Medicard: Transforming Healthcare in Every Direction

Submitted in partial fulfillment of the requirements
of the degree of

BACHELOR OF ENGINEERING

In

COMPUTER ENGINEERING

By

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CERTIFICATE

This is to certify that the project entitled **"Medicard: Transforming Healthcare in Every Direction"** is a bonafide work of

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Examiners

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Declaration

We declare that this written submission represents my ideas in my own words and where others 'ideas or words have been included, we have adequately cited and referenced the sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be because of disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

Every year, nearly 5 million deaths occur in India due to medical negligence, which includes errors like not receiving proper treatments in time or lack of information about the patient's medical history. For instance, if a person allergic to anaesthesia is involved in a life threatening accident, he might lose his life if the doctors fail to realise his allergy. But, if he has his MediCard on him, the doctors can access his medical history via the card or and prevent his death. This project aims to minimise such medical errors and in turn prevent these mortalities by generating a unique identity medical card that can be accessed by their unique 16-digit identification number and thereby making their medical history accessible in a dire situation. MediCard will provide the user with not only a physical card containing medical details, but also a digital access to the records through a portal. This portal will contain user’s relevant medical information like basic patient details, medical history and documents that may be life-saving in certain situations. In addition to these functionalities, the MediCard portal will allow the user to have access to a disease prediction chatbot.

TABLE OF CONTENTS

List of Figures

Chapter 1

Introduction

1.1 Introduction

In India, there has always been a dearth of technology aiding medical science. There are various incidents where people lose their lives or do not get proper resources for their medical needs. Additionally, India has a manual paper based record maintenance of medical history of all the citizens. A lack of digital revolution in this field has led to a hard copy based physical files record keeping. Additionally, there is no facility for a doctor to view his previous diagnosis for a patient. Whenever a patient visits a doctor, the doctor needs to diagnose the patient and provide a proper medicine for his illness. Now, there might be situations wherein a doctor might want to check the previous medication provided to the patient when he/she was suffering from the same illness in the past. To achieve this, doctors maintain a log book or a register and manually write their important observations. Again, this is inefficient as it requires you to physically write down everything and maintain the records properly and also it leads to wastage of paper.These are the major setbacks in the medical field in India and it needs to be changed for the well-being of the masses. On the same line of thoughts, the proposed system addresses these problems by aiding medical science by using concepts of databases, machine learning & data analytics. Additionally, if a disease prediction system can be made for patients it will save a lot of time. Generally, the patient is confused as a large amount of medical information on different mediums are available. The idea behind this system is to adapt to cope with the special requirements of the health domain related with users.

1.2 Aim & Objectives

This project aims to minimise medical errors and in turn mitigate mortalities by generating a unique identity medical card that can be accessed by their unique 16-digit identification number and thereby making their medical history accessible in a dire situation. To register for MediCard, the user will have to input all his medical details after which, each user will be assigned a 16-digit unique identification number which will be the key for the user's medical information (i.e. basic details, medical history etc.). On completion of the registration process, the user will be able to access his medical records via an app or website using his 16 digit unique pin. In addition to digital access, the user will also be provided with a physical card. The records will be stored in our online repository and will be maintained using database technologies. The user will be able to log into the portal where he can view his/her medical history and access a disease prediction chatbot. The user will be able to access a chatbot for all his medical queries and will be provided with all the necessary precautions he/she needs to undertake based on his/her symptoms.

1.3 Scope

The scope of this project is to provide a framework to the user which includes such features that are much required for him/her to seamlessly deliver his past medical history to concerned doctors along with some additional features. The set of features provided will be:

1. Generate a physical card with a unique 16-digit code.
2. Search doctors by various filters.
3. Chatbot for disease prediction.
4. Platform where users can maintain past medical history and reports.

The future scope of this project includes the addition of more features to make things much more convenient for the user. The features that can be added is analysis of users' medical information. Another feature that can be added is based on the analysis, the system can predict the prognosis or can suggest the doctor specialized in a particular field.

Chapter 2

Review of Literature

2.1 Domain Explanation

2.1.1 Web Development

A) MERN Stack:

MERN Stack is a Javascript Stack that is used for easier and faster deployment of full-stack web applications. MERN Stack comprises 4 technologies namely: MongoDB, Express, React and Node.js. It is designed to make the development process smoother and easier. Each of these 4 powerful technologies provides an end-to-end framework for the developers to work in and each of these technologies play a big part in the development of web applications.

1) **React: Front-End Library**
   React is a JavaScript library that is used for building user interfaces. React is used for the development of single-page applications and mobile applications because of its ability to handle rapidly changing data. React allows users to code in JavasScript and create UI components.

2) **Node.js: JS Runtime Environment**
   Node.js provides a JavaScript Environment which allows the user to run their code on the server (outside the browser). Node pack manager i.e. npm allows the user to choose from thousands of free packages (node modules) to download.

3) **Express: Back-End Framework:**
   Express is a Node.js framework. Rather than writing the code using Node.js and creating loads of Node modules, Express makes it simpler and easier to write the back-end code. Express helps in designing great web applications and APIs. Express supports many middlewares which makes the code shorter and easier to write.

4) MongoDB: Cross-platform Document-Oriented Database

MongoDB is a NoSQL database where each record is a document consisting of key-value pairs that are similar to JSON (JavaScript Object Notation) objects. MongoDB is flexible and allows its users to create schema, databases, tables, etc. Documents that are identifiable by a primary key make up the basic unit of MongoDB. Once MongoDB is installed, users can make use of the Mongo shell as well. Mongo shell provides a JavaScript interface through which the users can interact and carry out operations (eg: querying, updating records, deleting records).

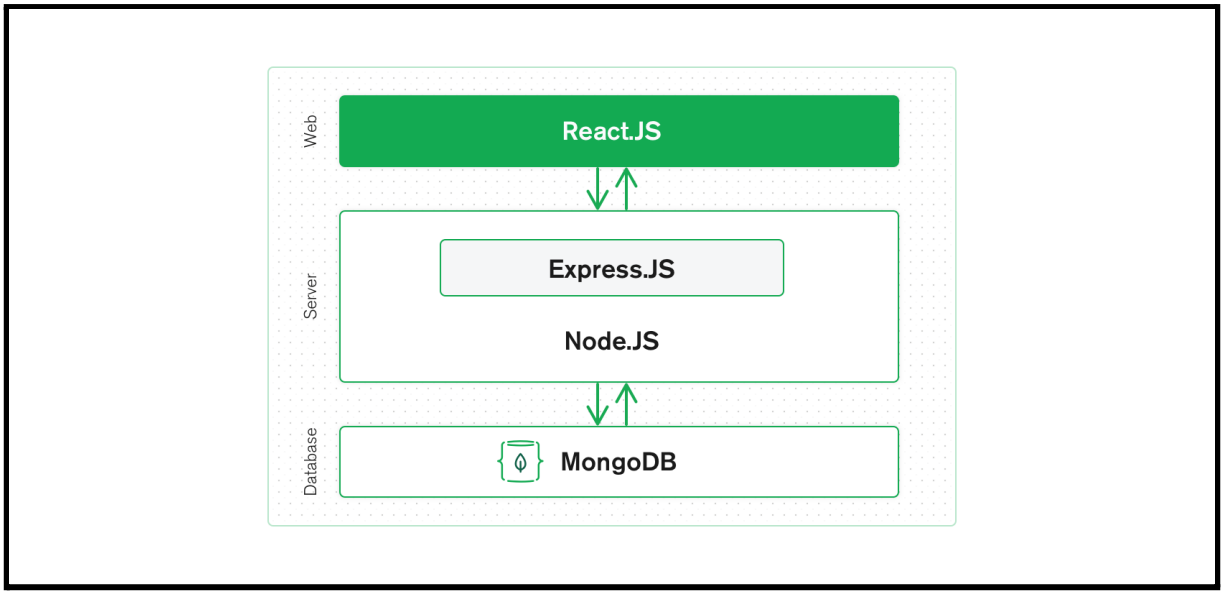

Fig 2.1 Block Diagram of MERN Stack

B) Flask:

Flask is a web application framework written in Python. It was developed by Armin Ronacher, who led a team of international Python enthusiasts called Poocco. Flask is based on the Werkzeg WSGI toolkit and the Jinja2 template engine.Both are Pocco projects. Unlike the Django framework, Flask is very Pythonic. It's easy to get started with Flask, because it doesn't have a huge learning curve. On top of that it's very explicit, which increases readability. To create the "Hello World" app, you only need a few lines of code.

This is a boilerplate code example.

```
from flask import Flask
app = Flask(__name__)

@app.route('/')
def hello_world():
    return 'Hello World!'

if __name__ == '__main__':
    app.run()
```

Fig 2.2 Flask sample code

2.1.2 Machine Learning

Machine Learning plays a significant role among the areas of Artificial Intelligence (AI). During recent years, Machine Learning (ML) has been attracting many researchers, and it has been successfully applied in many fields such as medical, education, forecasting etc., Right now, the diagnosis of diseases is mostly from expert's decision. Diagnosis is a major task in clinical science as it is crucial in determining if a patient is having the disease or not. This in turn decides the suitable path of treatment for disease diagnosis. Applying machine learning techniques for disease diagnosis using intelligent algorithms has been a hot research area of computer science. This project throws a light on the comprehensive survey on the machine learning applications in the medical disease prognosis during the past decades.

2.1.2.1 Decision Tree algorithm

Decision Tree algorithm belongs to the family of supervised learning algorithms. Unlike other supervised learning algorithms, the decision tree algorithm can be used for solving regression and classification problems too.The goal of using a Decision Tree is to create a training model that can use to predict the class or value of the target variable by learning simple decision rules inferred from prior data(training data).

In Decision Trees, for predicting a class label for a record we start from the **root** of the tree. We compare the values of the root attribute with the record's attribute. On the basis of comparison, we follow the branch corresponding to that value and jump to the next node.

Types of Decision Trees:

Types of decision trees are based on the type of target variable we have. It can be of two types:

1. **Categorical Variable Decision Tree:** Decision Tree which has a categorical target variable then it is called a Categorical variable decision tree.
2. **Continuous Variable Decision Tree:** Decision Tree has a continuous target variable then it is called Continuous Variable Decision Tree.

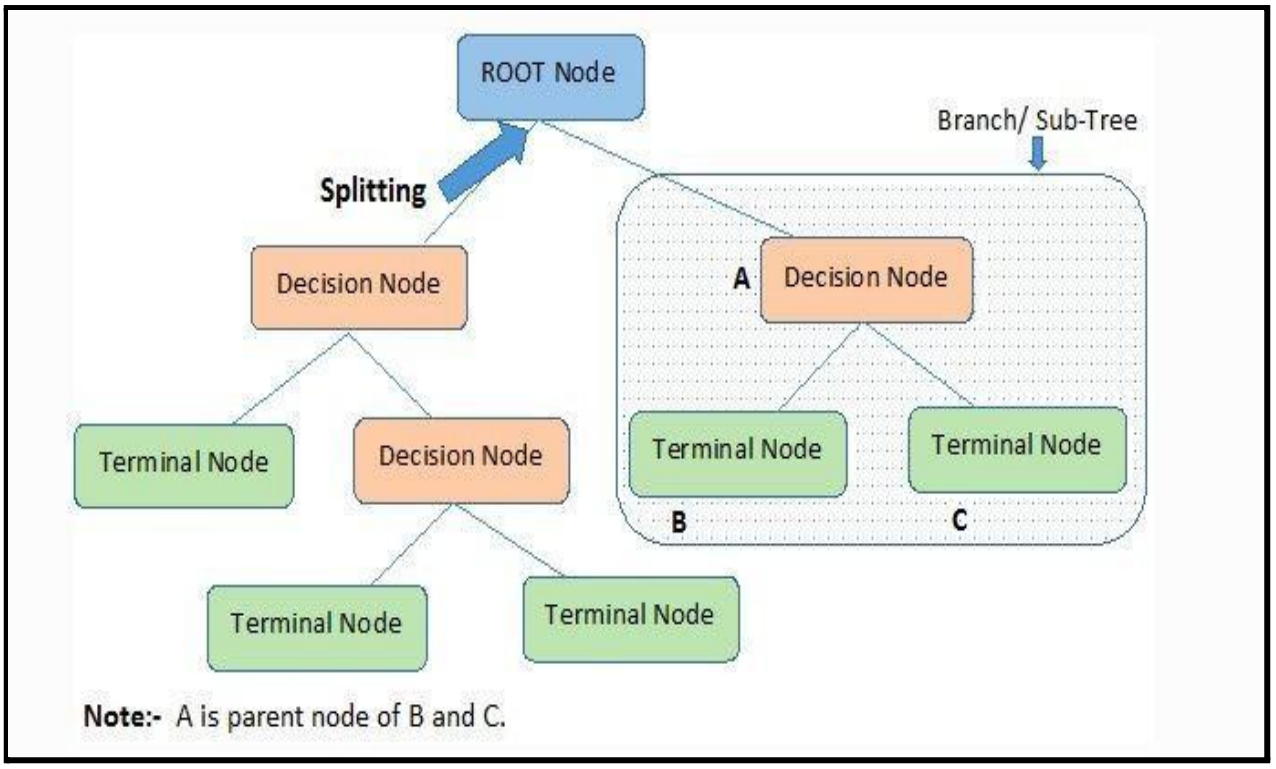

Fig 2.3. Decision Tree Architecture

2.1.2.2 Support Vector Machine algorithm

Support vector machines (SVMs) are a set of supervised learning methods used for classification, regression and outliers detection.

