

MEDICAL PRESCRIPTION DETECTION AND HEALTH GUIDANCE SYSTEM USING MACHINE LEARNING

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Project Proposal Report

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Information Technology

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DECLARATION

I declare that this is my own work, and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Name	Student ID	Signature
S.W. Samaranayaka	IT19955414	

The above candidate is carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor

Date

.....

.....

(Mr. Ravi Supunya)

Signature of the Co-supervisor

Date

.....

.....

(Ms. P.K.Suriya Kumari)

ABSTRACT

Acute or chronic joint inflammation is what is known as arthritis. Several symptoms, such as pain, stiffness, reduced range of motion, and joint deformities, can be attributed to arthritis. There are several different types of arthritis, with management being different for each. The method proposed in this paper is to enable arthritis patients to get the necessary prescriptions through a voice based electronic prescription system. That is, build a user interface that will record the doctor's voice-based summary report, convert it into text using natural language processing, and send the text-based summary report to the relevant patient. Due to difficult handwriting, drug interactions, confusing medicine names, etc., caregivers make many of these mistakes by taking the wrong medication or dosage. Speech perception mobile applications, which allow prescription information to be accessed and heard through voice responses rather than medical script, can help to reduce some of these errors. Drug side effects are the primary cause of death worldwide, and drug or prescription errors result in tens of thousands of deaths each year. It is important that every patient get the proper medication and avoids any mistakes because doing otherwise could result in major health issues. Therefore, the majority of errors can be solved and reduced if an electronic prescription is issued, and all of the medications prescribed by doctors are received via PDF or SMS Prescription. Speech perception mobile applications, which allow prescription information to be accessed and heard through voice responses rather than medical script, can help to reduce some of these errors. If this solution is implemented in the real-time hospital system, several advantages can be achieved. That is to save paper by introducing an electronic prescription that can directly view a document file and by talking with the application rather than writing the prescription on paper, you can save time and energy as well as decreased medication errors.

TABLE OF CONTENTS

DECLARATION	1
ABSTRACT	2
TABLE OF CONTENTS	3
LIST OF FIGURES	4
LIST OF TABLES	4
LIST OF ABBREVIATIONS.....	5
1. INTRODUCTION.....	6
1.1 Background	6
1.2 Literature Review	7
1.3 Research Gap	9
1.4 Research Problem.....	11
2 OBJECTIVES	13
2.1 Main Objectives	13
2.1 Specific Objectives	13
3 METHODOLOGY	14
3.1 User Research	14
3.2 Feasibility Study.....	15
3.3 System Overview	16
3.4 Software Solution	18
3.5 Work Breakdown Structure	21
3.6 Grant Chart.....	22
4 PROJECT REQUIREMENTS	23
4.1 Functional Requirements	23
4.2 Non-Functional Requirements.....	23
5 DESCRIPTIONS OF PERSONNEL AND FACILITIES	25
5.2 Resource Personnel for development	26
5.3 System and Software Requirements for development	26
6 COMMERCIALIZATION PLAN	27
6.1 Targeted Audience	27
6.2 Benefits to the end-users	27
6.3 Advertising and Communication.....	27
6 BUDGET AND BUDGET JUSTIFICATIONS	28
References	29

LIST OF FIGURES

FIGURE 1.1 SUMMARY OF THE RESPONSES WHICH SHOWS THE REPORT OF PEOPLE SUFFERING SIDE EFFECTS AND DYING	11
FIGURE 2 SUMMERY OF THE RESPONSES WHICH SHOWS THE FACED DIFFICULTIES IN	12
FIGURE 3 SUMMARY OF THE RESPONSES WHICH SHOWS THE USE A MOBILE APPLICATION	14
FIGURE 4 SYSTEM OVERVIEW DIAGRAM.....	17
FIGURE 5 SUMMARY OF THE RESPONSES WHICH FACED DIFFICULTIES IN BUYING PRESCRIPTION DRUGS	18
FIGURE 6 WORK BREAKDOWN CHART	21
FIGURE 7 GRANT CHART	22

LIST OF TABLES

TABLE 1 COMPARISON OF FORMER RESEARCHES	9
TABLE 2 DESCRIPTION OF PERSONAL AND FACILITIES	25
TABLE 3 RESORCE PERSONAL FOR DEVELOPMENT	26
TABLE 4 BUDGET	28

LIST OF ABBREVIATIONS

Abbreviation	Description
NLP	Natural Language Processing
AWS	Amazon Web Services
SDLC	Software Development Life Cycle
EHR	Electronic Health Record
ML	Machine Learning
NPL	Natural Language Processing
UID	User Identification
NER	Name Entity Recognition

1. INTRODUCTION

1.1 Background

An inflammation of the joints is arthritis. It may affect one or more joints, making it difficult to move or maintain activity. There are many types of arthritis (Rheumatoid, Psoriatic, Osteoarthritis etc.) Each kind has different symptoms and can require various therapies. Even while arthritis typically affects older people, it can affect men, women, and kids of any age. If a person is suffering from arthritis, he must see a doctor and get proper treatment for this.[11]

