CLOUD COMPUTING BASED TELEMEDICINE APPLICATION

Major project report submitted in partial fulfillment of the requirement for the degree of Bachelor of Technology

in

Computer Science and Engineering

By

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UNDER THE SUPERVISION OF

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DECLARATION

I hereby declare that this project has been done by me under the supervision of (Dr Rajni Mohana, Associate Professor, Deptt. Of CSE & IT), Jaypee University of Information Technology. I also declare that neither this Project nor any part of this Project has been submitted elsewhere for the award of any degree or diploma.

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CERTIFICATE

This is to certify that the work which is being presented in the Project report titled "**Cloud Computing Based Telemedicine Application** " in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science & Engineering** and submitted to the Department of Computer Science & Engineering, Jaypee University of Information Technology, Waknaghat is an authentic record of work carried out by "Ishika Goel (181356) and Ameesha Varma (181358)" during the period from August 2021 to December 2021 under the supervision of Dr. Rajni Mohana, Department of Computer Science and Engineering, Jaypee University of Information Technology, Waknaghat.

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The above statement made is correct to the best of my knowledge.

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ACKNOWLEDGEMENT

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ABSTRACT

In today's healthcare world, Genuine health advice as well as easy accessibility is the key and this is one of the most attractive advantages of our telemedicine application.

In times like these, when the entire world is fighting the pandemic and people are trying to protect themselves from the virus in any way possible , all of us are going through tough changes that we never thought of. This pandemic has not only altered our way of living in general but has also changed our attitude and perspective to today's every smaller aspect of livelihood. It is high time now that we make efficient use of the enormous available technology and data in order to make our lives easier and much more safe.

Thus we came up with the vision of a cloud based telemedicine application 'TeleMediCare'. It will not only make the Health Care system of the country highly efficient but also it will make it a 1000 times faster and convenient and at the same time it will also help to prevent the spread of communicable diseases such as COVID-19, flu and other infectious diseases.

It also aims towards the better treatment of Old Aged People and also towards the people who need OPD/Doctors Assistance quite often from their birth or due to an accident, also this can be very helpful for pregnant women..

With the help of this application it will be possible to make video or phone appointments between a patient and their health care individual, thus benefiting both health and convenience. More and more people are now showing interest towards virtual diagnosis and doctors too are finding it pretty convenient to see patients by computer and smartphones. Improved technology has made this possible and even easier, even for those who don't consider themselves computer savvy.

Chapter 01: INTRODUCTION

1.1 Introduction

A fundamental point to be considered when it comes to cloud computing is that the location of the service, or many of these other details such as the hardware or operating system on which it is running, is basically of no use to the user. It's with this in mind that the metaphor of the cloud was borrowed.

Today, you can get anything on demand, from taxis to food. While these services have been popular for some time, on-demand doctor consultations came into the scene recently.

The World Health Organization (WHO) explains virtual diagnosis as **"healing from a distance"**. It is the use of telecommunications technology and IT to provide remote healthcare services to patients.

Today, individuals no longer need to book an in-person visit to a doctor to receive treatment. The use of highly secure video and audio connections makes it possible for doctors to consult patients who reside in places where reaching out every second day is tough. You don't have to drive to the doctor's office or clinic, park, walk or sit in a waiting room when you're sick. You can see your doctor from the comfort of your home.

Today, most people have access to basic smart devices like mobile phones and computers. With improved accessibility, individuals in rural areas and busy urban areas can connect with a healthcare provider easily and conveniently.

1.2 Objectives

The goals of this project are :

1. **Virtual Prescription** We have taken the doctor patient relation into a new way of interaction by facilitating virtual prescriptions with reminders for your medicines and many more.

2. **Panel of best doctors** We aim to bring in the best panel of doctors where you have the liberty to choose your own doctor, get appointments from them and additionally they can even monitor your daily diets , your health 365 days.

3. **Storage of all previous Health Records** All the Medical information of the patients will be stored in highly secured servers with the help of cloud technology which is known for its reliable storage and access control options and features.

4. **Consult Your Doctor via Video Conferencing** You can schedule a call with your very doctor at the convenience of you both. It's upto to the patient as well as the doctor as to when they can schedule an appointment.

5. **Encryption and Security Protocols** Using security and encryption protocols, this project aims to allow patients and doctors to keep confidential patients' data secure and safe.

6. **Appointment Management** Appointment scheduling allows patients to select an available slot from the doctor's calendar and schedule appointments themselves.