The advantages of support vector machines are:

- Effective in high dimensional spaces.
- Still effective in cases where the number of dimensions is greater than the number of samples.
- Uses a subset of training points in the decision function (called support vectors), so it is also memory efficient.
- Versatile: different Kernel functions can be specified for the decision function. Common kernels are provided, but it is also possible to specify custom kernels.

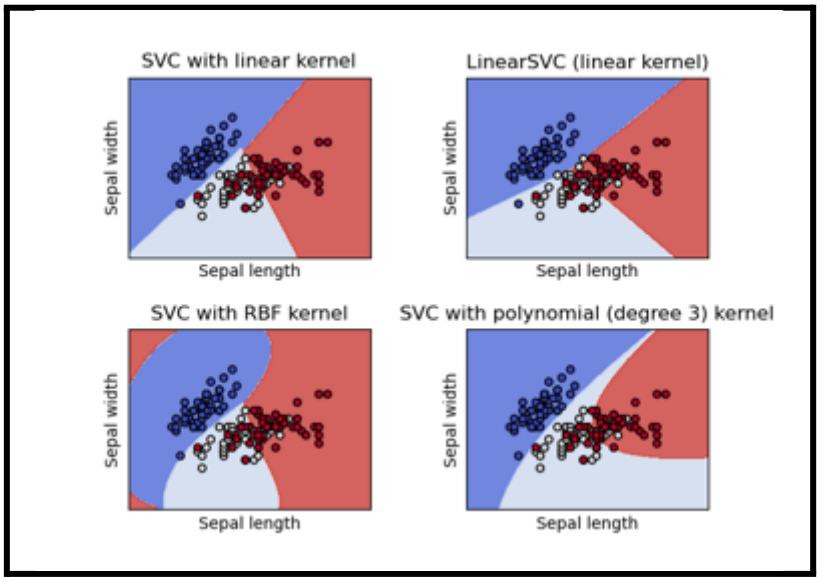

Fig 2.4 SVC Classifier

2.2 Existing Solution

In the previous system, medical records of all Indian citizens dispersed at various sites like dispensaries and hospitals were made available onto the doctor's terminal at a given point of time. The primary goal of the existing system was to provide digital records and amalgamate the records at one site whenever a patient visits a doctor. In addition to this, our system will provide additional features such as disease prediction with the help of a chatbot and we are also aiming to include statistical analysis of a patient's medical report.

2.3 H/W and S/W Requirements

In our project we are using multiple hardware and software components. All those components are mentioned below:

The hardware requirements of the system are:

- Physical card
- Desktop/Phone

The software requirements of the system are:

- Internet
- Google Maps
- Web Browser

Chapter 3

Analysis

3.1 Functional Requirement

- **Business requirements**:

  Consistency in the Training Data, Accurate Predictions, Compatibility.

- **Administrative functions**:

  Disease Prediction, Maintaining user credentials and medical reports, Filter doctor.

- **User requirements**:

  Uploading data, Location services.

- **System requirements**:

  Web Browser, Internet.

3.2 Non-Functional Requirements

- **Usability**:

  Web servers and API

- **Reliability / Availability**:

  Easily available and reliable , user friendly

- **Scalability**:

  Restricted to pred-defined instructions, Need regular up-gradation of software

- **Performance**:

  Low latency system, handles many HTTP requests per second

- **Security**:

  Secured data using various encryption algorithms

3.3 Proposed System

In the proposed system, the entire medical record of all Indian citizens registered through the portal will be made available. The system revolves around an entity-physical card which provides a unique identification of every citizen. Using this entity, medical records can be analyzed and used for better medical diagnosis and assessment. The primary goal of the proposed system is to provide digital records, help patients identify a disease by inputting symptoms he/she is facing using the chatbot and amalgamate the records at one site whenever a patient visits a doctor. In addition to this, search for a doctor based on specialization and degree.

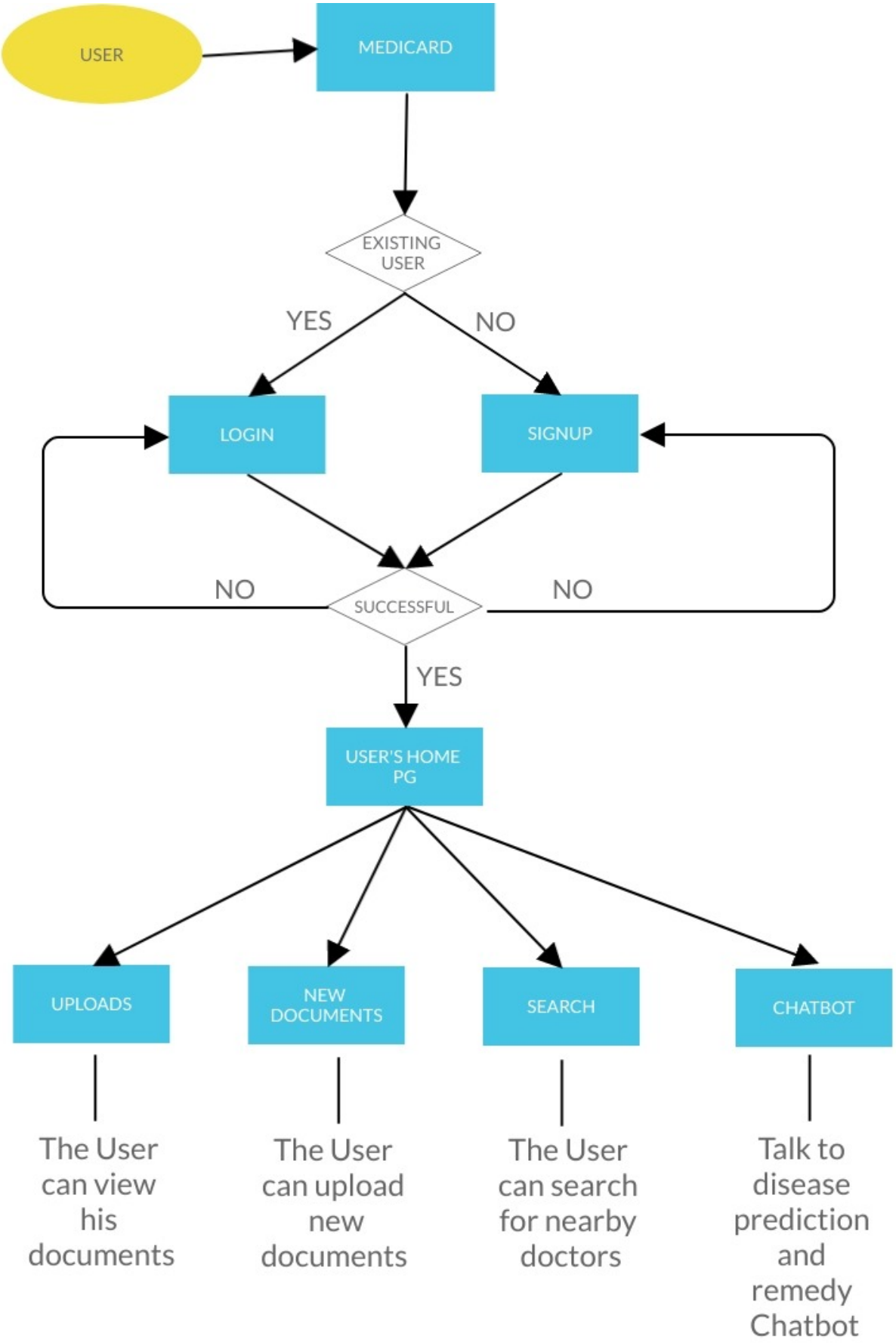

Fig 3.1 Architecture Diagram

Chapter 4

Design

4.1 Design Consideration

For Designing our Software Model, we have incorporated MVC Design Architecture to plan our application and how the interaction between different models and routes occurs.

In order to make our application reachable from different front-end views (Mobile and PCs) and enable cross-platform features, we have considered building our backend server as a **RESTful API.**

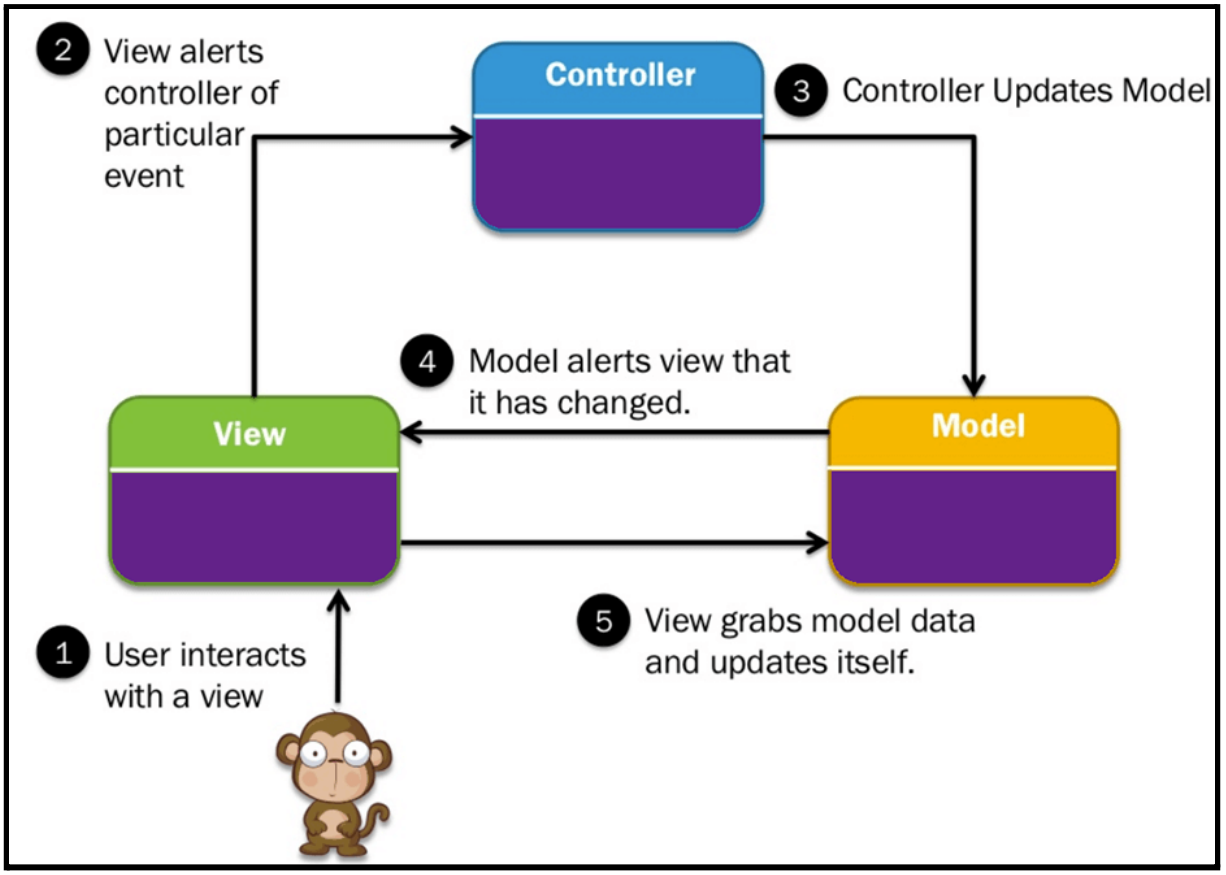

Fig 4.1 Block Diagram of MVC Pattern

The Model View Controller (MVC) design pattern specifies that an application consist of a data model, presentation information, and control information. The pattern requires that each of these be separated into different objects.

