescription which can be viewed directly from the application.
• Reading doctor’s handwriting is no longer a problem.
• Easy access to retrieve patient prescriptions.
• Medication errors are reduced.
• Helps hearing-impaired patients.

• Sending prescriptions to people with or without smartphones.
• Contactless consultation helps reduce human contact which results in safer experience.

Conclusions and Future Enhancements

The suggested and deployed system aims to reduce the time it takes to create and access patient records. This application is available to all doctors and patients with or without a smartphone. The implemented application is a unique solution to solve the problem of illegible handwritten prescriptions and a great solution to hold consultations during a pandemic like Covid-19.

Voice-based e-prescription requires only minor adjustments to a doctor's workflow, but it will have a massive impact on the development of a digital environment for patients in the long run. The established solution will reduce the time it takes to enter patient folders while maintaining high security and privacy for uncomplaining data. In the coming years, there is a plan to integrate and use the system in an established hospital ecosystem to test and validate the implementation and analyse the effects it will have on the healthcare domain.

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