Chapter 2

Literature Survey

Huge amount of literature exists on processing of medical data.There are many ways through which health care solutions can be provided to the people. We have studied and listed few papers over the same issue, as follows:

1. Mobile Health Application in Indonesia: Most Indonesians do not have an easy access to Healthcare facilities. A survey from 2011 stated that 94.1 % of Indonesian households were located more than 5 kilometers away from the nearest healthcare centres. These drew them significant amount for travelling all the way to these healthcare centres that delayed their healthcare services. This sort of reciprocal action needed satisfactory concord between the requesting and consulting physicians who were responsible for making a decision to give appropriate analysis to the patients. By adopting these applications, doctors could have information about the patient's health such as clinical locations, doctor tutorial,etc. Doctors always wanted to ask about supplementary information such as videos, tutorial and tips. They also scheduled appointments for patients planning their health care.[1]

2. Web application for Health Semantics : In this system, the server database held the patient healthcare record which was used for reference purpose.The system was made to analyze the health related information of the patient stored in their records in order to convey basic medicines to the patient on time. Home monitoring programs helped in reducing travelling costs and high cost of hospital centre visits for patients in remote areas. Results determined that the proposed real time system's medical data was transmitted with a high accuracy. This accelerated individual and the whole population with good health outcomes, bolstered up patient care and strongly growing clinician-patient relationship.[2]

3.**E-Health Web Application for Patient Management** : The main objective of this project is to develop and implement an application that will facilitate real-time management of long illnesses, reactions or side effects to prescribed medication, update patients on scheduled doctor patient appointments and make prescription reminders, provide survey data for medical research and also access diagnosis from a physician and general medical assistance using a combination of a web services speech recognition, IVR (Interactive voice response) and SMS. The application will be hosted by Medical service providers and patients will be able to access medical services through their mobile phones and web browsers. The requirements definitions were done through review of existing technologies, interactions with medical service providers and patients and personal experiences as well. The application is supported by MySQL Database and web services. [3]

4.An Intelligent Decision support system for M-Health application: The Idea of the Decision support system presented in this paper[4] has been broadly recognized in healthcare sector. It is an arduous task to develop a decision support system that can be used for detecting almost all major types of diseases, this system aims to develop a system that is capable of detecting any type of disease. In this research paper, they have proposed a decision support system that can detect some of the major types of cardiac diseases. This system is basically a software designed to directly help in making health related decisions in which attributes or traits of individual patients are processed for the purpose of generating patient's distinct detailed reports that are then conferred to clinicians for examination.

Chapter 3

Problem Statement

We Indians love to consult another doctor for a second opinion. However, We have challenges of providing health care services to the people, delivering medical services and monitoring patients for progress and real-time data collection for research and development.There is a great need to deploy technologies like web applications in the health sector that will provide patients with real-time management of illnesses, schedule doctor patient appointments and make prescription orders[9]. Currently patients have some problem like for example pain in their legs, it can be due to muscle pain, but there can be a possibility that it is due to malaria or maybe even arthritis. This can be one of the reasons the patient does not recognize his health issue and can't visit a proper doctor and rather visits a general physician. Even after he recognizes the issue and decides to visit the right doctor, he still has a problem of getting rush in the clinics and wait for long queues to get over. The problem also lies in availability of the doctor at that instance of time and also the high consultation fees charged by the doctors. We propose a website that integrates all of these facilities into one single website and instead of providing users with online drug ordering we collaborate local chemist stores for faster and quick deliveries.

Chapter 4

System Requirements

4.1. Introduction.

4.1.1 Purpose.

The purpose of the document is to collect and analyze all assorted ideas that have come up to define the system, its requirements with respect to patients. Also, we shall predict and sort out how we hope this document will be used in order to gain a better understanding of the project. Aim of this software specification requirements document is to provide a complete description of all of the features that are planned to implement to system and define the expectations from the ASK-US-HEALTH project. It also describes how the system operates and how users interact with the application. Project members will utilize this software specification requirements document to define test scenarios according to the mentioned requirements. Besides project manager and quality manager can use this SRS document for reviewing purposes.

4.1.2 Scope of the Project.

The ASK-US-HEALTH Project is an Web technology as well as data mining research based application which includes user interaction. The project will provide communication environment for users (Patient and Doctors). Every user has their own profiles and the Doctors as well as the patients can have access with given logins to the system. The patients can enter their symptoms and the system will provide them with a list of probable diseases.They will also be provided with a list of nearby chemist shops as well as relevant Doctors and few tips and tricks to maintain a healthy lifestyle.

4.1.3 Intended Audience.

Project team members, patients and Doctors.

4.2. Overall Description.

The remaining sections of this document provide a general description, including characteristics of the users of this project, the product's software, and the functional and data requirements of the product.Although we will not describe every requirement in detail, this section will describe the factors that affect the final product.The system shall display the FAQ's upon request.

4.2.1 Product Perspective.

ASK-US-HEALTH system will be independent and self-contained. The constraints which describe how the software operates are listed below:

4.2.2 Product Functions.

All the use cases are explained below:

- **Patient Registration:** The System will ask the patients to register first by providing their personal credentials in order to create a login id.The system shall allow user to create profile and set his credential.The system shall authenticate user credentials to view the profile.
- **Doctor Registration:** Doctors will be asked to login into the system by registering with their details and uploading a photocopy of their medical degree certificate.
- **Admin Login:** The admin will have his own id and password to login into the system.
- **Chemist Login :** The chemists will be asked to register with us.They will have their own unique id and password.
- **View Results:** A textual representation of the list of probable diseases in relation to the target class,that is,the symptoms of the patients.

4.2.3 User Classes and Characteristics.

All the patients can login into the system by using their own login id and password. They can enter their symptoms and the system will display a list of most possible diseases using the learning pneumatic algorithm. We intend to provide accurate results for the users which will be helpful for further diagnosis.

4. 3 Operating Environment.

4.3.1 Design and Implementation Constraints.

The basic constraint of ASK-US-health system is to keep the data of the patient confidential to the System and Doctors only. Also, the maintenance of the patients medical prescriptions are to be considered. In addition to these, since the user information is stored in a database and this database can be hacked and user information will be no longer private to the user. An Internet connection is must for the web application to operate. To sum up, Ask-us-Health system has constraints in terms of regulatory, reliability, safety and security but these constraints can be manageable.

4.3.2 Assumptions and Dependencies.

User interface and some functionality can change during the development process of project. And also new functionalities can be added which is able to change the dependent system requirements.

4.4. External Interfaces Requirements

4.4.1 User Interfaces.

Ask-us-health is a web application where the admin will operate the system.The Doctors and the patients will use the services provided by the system.The login page will appear first where the user will get authenticated.Thereafter the patients will be asked to enter the symptoms into a textbox and the appropriate result will be displayed on the screen.Old users can also view their previous medical history.

4.4.2 Hardware Interfaces.

Ask-us-Health System is a web application which can run on any browser, however an internet connection is a must.