The objective of this project is to design a system which will generate voice-based prescriptions on arthritis. Today, a major problem in Sri Lanka as well as abroad is that prescriptions are still written by hand [3]. Some of handwritten prescriptions are difficult to read. When a doctor prescribes medication to a patient and then gives a handwritten prescription, the doctor's use of incorrect spelling makes it difficult for anyone without a medical background to understand the prescribed medication. It can only be read by pharmaceutical experts such as chemists [8]. A patient will have difficulty reading a prescription correctly, and they won't be able to check whether the drug a pharmacist gives them is in accordance with the prescription. If a pharmacist gives the patient the wrong medication because of a miscommunication, the patient may experience severe damage or adverse drug reactions [2]. Also, adverse drug effects from medication or prescription errors are leading cause of tens of thousands of deaths worldwide each year. Due to unclear handwriting, drug interactions, and unclear drug names, many of these mistakes have an impact on how caregivers administer the confusing drug or dosage to patients [6]. Additionally, the issue with all hospitals is the lack of a system, such as an electronic health record system, to know a patient's history and the types of tablets they have used in the past. Because handwriting prescriptions takes time, doctors can see fewer people during the given individuals [9]. A voice-based prescription generation system has been developed to solve this problem. The system accepts voice input and converts it into spoken text using the Google speech recognition API. Here, the name entity recognition (NER) model is used to suggest comparable names for the drug and the information of the generated transcripts is extracted using natural language processing (NLP) [8].

After diagnosing the patient's symptoms, the doctor determines the type of arthritis (Rheumatoid, Psoriatic, Osteoarthritis) and prescribes medication. The application suggests creating the drug name in an auto-generated manner. Thus, the information in a prescription is the type of arthritis, drug name, strength, route form, dose, and frequency. Finally, doctors generate the patient's prescriptions with the help of voice commands and send them in pdf, doc, image or ppt format to his email id. A digital signature of the prescription is used to prove that any prescription has been issued by the concerned doctor. Here the doctor is allowed to get a digital signature easily through an online tool. Additionally, this app should enable doctors to send messages and access patient information, as well as edit and sign prescriptions. It will save a lot of time for doctors to write prescriptions and for patients to search up previous prescriptions if this solution is implemented in a real-time hospital system [2].

1.2 Literature Review

The concept of voice-base E-prescription is not a new concept and several research have been done before. Prior to proceeding with the project, similar approaches taken to address the identified issues were sought and the literature surveys searched are as follows.

Kuldeep Choudhary, Tanmay Agrawal, Riddhi Dama; Dr.Mansing Rathod published the paper "Voice Based E-Prescription".This research proposed a method for prescribing medication using voice recognition technology.The planned and implemented project aims to reduce the amount of time a doctor has to communicate with a patient. Doctors can use their smartphones to access this system. Here, the problem of not being able to read handwriting is resolved. The developers also have plans to implement a payment gateway in accordance with the requirements and design a successful checkout procedure. In order to test and approve its execution as well as examine the effects it will have on the healthcare industry; the device's developers plan to set up and try to utilize it in a real hospital soon. A system that will assign each doctor in an organization a UID - User Identification - for future use is also scheduled to be implemented for the work that will be done. It will be more authentic and well detailed because the doctor will use the IDs directly for login.[2]

Ikhu-Omoregbe N. A. and Azeta A. A. published paper "A Voice-based Mobile Prescription Application for Healthcare Services." In to enhance health care services, this paper explores the design and implementation of a voice-based mobile prescription application. By dialing the relevant number, a mobile device can access the application. This method has the ability to lower costs and save lives in hospitals around the world, particularly in developing countries where treatment is currently cumbersome and paper based. [10]

Waheeda Dhokley,Atif Khan,Danish Ali Shaikh,Amaan Shaikh and Burhanuddin Fatehi,"Speech Recognition Based Prescription Generator".This paper is primarily focusing on the task of prescription generation by utilizing state-of-the-art technologies that are currently available in the NLP domain. Their model was jointly trained using StackPropagation to perform the tasks of intent detection and slot prediction, which detects intent first and predicts slots based on that intent. This improved the model's accuracy in comparison to its predecessors.This task can be expanded to make it easier for the doctor and prevent the unacceptable problems that are related to prescriptions that are written by hand. Finally, they want to use the mobile application to help people switch from a handwritten prescription to one that is faster, more effective, and clearer.[9]

Jitendra Mahatpure, Dr Mahesh Motwani and Dr Piyush Kumar Shukla,"An Electronic Prescription System powered by Speech Recognition, Natural Language Processing and BlockchainTechnology". Additionally, it provides EHR features via a mobile application. Illegible handwritten prescriptions were a challenge, so authors came up with an innovative solution. Voice-based e-prescription requires only a small change to the doctor's workflow, but over time, it will have a significant impact on the creation of a patient-centered digital ecosystem.The ePrescription technology aids with real-time EHR management while maintaining patient privacy. The newly implemented system will speed up access to patient records while maintaining the highest levels of security and privacy. The patient is given the

choice of whether to allow other doctors access to their medical records. To test and evaluate the implementation and to assess the impact it will have on the healthcare industry, the authors want to integrate and utilize the system in a real hospital setting soon.[5]