MVC is more of an architectural pattern, but not for complete application. MVC mostly relates to the UI / interaction layer of an application. You're still going to need a business logic layer, maybe some service layer and data access layer.

- The **Model** contains only the pure application data, it contains no logic describing how to present the data to a user.
- The **View** presents the model's data to the user. The view knows how to access the model's data, but it does not know what this data means or what the user can do to manipulate it.
- The **Controller** exists between the view and the model. It listens to events triggered by the view (or another external source) and executes the appropriate reaction to these events. Since the view and the model are connected through a notification mechanism, the result of this action is then automatically reflected in the view.

REST API : The term REST stands for REpresentational State Transfer. It is an architectural style that defines a set of rules in order to create Web Services. In a client-server communication, REST suggests to create an object of the data requested by the client and send the values of the object in response to the user. For example, if the user is requesting for a movie in Bangalore at a certain place and time, then you can create an object on the server-side.

So, over here, you have an object and you are sending the state of an object. This is why REST is known as Representational State Transfer.

The architectural style of REST helps in leveraging the lesser use of bandwidth to make an application more suitable for the internet. It is often regarded as the "*language of the internet*" and is completely based on the resources.

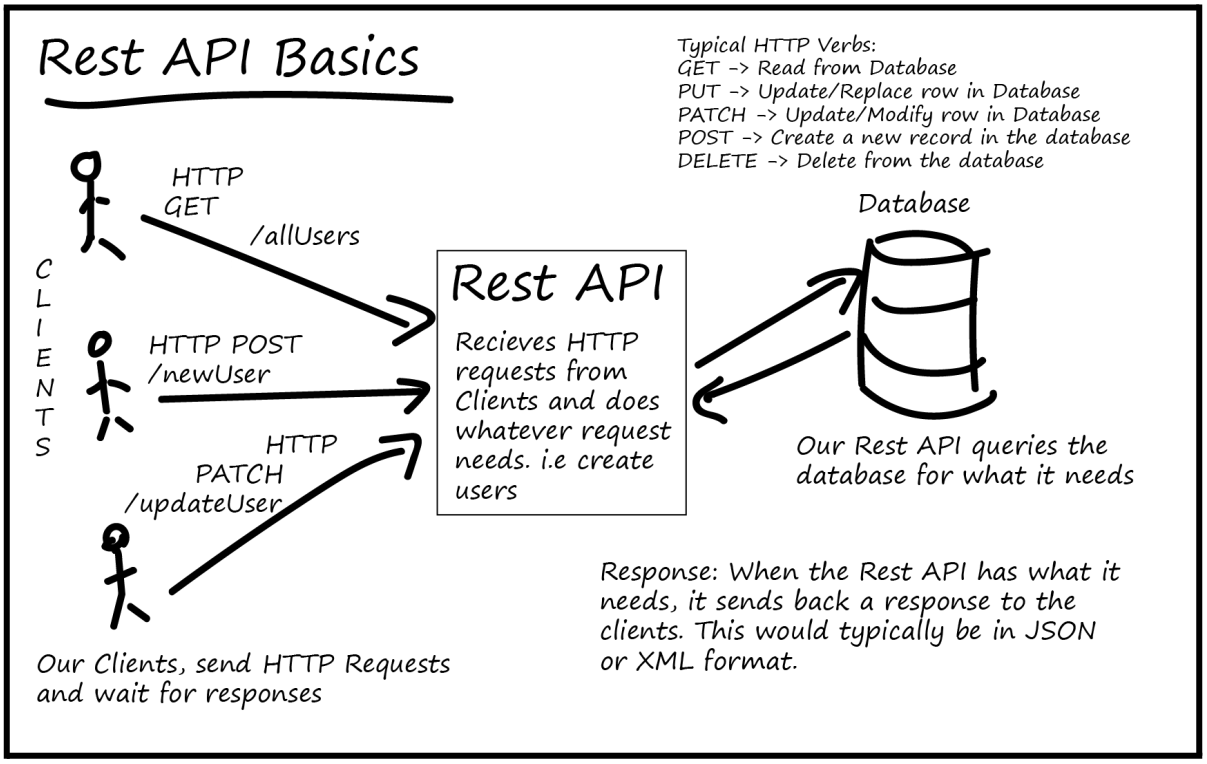

Figure 4.2 Request Response Model For REST API

Disease Prediction Chatbot Design:

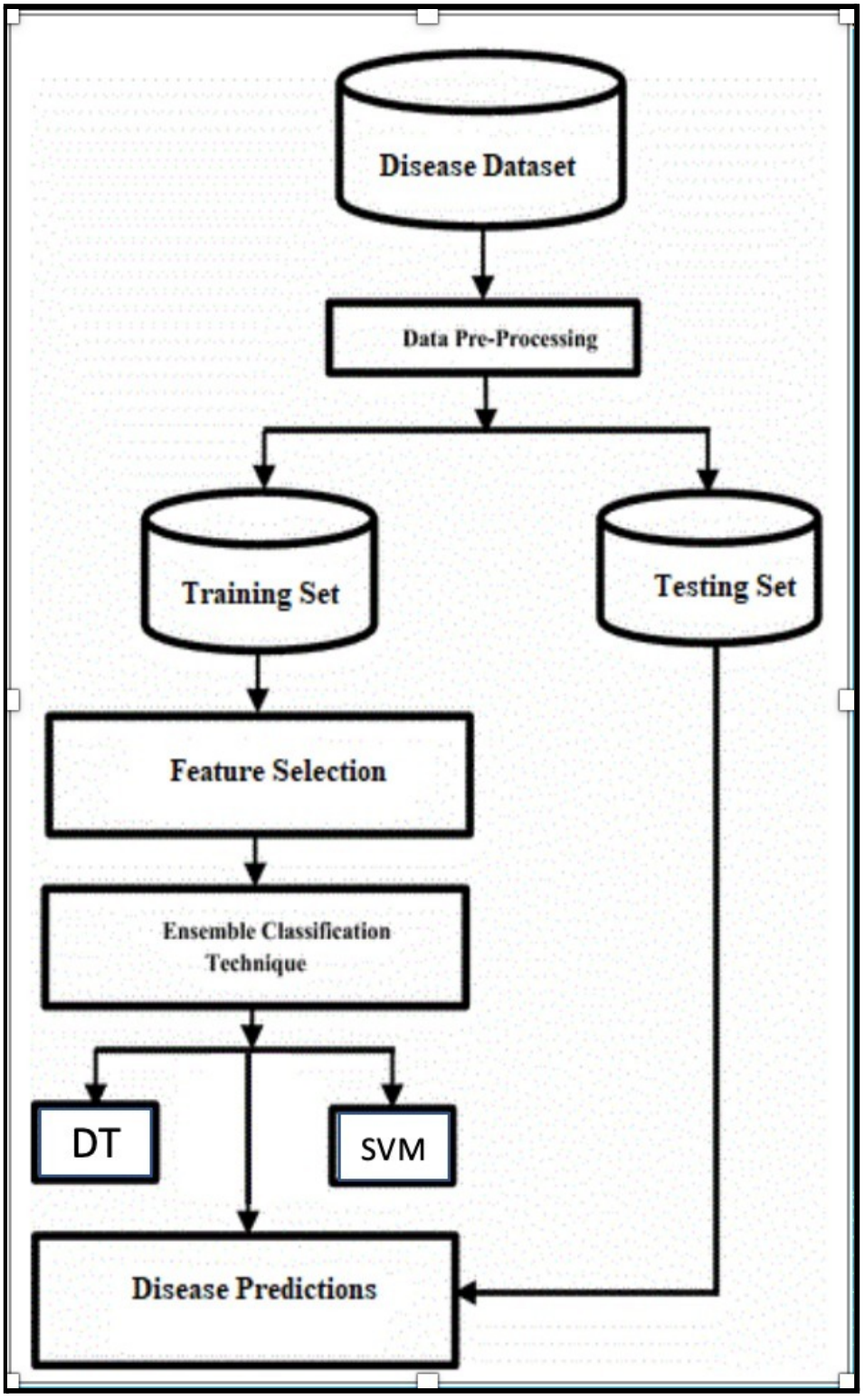

Fig 4.3 Disease Prediction Chatbot Architecture

4.2 Design Details

The proposed system is a website application which provides universal access to the users depending on their roles. The website is created to provide coherent access to all the users irrespective of their system specifications. In addition, the proposed system will also provide extensive insights by providing analytics of data sets as per the user needs. Entire functionality is divided into two primary users of the system as given below:

A. Doctors

The doctors are one of the primary users of the proposed system. Every doctor will have his own user terminal.The doctor simply logs into the website using his login-id and password. Further, whenever any patient approaches the doctor, he/she enters the patient's code onto his/her terminal. Upon submitting this detail, entire medical records that are linked to this code are made available at the doctor's terminal. However, the data of other doctors are not made available and every doctor gets details of patients persistent to their own diagnosis. The doctor gets essential information like the previous health issues, diseases, allergies, etc. of the patient.

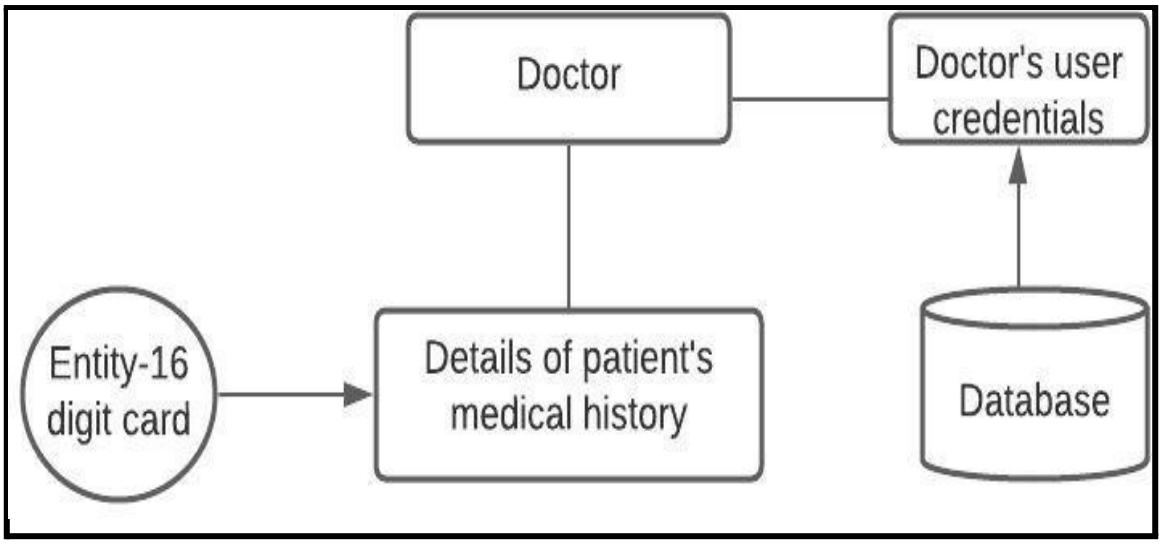

Fig 4.4 Functions of system available for Doctors

B. Patients

The patients are the other users of the proposed system. Every patient will enter his/her login-id and password to log onto their terminal. Initially, when the patients will register themselves, they will enter their personal details like name, age, sex, etc. as well as their previous allergies. They will also enter their Mediclaim policies. The patient's physical card will be particularly helpful in situations like accidents wherein knowing the previous medications and allergy details of a person can be helpful for the treatment. Additionally, the proposed system also provides a chatbot feature wherein a patient can enter his/her symptoms and find the chances of contracting a particular disease. Further, patients can also search for a doctor based on specialization and degree. This will provide added assistance to the users.

Lastly, the entire medical history of every individual patient will be provided to that particular patient. This will help the patients to keep track of their past admits, allergies and medications for providing a proper medical history to doctors in the future. It also provides additional benefit that all the records are digitized. This removes the redundant need of hardcopy papers to maintain the records in a file.