4.4.3 Software Interfaces:

Data will be stored in csv files from which data will be retrieved. Algorithm will be trained at the backend and results will be shown to the users. Software technologies like Html,CSS and Bootstrap is used for front end, Laravel PHP framework for backend and MySQL for database.

4.5. System Features.

4.5.1 Patient Login

4.5.1.1 Description.

The patient will be provided with a login form where they will be asked to register if they are first time users.Once registered they will have their own username and password.They can access their account/profile thereafter.

4.5.1.2 Validity Checks

- Input field is Patient username,which is mandatory.
- If this field is missing, he/she can't login and a warning message will appear.

4.5.1.3 Stimulus or response sequence

- The user (Patient/Doctor/Admin) opens the application.
- User presses the sign in button.
- User enters his/her login credentials.

4.5.2 Doctor Registration

4.5.2.1 Description.

A registration form will be provided for the Doctors to enter their credentials and upload a photocopy of their medical degree certificate.

4.5.2.2 Validity Checks

- User forgets to fill personal credentials input field.
- User forgets to upload a photocopy of his/her medical degree certificate.
- The related warning message is shown to the user to fill the input fields properly.

4.5.3 Admin Login

4.5.3.1 Description.

The admin is the one who has the entire control over the system.He/She will have his/her own login id and password to get into the system.

4.5.3.2 Validity Checks.

- If the Admin enters a wrong username or password.

4.5.4 Chemist Login

4.5.4.1 Description

Each chemist will have their own login to have a peek into the system.They can view the record of the orders they have received by the patients.

4.5.4.2 Validity Checks

- If the chemist enters a wrong username or password.

4.5.5 View Results

4.5.5.1 Description.

A textual representation of the list of probable diseases of the patient in accordance to the symptoms is shown.

4.6. Other Non-Functional Requirements.

4.6.1 Performance Requirements.

Good response time and Good Accuracy.

4.6.2 Safety Requirements.

A database is used for maintaining the database and the application server takes care of the application. In case of failure, re-initialization of the program will be done.

4.6.3 Security Requirements.

Sensitive data will be encrypted before being sent over insecure connections like the internet.

4.6.4 Software Quality Attributes.

Availability:

The system should be available at all times. In case of a hardware failure or database corruption, backup of the database should be retrieved from the server and saved by the admin.

Chapter 5

Project Design

5.1 Project Model

The following design outline displays the workflow of the system. It describes how the user is guided while using the system.
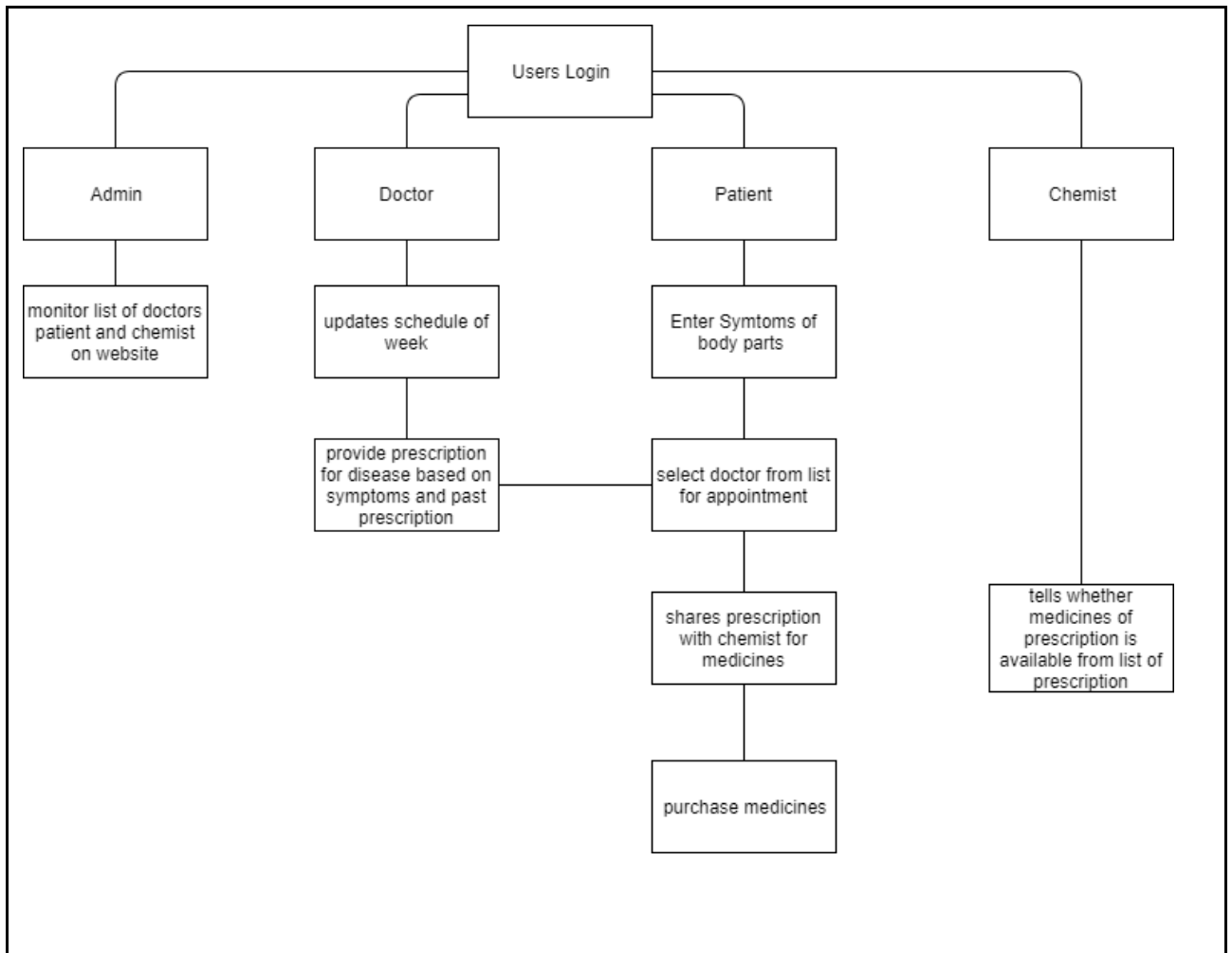
Figure 5.1   Project Model

5.2 Use Case Diagram

              A use case diagram at its simplest is a representation of a user's interaction (Surgeon) with the system and depicting the specifications of a use case.