Omatseyin L. Eyesan; Senanu R. Okuboyejo "Design and Implementation of a Voice-Based Medical Alert System for medication Adherence."Using mobile voice technology, medical professionals can rapidly update and access patient records from any location that is covered by a telecommunications network. This indicates that the patients' medical records are still current. Access to the most recent data increases the chances that doctors will write prescriptions with knowledge. Utilizing mobile technology-based apps could reduce overall documentation, improving the responsiveness and dependability of healthcare practice.[12]

iRxClinics, —Digital Prescription Writing & Smart Pen | iRx Clinics –Digitally Yours | Digitized patient record.A complete clinic management suite called IRX Clinics[3] was created by Trata E Systems. It comes with a tablet, a smartpen, and a prescription pad. Doctors can continue writing prescriptions by hand with the technology taking data in the background automatically. The prescription pad and smartpen work together to save the data digitally. The clinic management suite, which can be used to handle medications, appointments, and diagnosis, is already preloaded on the tablet.[13]

1.3 Research Gap

Many side effects and deaths are reported today due to taking the wrong medication or dosage. This situation can be mitigated by the introduction of speech-generating mobile applications, which aim to provide a digital copy of all medicines prescribed by doctors. During the literature review, I found some research that have been done for this. The following table shows the comparison of the features of research that have been done so far and our proposed research.

Table 1 Comparison of former researches

Features	Research A	Research B	Research C	Research D	Research E	Proposed System
Generating voice-based prescription	✓	✓	✓	✓	✓	✓
Applying a digital signature in the prescription	✗	✓	✓	✗	✗	✓
Sending the prescription to the patient as pdf format	✓	✓	✓	✓	✓	✓
The drug name is automatically suggested	✗	✗	✗	✗	✗	✓
Ensure high accuracy about the drug name	✗	✗	✗	✗	✗	✓
Storing the prescription in the database	✓	✓	✓	✓	✓	✓
Unique only for Arthritis patients	✗	✗	✗	✗	✗	✓

As mentioned in the table above, all five types of research A, B, C, D, and E are described to generate voice-based prescriptions using different techniques and then directly delivering the prescription to the respective patient's mobile phone or email as an attachment in PDF format[2][3][5][6][8]. But our research suggests, that developing our application so that the prescription sent to the patient is not only in pdf format, but the doctor can send it in different file formats (image, word, pptx).

Further in the study of this research, only in research B and C, a digital signature has been used in the prescriptions issued by the concerned doctor. This can be used as a unique factor to prove that it has been issued by the doctor[3][8]. Our research proposed that any doctor can use an online tool to easily apply his digital signature to the prescription.

Many of the research (A, B, C, D, and E) that I studied also described that the mobile application was created with the aim of different types of diseases [2,3,5,6,8]. But, according to our research, the selected domain is specific only for arthritis patients, so the high accuracy of prescription can be maintained. Here, according to the patient's symptoms, the doctor determines the type of arthritis and then determines the relevant medicine. This application proposes to create the drug name in an auto-generated manner. So far, no proposed or implemented research has designed a system in such a way that the name of the drug is automatically generated in the prescription.

Before prescribing a prescription to the patient, there is a direct communication between the doctor and the patient to identify the symptoms of the patient concerned. Since there is no interruption during communication, we can maintain high security and privacy in our proposed system.

Considering the above information, we can conclude that our research has a significant research gap compared to several studies.

1.4 Research Problem

One of the major problems in research studies is the miscommunication of handwritten prescriptions or drug interactions, causing tens of thousands of deaths worldwide.

In earlier times, doctors kept personal records of their patient's medical histories by writing notes. Today, many doctors observe many patients in a short period, write notes and give prescriptions. Here, the doctor writes the prescriptions for the patient very quickly, so the handwriting is very unclear. Sometimes doctors themselves cannot read their handwriting. Illegible handwriting can delay medical care, and result in pointless testing and dosage errors, which can cause suffering and even death from the patient's point of view.

Eg: In 1999, an American cardiologist accidentally killed a 42-year-old patient after the pharmacist confused his prescription for 20 mg of the antianginal medication Isordil for 20 mg of the antihypertensive medication Plendil. Another inconvenience is surely exacerbated by poor handwriting.

5. Have you heard of reports of people suffering side effects or dying because they couldn't understand handwritten prescriptions correctly?

