

System development project report

E-prescription system

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Acknowledgement

It is indeed a great pleasure and proud privilege for the group members to present the web health informatics project. The purpose of the project was to showcase the talent among the students studying in master of Computer Science to know the practical applications and solve the various problems occurring in computer engineering.

The group members pay their profound gratefulness and express their indebtedness to the guide **Prof. Dr. Q. Pang's** support and guidance to successfully complete the project work within the time duration.

Lastly, we would thank God and our parents for their support without which it would not be possible to complete our project.

Abstract

Electronic prescription is the use of an automated data entry system to generate a prescription, rather than writing it on paper. Furthermore, E- Prescription is system which allows and enhance quality and safety of the prescription process. It allows different providers to send prescription electronically to the patients or pharmacy and also integrated with electronic health record system. Automation of the outpatient prescribing process has many potential benefits to different health care stakeholders. Moreover, the benefits that are potential in terms of E-prescription are extends to pharmacies, patients, payer and prescribers or we can say doctor so, in contrast those benefits are fall into following point such as patient safety, efficiency or workflow, cost savings and improved prescribing. The proposed system along with electronic prescriptions will allow users to access the functionality of video calling with the doctor. The system allows users to video call the doctor if meeting in person is not an option at the current time. Therefore by that patient can save their time to get the prescription or renew the prescription from doctor.

Keywords :- E-prescription, pharmacy, electronic health records, workflow, safety and efficiency, e-prescribing.

Introduction

As e-prescribing becomes more and more important nowadays and it is more enhance and effective medication management and safer systems therefore by implementing that and using this kind of systems it will definitely improved patient outcomes and also reduced human efforts and doctor's work. Moreover it will reduce lots of paper works as there are lots of benefits such as it will improved patient safety, few risk of lost paper written prescription and less medication errors because of handwritten prescriptions. In general, Many people go through a dosage of medicines which they need to have every day. Many times these patients need to visit the doctor only for renewing their prescription which wastes a lot of time. E-prescriptions would allow patients to request the doctor to renew the prescriptions online thus saving the time of visiting the doctor just for a single prescription.

In our e-prescription system there will be two different portals, one for the patients and one for doctors. Both the portals will have a secured login system using email id and password.

Proposed system

Electronic prescription system allows the whole of medical consultation process to go online. Our proposed system will allow users to consult the doctor by means of video calling in case of an emergency during non-working hours of the doctor. It also provides access to the patients to request a electronic prescription which will allow to buy the required medicines from the pharmacy. If the symptoms seems to be serious the doctor can ask the patient to schedule the earliest appointment through our system. Moreover, our system will gives some health tips to patients with some general tips that can help patient for maintain their health.

Problem statement

A health problem can arise anywhere and anytime. Many times it may not be possible to visit the doctor personally. Our system provides the flexibility to patient to connect and consult the doctor

without an actual visit. Also if the patient just needs the prescription of his regular medicines to be renewed by the doctor it would be too time consuming to visit the doctor just for the prescription. Migrating to a new town and finding a good doctor nearby and then getting used to his medications may also be difficult. This system would allow users to consult their regular doctors even being at different locations.

Literature review

Prescription order is an essential exchange between the doctor and the patient. It is a request for a logical medicine for an individual at a specific time. It brings into center the diagnostic keenness and remedial capability of the doctor with directions for whitewashing or reclamation of the patient's health. Prescription is a hand written record that connects with the therapeutic and lawful obligation of the doctor as well as of every one of those in this way associated with its execution. prescription composing used to be an art just as a science. Sadly, times have changed. Usually, we find deficient and illegal prescriptions being given over to patients, and, all the more tragically, respected at drug stores. This has brought about an disturbing trend of putting the patients health in danger; and there is a emergency need to put things right. Nowadays the prescription design is changing and it has turned out to be only a sign of drug with certain guidelines of portions without thinking about its rationality.

[Mahnaz Samadbeik and Marayam Ahmadi, 2013] The authors in the paper “ A Theoretical Approach to Electronic Prescription System”. For a considerable length of time, manually written medicine has been a preferred specialized strategy for doctors in decision making concerning drug treatment, and pharmacists in distributing prescriptions. Then again, it has been a profitable guidance on the best way to utilize medications for patients. In addition, it is considered as a critical movement in the health care process. Prescription procedure is a mistaken strategy. Among various sorts of mistakes related with drug process, medicine errors are the most preventable reason for prescription errors. Conventional written by hand medicine is excessively moderate because of utilizing pen and paper. The paper-based remedy process is wasteful, costly and asset serious. This methodology has a few different confinements, for example, high rate of human mistakes in controlling information, and documentation blunders which are unavoidable. Be that as it may, it is so difficult to defeat the limitations of paper prescription that emerge because of the developing number of pharmaceuticals and multifaceted nature of restorative consideration. A large portion of the constraints of paper medicine could be disposed of or limited by electronic remedy or e-prescription (e-Rx). Hence, electronic prescription has risen as a viable and conclusive answer for counter weaknesses of the present paper-based prescription design, as far as fraud, wastefulness and managerial administrative workload at hand. The prevalence of electronic prescription is encouraged by the great advancement in data and

communication innovation (ICT), the vast utilization of computer in medicinal services, and the proceeding with decreasing in the cost of computer innovation. This methodology improves the quality and decreases the developing expenses of health care services. All in all, drug prescription is a vital and important procedure in modern health care, and execution of electronic prescription frameworks gives various functionalities to progressively compelling and effective solution. As we didn't identify writing equitably revealing the present information on electronic prescription systems, this narrative literature review is expected to connect together numerous investigations on various subjects concerning point territories for purpose behind interconnection, which might be useful to an assortment of potential stakeholders, including medicinal services suppliers, drug specialist, health information technologist and health strategy creators.

[Annie Hahn and Annesha Lovett, 2014] Electronic prescription (or e-prescribing) is the electronic transmission of prescription or medicine related data between a prescriber, dispenser, drug store advantage administrator, or health plan. In the most recent 10 years, the utilization of e-prescribing has thrived because of the guarantee of improving productivity and diminishing medicine errors brought about by its written by hand partner, yet as indicated by 2012 estimates, just 44% of specialist's workplaces utilize paperless prescriptions. However, this is a drastic increment from 12% usage in 2009. While there was starting resistance towards e-prescribing because of view of expanded expenses, preparing necessities, and time imperatives, numerous examinations have been distributed to address those concerns. For example, numerous clinicians felt that the utilization of e-prescribing would disturb work process and take more time. However, it has been demonstrated that e-prescribing really spares time and can be executed into the work process with appropriate preparing. The reason for this review was to talk about e-prescribing as a favored type of prescribing and its current impact. With the Medicare Modernization Act of 2003 pushing for e-prescribing and numerous different safety net providers going with the same pattern, this article outlines the present situation with e-prescribing and its future use. In expansion, the importance of clinician acceptance of electronic prescribing and strategies to improve combination are discussed. Clinical pharmacists have an chance to distinguish recommending errors and improve prescription quality using electronic prescribing. Furthermore, electronic prescribing has been used to monitor and assess patient consistence and prescription discrepancies. Several studies demonstrate that electronic prescription has been appeared to reduce prescribing mistakes in United States hospitals. Nonetheless, there is no accord on best practices in the utilization of electronic prescribing. Further look into is expected to investigate execution of electronic prescribing inside hospital system thinking about that just 67% of qualified clients were using electronic health records (EHR) in 2012, and an indeed, even lower rate for electronic prescriptions. With more prescribers using electronic prescribing and pharmacists handling electronic prescriptions throughout the following barely any years, more analysis of e-prescribing techniques can be made and best practices can be developed. These method can help patients to achieve disease state goals and help clinicians achieve the general

objective to improve patient care through better integration and communication between the patient, drug specialist and doctor.

Document preview

Purpose of the document

The primary objective of this document is to act a user's manual for the users. Also it will provide detailed information about the system architecture, modules and various roles for future developers and researchers.

Document's intended audience

Pharmacists, Healthcare professionals, Medicare service providers, Patients, Hospital software engineers, website designers, trainee in healthcare and future researchers.

Important terms, acronyms, or abbreviations

PSe – Patient Service
eRx – Electronic Prescription
EHR – Electronic Health Record
PHR – Personal Health Record

Module description

General module description of the e-prescription system are as follows:

The system will include the following modules:

The first module will be the login/register module:

It will allow users to register in the application using their email id and password. Once the user registers it can login anytime using its unique login credentials.

The second module would be a video calling module:

Here the patient would be able to video call the doctor (The patients would be able to talk to doctors only who have registered using this system).

The third module would be Electronic Prescription:

In this module the user can request the doctor for an electronic prescription. The doctor and patient will have two different portals for this. The doctor's portal will allow doctor to generate the prescription and send to the patient. In the patient's portal the patient can view all its prescriptions.

The fourth module is a reminder:

In this module patients can set a reminder for their medicines according to the dosage as prescribed by the doctor.

The fifth module is a logout option:

This module simply allows you to logout from the system if you do not wished to be logged in all the time.

System Overview/methodology

The primary objective of our system is to allow patients to video call their doctors from anywhere. We will be using Firebase Database to store user credentials and also their e-prescriptions. The patients can login into the system using username and password. Then the patient can video call the doctor. The doctors can login using their credentials and check for appointments scheduled by patients. Also the doctor can send the e-prescription to the user if requested for.