- In the system, actors are Doctors, Patient, Chemist and Admin.
- System will take inputs from the Patients in the form of symptoms..
- Patients can view the outcome of the system in the form of probable list of diseases.
- The Patients can contact the nearby list of chemist shops provided to them.
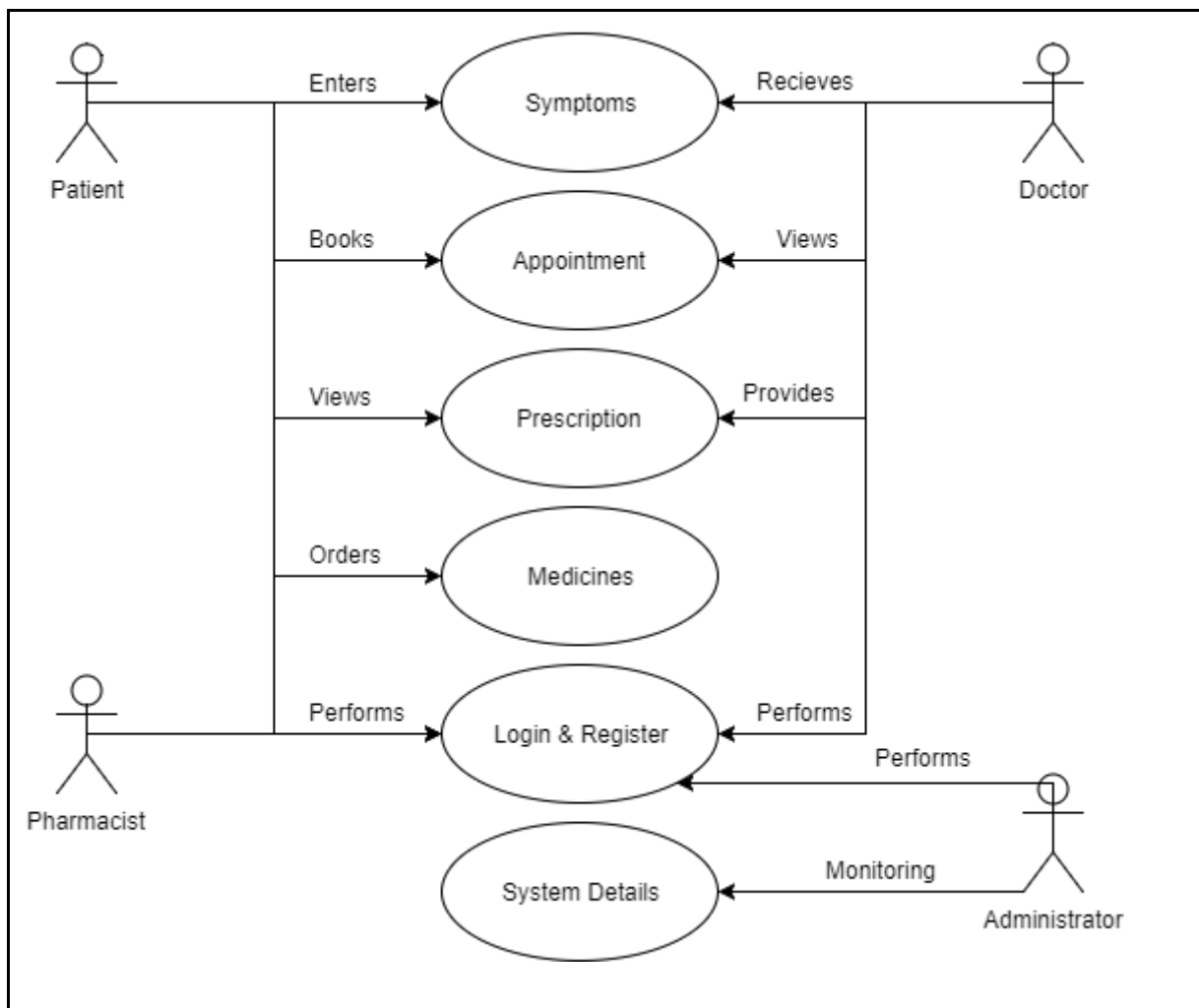
Figure 5.2 Use Case Diagram

5.3 Activity Diagram

Activity Diagrams are used to illustrates dynamic view of the application. It shows the flow from one activity to another activity within application. An activity shows the set of activities, the sequential or branching flow from one activity and object that act and are acted upon.
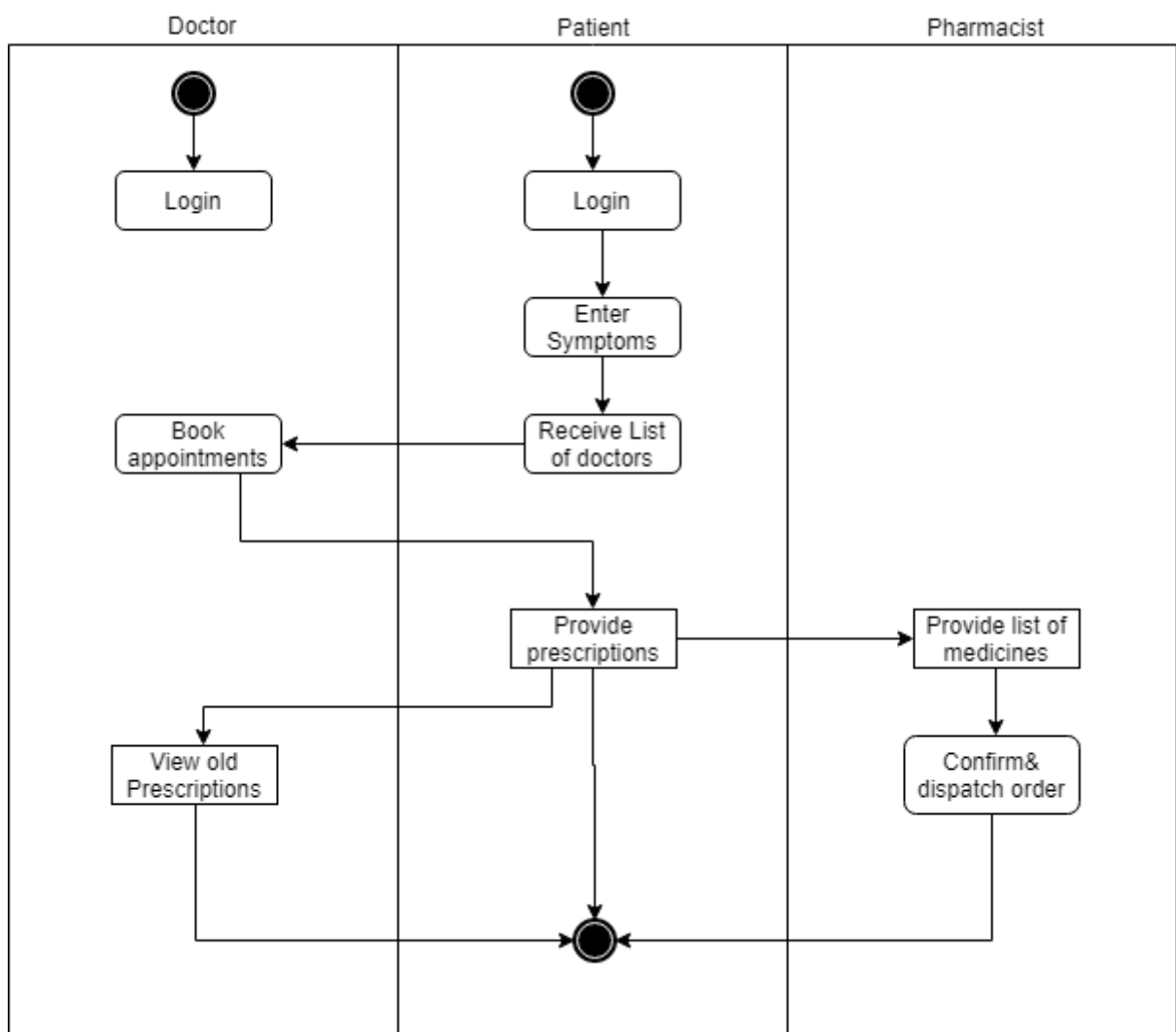
Figure 5.3 Activity Diagram

Chapter 6

Implementation Details

6.1 Learning Pneumatic Algorithm

 In this section we present the proposed novel Learning Pneumatic algorithm which works as per explained in the previous sections, by taking the inputs from the patients in the form of symptoms and displaying the output to them in the form of list of most probable diseases and connecting them with the specialists concerned.