48 responses

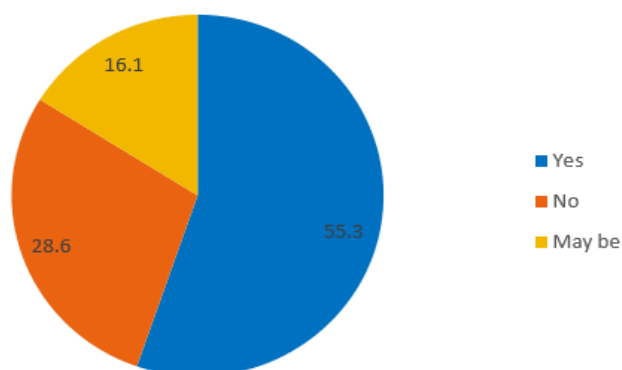


Figure 1.1 Summary of the responses which shows the report of people suffering side effects and dying

Due to the current economic crisis in the country, many services such as education, health, transportation, communication, etc. have been inactivated. Investigations have reported that the patient does not receive efficient and effective service when paying special attention to the health sector. This means that the supply of paper needed to dispense prescriptions to the patient is insufficient.

7. As a person affected by the economic crisis in the country, have you faced any difficulties in buying prescription drugs?

48 responses

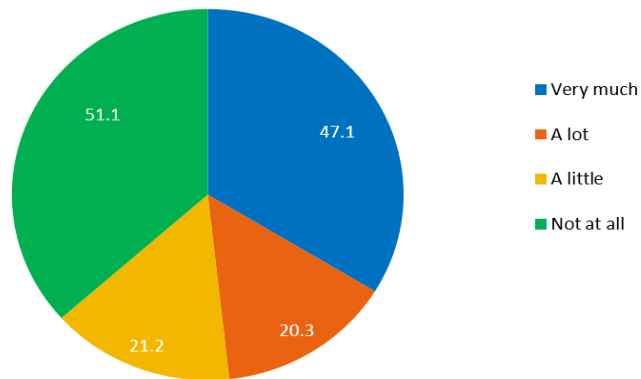


Figure 2 Summary of the responses which shows the faced difficulties in buying prescription drugs

As shown in Figure 2, more than 51.1% of the survey respondents say that they faced some difficulty in getting the necessary medicines.

Overall, in most hospitals in Sri Lanka today, prescriptions are still written by hand, so sometimes it can be inaccurate or unclear to patients. Thus, paper-issued prescriptions are affected by the patient and external factors, and therefore have a greater risk of being destroyed. Therefore, it is difficult to recognize the name of the medicine and it may be difficult for the patient to buy the medicine. On the other hand, once a medication has been taken, the same recommendation should be followed again while taking the medication. In this way, the patient's medical history is recorded, but if it is lost or destroyed, it may disturb with the doctor's ability to formulate a medication based on the patient's medical history.

2 OBJECTIVES

2.1 Main Objectives

In our research, the main objective is to create a speech recognition electronic prescription system based on mobile devices targeting patients with arthritis. Basically, only three types of arthritis are based Rheumatoid, Psoriatic, and Osteoarthritis.

With this mobile app, tracking the names of prescription drugs, tracking the best pharmacy to get the patient's required drugs, and using a voice-based electronic prescription system, users can easily access and understand what drugs are prescribed in the doctor's prescription.

2.1 Specific Objectives

The main objective of this project is to create a voice-based prescription generation system based on arthritis patients through which the patient can receive a prescription in pdf format via email or SMS. The application also has features that allow doctors to send messages and access patient details.

1. Converting the audio file to Text format and sending it as PDF to the patient

The concept behind the app, is to develop a system that allows doctors to create patient reports using voice input and a few keywords. The doctor's audio instructions are generated as a prescription and an email is sent to the patient's personal email account and the security of the prescription is confirmed.

2. Maintaining the prescription audio file in the database

The prescription system aids with real-time EHR management while securing patient privacy. The recently implemented technology will speed up access to patient records while maintaining the highest levels of security and privacy. The patient is given the option of whether to allow other doctors access to their medical records.

3. By automatically suggesting the name of the drug through the prescription form, the patient can confirm its correctness.

After a doctor log into the system, identifying the symptoms of the patient, the type of arthritis is selected. Based on the selected type of arthritis, the doctor can confirm the correctness of the drug name when entering the prescription form.

4. Saving paper by introducing a digital prescription

By designing a paper-based electronic prescription system can save paper because the prescription can be delivered directly to the user's phone or email.

5. Developing easily understandable system that any patient can access through their mobile phones.

3 METHODOLOGY

3.1 User Research

Here we created a research series and collected data on the side effects or deaths heard from around the world due to the difficulty of recognizing handwritten prescriptions. I also explored the difficulty of buying prescriptions due to the current economic crisis in the country.

4. Do you use a mobile application for purchasing your prescription?

48 responses

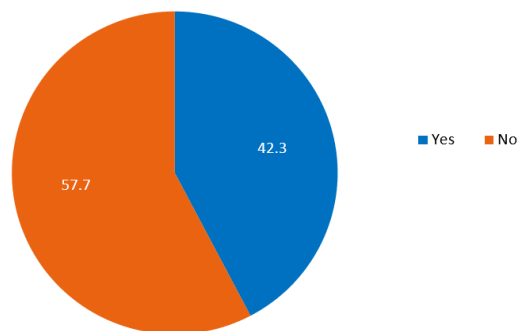


Figure 3 Summary of the responses which shows the use a mobile application for purchasing prescription

As shown in Figure 3.1, according to the survey, more than 57.7% of respondents said that they have not used a localized mobile application to purchase prescription drugs. So, we decided to create an E-prescription system based on our proposed system especially for arthritis patients.