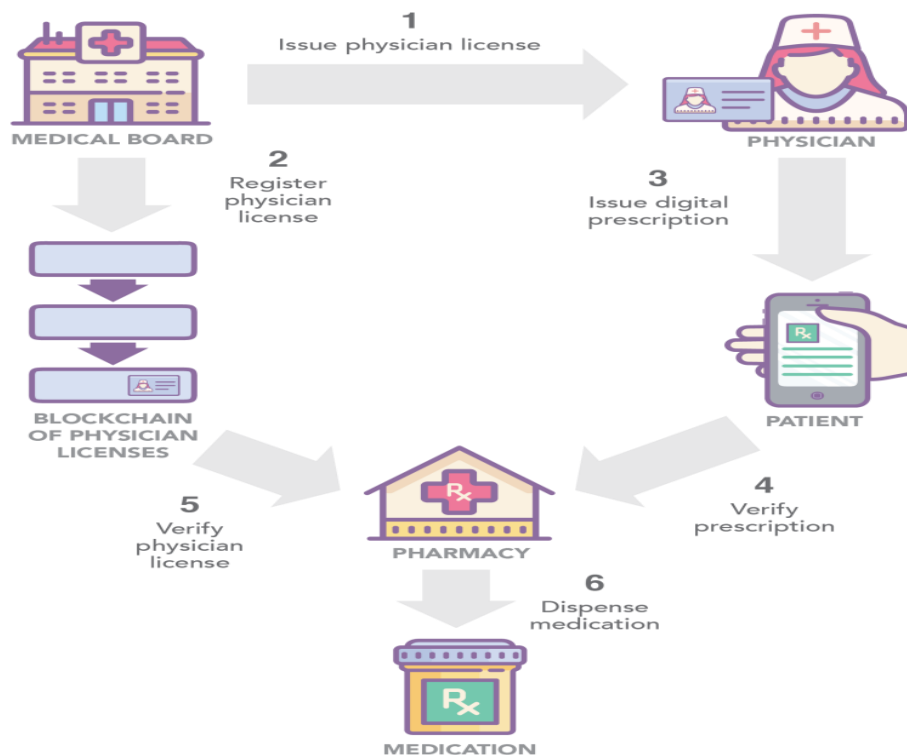
At the system level there are three entities:

1. Patient –The patient contacts the doctor for consultation by means of video calling. For accessing the video calling feature the patient needs to register/login using the patient register/login portal. The patient can also view his active medical prescriptions and request for a renewal if needed. Reminders for medicines can also be set by the patient.
2. Doctor – The doctor can register/login using the doctor's portal. Doctor can provide an electronic prescription based on patient requests by checking their previous records. The doctors can also accept video call requests from patients. The doctor is certified by the medical board and issued with a license for electronic prescriptions.
3. Pharmacist/Druggist – The pharmacist can provide medicines to patients based on their prescriptions. The pharmacist can check the prescription either by scanning the barcode or digital signature or any other means of verifications.

NOTE: The patient and doctors can only access users that are registered on the application. If the registered doctor is not a patient's family doctor, the patients can provide the doctor with his/her medical history if requested by the doctor.

The diagram below shows a basic workflow from getting a license from the medical board to providing medicines to the patient by the pharmacist.

1. The medical board issues a physician license to the doctor.
2. It registers the physician in its database.
3. The physician sends e-prescription to the patient.
4. The pharmacy verifies prescription by the patient.
5. The pharmacy verifies prescription with the medical board.
6. Issues medicines to the patient.



Benefits/function of the system

The main features, guidelines and principles of this system are as following:

- To provide e-prescription in which can eliminate the risks associated with traditional prescription script writing.
- less prescription fraud and less potential for abuse of prescriptions
- To provide on-demand health care.

- The layout of an application is simple and clear, it should be indicated correct information flow.
- Design of application and its structure should be simple and easily understandable by user, so it will make user communication better.
- Give some useful medical tips.
- We search for medicine name and its generic alternatives and its medicines side effects.
- News letter.
- Health line website link to check symptoms of specific disease.
- Various health topics.
- A link to find doctor online and scheduled an appointment.
- A tab for 7 myths about medication and the facts behind them.

Design considerations

This section obtain various problem which need to be handle or resolved before attempting to devise a complete design solution.

1. Assumptions and Dependencies

The healthcare programming application is coded utilizing specialized capability, for example, HTML, CSS, JavaScript, Android Studio association, JSON and other powerful web structure interactions. After that files are stored in a Firebase Database of client credentials and their e-prescriptions. This section listout all the problems, challenges, assumptions and dependencies which are going to be faced while developing the HI project.

- Fast Network Connection
- Login into the system using username and password
- Speedy data retrieval from database
- Authentication and privacy of information
- EHR Accessibility errors
- Reminders for medicine tracker
- History of medical records
- Limitation of scanning the barcode or digital signature or any other means of verifications

2. General Constraints

The requirements or impediments which have or will significantly affect the HI software web application venture are recorded down underneath with descriptions as follows:

- Connectivity of patient and doctor for consultation via Video calling. The Patient should be able to contact the doctor by means of video calling feature of the application. And if video calling features fail due to network problem, patient can take the appointment of doctor with available date and time.
- User session timeout: The user(Patient, Doctor, Pharmacist) have a particular time run after which they the session lapses and client is re-coordinated back to login page as a result of no action performed.
- Technical Interoperability requirements
- Network communications
- Barcode scanner requirement
- Limitation of scanning the barcode or digital signature or any other means of verifications
- Verification and validation requirements: The information of user credentials and their e-prescriptions or renewal prescription should be updated and reflect the changes in the database at the back-end.

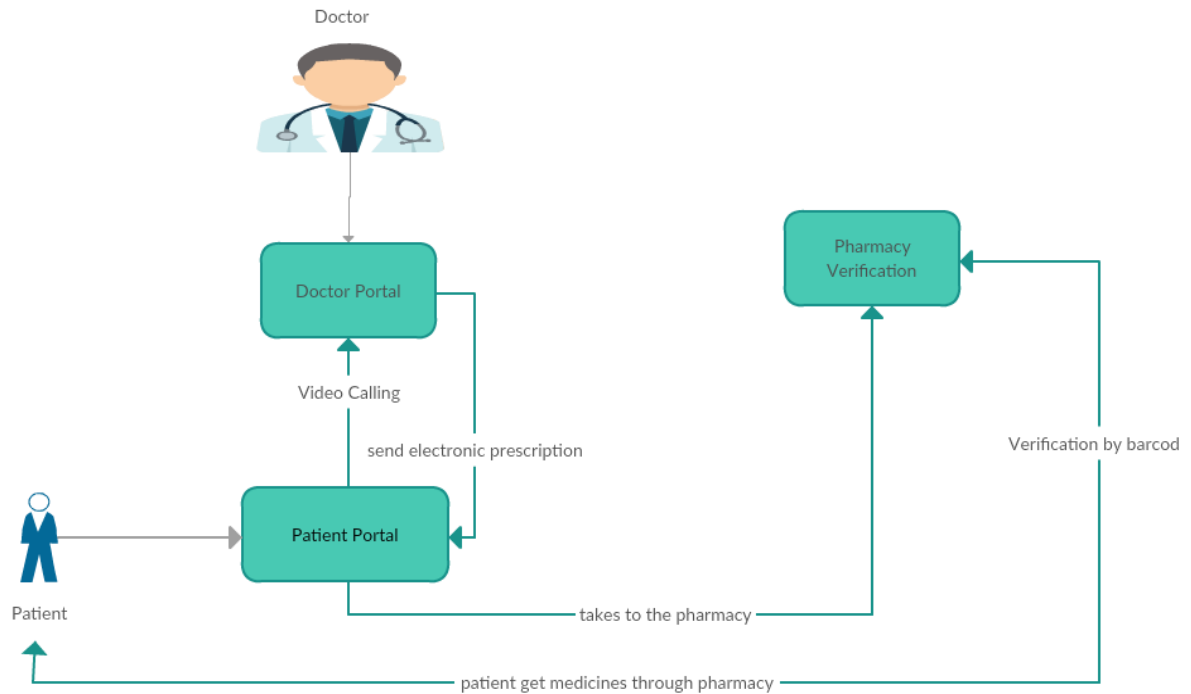
System architecture and description

The diagram below represents the system's architecture and workflow at the most basic level. It displays the two primary entities viz. Doctor and patient. There will be two different portals for the patient and the doctor respectively. The portals will be designed according the functionalities needed by each of the entities. Both the entities will be commonly interfaced by video calling feature which will allow the doctor to perform basic diagnosis on the patient from a remote location. Furthermore, patients can request for electronic prescriptions or renewal for expired prescriptions.

The whole system will be primarily coded in Android Studio for front end. For backend we will be using Firebase which is developed by Google. It helps you manage large datasets without actually managing the infrastructure. It provides features such as crash analytics, real time database, secure authentication and cloud storage facilities.

Our system will be using the cloud storage which is provided by Firebase to store all our data. Firebase provides free storage up to a certain limit.

Future enhancements can be done by using Artificial Intelligence which would ease the process of providing some basic functionality by a bot instead of manual procedures by the doctor. For example the patient can talk to a chatbot and ask for a renewal of prescription, the bot can wherein check for patient's database and provide the prescription accordingly.