1.3 Motivation

As Computer Science & Engineering department students, we have introduced and learned about different kinds of new world technologies. Also, learn to combine our software programming knowledge with technology like cloud computing. Our basic purpose is to make a Virtual product showcasing application by using the technology and benefits provided by cloud computing. We decided to apply our Product-Showcasing idea on a Telemedicine Application to create something that helps the healthcare providers, and also to help patients (customers) get diagnosed from the comfort of their home.

The coronavirus pandemic has completely restructured the healthcare scenario. Cloud

computing can now be used for helping healthcare providers access patient data securely, arrange voice and video appointments, and remain updated with health records. With cloud-based technology, healthcare providers are able to provide mobility and choose platforms with easy-to-use interfaces for first-time patients and busy healthcare providers.

These are the facts that motivated us to create an application in order to provide a better and much more convenient future to the clients(patients) and healthcare providers. And many industry experts believe that this could be the beginning of a major shift in the way medical care is delivered, seeing the current trends and increasing demand for digital-based healthcare solutions. In other words, this IT step in the field of medicine could be laying the groundwork for critical future growth. This will improve our certainty and abilities for the work market too.

1.4 Language Used

1. **Frontend**

- React - It is a JavaScript library which can be used to build user interfaces. It has the following features:
    1. Declarative - React allows us to make intelligent UIs. Planning straightforward perspectives for each state in our application. React will effectively refresh and deliver the perfect parts when your information changes. Revelatory perspectives make your code more unsurprising and simpler to troubleshoot.
    2. Component based - As the code logic is provided in JavaScript rather than layouts, we can undoubtedly provide information through our application
    3. Learn Once, Write Anywhere - Because, we don't build up any suspicions about the remainder of our innovation stack, thus we can foster new highlights in React without rephrasing existing code.

- React - Bootstrap - It is the most famous front-end structure modified by react. It has the following features:
    1. Rebuilt with React - The Bootstrap JavaScript is replaced with

React-Bootstrap. Every component was created from the ground up as a pure react component, with no unnecessary reliance, for example jQuery.

2. Bootstrap at its core - Worked in view of similarity, we like our bootstrap center and endeavor to be viable with React.

3. Accessible by default - This provides us with better command over structure and capacity of every part.

● Redux - We have used Redux for its following properties:

1. Predictable - It assists us with composing applications that act reliably, run in various conditions

2. Centralized - Incorporating our product's state and rationale empowers incredible abilities like fix/re-try, state ingenuity, etc.

3. Debuggable - It makes it simple for us to see how, where, when the status of our web app changed.

4. Flexible

2.   Backend

● mongoDB - It is a record data set with adaptability and availability. We need this with the questioning and ordering which we want. It keeps the data in the json-like format and maps to the objects in our code.

● NodeJs - It is fundamentally utilized for non-obstructing, occasion driven servers.Due to the fact that it is single threaded in nature. It's utilized for conventional sites and back-end API administrations.

● Express - It is part of the most famous NodeJs application. It is used to :

1. Compose controllers for demands with various HTTP action words at various URL ways (courses).

2. Incorporate with view delivering motors to create reactions by embedding information into formats.

3. Add extra solicitation handling middleware anytime inside the solicitation taking care of the pipeline.

3. **Others**

- Google map API - It is one of the sharp pieces of Google innovation that assists us with taking the force of Google Maps and using it straightforwardly on our web application. It allows us to add important substances that are helpful to our customers and tweak the look and feel of the guide to fit with the style of our application.
- Stripe - Stripe permits entrepreneurs to acknowledge installments from credit and debit cards.

1.5 Technical Requirements

1. **Microsoft visual studio**

   This product is utilized to foster PC programs, sites, versatile applications and parcels different things. Likewise, the coordinated debugger equipped for source troubleshooting and engine investigating. It can create local and supervised code. It is liked by various authorities and this impacted us to utilize this for our project.

1.6 Deliverables

A telemedicine application with the following key features:

- Patients can get observed by the specialist and consult for good well being.
- Web application can be installed to the landing page
- Can give a message pop-up which makes it special to utilize.
- Patients can book the appointment with the doctor according to his/her requirements.
- Doctors can prescribe patients and schedule appointments through video calling.

Chapter 02: MAJOR PROJECT SDLC

2.1 Feasibility Study

People nowadays are more likely to use smartphones and other forms of technology. They want their phone to have all of the features. Since all facilities, from food to personal tutors, are just one click away, why not diagnosis by healthcare providers too. As a result, we decided to create the "TeleMediCare" cloud based application. Our survey gave us the idea that creating cloud based applications will be beneficial for both doctors and patients.

Survey Report

Before we start working, we'd like to conduct a survey to learn more about the needs of the users/clients. The survey helps us understand their needs and wants, as well as how we can improve this project, since we need to make the applications helpful for the healthcare provider as well as the clients, and we need to make them easy to understand, appealing, and intelligent for both.