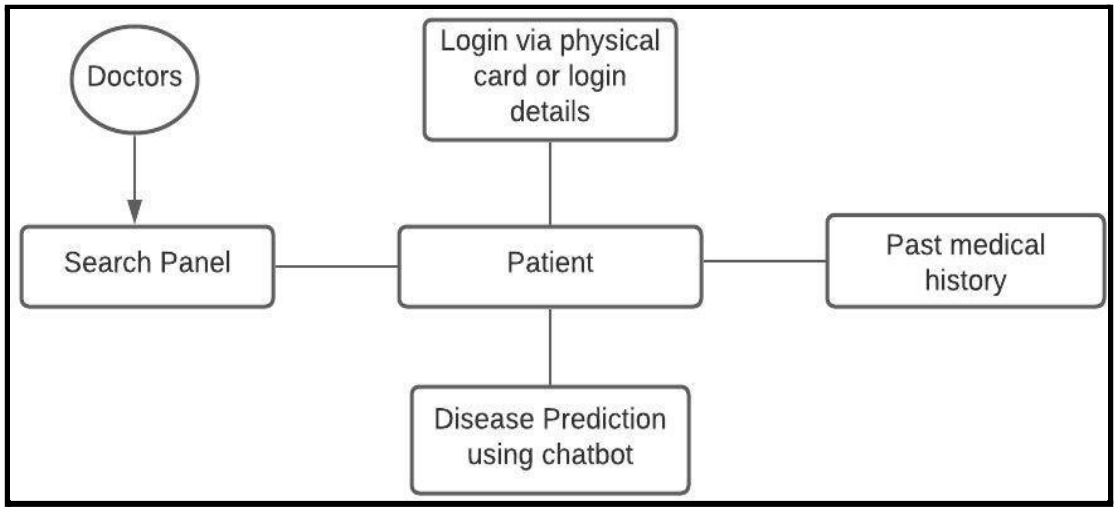

Fig 4.5 Functions of the system available for patients

4.1 GUI Design:

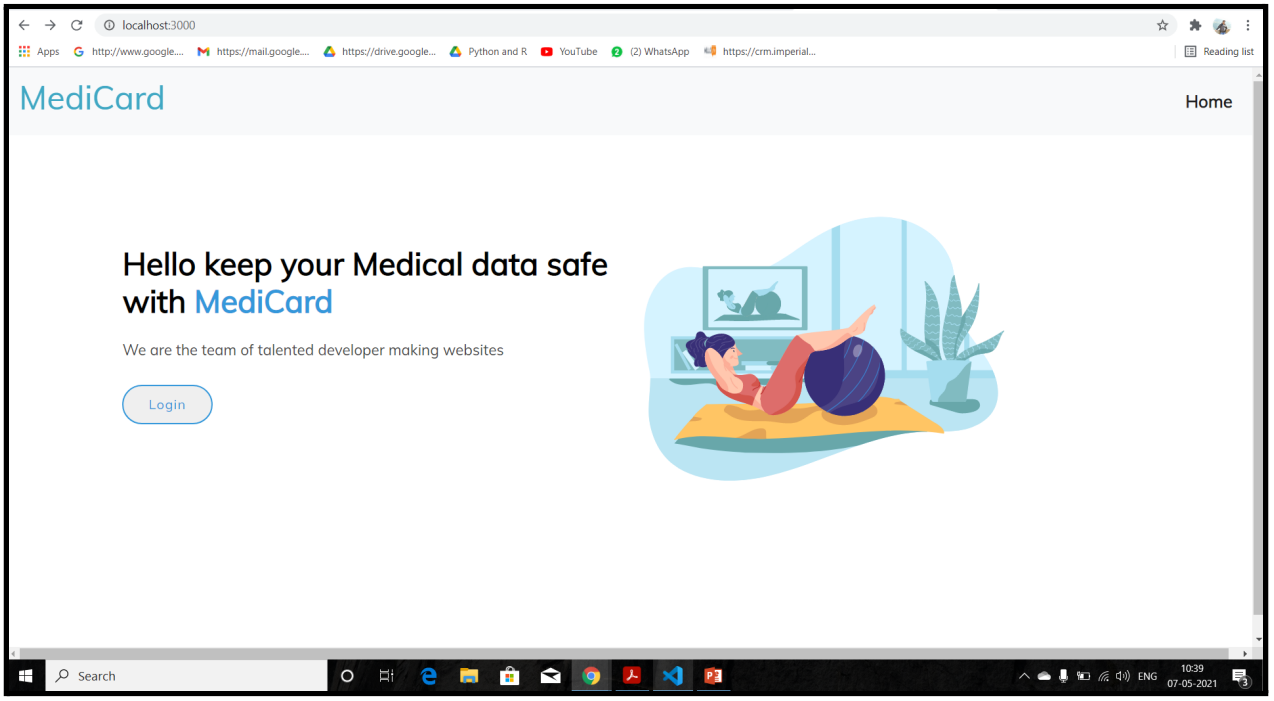

Fig 4.6 Home Page before Login

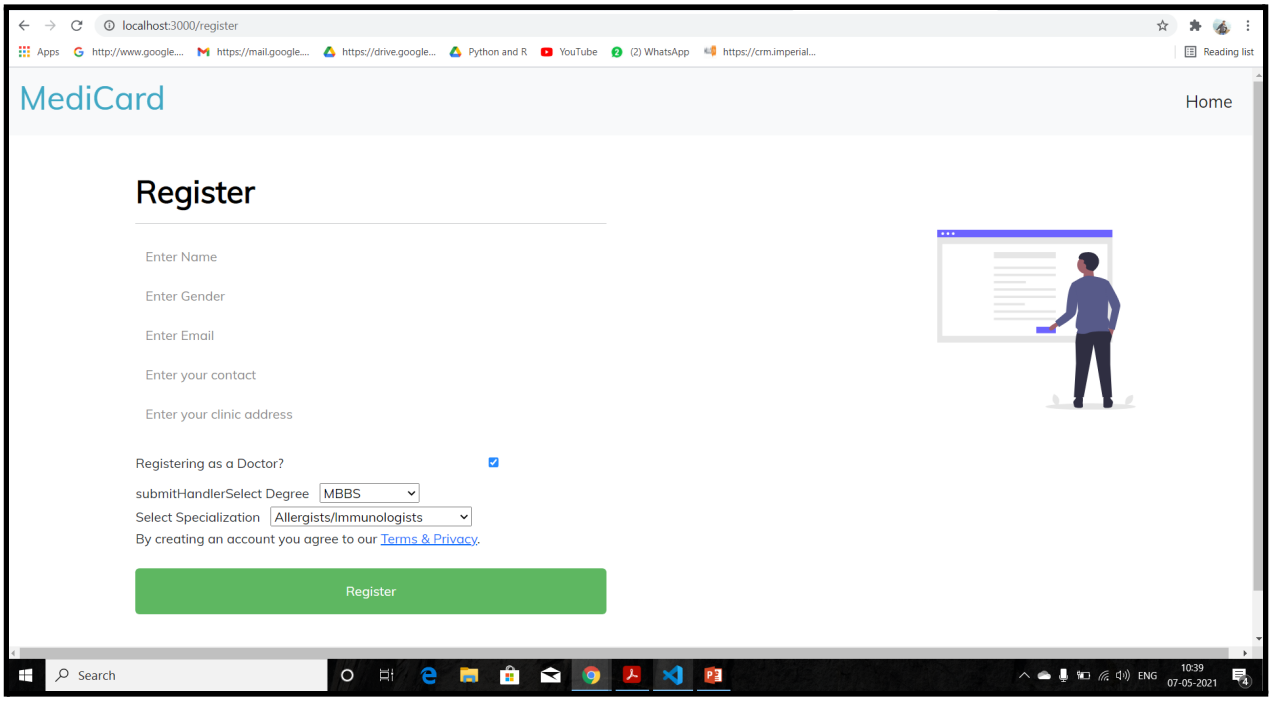

Fig 4.7 Registration Page

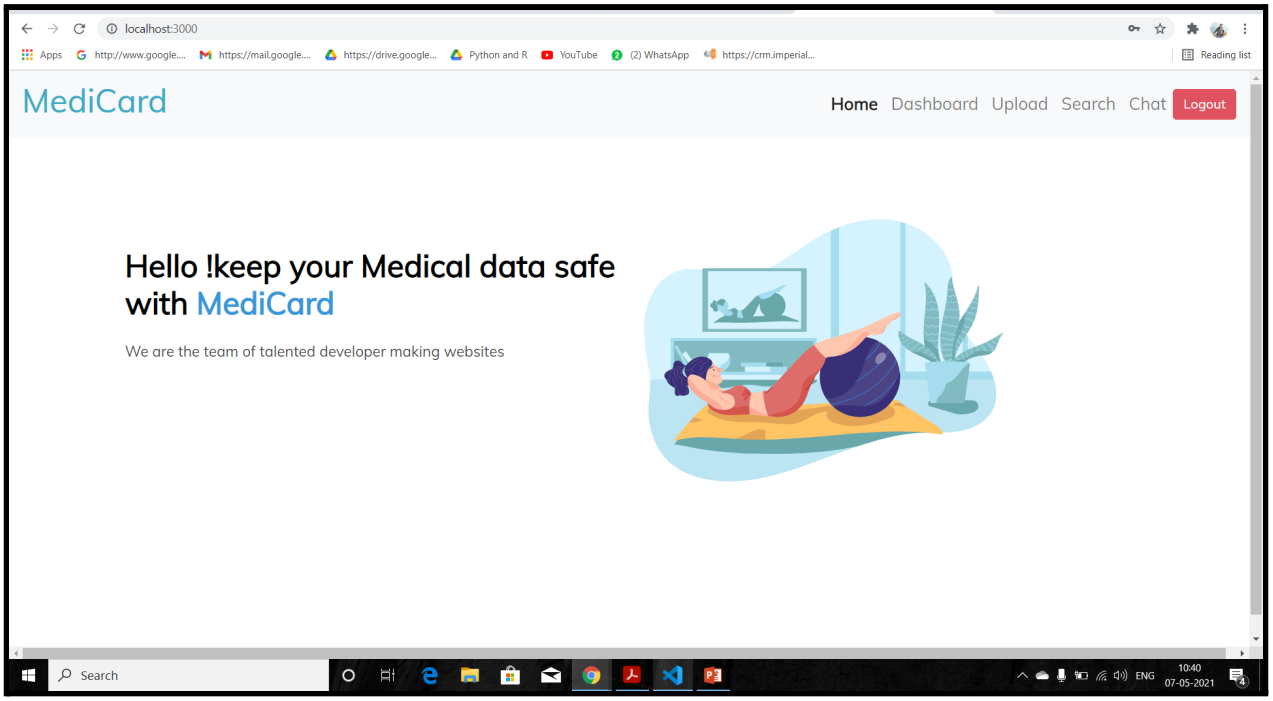

Fig 4.8 Home page after Login

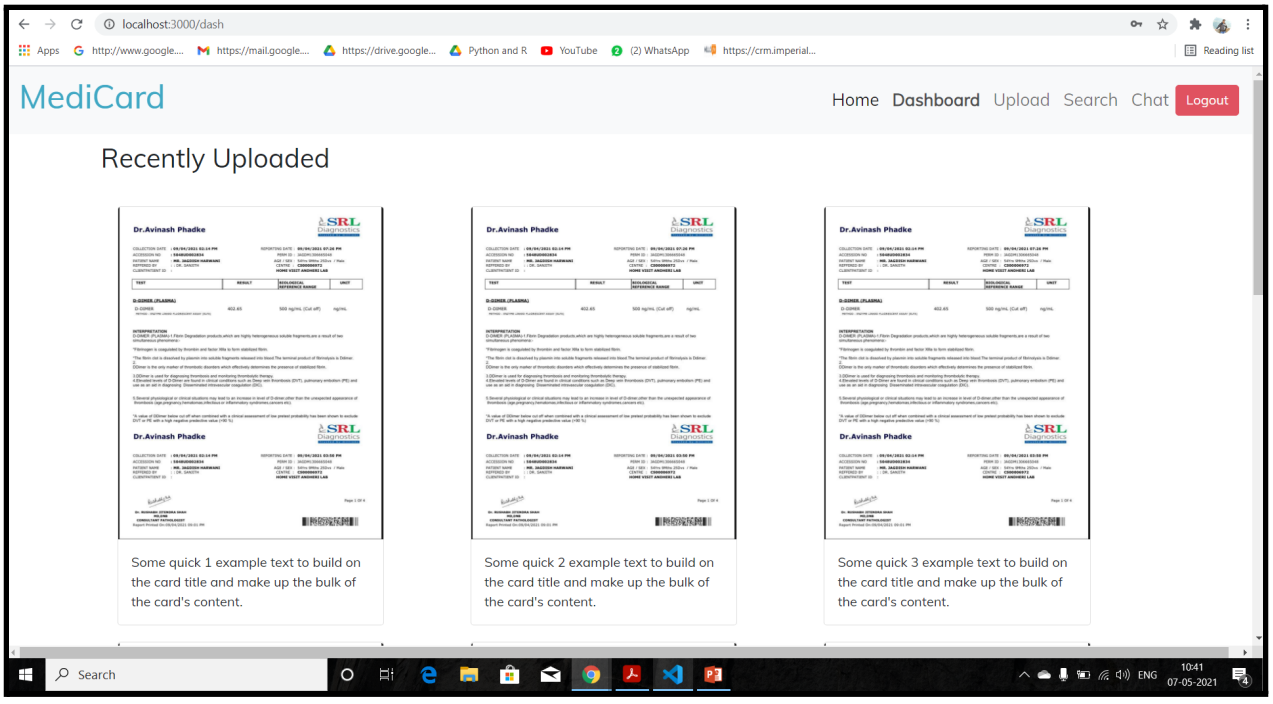

Fig 4.9 Dashboard page

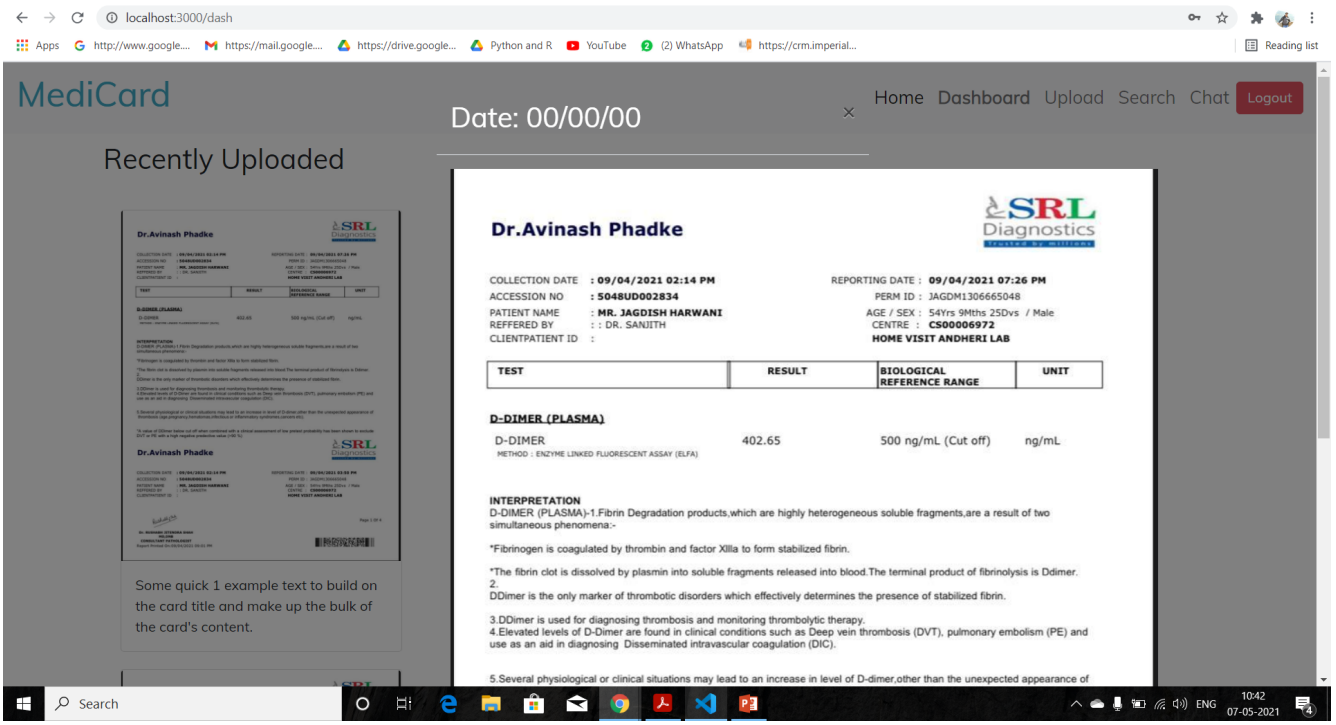

Fig 4.10 View Document

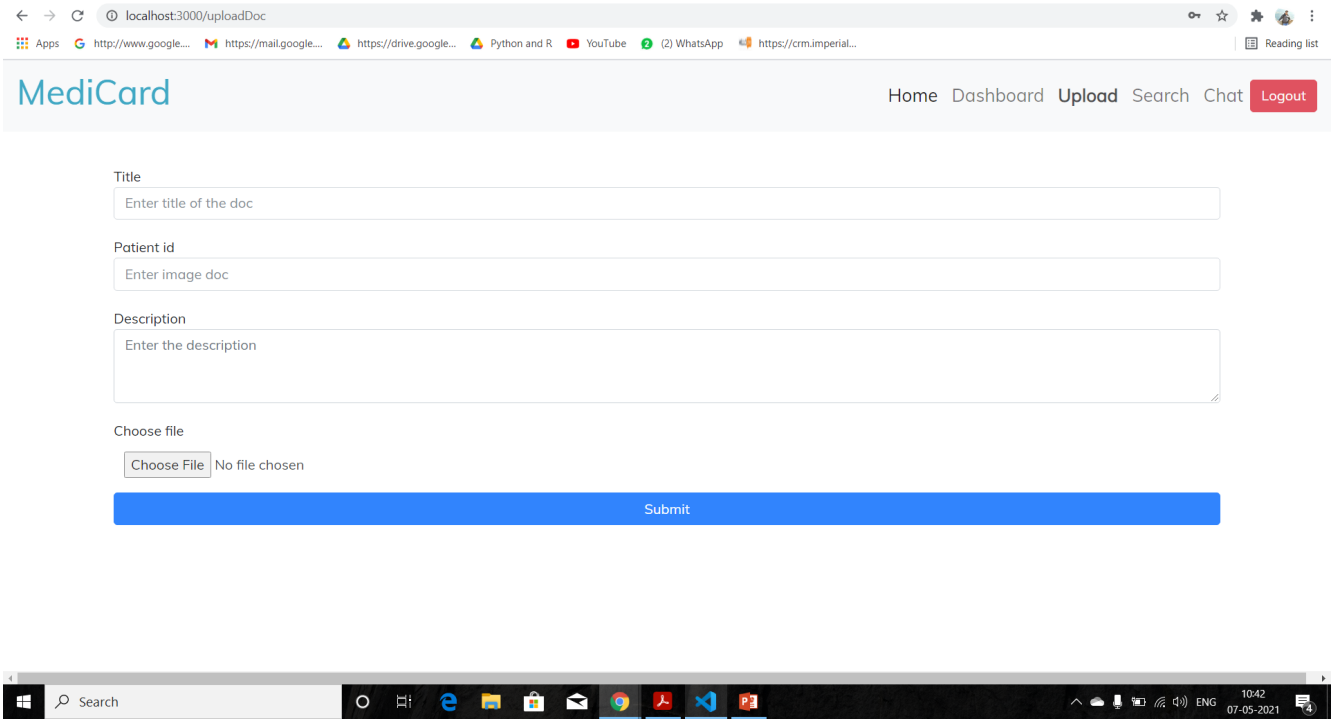

Fig 4.11 Upload Page

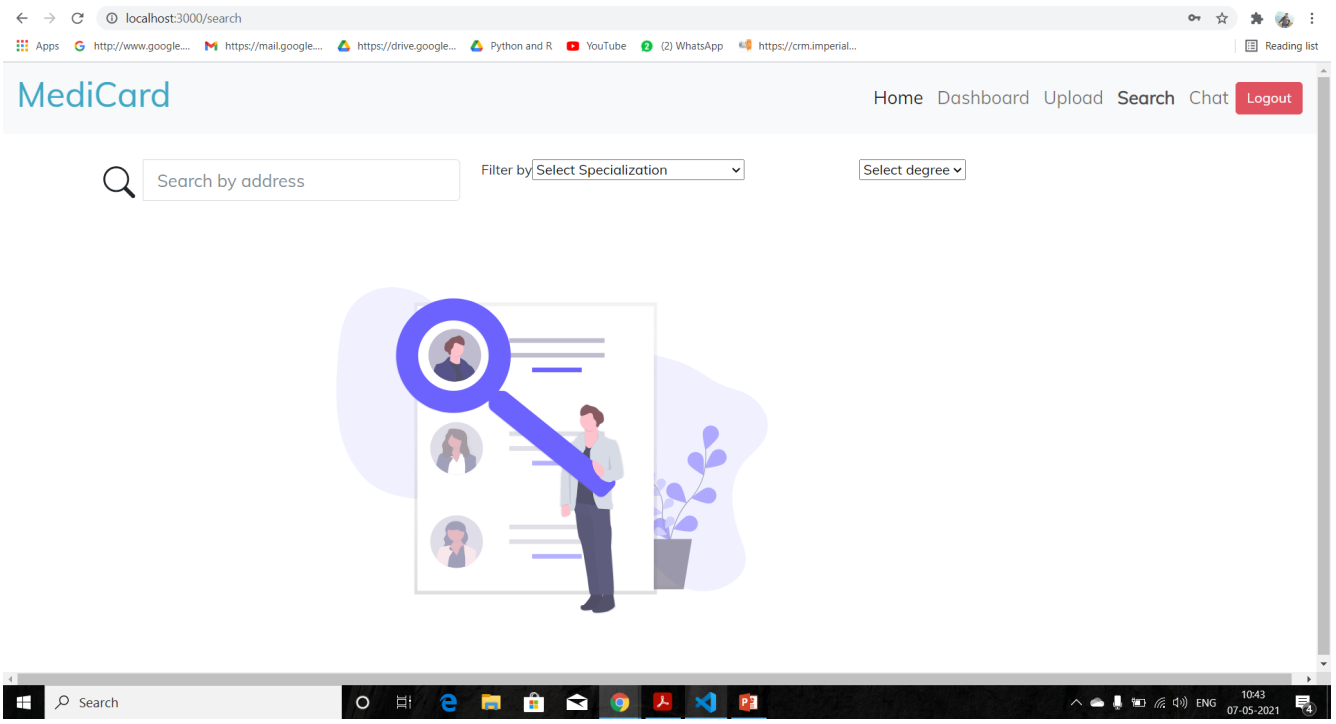

Fig 4.12 Search Doctor

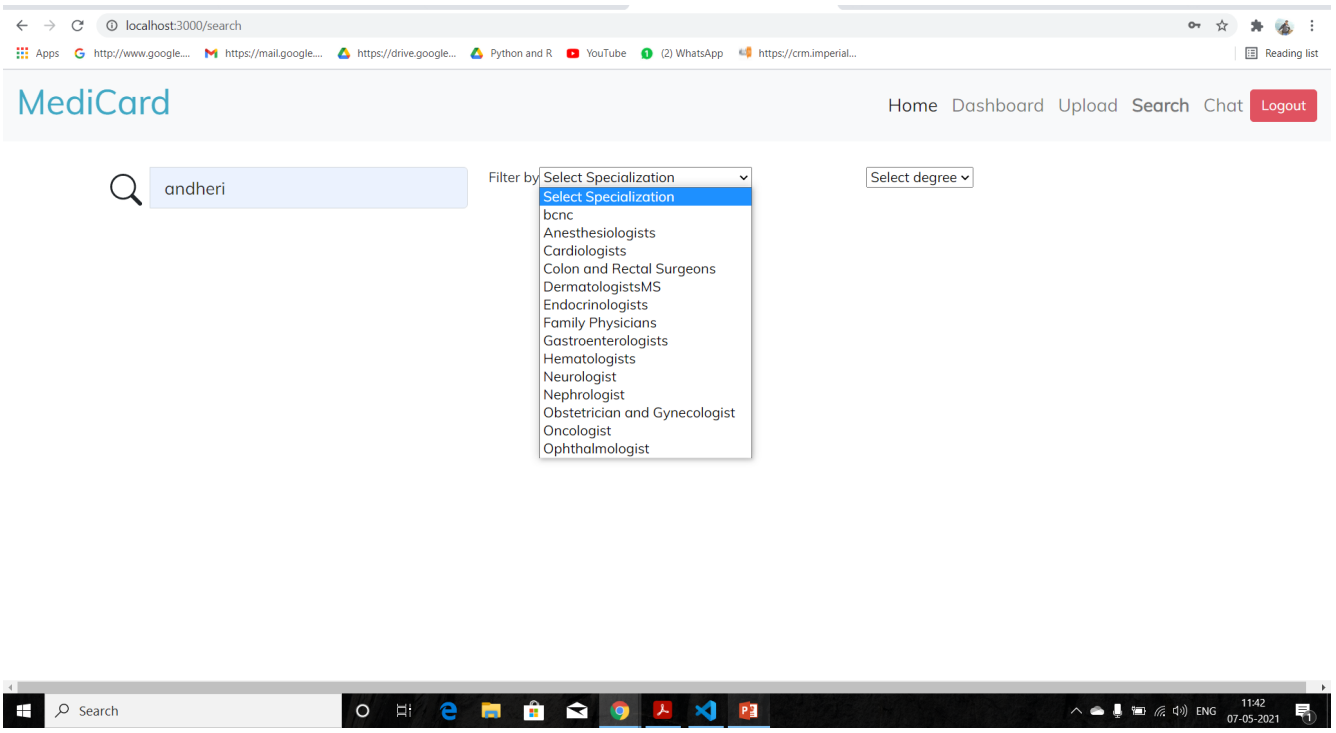

Fig 4.13 Search by Specialization

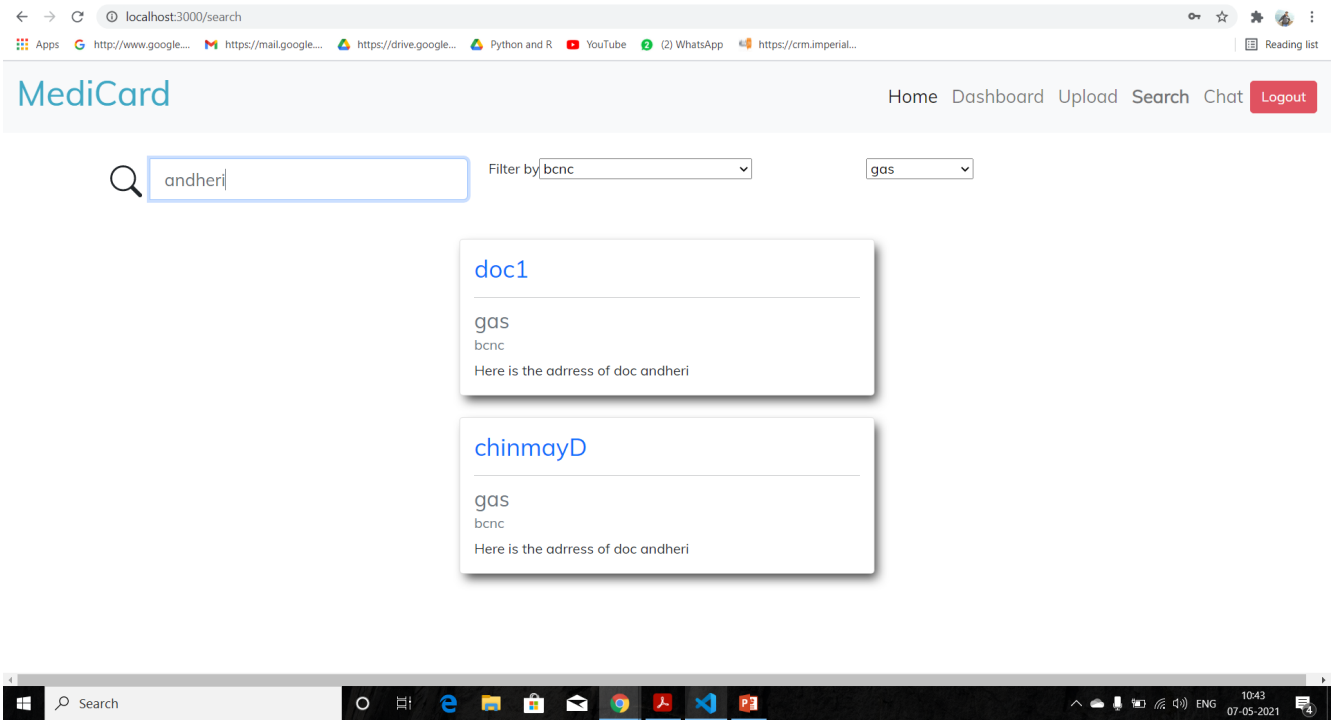

Fig 4.14 View Doctor

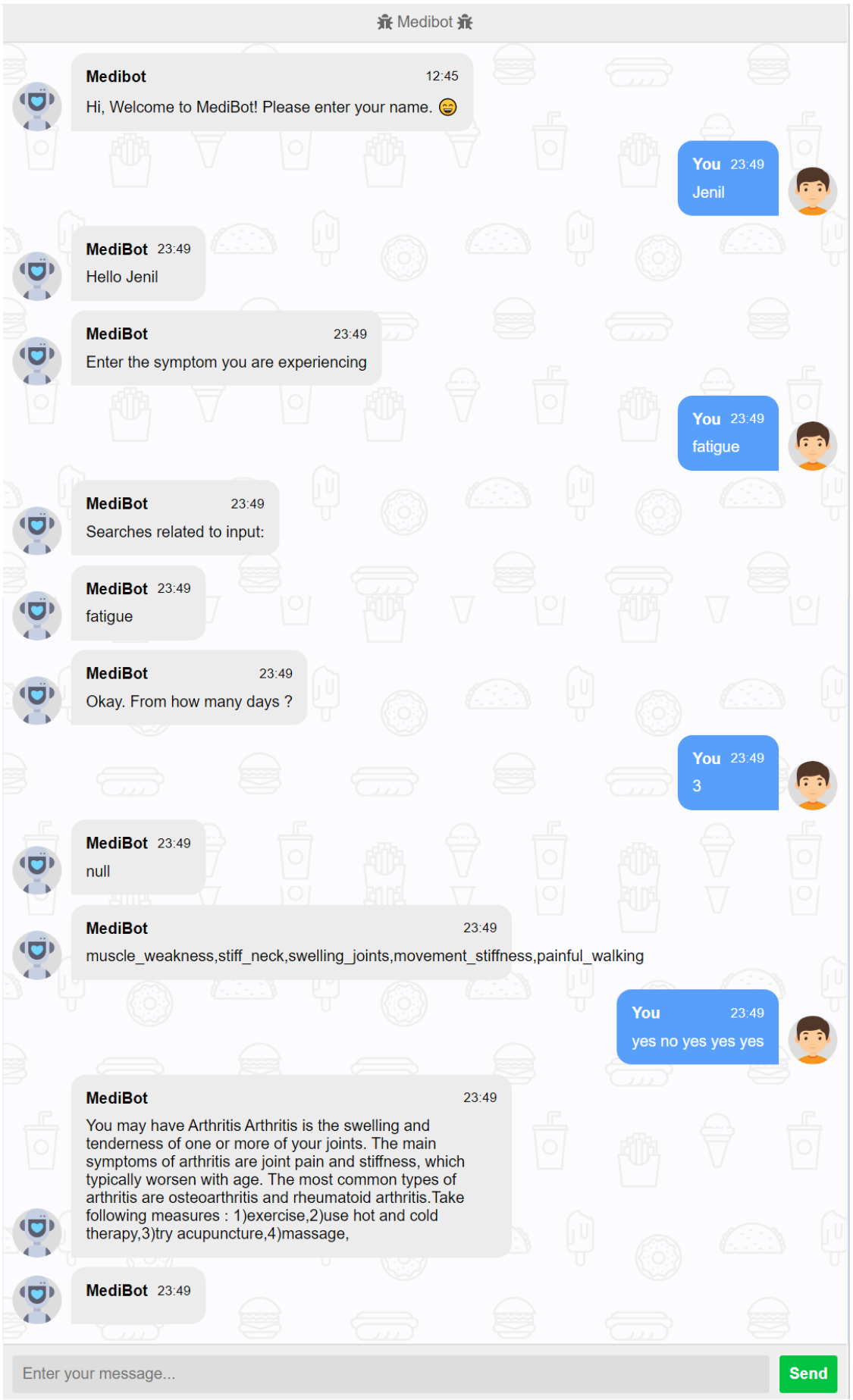

Fig 4.15 Chatbot

Working 1

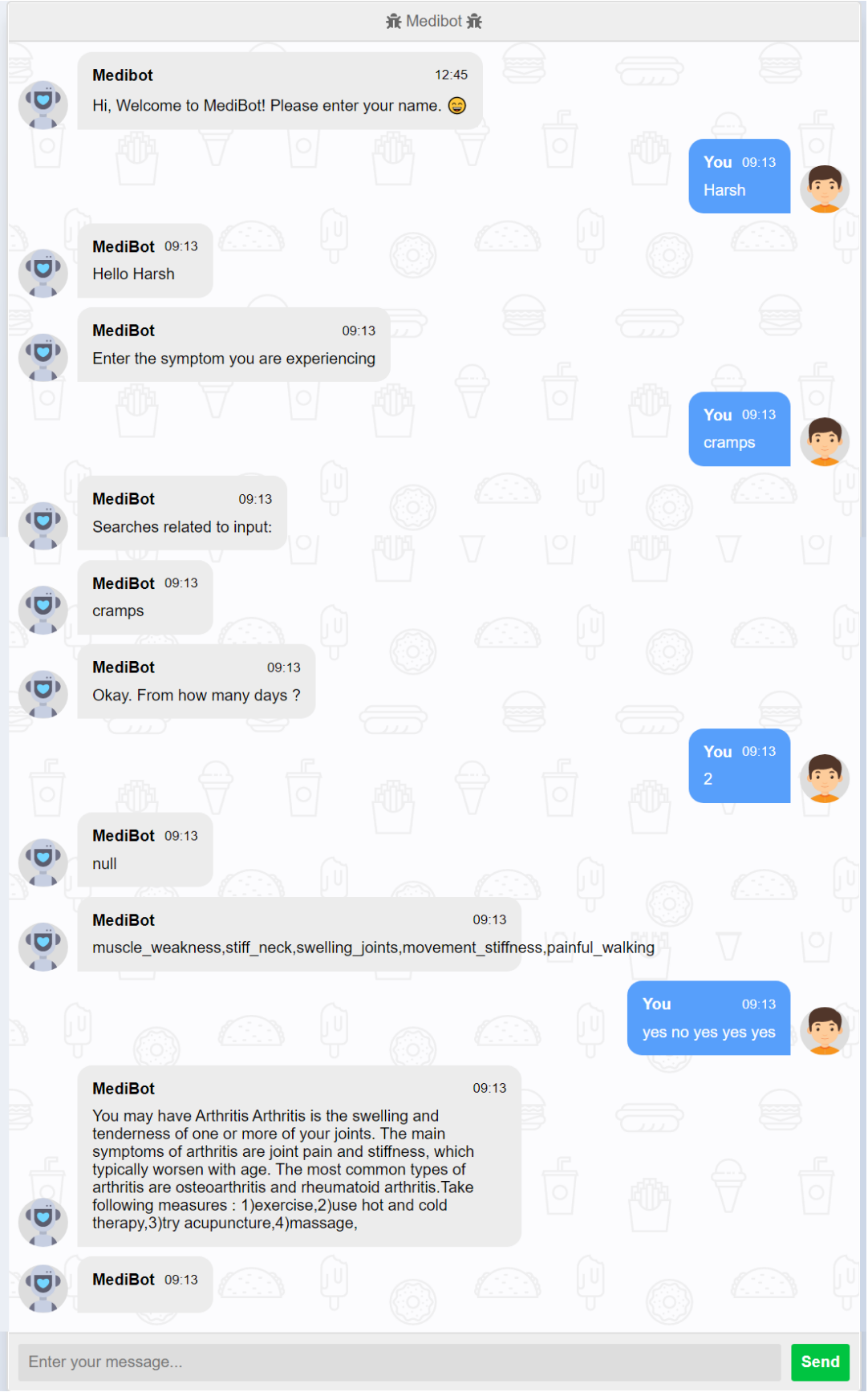

Fig 4.16 Chatbot Working 2

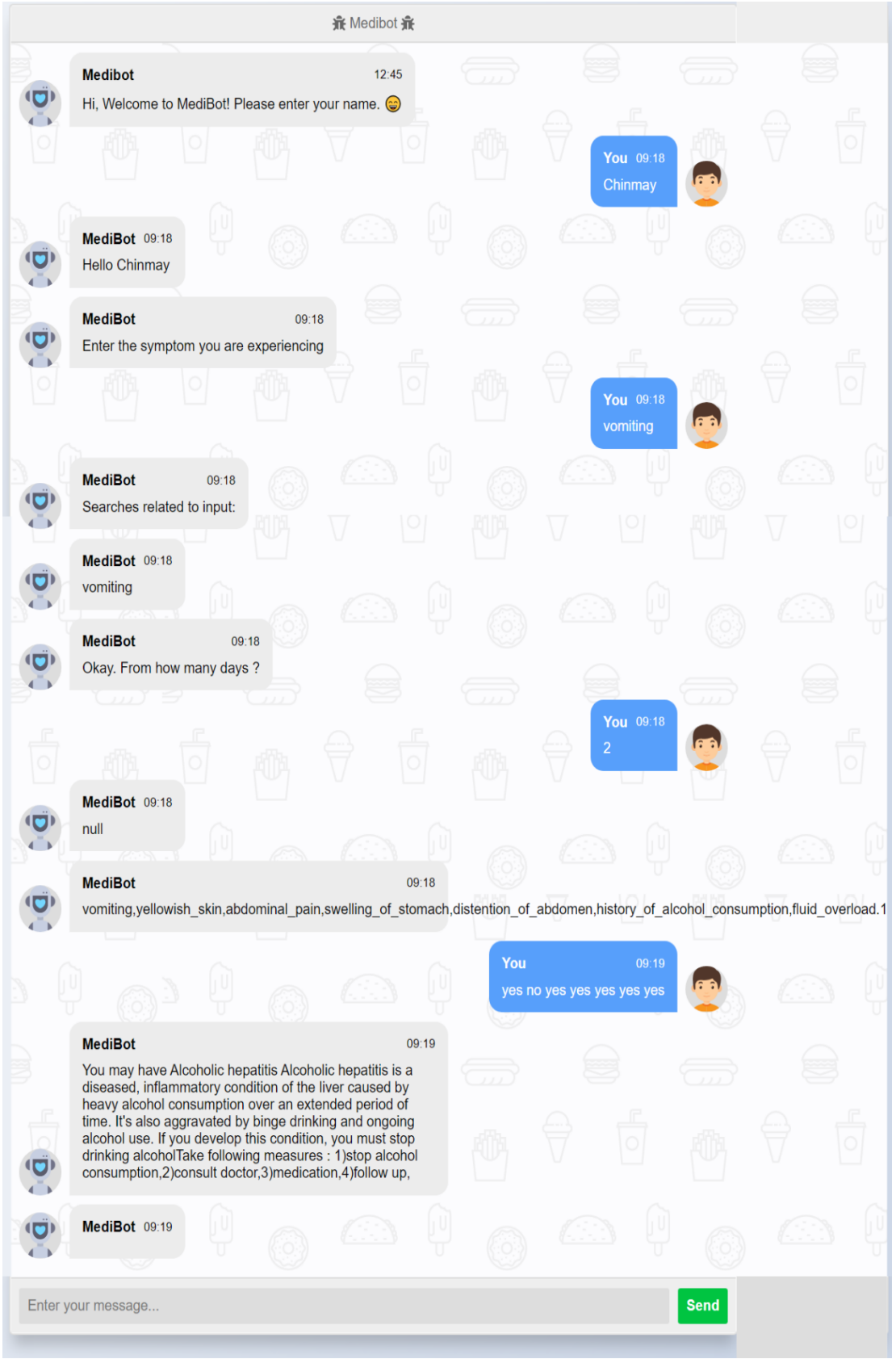

Fig 4.17 Chatbot Working 3

Chapter 5

Implementation

5.1 Implementation Details

1. **View and upload documents**

   This module aims at providing the user with a platform for viewing and uploading his/her medical documents to the system. Users data is encrypted with encryption algorithms to ensure security for the data.

2. **Search Doctors**

   This module aims at searching the doctors based on their specialization, Degree and by name. It accepts input from the user and queries the doctor from the database based on the filters.

3. **Disease prediction and remedy using Chatbot**

   3.1.Dataset Description

   The disease prediction dataset that we found is from a study of the University of Columbia. The table in the dataset is a knowledge database of disease-symptom associations generated by an automated method based on information of patients at New York Presbyterian Hospital admitted. The dataset contains 95 symptoms and 41 diseases. We have also used the symptom_precaution dataset which advises users to take the necessary measures in order to recover from a particular disease. Apart from these, the symptom_Description dataset gives a detailed overview of the disease and the symptom_severity dataset provides information about the degree of severity.

3.2.Data Preprocessing