3.2 Feasibility Study

Technical Feasibility

In evaluating previous research reports, we discussed whether current resources, hardware, software, and necessary technology were used for project development. At the same time, the feasibility study analyzed the technical skills and capabilities and examined whether the existing technology is compatible with the proposed framework.

Economic Feasibility

In Economic Feasibility study cost and benefit of the project is analyzed. The application's components are distributed among the team members for us to complete the application with all the functions integrated effectively. Using a voice base electronic prescription system can reduce paper costs for writing prescriptions and reduce travel costs for the patient to meet the doctor. This means that as part of the feasibility study, a thorough analysis is done to determine the project's development costs, which include all costs necessary for the project's final development, such as the cost of the design and development process as well as any operating costs.

Scheduling Feasibility

In the Schedule Feasibility Study, mainly the proposed project should be completed on time within the relevant period. We examine the scheduling feasibility and arrange our tasks according to the due dates. Moreover, be there to ensure on-time delivery of the final product.

Operational Feasibility

The focus here is on reducing the complications or deaths that can occur when a handwritten prescription becomes illegible to the patient or is destroyed due to some other environmental factor. As a solution to this problem, we proposed to create a voice-based electronic prescription system to be adapted to existing new software.

3.3 System Overview

This project demonstrates the design and implementation of a voice-based E-Prescription along with the capability to support doctors in generating patient prescriptions using voice commands and sending them as either a pdf to patients over social media or as an SMS to those who do not have access to smartphones. The application also features that allow doctors to send messages and access patient details.

1. A doctor must first log in to the system for authentication purposes. The doctor can write a prescription via our app. The doctor is not required to communicate in a prescribed format. Only a smartphone and a good internet connection are needed to use our app.
2. The doctor can identify prescription patients after successfully logging into the system and enter prescriptions by clicking the "START" button on a web page. In here, the prescription is taken as input in voice format with help of Google speech recognition API to convert speech to text.
3. Mainly this app is created on the basis of Arthritis patients, so the doctor has to select the respective type of Arthritis according to the identified symptoms after observing the patient. The next step is to enter the drug name according to the type of arthritis selected. Here, the medicine inserted by the doctor verifies the accuracy. This is because a list of drug names is automatically generated for the type of arthritis entered.
4. Finally, using voice commands, doctors generate electronic prescriptions, which they then SMS or PDF to the patient. The formatted prescriptions generated by this suggested system are based on the doctor's voice commands. The patient can access the prescription via an application on a smartphone or via SMS on a non-smartphone.