Learning Pneumatic Algorithm

1. Accept the list of symptoms provided by the user

2. For each symptom

    a. Find the list of disease associated with the symptoms

       i. For each disease check

       ii. Whether that disease exist in an array

       iii. If it does not exist create its key and assign the value as 1

    b. Else increase key value by 1

3. Sort the above array based on value.

4. If a batch of disease has the same number of match_count then sort them based on total number of symptoms matched.

5. For each diseases, compute weight of all associated symptoms that are provided by the user and store in Key-Value pairs.

6. Sort the above pairs in descending order based on value.

The next proposed novel algorithm deals with the inputs received from the doctor's side in the form of accepting that the disease predicted by our system is correct and we thereby increase the weightage of those symptoms in order to give better user experience to the next users using our system.
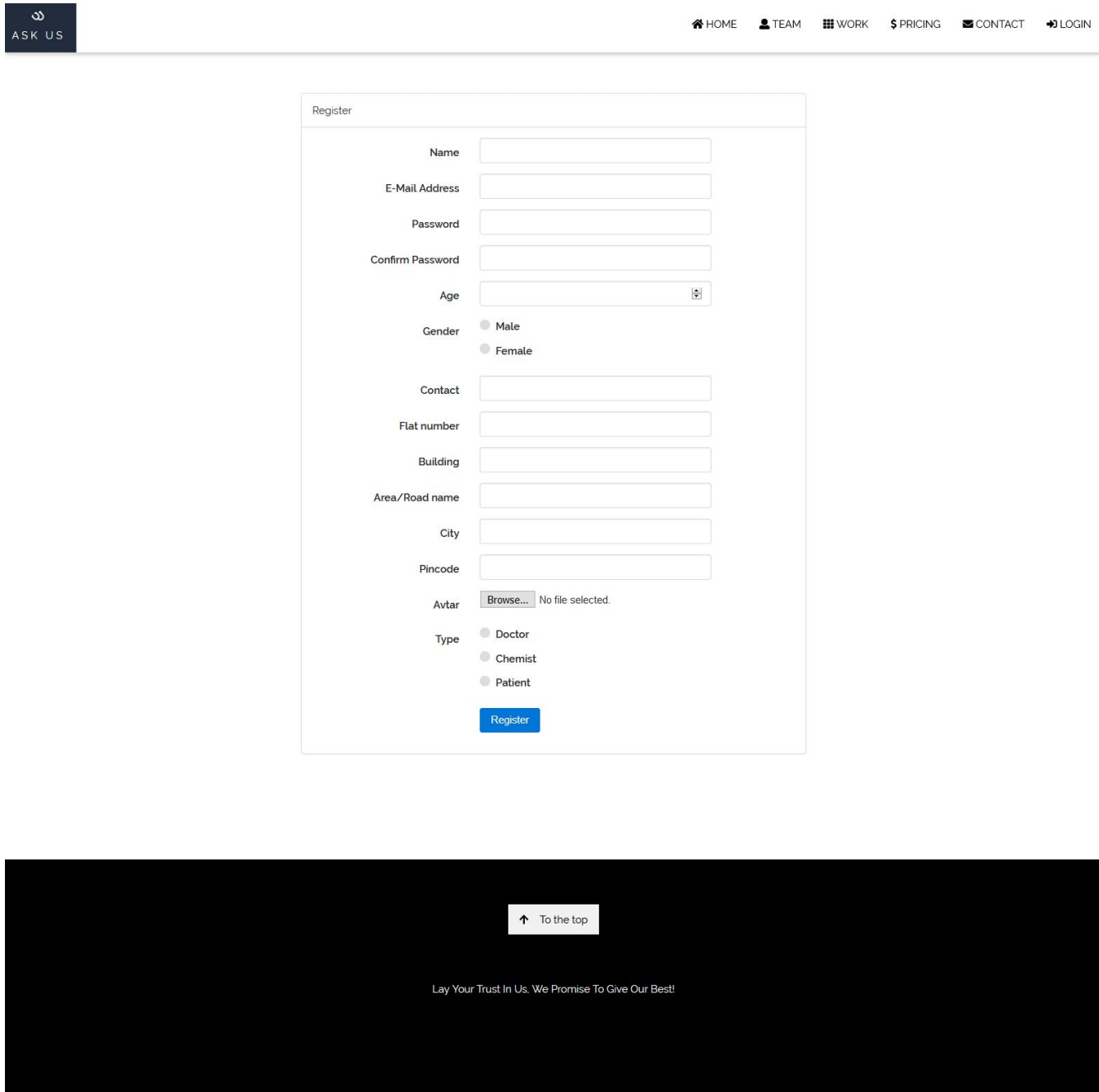
Doctor Input Phase

Doctor will be provided with an option to review the disease predicted by our System.

1. If disease predicted by our system is verified by

the doctor

    a. Increase weight of the user provided symptoms that are associated with that

       disease by '0.1'.

2. If disease predicted by our system is incorrect the doctor provides the correct disease name

    a. If disease exist in database, for each symptoms

        i. If symptom is associated with that disease

            1. Increase weight of that symptom by '0.1'.

        ii. Else if symptom is not associated with the disease

            1. Create relation of that symptom with that disease and body

              parts provided by doctor for that symptom.

    b. Else enter the disease in database and enter all the corresponding symptoms

       with the respective body part.

6.2 Screenshots of the working project

1. Patient Registration Page: The Patients need to provide their personal details to register themselves into the system, they need to provide their unique username and password in order to get an entry in to the system. The password for every patient is distinct.

Figure 6.1 Patient Registration Page

2. Symptom checker page: It allows the patients to choose a specific body part and then they can select the symptoms they are experiencing, from the list of symptoms, provided specifically to the chosen body part.