Software/platforms/tools/languages/frameworks/APIs

Back-end	Middle-end	Front-end
FireBase	-	Android Studio
-	-	JavaScript
		JSON

Languages : Java Script

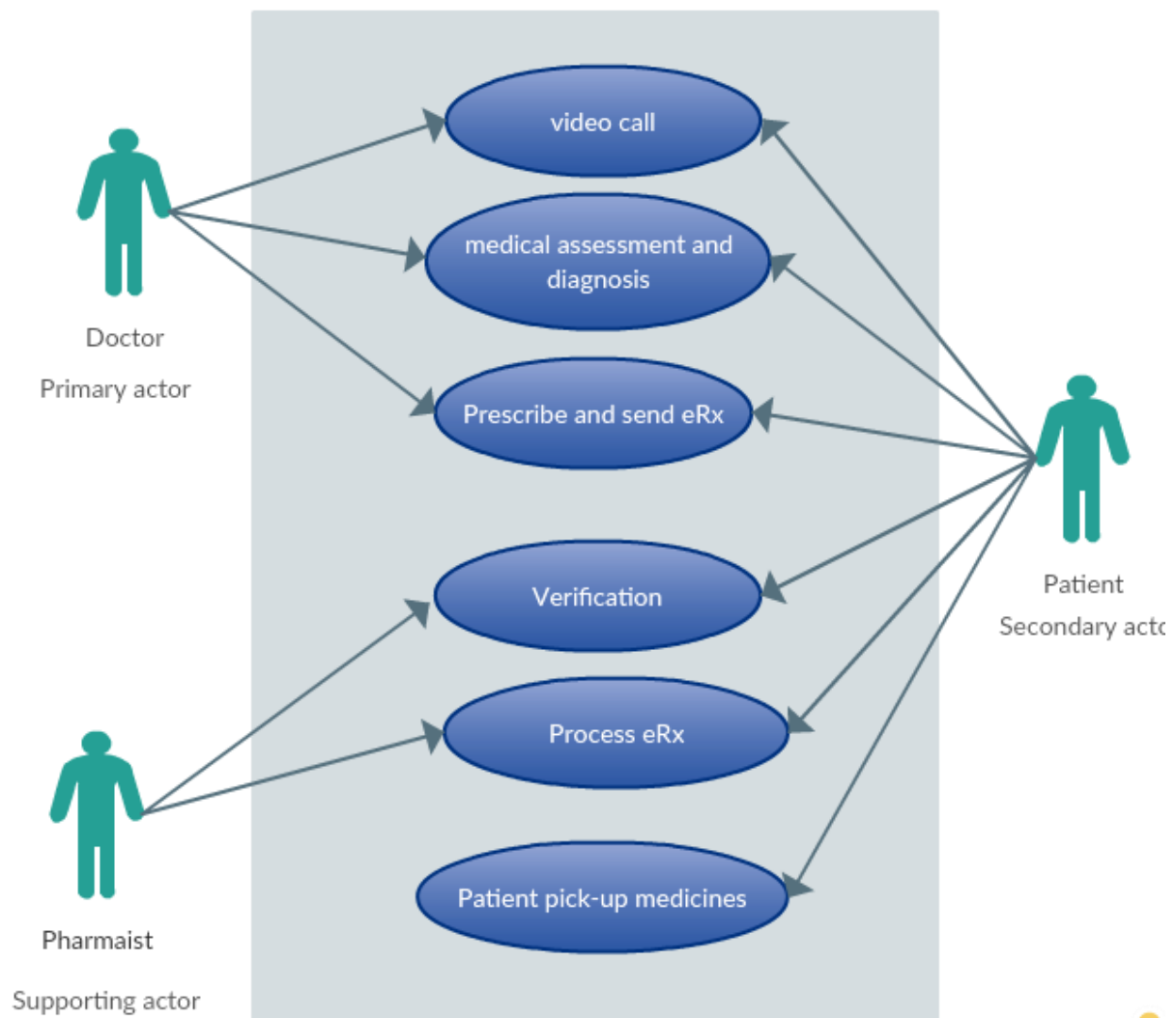
Software/framework : Android Studio

Tools : FireBase

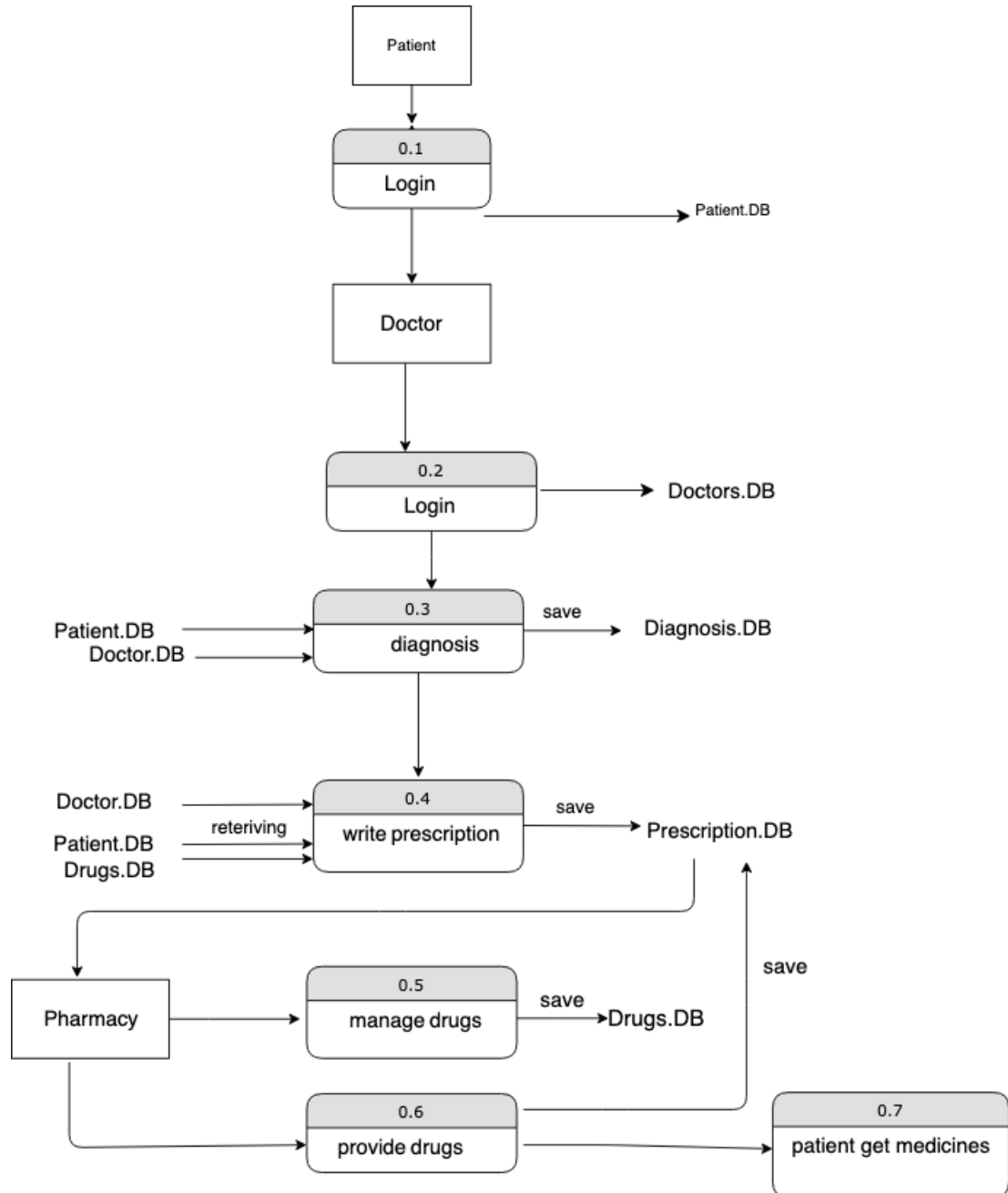
We have developed two android application one for video calling and another for medical prescription by using android studio. We have used java script coding for making Graphical user interfaces and layout of application. And for maintain all of data we are using firebase as back-end as it is used and provide real time database and it also allows real time changes that occur on the all the connected client side. Therefore, all of the data or information that can be used for e-prescription system will be stored using that and it will stored as JSON files.