There is a CSV document containing diseases and symptoms, named training.csv, which is utilized to prepare the model. Read_csv() function is utilized to store the information in the dataframe, named df. Utilizing replace() function, prognosis column that are the different diseases, it is replaced by the numbers from 0 to n-1, where n is the number of different diseases present in the .csv record. Head() function is utilized to print the initial five rows of the preparation dataframe.

Out[179]:

	itching	skin_rash	nodal_skin_eruptions	continuous_sneezing	shivering	chills	joint_pain	stomach_pain	acidity	ulcers_on_tongue	...	blackheads	scurri
0	1	1	1	0	0	0	0	0	0	0	...	0	
1	0	1	1	0	0	0	0	0	0	0	...	0	
2	1	0	1	0	0	0	0	0	0	0	...	0	
3	1	1	0	0	0	0	0	0	0	0	...	0	
4	1	1	1	0	0	0	0	0	0	0	...	0	

5 rows × 133 columns

Fig 5.1. Disease Prediction dataset

Drug Reaction	An adverse drug reaction (ADR) is an injury caused by taking medication. ADRs may occur following a single dose or prolonged administration of a drug or result fr
Malaria	An infectious disease caused by protozoan parasites from the Plasmodium family that can be transmitted by the bite of the Anopheles mosquito or by a contaminated needle or t deadly type.
Allergy	An allergy is an immune system response to a foreign substance that's not typically harmful to your body.They can include certain foods, pollen, or pet dander. Your immune syst harmful pathogens.
Hypothyroidism	Hypothyroidism, also called underactive thyroid or low thyroid, is a disorder of the endocrine system in which the thyroid gland does not produce enough thyroid hormone.
Psoriasis	Psoriasis is a common skin disorder that forms thick, red, bumpy patches covered with silvery scales. They can pop up anywhere, but most appear on the scalp, elbows, knees, from person to person. It does sometimes happen in members of the same family.
GERD	Gastroesophageal reflux disease, or GERD, is a digestive disorder that affects the lower esophageal sphincter (LES), the ring of muscle between the esophagus and stomach. M suffer from heartburn or acid indigestion caused by GERD.
Chronic cholestasis	Chronic cholestatic diseases, whether occurring in infancy, childhood or adulthood, are characterized by defective bile acid transport from the liver to the intestine, which is cause epithelium in most cases
hepatitis A	Hepatitis A is a highly contagious liver infection caused by the hepatitis A virus. The virus is one of several types of hepatitis viruses that cause inflammation and affect your liver's