Figure 6.2 Symptom Checker page

3. Disease output page: This will display the list of probable diseases the patients could be suffering from on the basis of the symptoms entered into the system by them.
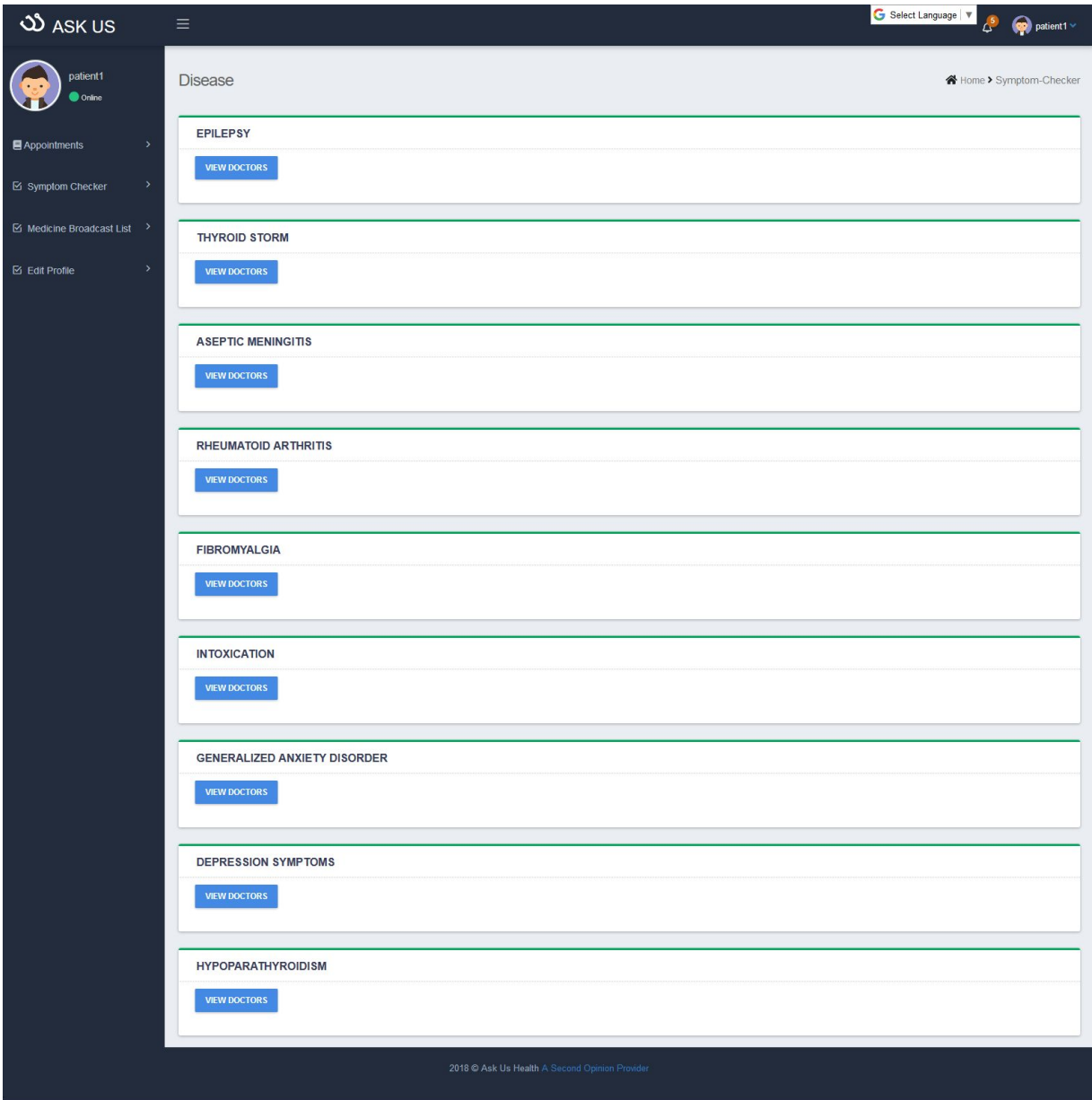
Figure 6.3 Disease output page

4. View list of Doctor's page: On selecting a specific disease, this page will display a list of specialized doctors suited for treating it.
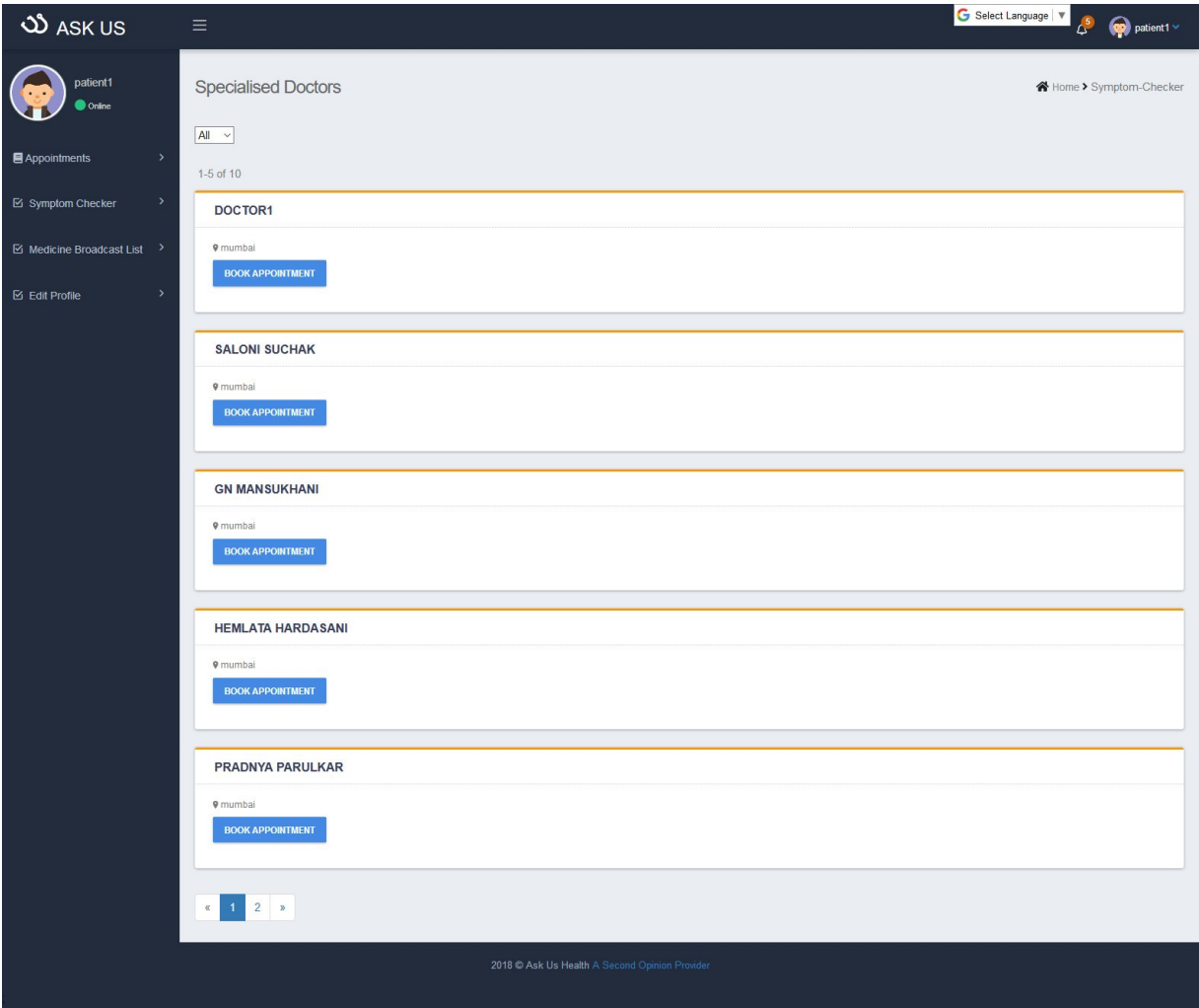
Figure 6.4 View list of Doctor's page