Diagrams/flowcharts

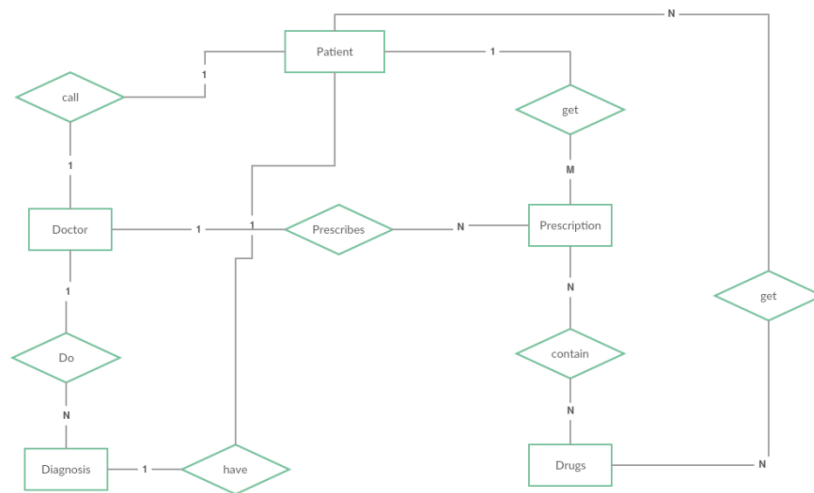
1. Use case Diagram



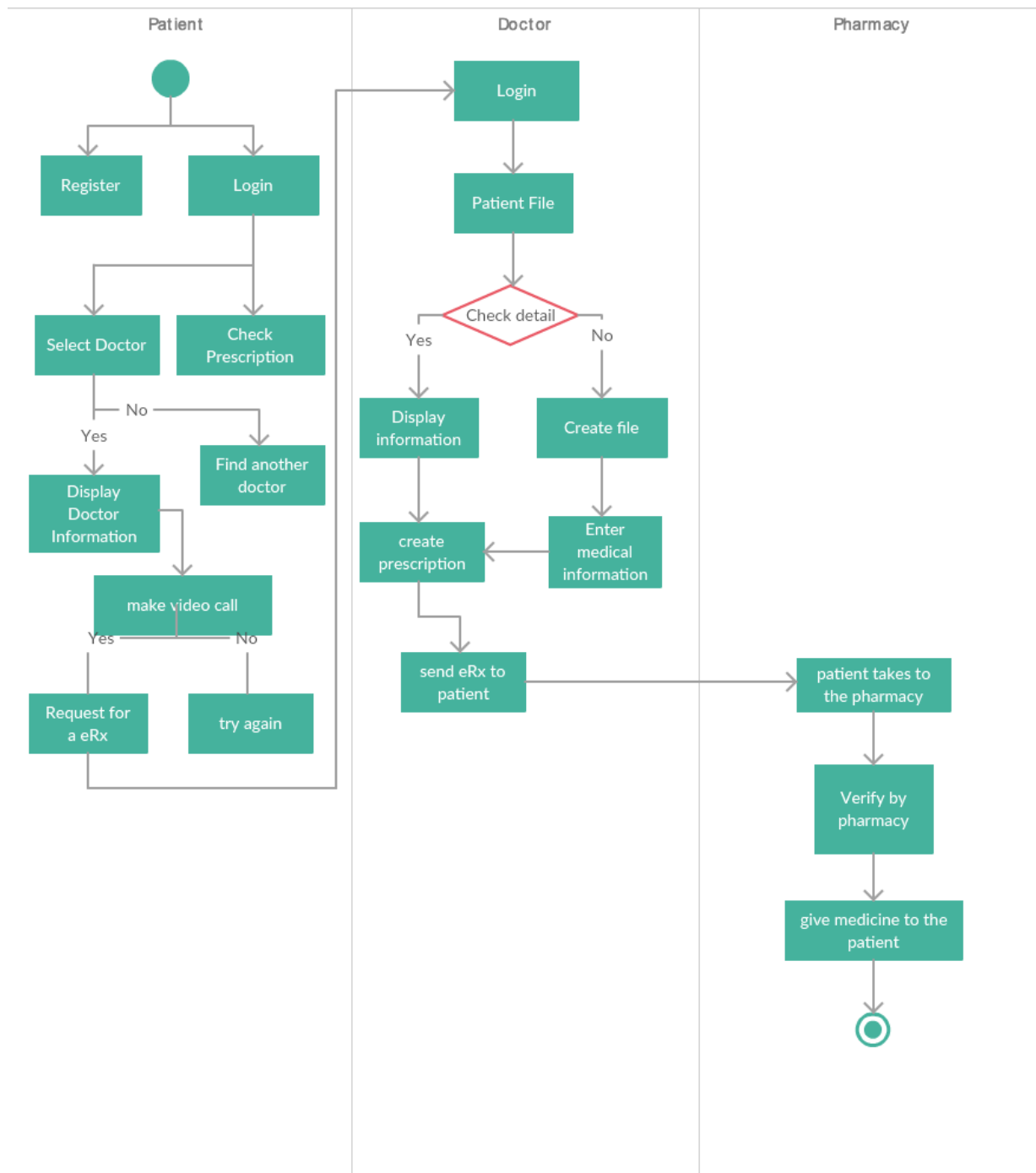
2. Data Flow Diagram



3. E-R Diagram

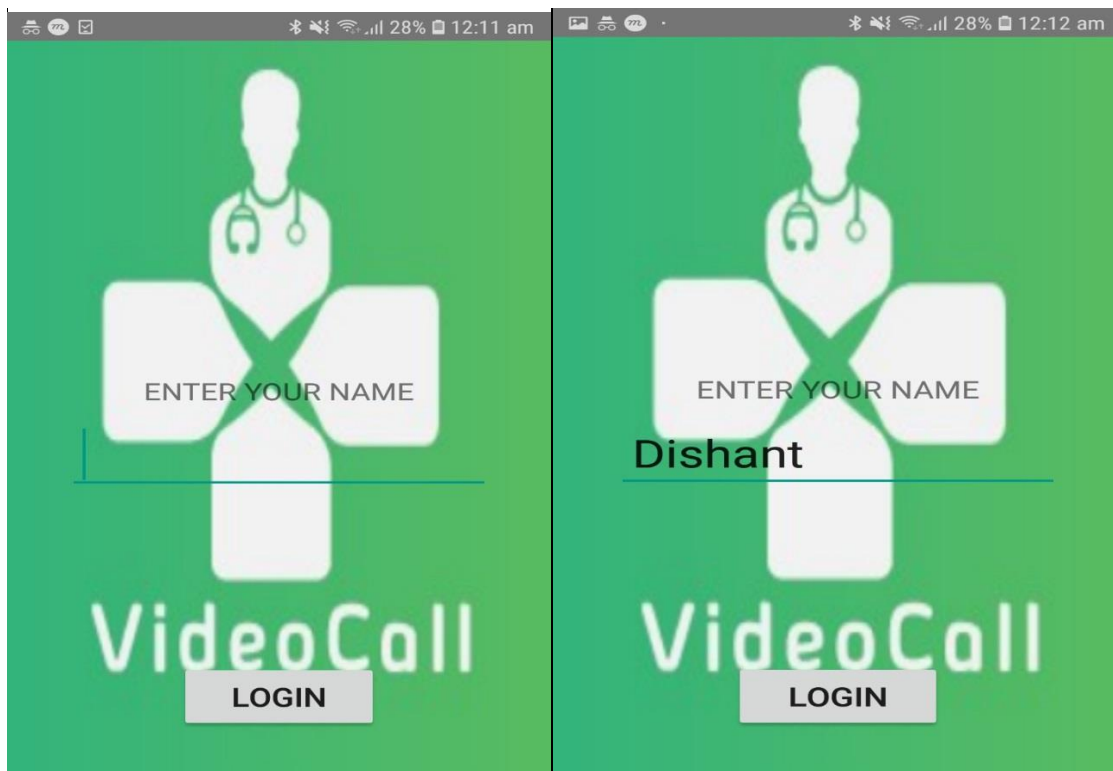


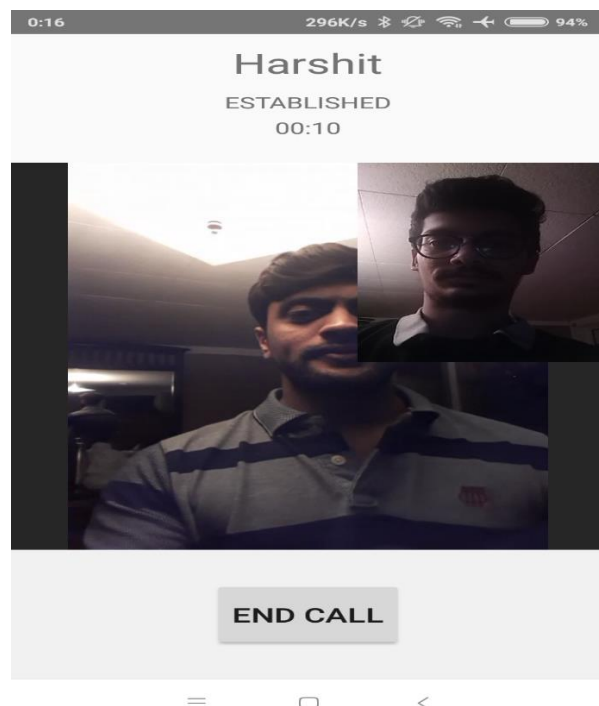
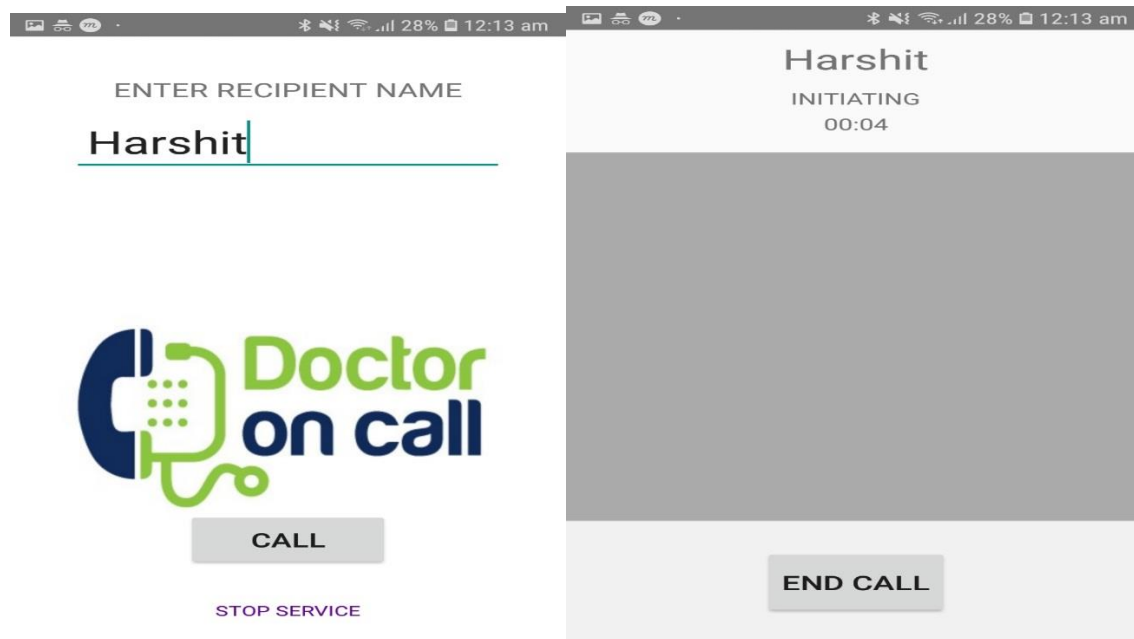
4. Activity Diagram