1.   Prerequisites Analysis :

64% of the people surveyed reported that due to this **pandemic** there has been a lot of **ignorance** of their health condition as it was not feasible to go and check out a **Doctor for minor health issues.**
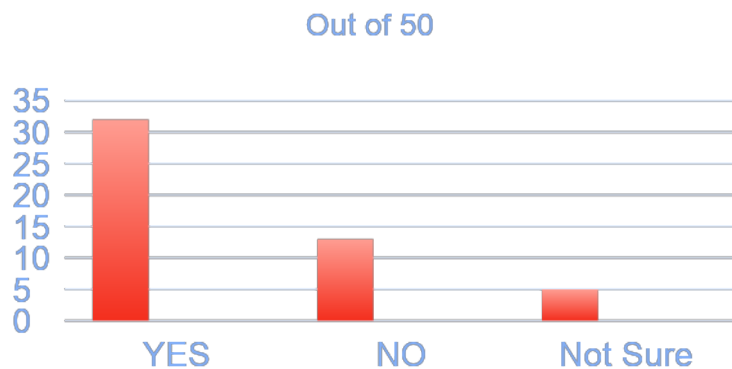
Figure 2.1: Ignored minor Health issues Due to Pandemic?

48% of Old Aged people agreed that at times they and their health care was being ignored

because of lack of time with their wards, lack of previous Records and lack of continuous guidance.
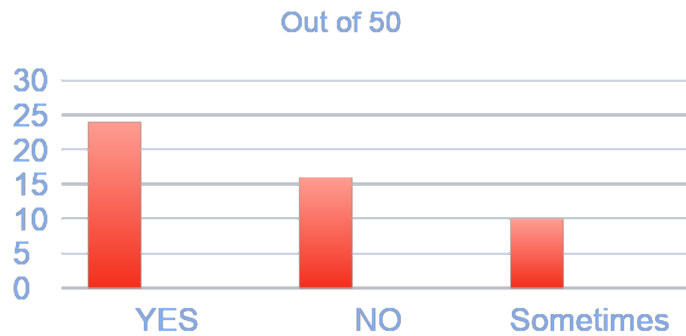

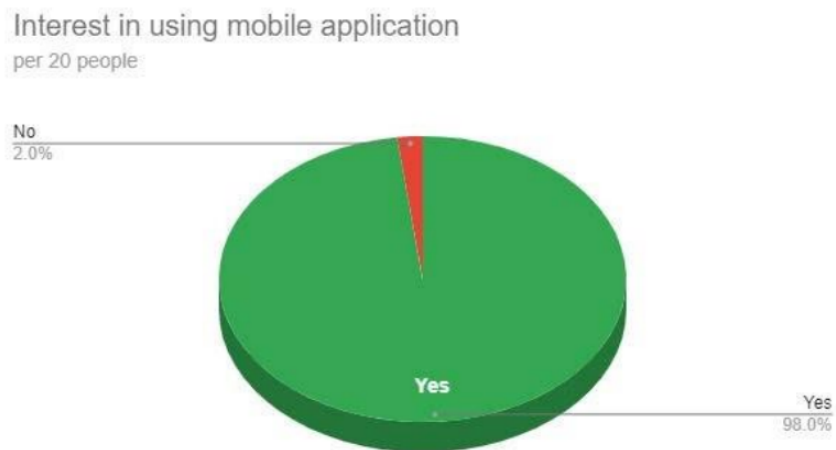Figure 2.2: Dependent on your wards for Health Care

Figure 2.3:Healthcare providers and patient using smartphones as a result

From this survey, we all know from healthcare workers to patients, the majority of them owned a smartphone.
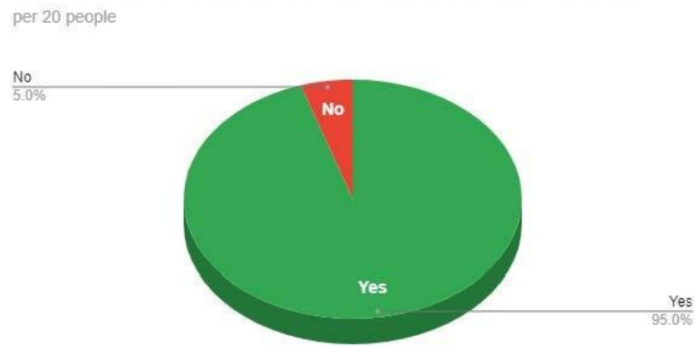
Figure 2.4: Desire to use mobile apps as a result