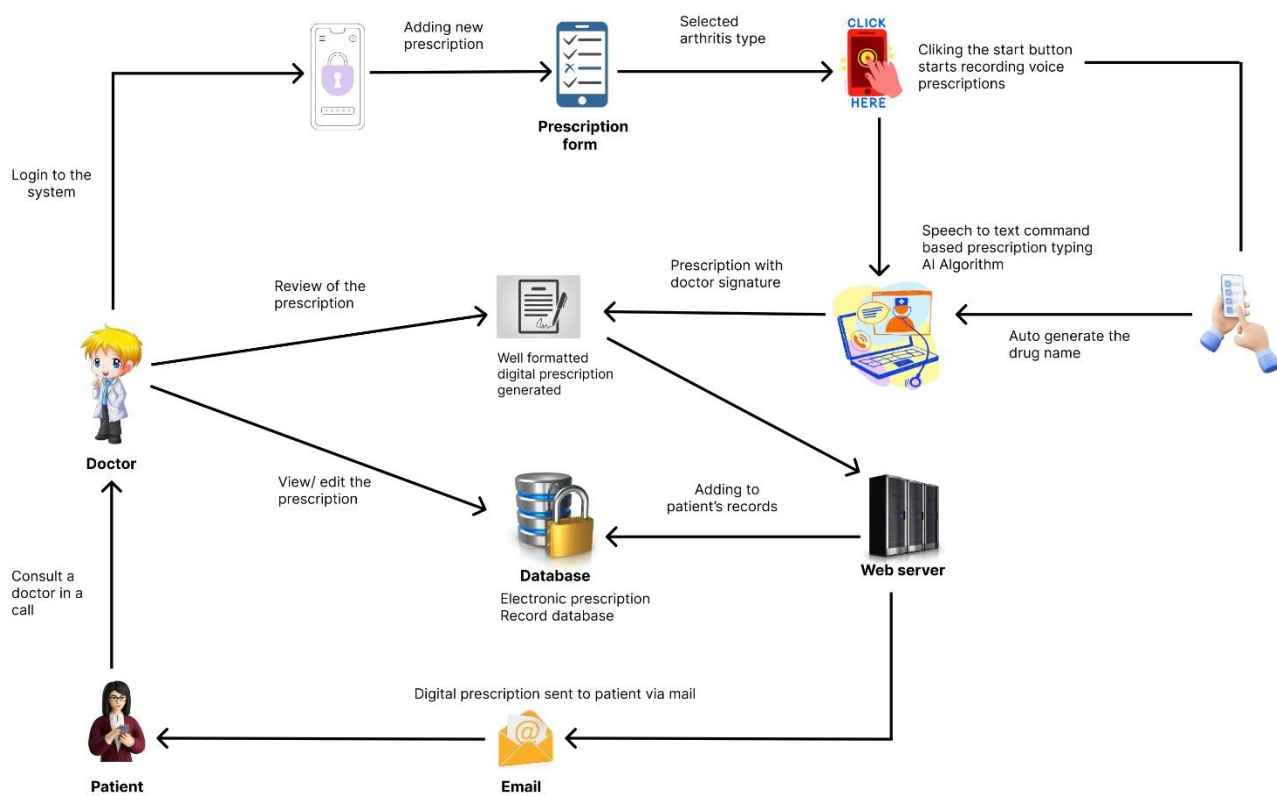


Figure 4 System Overview Diagram

3.4 Software Solution

For the implementation of the proposed solution, the SDLC (Software Development Life Cycle) approach is considered as the agile methodology where Scrum project management framework is followed

Requirement Gathering and Analysis

The requirement gathering and analysis stage is the first phase in the Software Development Life Cycle (SDLC) model. The correct requirement gathering must occur before the implementation in order to determine whether the proposed system will provide the best solution. To gather requirements, the given methodologies will be used.

6. As a person affected by the economic crisis in the country, have you faced any difficulties in buying prescription drugs?

48 responses

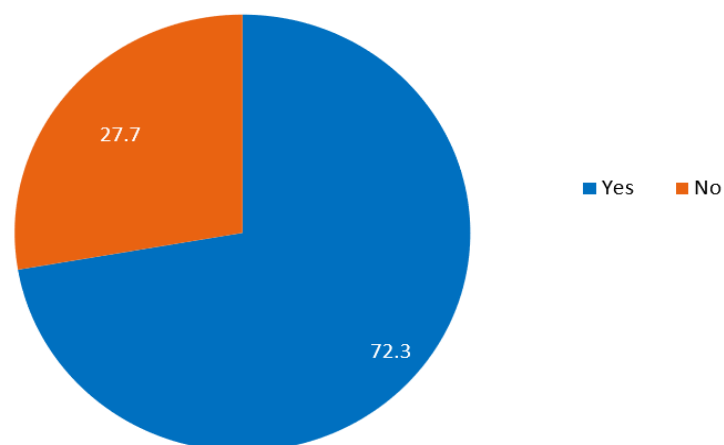


Figure 5 Summary of the responses which faced difficulties in buying prescription drugs

A mini-survey of several individuals was conducted as shown in figure 1.4 to identify whether or not patients had previously used an app with a voice base E-prescription system to get their prescriptions.

Design

The design stage is a necessary precursor to the main developer stage. After the complete requirements, gathering and analysis go to the design phase of the part. Design helps in defining the architecture and in defining system requirements. The architecture is based on gathered needs and requirements. Each level will be completed before going on to the testing phase, which will evaluate and validate the developed system.

➤ Tools and technologies

While building this application we proposed a healthcare system based on natural language processing and blockchain technology for voice recognition. The system consists of the following modules.

1. Python Django REST API Server

Here we proposed an approach to use speech recognition to speed up the prescription generation process. And Natural Language Processing (NLP) to extract prescription information from the transcript. The voice prescription backend text processing done on the python Django REST server.

2. Google speech to text API

The Google Speech API, commonly referred to as Cloud Speech-to-Text, is a powerful technology that enables Google's machine learning technology to convert voice to text. It is also accessible as an integrated, free service in Android smartphones. In this particular application speech to text is done while generating prescriptions, which is one of the main aspects.

3. React-Native Mobile Application

The mobile application is developed to make the system more accessible to doctors. Using the mobile app, a doctor can register patients, identify the patient, and generate an electronic prescription. Patients can use this app to view their prescriptions as well. The Doctors mode of the mobile application provides a text-processing and speech recognition interface for filling out the prescription form's details.

4. Firebase

Because it is able to easily access our database from anywhere at any time using the firebase Google service, this technology is mostly used to develop and implement our database. Since it is a real-time database, this system can allow access to many new features.

➤ **Testing**

This stage would be completed in order to verify the developed function's outcomes. The quality of the function would be maintained via testing throughout the software life cycle. Therefore, model testing would be done in this stage to evaluate the performance of classification models. For this confusion matrix will be used.

➤ **Maintenance**

This stage would include the maintenance of the hosting service and database.