5. Appointment booking page: This page allows the patients to book an appointment with a doctor of their choice for the treatment of a particular disease.
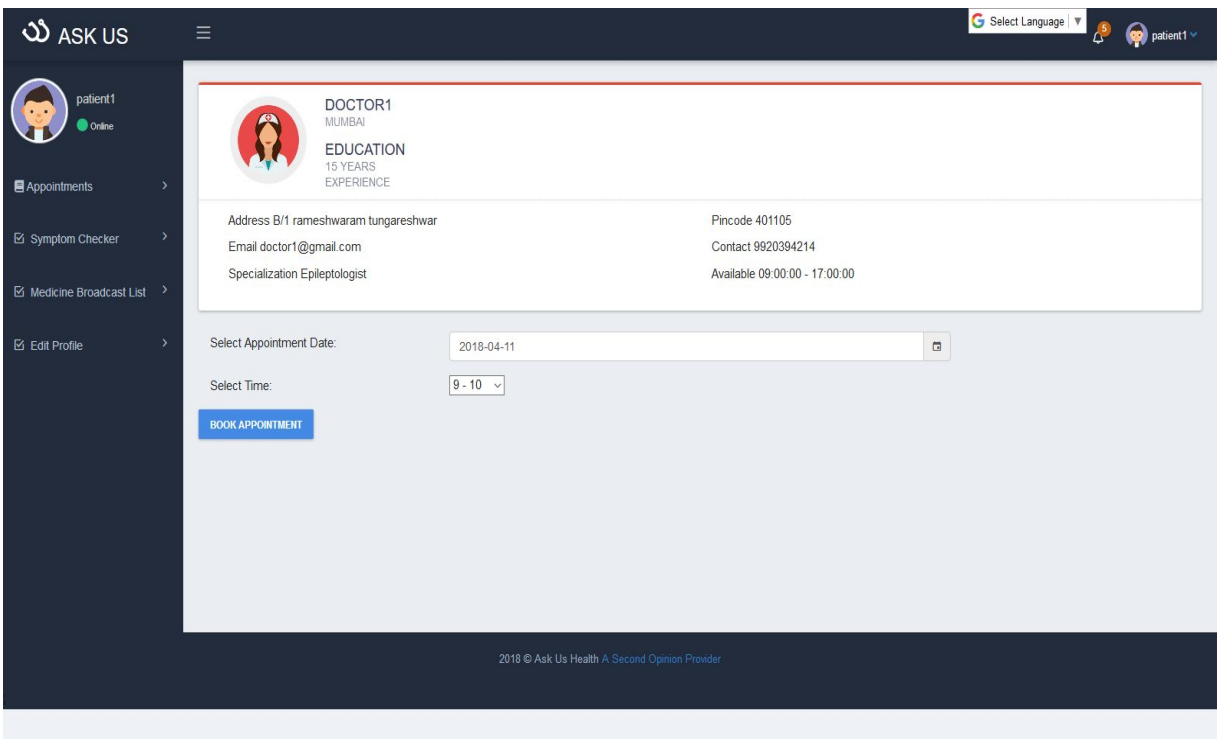
Figure 6.5 Appointment booking page

6. Doctor Registration Page: The Doctor needs to provide their personal details including their medical degree bearing certificate for authenticity to register themselves successfully into the system. They need to provide unique username and password in order to get an entry in to the system. The password for every doctor is distinct.

Figure 6.6 Doctor Registration Page

7. View booked appointment page: This page allows to doctor to view all the appointment bookings meant for him with the patient's name.
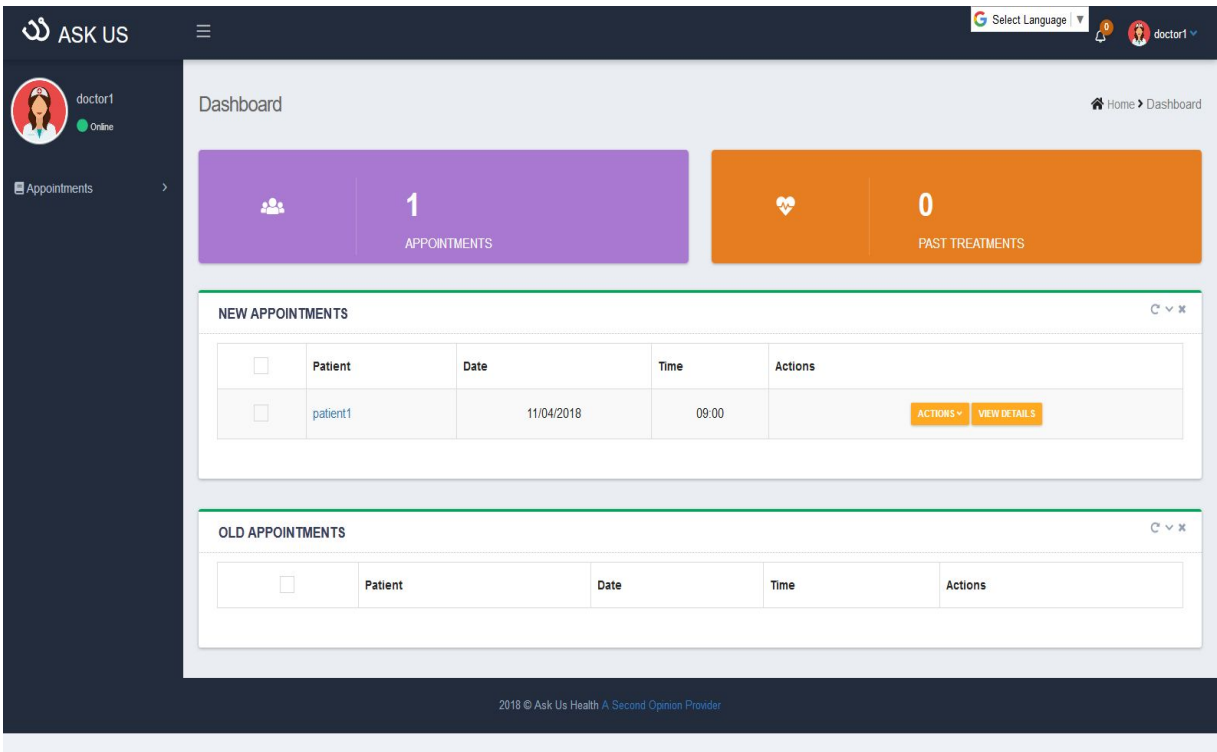

Figure 6.7 View booked appointment page

8. Prescribe medicine page: This page gives the doctor the privilege to prescribe medicines to his/her patients online.

Figure 6.8 Prescribe medicine page

9. Disease correction page : This page allows doctors to add more relevant symptoms to the list of symptoms entered by patient related to their disease. It also allows doctors to verify whether the disease predicted by our system was right or wrong.