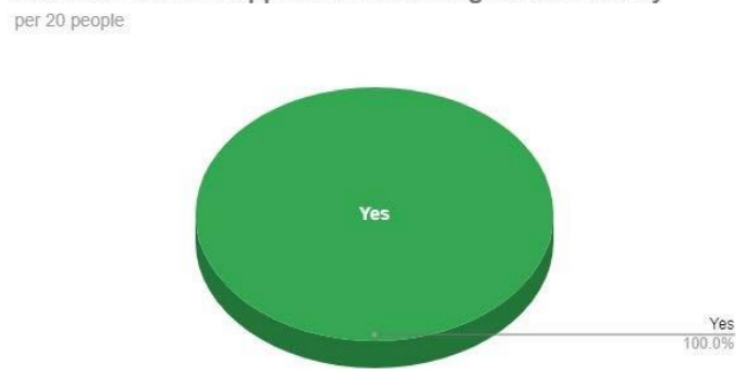From this survey, principally they like to get services through mobile apps.

Figure 2.5: Interest in cloud and Virtual Technology as a result

From this survey, we all know that everybody loves the cloud based application in their smartphone. They surprisingly like this technology and find it beneficial.

per 20 people

Figure 2.6: Results of plan regarding Cloud Based technology

From this survey, we realize that most clients need to utilize cloud technology, and the greater part of them are now presented with this technology.

Smart Healthcare Welcomes Blockchain Technology

Medical services suppliers and purchasers the same have benefitted gigantically from the quick advancement in programming based innovations. With the clinical consideration industry creeping quickly into customization, predominance in blockchains appears to be fast approaching.

Decentralization seemed to be a major hurdle for the telemedicine industry until blockchain took the steering. Centralized technology always has a risk of a single point of failure and is prone to data breaches, attacks and hacking, thus affecting user reliability. Blockchain technology provides efficient solutions to these problems. With the help of blockchain we are able To manage the record of medical records, as blockchain uses decentralized technology. Every node connected on the network checks and verifies all the ledger copies.
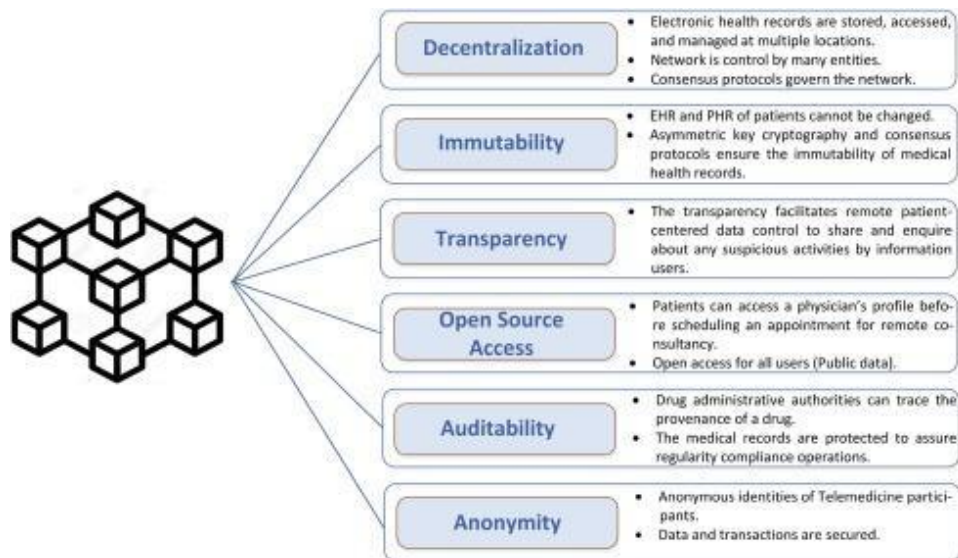
Figure 2.7: Features of blockchain

Blockchain safely produces total exchange chronicles to dispose of any clinical misrepresentation. Its uniqueness offers progressed security, because its information is unalterable. Because of its amazing installment framework, claims are resolved right away. Also it offers convenient admittance to computerized structure wellbeing records, prompting progressed patient treatment.

2.1.1 Opportunities for Blockchain

● Patient assent the board

A few difficulties are related with the traditional assent to the executives approach, for example, restricted trust on outsider servers, failure to perform fair review trails, and some more. Blockchain settles these provokes and helps telemedicine users to construct trust. Besides, Blockchain helps with performing review preliminaries to confirm consistency with assent the executives approaches.

● Recognizability of Medical equipments

The utilization of clinical units and gadgets at home was thought of as less solid by doctors due to the absence of information about the provenance of clinical hardware. Blockchain tended to this worry by giving totally changeless record exchanges to the possession and execution of testing units on the conveyed record.