3.5 Work Breakdown Structure

The working breakdown structure of the development process is shown in Figure 6

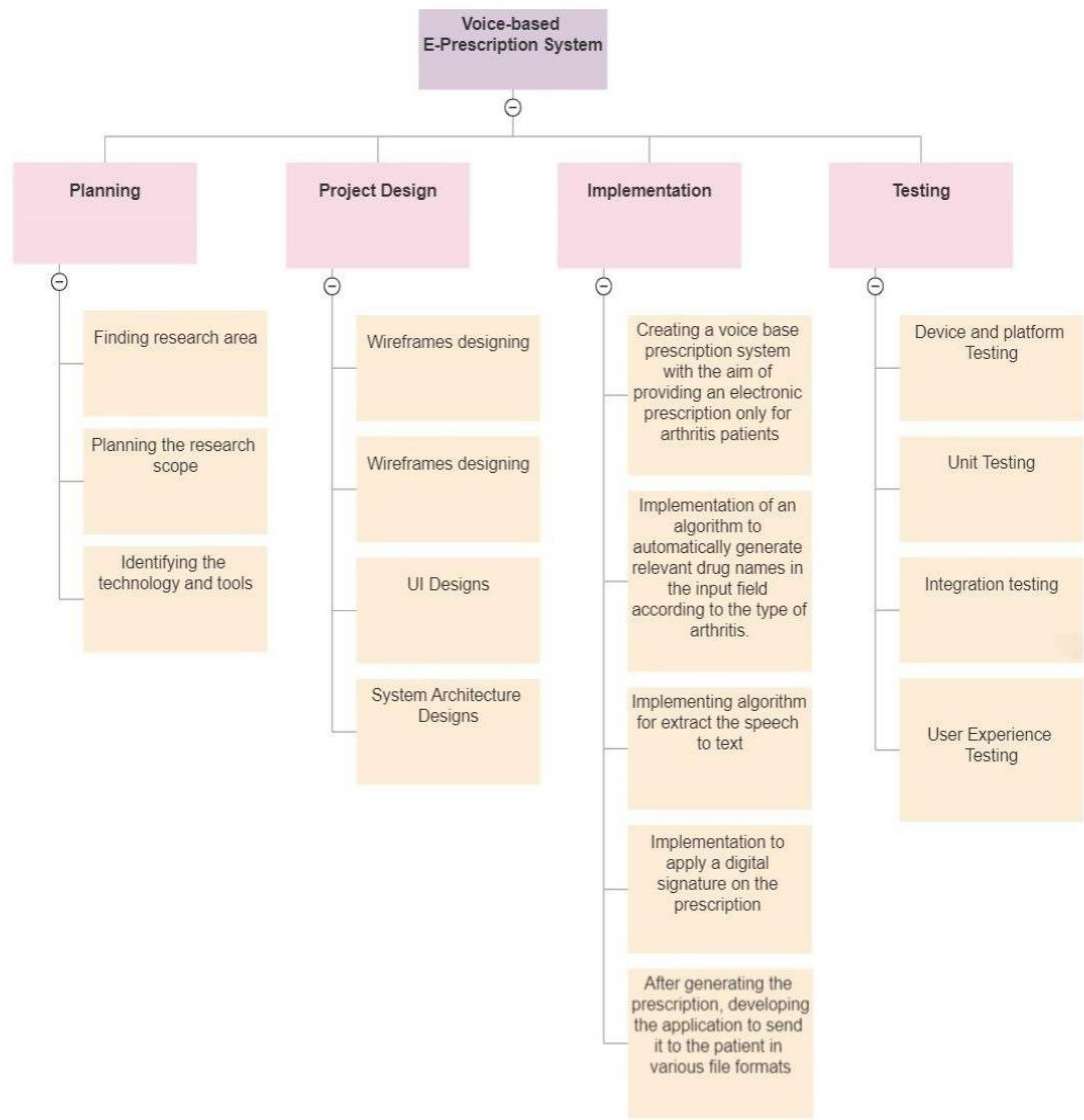


Figure 6 Work Breakdown Chart

3.6 Grant Chart

The Gantt chart of the development process created according to the temporal time periods is shown in Figure 7

	June	July	August	September	October	November	December	January	February	March	April	May	June
Online registration for the topic evaluation													
Topic Evaluation form submission													
Project charter submission													
Project proposal report													
Project proposal presentation													
Project Status document													
Progress Presentation - 1 (50 %)													
Submit the Research Paper													
Final Report (draft) individual and Group Submit to the Supervisor													
Progress Presentation 2-(90%)													
Integrated Product													
Final Report													
Project Status document and Student Logbook													
Final Presentation and Viva													

Figure 7 Grant Chart

4 PROJECT REQUIREMENTS

The success of the project depends on the clear definition of the requirements. With the development of the project, listing out a set of requirements helps the developers to ensure that the project should be done to reach a common specific objective.

Following are the classified requirements of our application to be achieved together throughout the project timeline.