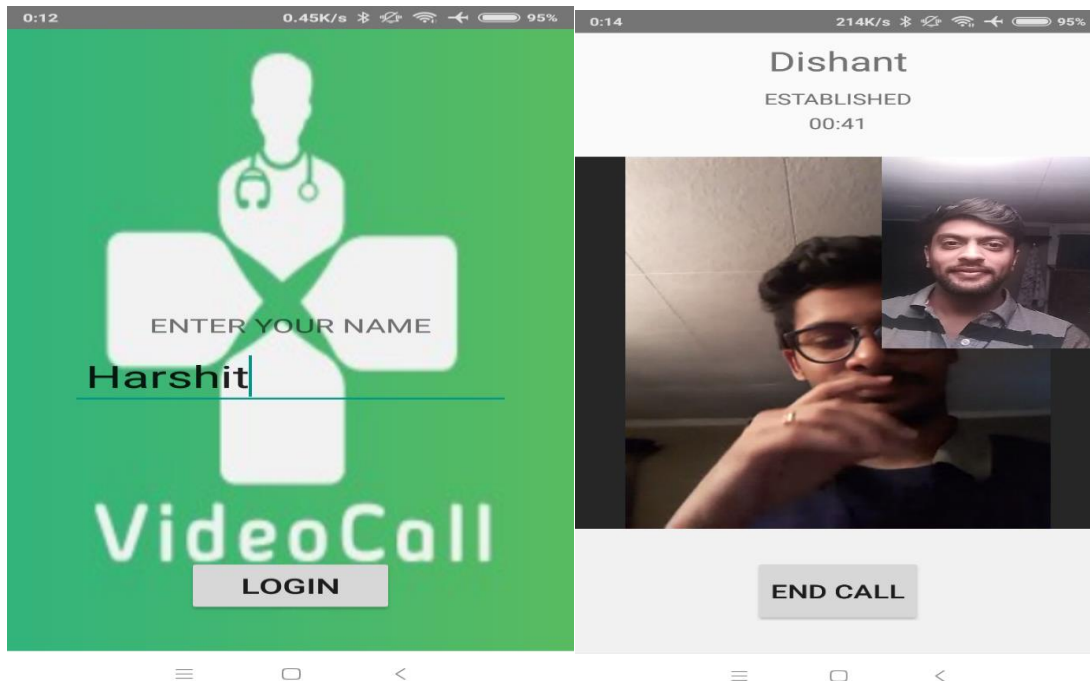
GUI Interfaces

Screenshots of video calling app (DEVICE 1)

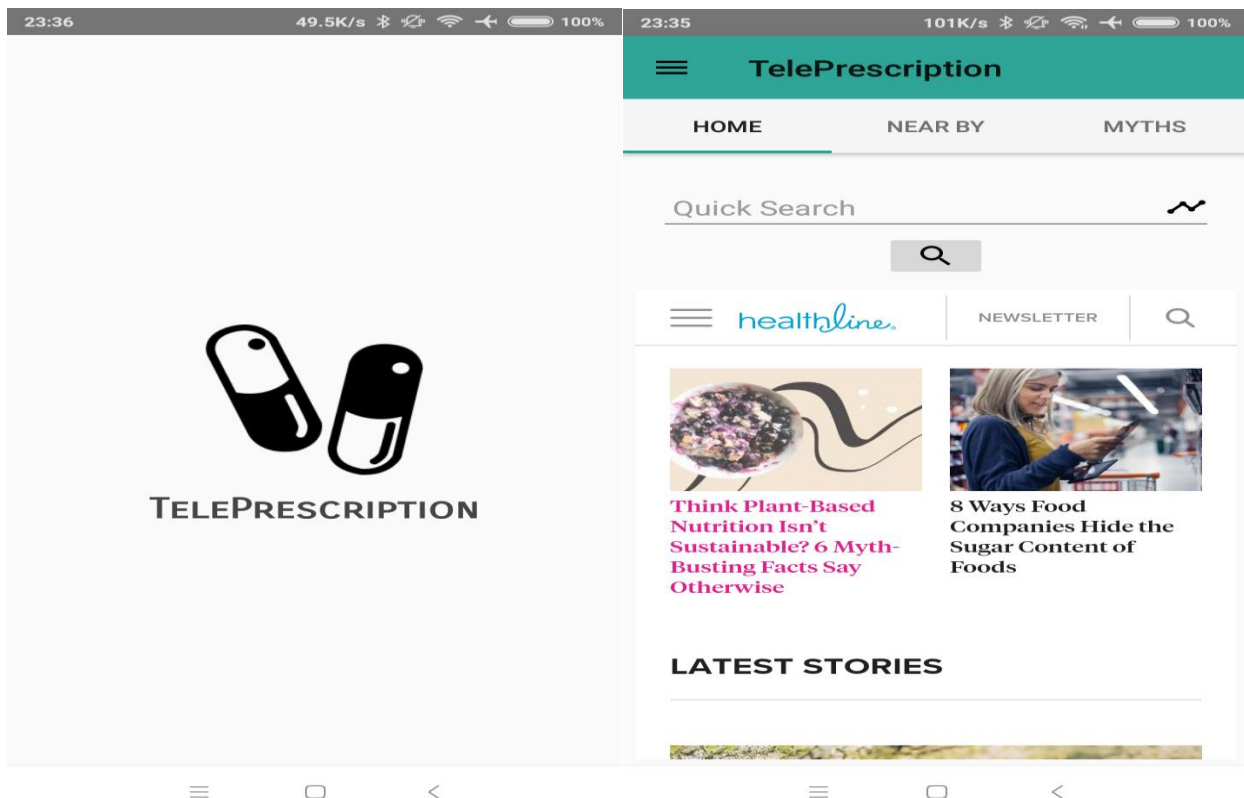


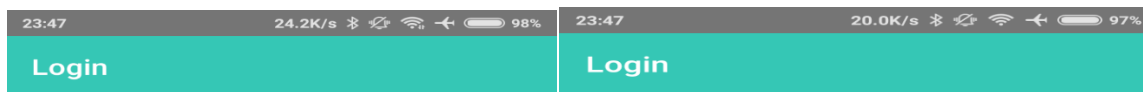
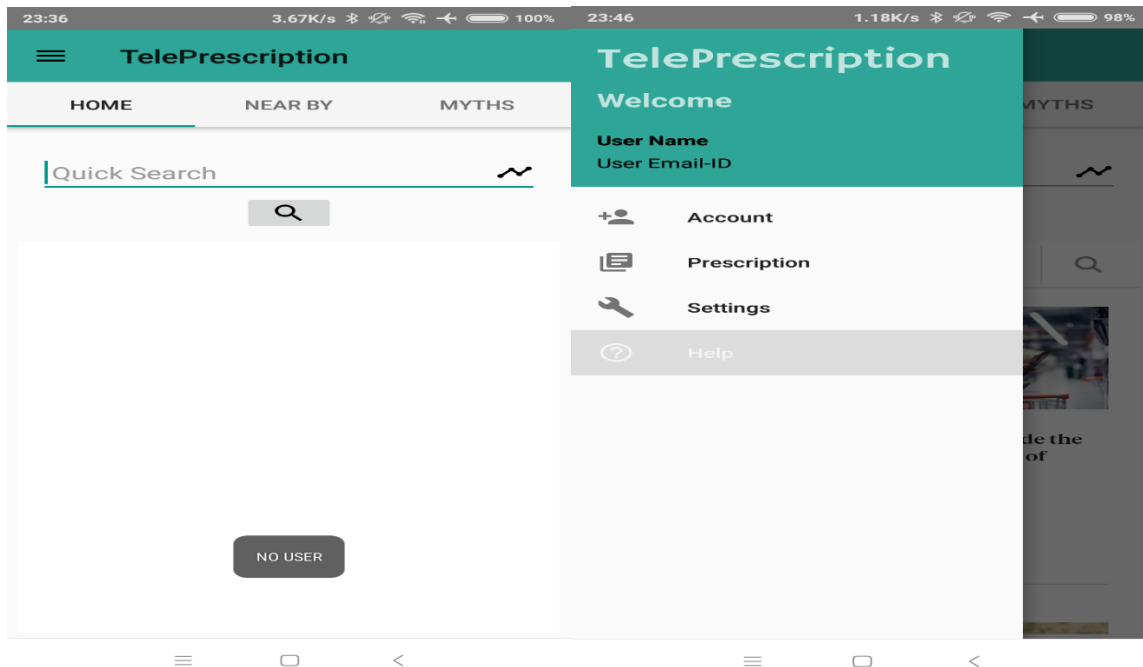