Notoriety scores of every clinical device and test packs are recorded utilizing savvy contracts.

● Distant Treatment

In order to ensure patients receive proper care and treatment,it is essential that a one-to-one discussion with patients and doctors happens.. Telemedicine offers both a D2C and B2B model. In this model, healthcare providers can engage in the consultation using software that provides video and audio facilities.

● Efficient Payment gateway

Blockchain allows payments through digital signature technology in order to ensure secure transactions. centralized technology on one hand depends on a third party to manage transactions but Blockchain does not make use of any third-party services for transactions, thus enabling Blockchain to gain the trust of users. micropayments by offering a more secure, fast, and transparent approach.

After these open doors, a developing number of medical organizations are taking a strong fascination to put resources into blockchain improvement administrations for long haul business benefits.
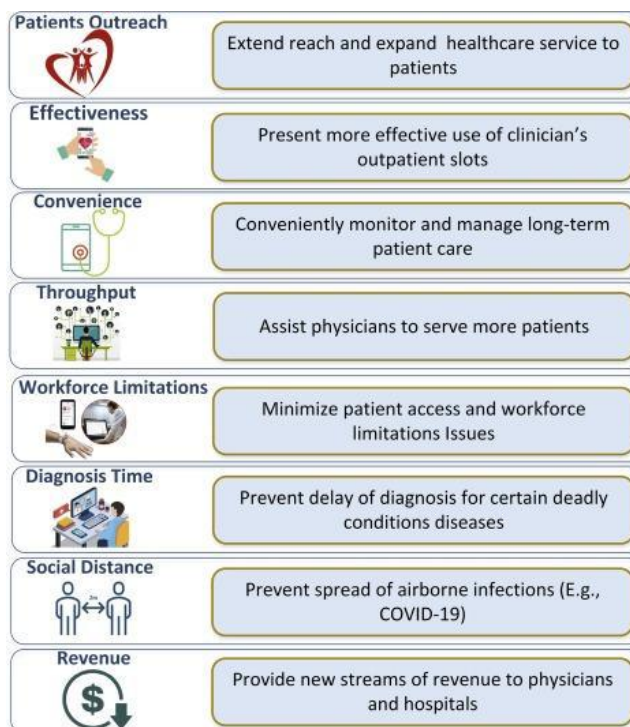

Figure 2.8: Blockchain x Telemedicine

2.1.2 Blockchain and Telemedicine trends 2022

Blockchain enables healthcare providers to permit easy flow of information, data security and integrity. Covid-19, a worldwide pandemic, was an unforeseen situation where so many people were unable to access medical care. From weekly lockdowns to slowly shifting to monthly lockdowns and with the ever increasing fear of infection accessing healthcare facilities became even more difficult.,thus enabling doctors and patients to take on smart healthcare.

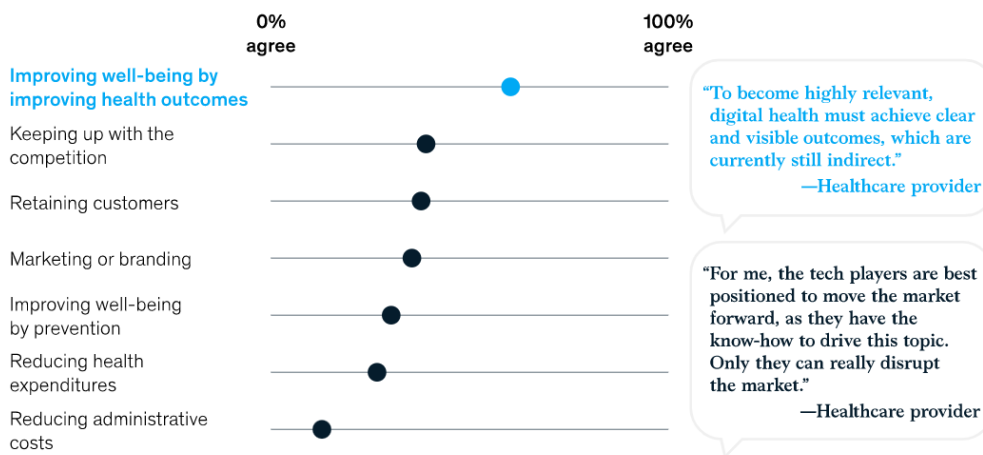**What is the main purpose of providing digital health services?**

Figure 2.9: Survey for providing digital health services

The telemedicine market has seen potential market and opportunities in the past year. The telemedicine market saw a growth of around $45 billion in 2019 per a Statista analysis. It is expected to grow by nearly four laps by 2026. This growth will be supported by various essential factors like increased one-to-one person cost, treatment costs, telehealth funding, and notable growth in the number of virtual healthcare users.