Figure 6.9 Disease correction page

10. Chemist registration page: The chemist needs to provide their personal details and registration number of certified chemist for authenticity. They need to provide unique username and password in order to get an entry in to the system. The password for every chemist is distinct.

Figure 6.10 Chemist registration page

11. Confirm medicine order page: This page displays the orders the chemists receive by the patients, the other pending orders as well as shows the confirmation of the order they accept.
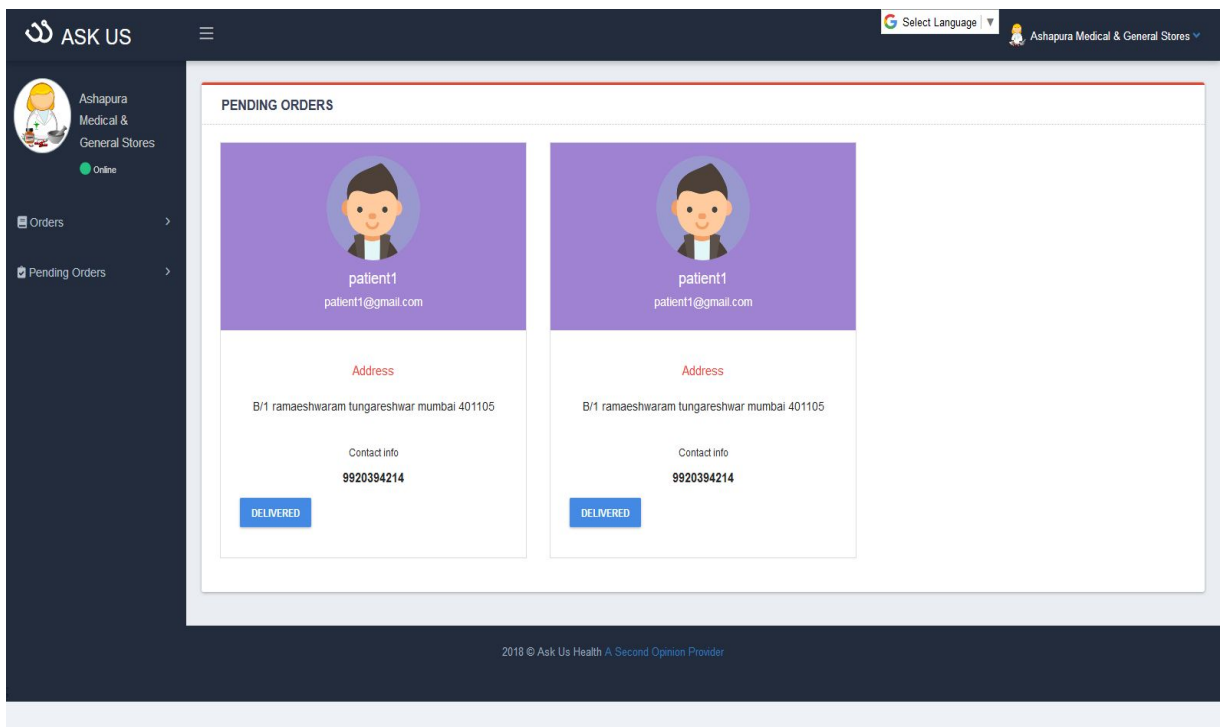
Figure 6.11 Confirm medicine order page

12. ASK-US-HEALTH Android Application View : We have developed an Android application of the system too. This is how the Android application of ASK-US-HEALTH looks like on a smart phone[6].
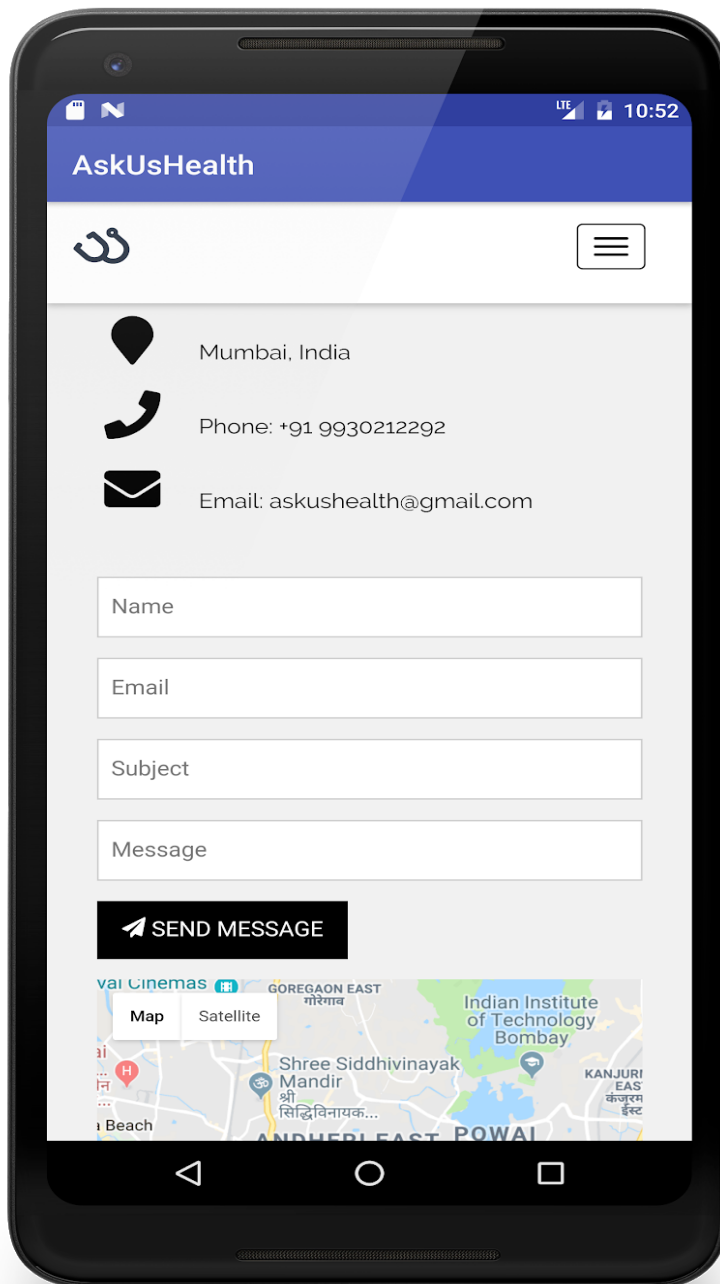
Figure 6.12 ASK-US-HEALTH Android Application View