Osteoarthristis	Osteoarthritis is the most common form of arthritis, affecting millions of people worldwide. It occurs when the protective cartilage that cushions the ends of your bones wears dow
(vertigo) Paroymsal Positional Vertigo	Benign paroxysmal positional vertigo (BPPV) is one of the most common causes of vertigo — the sudden sensation that you're spinning or that the inside of your head is spinnin causes brief episodes of mild to intense dizziness.
Hypoglycemia	Hypoglycemia is a condition in which your blood sugar (glucose) level is lower than normal. Glucose is your body's main energy source. Hypoglycemia is often related to diabete conditions — many rare — can cause low blood sugar in people who don't have diabetes.
Acne	Acne vulgaris is the formation of comedones, papules, pustules, nodules, and/or cysts as a result of obstruction and inflammation of pilosebaceous units (hair follicles and their a develops on the face and upper trunk. It most often affects adolescents.
Diabetes	Diabetes is a disease that occurs when your blood glucose, also called blood sugar, is too high. Blood glucose is your main source of energy and comes from the food you eat. I helps glucose from food get into your cells to be used for energy.
Impetigo	Impetigo (im-puh-TIE-go) is a common and highly contagious skin infection that mainly affects infants and children. Impetigo usually appears as red sores on the face, especially hands and feet. The sores burst and develop honey-colored crusts.
Hypertension	Hypertension (HTN or HT), also known as high blood pressure (HBP), is a long-term medical condition in which the blood pressure in the arteries is persistently elevated. High b symptoms.
Peptic ulcer diseae	Peptic ulcer disease (PUD) is a break in the inner lining of the stomach, the first part of the small intestine, or sometimes the lower esophagus. An ulcer in the stomach is called a the intestines is a duodenal ulcer.

Fig 5.2 Disease Description dataset

Drug Reaction	stop irritation	consult nearest hospital	stop taking drug	follow up
Malaria	Consult nearest hospital	avoid oily food	avoid non veg food	keep mosquitos out
Allergy	apply calamine	cover area with bandage		use ice to compress itching
Hypothyroidism	reduce stress	exercise	eat healthy	get proper sleep
Psoriasis	wash hands with warm soapy water	stop bleeding using pressure	consult doctor	salt baths