More than 87% of leaders concur that medical care industry and technologies they use have proactively become indivisible.With respect to the medical care industry, advanced change alludes to the execution of innovations, individuals, and cycles to convey more feasible results to patients and medical care. As such, everything without a doubt revolves around utilizing inventive methodologies and the furthest down the line advancements to get the most advantages of the business.

Almost 92% of medical care units accomplished better execution from the patient-driven system advancement model.
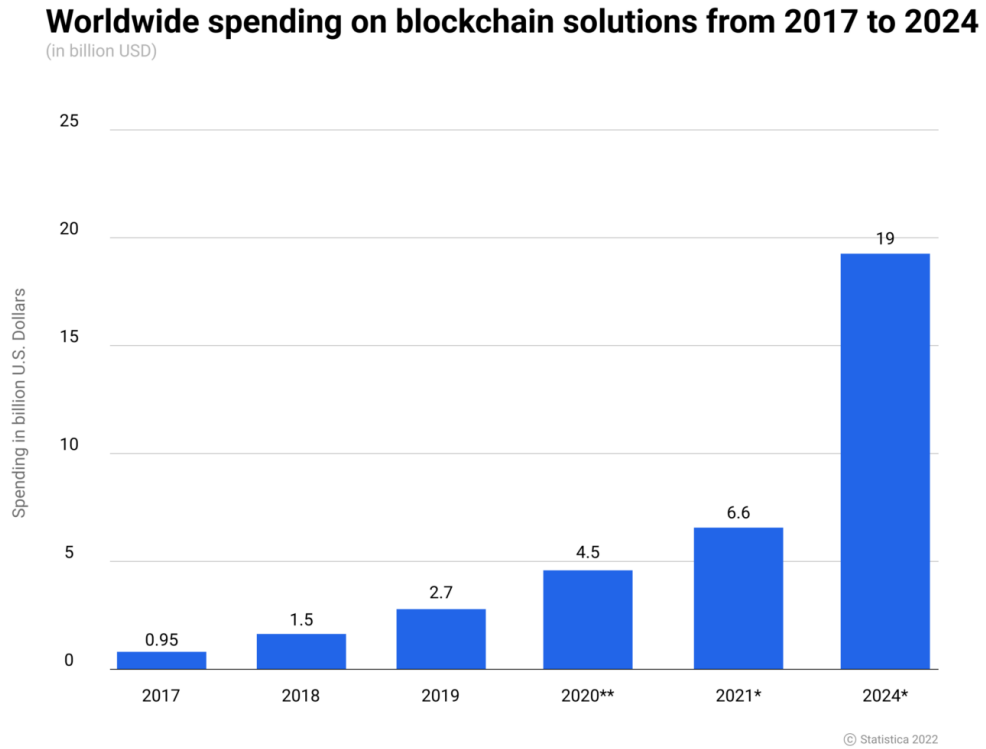

Figure 2.10: Spending on blockchain solution

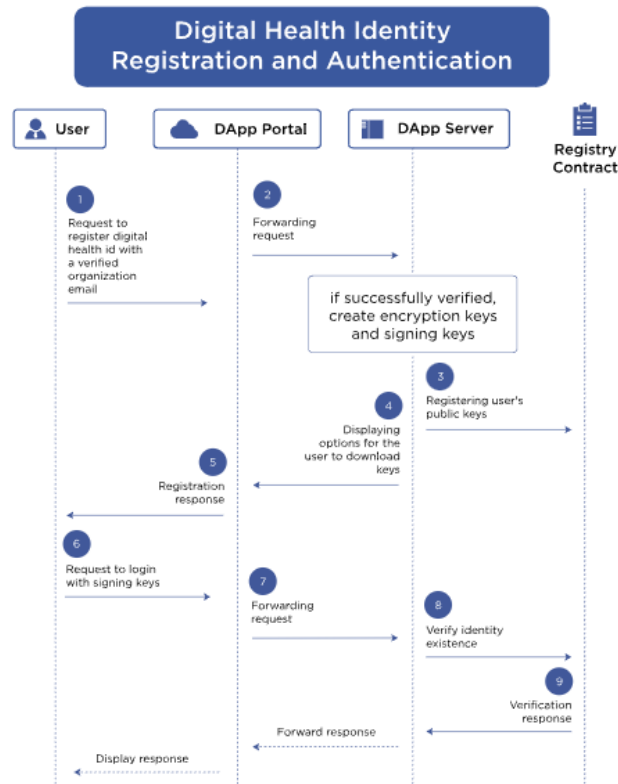## 2.1.3 Authorization and Authentication through Blockchain

Figure 2.11: Authorization and Authentication through Blockchain

The blockchain technology based on decentralized systems allows users to access a portal to enable easy sharing and viewing patients' data to create a cooperative treatment environment. users' identity authorization and authentication are done using digital verification.