Screenshots of video calling (DEVICE 2)



Screenshots of E-prescription app





Enter Email ID and Password

You are currently Signed Out

Email	Password
<input type="text"/>	<input type="password"/>
<button>SIGN IN</button>	<button>CREATE ACCOUNT</button>

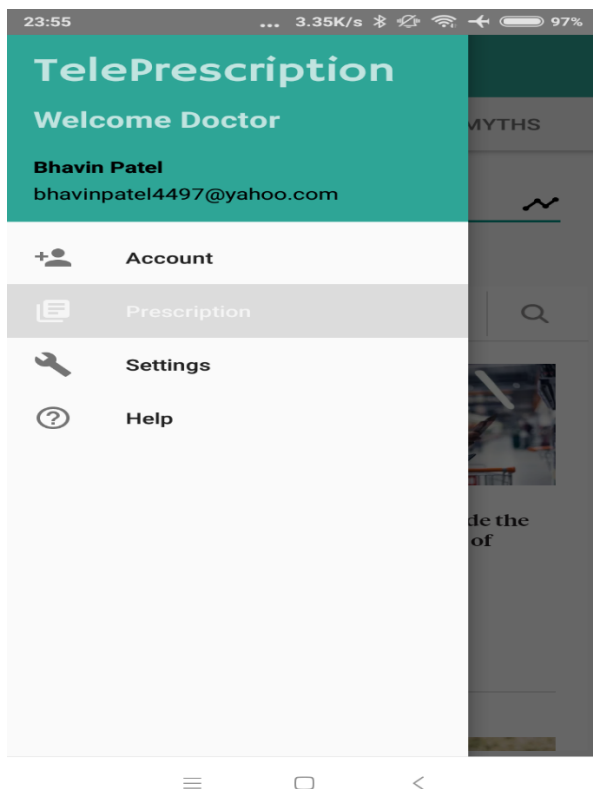
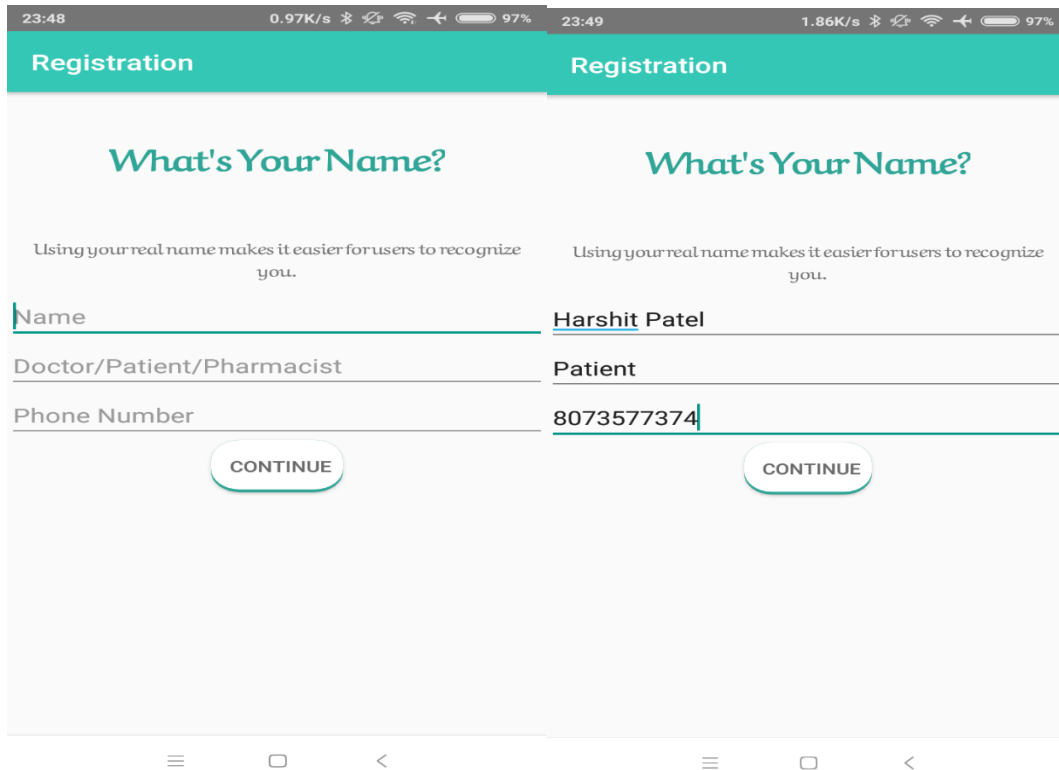


Enter Email ID and Password

You are currently Signed Out

Email	Password
hant64@gmail.com
<input type="text"/>	<input type="password"/>
<button>SIGN IN</button>	<button>CREATE ACCOUNT</button>

Authentication failed.