GERD	avoid fatty spicy food	avoid lying down after eating	maintain healthy weight	exercise
Chronic cholestasis	cold baths	anti itch medicine	consult doctor	eat healthy
hepatitis A	Consult nearest hospital	wash hands through	avoid fatty spicy food	medication
Osteoarthristis	acetaminophen	consult nearest hospital	follow up	salt baths
(vertigo) Paroymsal Positional Vertigo	lie down	avoid sudden change in body	avoid abrupt head movment	relax
Hypoglycemia	lie down on side	check in pulse	drink sugary drinks	consult doctor
Acne	bath twice	avoid fatty spicy food	drink plenty of water	avoid too many products
Diabetes	have balanced diet	exercise	consult doctor	follow up
Impetigo	soak affected area in warm water	use antibiotics	remove scabs with wet compressed cloth	consult doctor
Hypertension	meditation	salt baths	reduce stress	get proper sleep
Peptic ulcer diseae	avoid fatty spicy food	consume probiotic food	eliminate milk	limit alcohol
Dimorphic hemmorhoids(piles)	avoid fatty spicy food	consume witch hazel	warm bath with epsom salt	consume alovera juice
Common Cold	drink vitamin c rich drinks	take vapour	avoid cold food	keep fever in check
Chicken pox	use neem in bathing	consume neem leaves	take vaccine	avoid public places
Cervical spondylosis	use heating pad or cold pack	exercise	take otc pain reliver	consult doctor
Hyperthyroidism	eat healthy	massage	use lemon balm	take radioactive iodine treatment
Urinary tract infection	drink plenty of water	increase vitamin c intake	drink cranberry juice	take probiotics
Varicose veins	lie down flat and raise the leg high	use oinments	use vein compression	dont stand still for long
AIDS	avoid open cuts	wear ppe if possible	consult doctor	follow up
Paralysis (brain hemorrhage)	massage	eat healthy	exercise	consult doctor
Typhoid	eat high calorie vegitables	antiboitic therapy	consult doctor	medication
Hepatitis B	consult nearest hospital	vaccination	eat healthy	medication

Fig 5.3 Disease Precaution dataset

1	itching	1
2	skin_rash	3
3	nodal_skin	4
4	continuous	4
5	shivering	5
6	chills	3
7	joint_pain	3
8	stomach_p	5
9	acidity	3
10	ulcers_on_	4
11	muscle_wa	3
12	vomiting	5
13	burning_m	6
14	spotting_u	6
15	fatigue	4
16	weight_ga	3
17	anxiety	4
18	cold_hand	5
19	mood_swi	3
20	weight_los	3

Fig 5.4 Symptom Severity dataset

3.3. Data Visualization

This is the distribution graph of the columns of the training.csv file.