Step 1: Demands for user registration

A client produces a solicitation to enlist an advanced id with a confirmed email.

Step 2: Request sent

The entryway of the telemedicine application gets this solicitation and advances it to the server.

Step 3: Creation of encryption keys

The server confirms the authenticity of the client. When the confirmation is fruitful,

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encryption and it are made to sign keys. These client's public keys are enlisted in registry agreements.

Step 4: Download keys choice accessible to the client

Presently, the server shows choices for the client to download keys on the entrance.

Step 5: Reaction of Registration

The entryway sends an enlistment reaction to the client.

Step 6: Demand for login

When the enrollment is done, the client demands for login with marking keys.

Step 7: Request sent

The demand for login is then shipped off the server for additional confirmation.

Step 8: Checking of Identity

Because of the login demand, the server checks character presence in the agreement.

Step 9: Verification reaction

The reaction of the check is then gotten back to the server.

Step 10: Response sent

Server advances this reaction to the entry.

Step 11: Response showed

At last, the entry shows the reaction to the client.
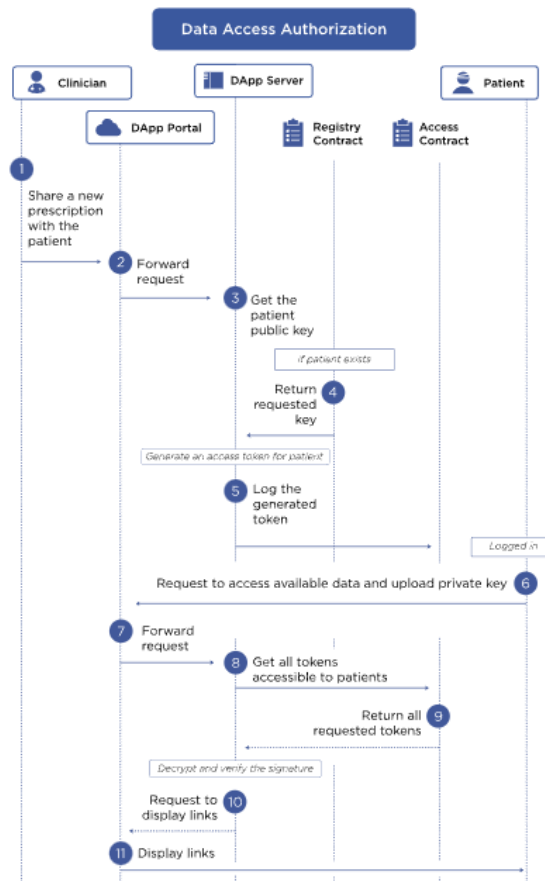
2.1.4 Data Access through Blockchain

Figure 2.12: Data access through Blockchain

Step 1: Healthcare provider shares lab reports and medical data with the patient.

A healthcare provider initiates a request to transmit a prescription with the patient details and results

Step 2: Request forwarded

The request is forwarded this request to the server.

Step 3: Server demands for the users public key

The server authorizes the patient's public key to verify their identity.

Step 4: Asks for requested key

The server cross verifies the patient's identity and returns the asked tokens to the main server.

Step 5: Logs through token

Now, the server releases a key through which the client logs.

Step 6: Enables patient access

Once the patient isauthorized and logged, one can generate a token to request to access medical information available via patient and lab staff and form a private encryption key.

Step 7: Request forwarded

The server delivers this request released by the patient to the main server.

Step 8: Server demands for all tokens accessible to patients

Step 9: Sending back of requested tokens

In response, the main server returns back all requested tokens to the server to ensure maximum privacy.

Step 10: Display links

These links are then allowed to be accessed by users, doctors, and medical staff.

2.1.5 Security and Confidentiality in telemedicine

A clinic or hospital in the smart cities of the future needs data security , integrity and confidentiality to cure patients properly. With the ever increasing development of our country and the way all our cities are now transforming into smart cities we for sure are on our path for development but with this comes many intelligent deceives.

A large amount of data is generated on a daily basis, which is also called big data . This data in smart cities certainly needs to be analyzed using Distributed computing systems. Processing and analyzing big data is not the only challenge for smart cities. Smart cities also have to take countermeasures for maintaining data security.