23:55... 0.22K/s 97%

23:56... 3.41K/s 97%

NEW PRESCRIPTION

Prescription

Phone No:
8073577374

Name:
Harshit Patel

Age:
23

Sex:
☒ Male ☐ Female

Diagnosis:
Viral Fever

ADD MEDICINE

23:56... 0.14K/s 97%

Panadol

SUBMIT

23:58... 0.08K/s 97%

☒ Tablet ☐ Syrup ☐ Cream

Dosage :
20
1
2

No. of times in a day :
2
3
4

Potency : 1

ADD MEDICINE

23:580.11K/s97%23:581.64K/s97%

Celexa

Tablet Panadol
Dosage 1days*3
Potency 1 mg

Tablet Celexa
Dosage 1days*3
Potency 1 mg

SUBMIT

Added Successful

Patient's Name:
Harshit Patel

Patient Phone:
8073577374

Age/Sex:
23/M

Date:
13-04-2019 23:58:19

R/
Tablet Panadol
Dosage 1days*3
Potency 1 mg

Tablet Celexa
Dosage 1days*3
Potency 1 mg

Viral Fever

23:580.04K/s96%0:000.00K/s96%

8073577374

Age/Sex:
23/M

Date:
13-04-2019 23:58:19

R/
Tablet Panadol
Dosage 1days*3
Potency 1 mg

Tablet Celexa
Dosage 1days*3
Potency 1 mg

ViralFever

EDIT PRESCRIPTION

SEND PRESCRIPTION

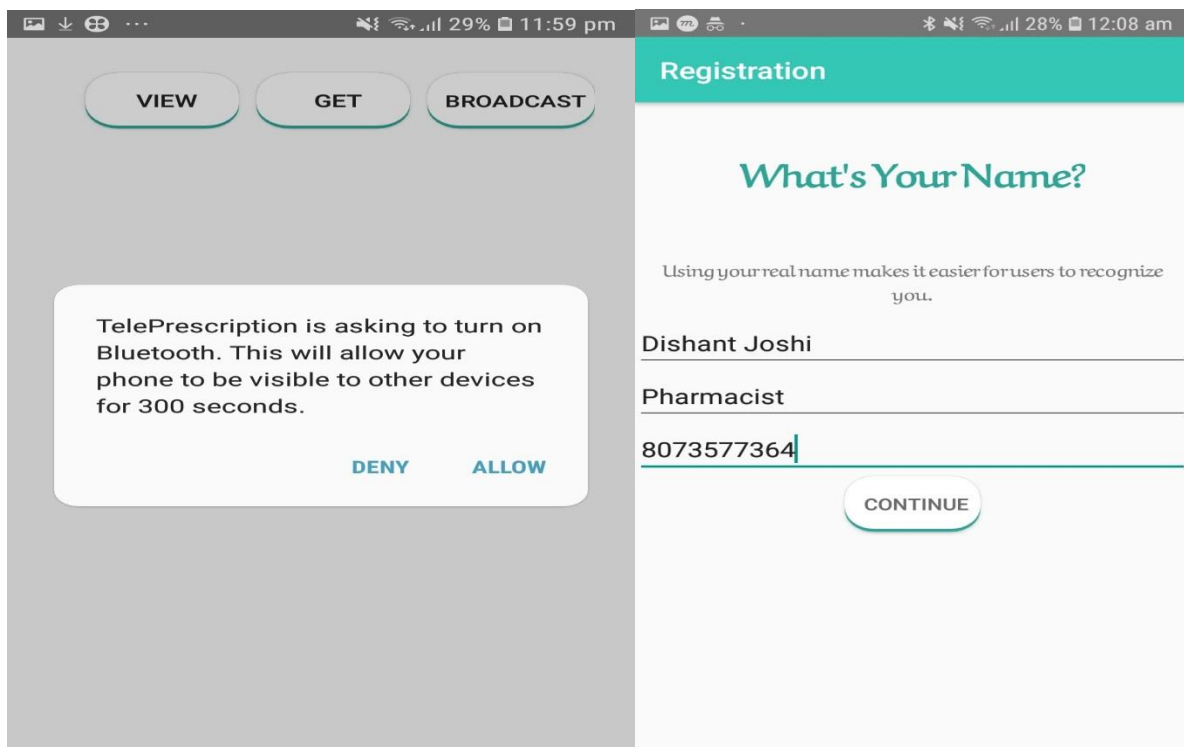
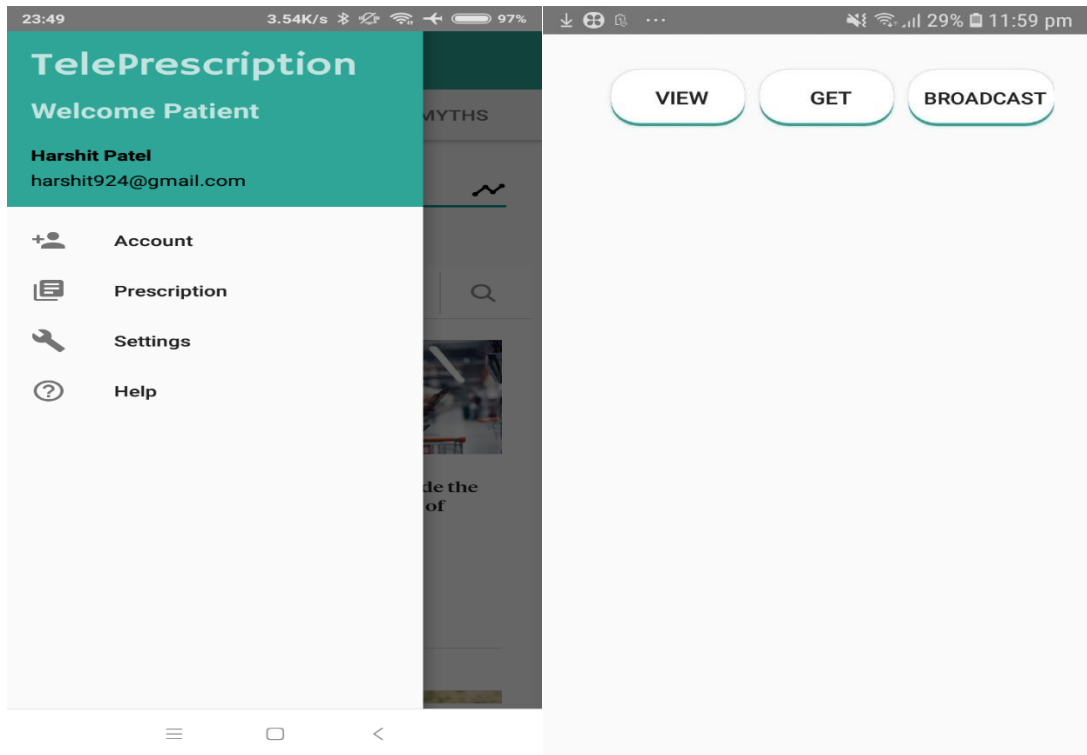
Please select file

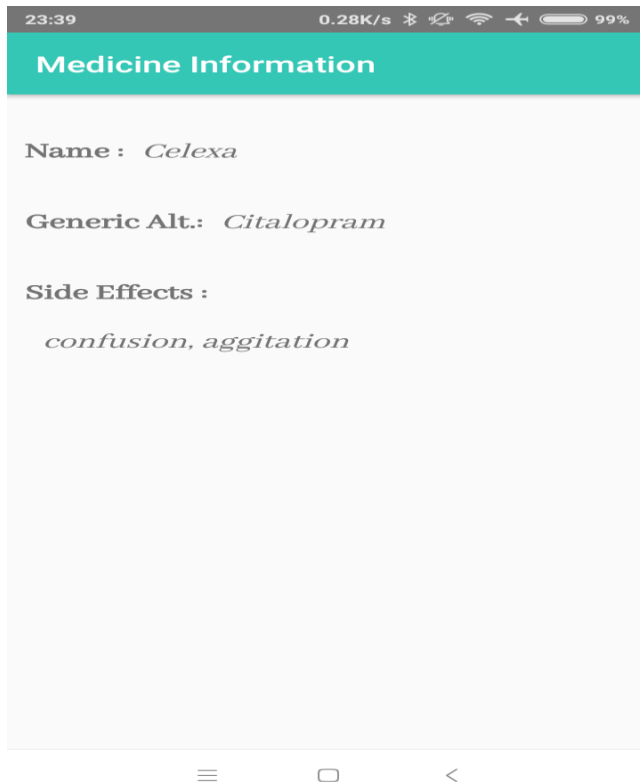
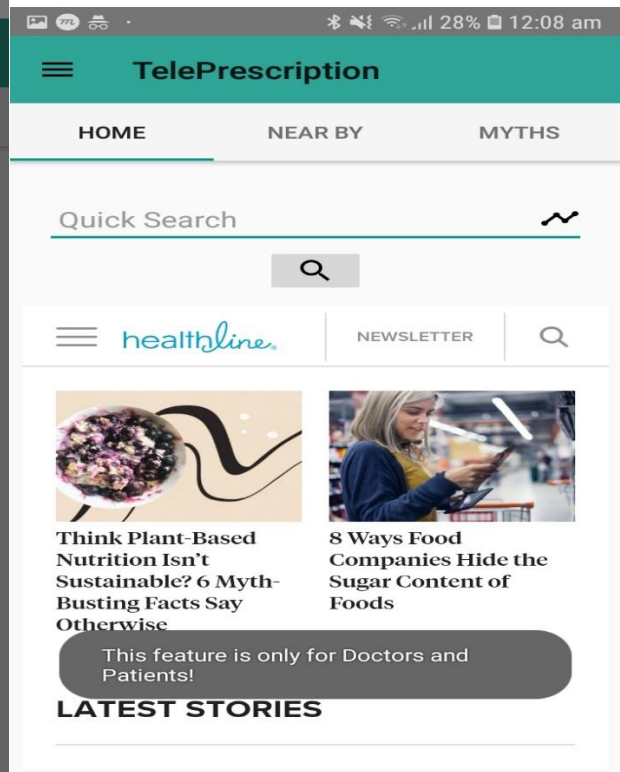
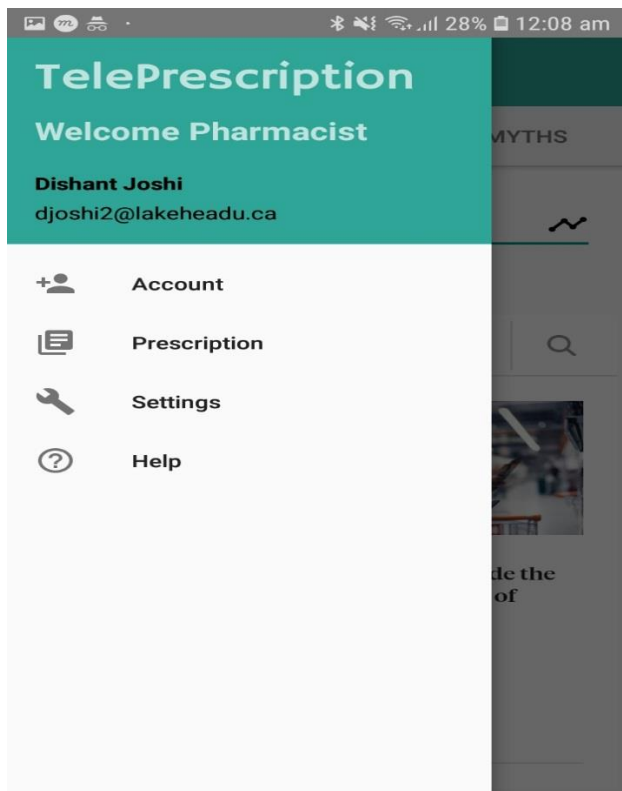
GET FILE FROM DEVICE