4.1 Functional Requirements

- ✓ The first step a doctor must perform in the system is authentication. In here, the doctor has to login into the system using Email-ID and password provided at the time of registration.
- ✓ Prescriptions can be formatted by doctors using voice commands. User should click the start button to begin recording voice prescriptions. It begins recording voice prescriptions after pressing the start button
- ✓ The application uses the Google Speech API as a recognizer (which can identify all disease names) to capture the speech and fill up a form with many categories, such as patient information, diagnosis, prescription, etc.
- ✓ A doctor must select the respective type of Arthritis according to the identified symptoms. This is because a list of drug names is automatically generated for the type of arthritis entered.
- ✓ The patient should receive the prescription from the doctor by SMS or email (in a PDF format). The PDF generated has a password that is assigned at the time of generation. A copy of the prescription is saved in the patient's secure fire base, together with copies of all previous prescriptions.

4.2 Non-Functional Requirements

✓ Usability

This feature concerns the users; it indicates how effectively they can learn and use system. That is to achieve the desired goals of the user efficiently and effectively. The system proposed in this study reduces the time spent on creating and accessing patient records and ensures the accuracy and safety of the prescription to the patient.

✓ **Reliability**

So that the translation results may be accepted, the app's output accuracy should be perfect, and the code should be free of bugs. In other words, reliability is the probability and percentage of a software program working properly over a given period of time or number of usages.

✓ **Availability**

This feature specifies how long the system operates for, how long it takes to fix a problem. The doctor can issue necessary prescriptions for the patients after logging into the system at any time of the day throughout the week.

✓ **Readability**

A prescription issued by an e-prescription system can be read very clearly by a patient without misunderstanding.

✓ **Modifiability**

The development process remains the agile process, and there are always requests for codebase changes. Therefore, the codebase needs to be changed from time to time to change the project's requirements.

✓ **Performance**

When the user interacts with the system the system should be able to output the result efficiently as possible. The execution time should be as minimum as possible. According to this study, as the doctor uses a voice base E-prescription system to produce a prescription, the time taken for it can be reduced.

✓ **Capacity**

This feature shows the storage capacity of your system, which depends on its type and features. Since this system is installed and used as a mobile application, the devices' storage capacity should be taken into consideration.

5 DESCRIPTIONS OF PERSONNEL AND FACILITIES

The tasks allocated to the component are shown in the Table.

Table 2 Description of personal and facilities

Registration Number	Name	Functions
IT19955414	S.W Samaranayaka	<ul style="list-style-type: none">• Conducting a discussion with an arthritis specialist about the types of diseases and symptoms related to the disease.• Discussing the information that should be included in a prescription issued to a patient.• Development of a mobile platform for extracting prescription information from script using natural language processing technique.• Using a machine learning approach to identify the most appropriate type of arthritis based on relevant symptoms.• Using Google API to successfully recognize the information verbally expressed by the doctor.

5.2 Resource Personnel for development

The following table lists the resource persons who assist in providing the database for the diagnosis process of arthritis types and symptoms.

Table 3 Resorce Personal for development

Name	Designation	Company
Charuni Pinnaduwa	Doctor	District Base Hospital Theldeniya
Namal Pathirana	Doctor	Badulla General Hospital

5.3 System and Software Requirements for development

The proposed solution must be implemented properly, which will require specific requirements for hardware and software. Below is a description of each aspect of the system and software specifications.

✓ System Requirements

- Android Phone/tab
 - Android Version: Below 10.0
 - Memory: 1GB
 - Free Space: 256MB
 - Back Camera: Minimum 5MP
 - ARM based processor

✓ Software Requirements

- VS code
- Android studio
- AWS/Google cloud
- Node.js

6 COMMERCIALIZATION PLAN

6.1 Targeted Audience

Our future aim is to improve the app and implement some features in addition to targeting arthritis patients so that they can easily get their required prescriptions through our app. Doctors, patients, pharmacist will be the end-users of this system.

6.2 Benefits to the end-users

- Saving time and effort by speaking the prescription into the application rather than writing it down on paper
- By using a digital prescription, patients do not have the problem of handwriting
- By delivering the prescription directly to the user's email, you rely on the security of the prescription and the security of the doctors' notes.
- Paper saving by introducing digital prescriptions for patients
- Improved pharmacy operations multi-option mail
- More improved patient safety access to patient prescription records is improved

6.3 Advertising and Communication

Commercializing an all-purpose tool would be very beneficial for users in the target industry and might be seen as a simple but rewarding innovation venture.

- The Sri Lankan medical centers would be this product's customers.
- A Facebook page and a YouTube channel will be established to advertise the mobile app in detail
- Clients would be charged according to the needed database requirements and maintenance costs.

6 BUDGET AND BUDGET JUSTIFICATIONS

Justification

We estimated the cost of the project based on the need for budgeting due to the project requirements. We also have to purchase some clients to build our system. As per our calculations, we will have to incur costs for the project as follows and these calculations may change with the upcoming project flow.

Budget

Table 4 Budget

Recourses	Price
AWS S3 Cloud Service	1500.00
Data connection cost	4000.00
Server cost	5000.00
Educational survey cost	1500.00
Travelling cost	2000.00
Documentation and printing cost	1000.00
Stationary	1000.00
Total	16,000.00

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