Chapter 7

Testing

7.1 Testing on Integrated Project

Table 7.1 Test Cases

Test Case ID	Test Case	Input	Expected Output	Actual Output	Result
T01	Patient Login	username = patient1@gmail.com password = patient1123	Go to next Page	Display patient's homepage	Pass
T02	Patient Login	username = patient1@gmail.com password = patient9876	Wrong password	These credentials do not match our record.	Pass
T03	Doctor Login	username = doctor1@gmail.com password =doctor1123	Go to next Page	Display doctor's homepage	Pass
T04	Doctor Login	username = doctor1@gmail.com password = 672doc	Wrong password	These credentials do not match our record.	Pass
T05	Chemist Login	username=ashapura@gmail.com password =chemist123	Go to next Page	Display chemist's homepage	Pass

T06	Chemist Login	username = ashapura@gmail.com password = chem5478	Wrong password	These credentials do not match our record.	Pass
T07	Patient enters the symptoms	Select specific body part and related symptoms	List of diseases	List of probable diseases on the basis of selected symptoms	Pass
T08	View related specialized doctors	Select a disease out of the list of diseases	Doctors list	List of doctors who treat that disease	Pass
T09	Select chemists to order medicines	User Location	List of nearby chemists	Displays list of nearby chemists	Pass
T10	Doctor prescribes medicines	list of medicines	Displays that medicine list to patients	Can successfully prescribe medicines online and can be viewed by patients on their homepage	Pass
T11	View appointments	Doctor needs to login with his username and password	Displays all appointme-ts on doctor's homepage	Displays all appointments on doctor's homepage	Pass

T12	Patient books more than one appointment with another doctor	Patient logins with his username and password and uses the symptom checker	Cannot book another appointme-nt	Displays list of doctors but cannot book an appointment if already has an appointment booked with another doctor as he cannot undergo two diagnosis simultaneous ly	Pass
T13	Chemist accepts and delivers orders	Chemist needs to login using his username and password and view the orders received.	Accept and deliver the order at the user location	Delivers the medicines at user specified location	Pass

Chapter 8

Result and Analysis

The proposed algorithm named as 'Learning Pneumatic Algorithm' works by taking the inputs from the patients in the form of symptoms and displaying the output to them in the form of list of most probable diseases and connecting them with the specialists concerned. Not only that, here the doctor acts as a teacher and provides inputs to the system. The algorithm iteratively makes predictions on the training data and is corrected by the teacher.

Another algorithm that we use is the 'Doctor Input Phase' which deals with the inputs received from the doctor's side in the form of accepting that the disease predicted by our system is correct and we thereby increase the weightage of those symptoms in order to give better user experience to the next users using our system.

Chapter 9

Conclusions and Future Scope

The numerous advantages of the Internet, such as easy accessibility and mutual communication, made it a new and free source of disseminating health information, moving toward an information revolution.Meanwhile, due to the accessibility to this ubiquitous medium, lay patients can complement the information obtained from physicians and easily learn what they need to know about prevention, diagnosis and treatment of diseases.

Here, in our system, the Patients can login into the system with their respective login id and password and view their account.The database will store all the previous medical prescriptions of the patients.On entering their symptoms, the system will display the possible disease that the patients could be suffering from.On the basis of the diseases, the specialized doctor in that field will be provided to the patient.They can book an appointment with them if they wish to.After the doctor prescribing the medicines, the patients can ask for the medicines from the chemists.

The main outcome of this project is that the patients can benefit from the doctors and chemists via an easy portal without much difficulty.Not only that, they can also get a rough idea about the problem they could be suffering from. The proposed developed system can be utilised by doctors, patients, pharmacies, Healthcare Mobile Applications [7], police, ambulances, etc which will help to save the life of an individual and also help them to connect with the needful services on time.

Initial experimental results are highly encouraging. In future,the proposed system can be integrated with ambulances, smart wearable devices [8], hospitals,etc for delivering highest level of user satisfaction.

References

[1] Overview The Development Of Telehealth and Mobile Health Application In Indonesia. Budi Wiweko, Aulia Zesario 2,Prince Gusti Agung 2 . Department of Obstetrics and Gynecology,Faculty of Medicine Universitas Indonesia, Indonesian Reproductive Medicine (INA REPROMED)2,Jakarta, Indonesia, 2016.

[2] Telehealth System For Home Environment Suganya M, Jayanthy S.2016 International Conference on Emerging Technological Trends [ICETT], 2016.

[3] An e-Health Tele-Media Application for Patient Management.Collins MWESIGWA , Ntinda, Kampala, 256, Uganda, IST-Africa 2013 Conference Proceedings,Paul Cunningham and Miriam, Cunningham IIMC International Information Management Corporation, 2013.

[4] An Intelligent Decision Support System for Enhancing an M-Health Application. Maneesha V Ramesh, Anu T. A., Hemalatha Thirugnanam Amrita Centre for Wireless Networks and Applications Amrita Vishwa Vidyapeetham, Amritapuri Kerala,India, 2012.

[5]The Internet of Things for Health Care: A Comprehensive Survey. S.M.Riazul Islam,Daehan Kwak, MD.Humaun Kabir, Mahmud Hossain,Kyung-Sup Kwak, 2015.

[6] [The Role of Mobile Technologies in Health Care Processes: The Case of Cancer Supportive Care. Greta Nasi, Maria Cucciniello and Claudia Guerrazzi,2015.

[7]Advances in Smartphone-Based Point-of-Care Diagnostics. Xiayu Xu, Altug Akay, Huilin Wei, ShuQi Wang, Belinda Pingguan-Murphy, Björn-Erik Erlandsson, XiuJun Li, WonGu Lee, Jie Hu, Lin Wang, Feng Xu, 2015.

[8]From Wearable Sensors to Smart Implants-–Toward Pervasive and Personalized Healthcare. Javier Andreu Perez,Daniel R. Leff,H. M. D. Ip Imperial College London,2015.

[9]Current and Future Challenges in Point-of-Care Technologies: A Paradigm-Shift in Affordable Global Healthcare With Personalized and Preventive Medicine.Atam P. Dhawan, William J. Heetderks, Misha Pavel, Metin Akay, Anurag Mairal, Soumyadipta Acharya, Bruce Wheeler, Clifford C. Dacso, T. Sunder, Nigel Lovell, Martin Gerber, Milind Shah, S. G. Senthilvel, May D. Wang, Balram Bhargava, 2015.

Publications

[1] Siddhi Udani, Ishank Kankaria, Shivam Jaiswal, Pruthav Joshi, "A SYSTEM FOR COMPLETE HEALTHCARE MANAGEMENT: ASK-USHEALTH (A second opinion provider using Learning Pneumatic algorithm and Data mining)" March 2018, International Research Journal of Engineering and Technology (IRJET).