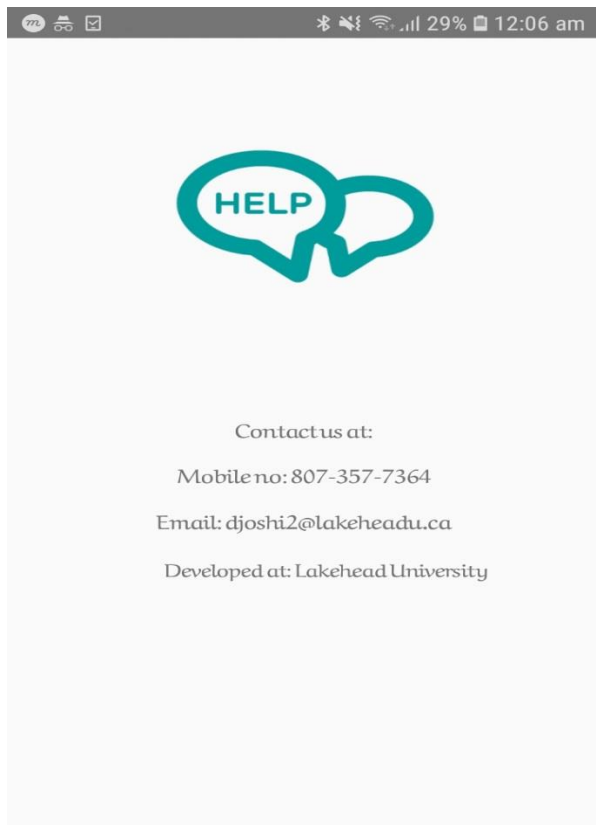
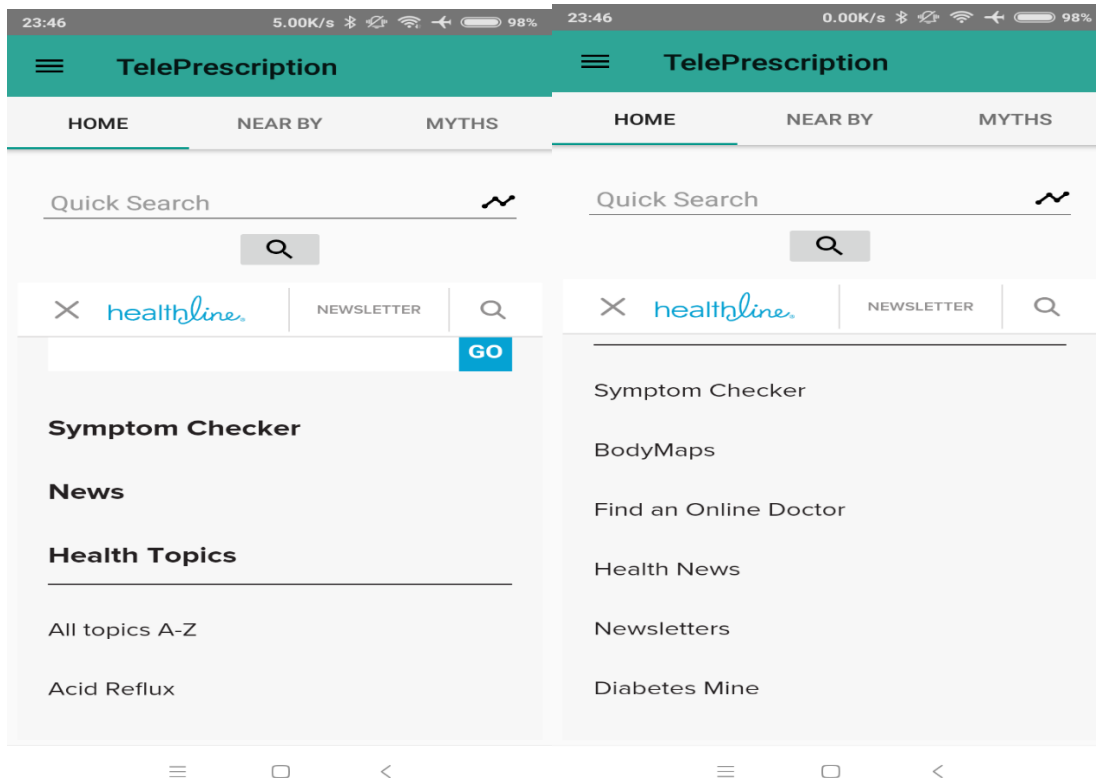
SEND VIA BLUETOOTH

Bluetooth is cancelled

Patient's tab







Testing/technical difficulty and solution

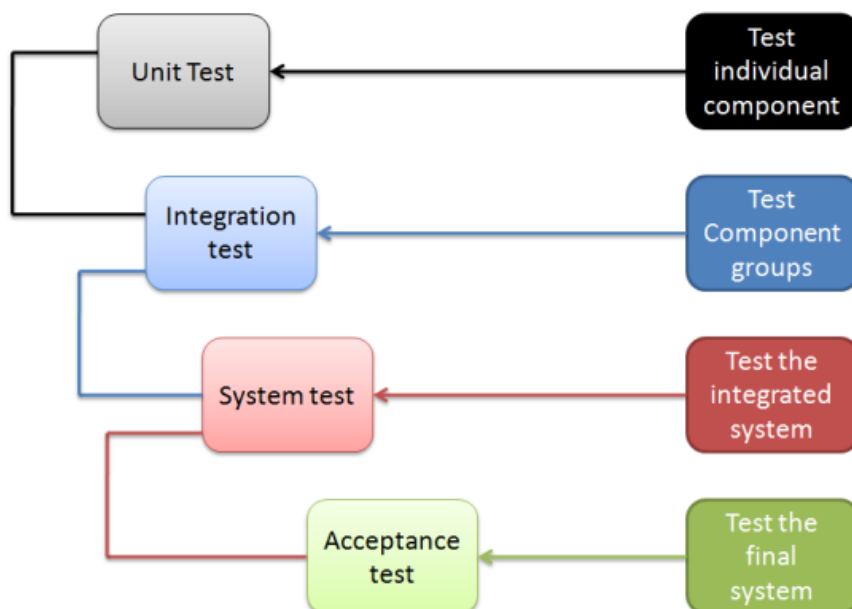
Our main aim is to provide the patients with an easy and user friendly GUI. Keeping in mind patients who will be using it we would provide an interface with simplified and bigger GUI components.

Testing will be performed at various levels to check for system's functionality. For our system we are planning to perform both white box and black box testing. We will be performing unit testing for each individual units in a white box testing fashion. Testing will be conducted using Basis Path testing methods, because of its simplicity and high effectiveness. Loop testing will be conducted to compliment Basis Path testing. Individual component are tested separately. Due to system's modular design, there is no need for test beds.

Further on, Integration Testing will be performed on all the units together in a black box testing fashion. Interface of the modules are tested, the interfaces and the linking of different modules is checked for flaws. Any connections to faulty interface are made.

Functional testing will be done in the black box fashion to check the functionality of the system as a whole. Using different test cases, the logic of the system is checked for flaws.

In the final step system testing will be performed, where in the whole software is checked as a whole to see if user requirements are met



Maintenance:

Maintenance of software product is done to remove any residual errors. Maintenance comprises of a major part in the development of the system. Every system requires periodic maintenance of hardware as well as software. If new information is consistent with the design specification then changes are made. Hardware also needs periodic maintenance for it to be in tune with design specifications. The importance of maintenance is to standardize the new system.

Hardware maintenance:

After every update or changes in the system, the system needs to be tested for hardware maintenance to compare the current performance specification with the new specification. The outcome of this evaluation indicates the difference between expectations and realized results. It also points towards any necessary modifications that may be required.

Software Maintenance:

Software maintenance is concerned with making changes in the software after it has been delivered to the customer. These changes enhance the software functionality and increase the services that the product offers. In this case software maintenance will be initiated when the patients or doctors face a lot of issues while using the application. The system is initiated to spend time in visits, but if the system starts crashing or becomes excessively slow you know it's time for software maintenance.

Roles and contribuion

Student-id	Names	Roles
0879224	Dishant Joshi	Front-end, Content Writer
0892170	Harshit Patel	Back-end, tester
0882186	Bhavin Patel	User-Interface(GUI) developer, Content Writer

Future work

- Now we are sending e-prescription via Bluetooth to the pharmacy or patients but we can enhance that feature or replace it with send via email or application to application.
- We can also give more options to the patient such as patient can set default pharmacy to send and receive prescription by doctor.
- Missing a single dose might not sound so serious but it is. Thus, we can enhance our system that provides users with functionality to set reminders according to doses prescribed by the doctor. This may lower the stress of remembering when to take which medicines.
- We can also send prescription directly to the by default or patient specific pharmacy by using block chain technology.
- We can also give additive function of medical tracker in which patient can track or measure heartbeats.

Conclusion

Nowadays Strengthening the health systems is advanced and demanding. also today e-Health has emerged as a aggressive technology and effective tool to fulfill day-to-day healthcare requirement. In this regard, the pace of victimisation data and information technology in prescription and dispensing medications to enhance the standard, safety, and health care potency has been quickly accelerated in recent years. Therefore, through implementing this project we have come to know that the electronic prescription system in the health care department will not only reduce errors of handwriting but also it will provides a more accurate and understandable prescription for the patient. As our system provide facility for patients to connect and consult with doctor through video calling so it will save time for patients to get prescription. Furthermore, this system allows patients to request a renew of prescription from doctor online so it will save lots of time of visiting the doctor just for a single prescription. So in nutshell we can say that e-prescribing has the potential to increase patient safety and efficiency of care. Moreover e-prescription allows prescriber to prescribe cost effectively and safely as convenient way to send prescriptions and it will likely continue to grow in the future as well.

Project Repository Link

<https://github.com/Hpatel6/HealthInformaticsProject>

References

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- <https://link.springer.com/article/10.1007/s11606-010-1253-9>
- <https://academic.oup.com/jamia/article/19/3/353/2909138>
- <https://creately.com/diagram/example/i0bk2qgt/E-Prescription%20Use%20Case>
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- https://surescripts.com/docs/default-source/education-and-training/e-prescribing_guide_surescripts.pdf
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