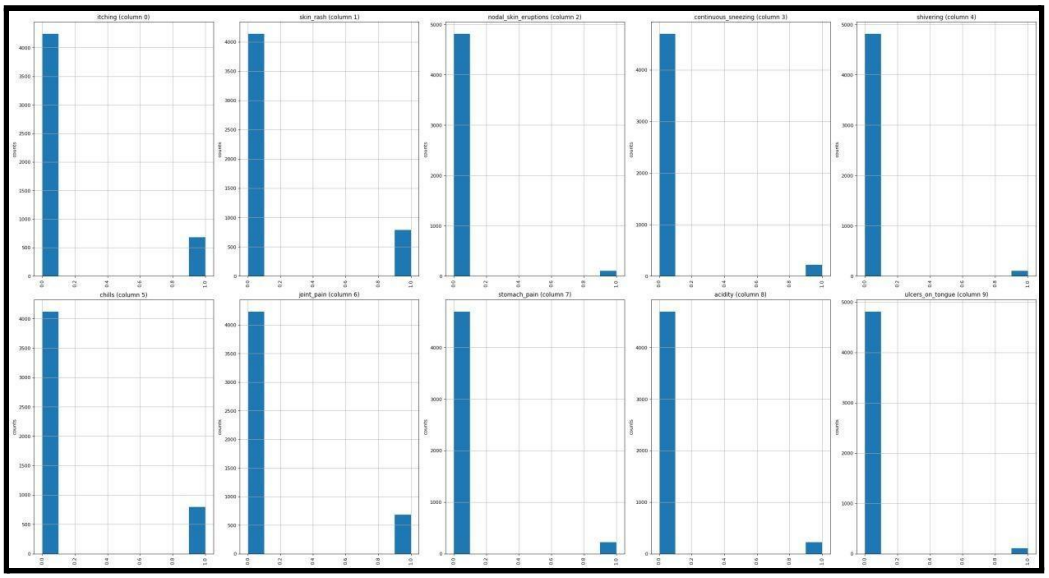

Fig 5.5 Data Visualization

3.4. Separating target and features

	back_pain	constipation	abdominal_pain	diarrhoea	mild_fever	\
0	0	0	0	0	0	
1	0	0	0	0	0	
2	0	0	0	0	0	
3	0	0	0	0	0	
4	0	0	0	0	0	
5	0	0	0	0	0	
6	0	0	0	0	0	
7	0	0	0	0	0	
8	0	0	0	0	0	
9	0	0	0	0	0	
10	0	0	0	0	0	
11	0	0	0	0	0	
12	0	0	0	0	0	
13	0	0	0	0	0	
14	0	0	0	0	0	
15	0	0	0	0	0	
16	0	0	0	0	0	
17	0	0	0	0	0	
18	0	0	0	0	0	

Fig 5.6 Dataset Features

```
print(y)
```

	prognosis
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	1
11	1
12	1
13	1
14	1
15	1
16	1
17	1
18	1
19	1
20	2
21	2

Fig 5.7 Dataset Target

3.5.Training the model

To build the precision of the model, we utilized two distinct algorithms which are:

- Decision Tree algorithm
- Support Vector Machine algorithm

```
clf1  = DecisionTreeClassifier()
clf = clf1.fit(x_train,y_train)
# print(clf.score(x_train,y_train))
# print ("cross result========")
scores = cross_val_score(clf, x_test, y_test, cv=3)
# print (scores)
print (scores.mean())

model=SVC()
model.fit(x_train,y_train)
print("for svm: ")
print(model.score(x_test,y_test))
```

Fig 5.8 Training the model

3.6. Accuracy

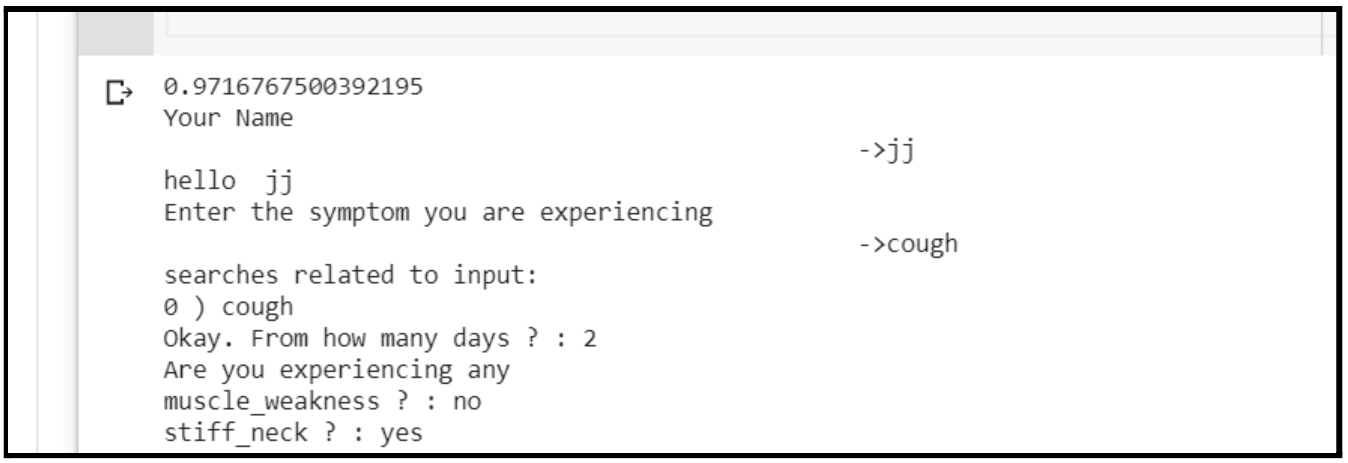

Fig 5.9 Accuracy

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5.2 Results and Evaluation

Lighthouse, an open source tool developed by Google and utilised for analysing various metrics of a Progressive Web Application was used for analysing the application upon creation.

The metrics analysed included the following:

1. Accessibility
2. Best Practices Used
3. Search Engine Optimisation
4. Various aspects of PWA

Lighthouse works as a plugin offered by Google Chrome and in order to generate a comprehensive report about the PWA in question, the Lighthouse plugin is simply run with the PWA already in the background. The plugin generates a report after analysing the various metrics. Each metric is graded on a score range between 0-100.

Upon running Lighthouse for Medicard, the following observations were recorded,

1. **Accessibility:**

   The Accessibility metric from Lighthouse checks the opportunities available to improve the accessibility of the web app. Medicard was graded 97/100 on this metric.

   Suggestions were made to improve Background and foreground colors contrast ratio.

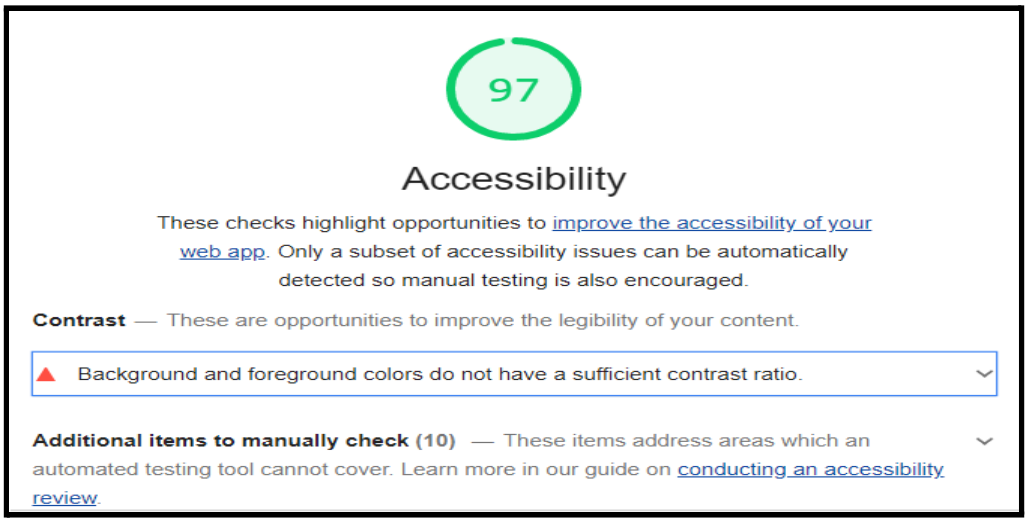

Fig 5.10 Complete report of the Accessibility Metric on Lighthouse

2. Search Engine Optimisation:

Creating web applications that are optimised to be visible on various search engines is a quintessential practice in any web development related project. The lighthouse checks ensure that the web page is optimised for search engine results ranking.

The Medicard was rated a perfect 100/100 in this metric.

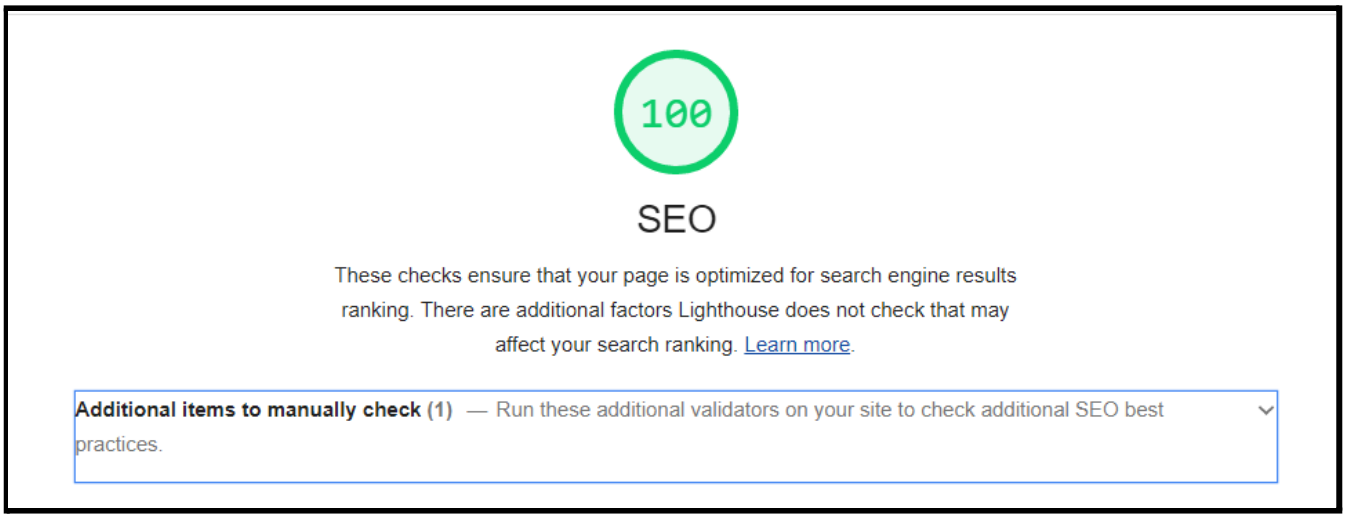

Fig 5.11 SEO report generated by Lighthouse

Chapter 6

Conclusion

6.1 Conclusion

There is a plethora of data related to healthcare in an unorganized form. Moreover, there is a dire need to come up with a remedy which can be universally acceptable. Hence, a solution to these problems is given by our project which includes disease prediction using machine learning. It also provides a solution to revolutionize the medical records maintenance procedure in India by establishing grounds to encompass digital records storage and maintenance. This work presents a system, which can be used as a professional system which can be used to view medical reports, upload latest documents, search for doctors based on their speciality and converse with a chatbot. One of the major hindrances in making a satisfactory healthcare portal available to one and all is the inaccessible nature of a well developed online portal. This is the gap we have tried to fill.

6.2 Future Scope

However, our chatbot does not cover all the diseases, so, there is a possibility to give an enhanced version of the chatbot by integrating this idea with a specialized disease prediction system and integrating a skin disease detection which would ease people to identify the skin diseases they are suffering from by merely clicking a picture of the patch that has been infected by parasites or some other disorders. Not just for skin disease, but also for other parts of the body. Additionally, patients can have virtual meetings with their respective doctors for follow ups. In future, with the advancements in technology, one could also get blood reports in place by providing samples to a report generating machine.

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