Data sent over the network/internet needs to be protected in order to maintain confidentiality of information. One of the major and most concerning security challenges in smart cities is the topic of medical data security. A lot of data is transmitted in the smart

city, including health-related data.

Health-related data must be transmitted with proper security over the network and its infrastructure in order to ensure that user information is safe and secure.

The security of medical data and its transmission in the smart city is an important issue because if this data is intercepted in the middle of the transmission path, then pieces of information will be leaked. In the transmission of medical data, it is possible that the confidentiality of the data will be lost and the data manipulated during the transfer. Manipulation of medical data in smart cities disrupts treatment and even kills patients in some cases.

We will talk about two ways to resolve this issue

1) In the primary layer data transmission will use blockchain.
2) In the secondary layer, blocks that are linked to patients' records are analyzed by machine learning methods. Patient records are placed in a block of the blockchain. Block of patients sent to other medical centers. Each treatment center can recommend the proposed type of treatment and blockchain attachment and send it to all nodes and treatment centers.
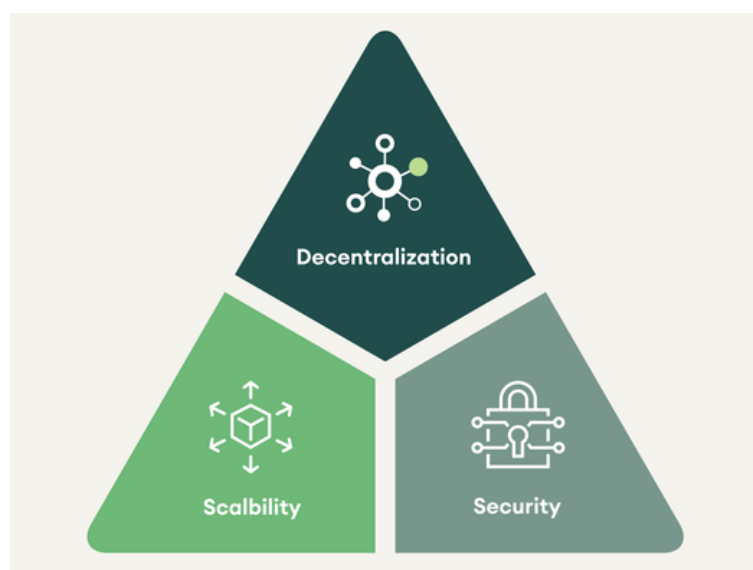

Figure 2.13: Features of Blockchain

A ton of medical care and telemedicine frameworks are brought together and neglect important data security and protection, straightforwardness, wellbeing records respectability, and detectability to recognize cheats and gatecrashers.

We have attempted to study and investigate the expected open doors and versatility challenges for blockchain innovation in the telehealth and telemedicine area. Blockchain innovation can give essential data security, honesty and client protection, straightforwardness, wellbeing records unchanging nature, and detectability to distinguish fakes connected with patients' protection cases and doctor accreditations.

Blockchain innovation can upgrade telemedicine administrations by providing distant medical care administrations in a way which is decentralized, sealed, straightforward, recognizable, solid, trustful, and secure. It empowers wellbeing experts to precisely distinguish cheats connected with doctor instructive accreditations and clinical testing packs normally utilized for locally established conclusions.

Wide sent of blockchain in telemedicine innovation is still in its early stages. A few difficulties and exploration issues should be set out to empower the boundless reception of blockchain innovation in telemedicine frameworks.

Data encryption

To comprehend the utilization of encryption in telemedicine security it means quite a bit to know what encryption is. Information encryption means to make an interpretation of the patient information into the structure that can't be decoded by unapproved clients or clients who don't have an encryption key. An individual with noxious aim can enter the organization, cheats can get scrambled wellbeing data with a misrepresentation mentality. For instance, we can utilize information encryption to guarantee the security of distributed video association among specialists and patients.

Encryption is applied to both put away and sent in the organization patient information:

- **Data encryption at rest** safeguards medical care information when it is put away

in the cloud or when it is in the organization.

- **Data encryption in transit** secures healthcare data when it's communicated utilizing on the way encryption guidelines.

2.2 Requirements

2.2.1 Functional Requirements

- A Web Application that interacts with the user intelligently and provides them with all the requirements that would be hosted on a private domain with MongoDB as a backend Database.
- A 24*7 Service will be provided and the patient's calls will be transferred to the Doctor On-Board at that present moment.
- The whole procedure would be even more efficient if the doctors make the necessary updates in the patients database simultaneously and one can do so by maintaining a unique patient ID.
- When a user logs into his/her account, he/she must be able to see his/her personal information on the screen.
- It must also prompt the user to ask for an appointment with the doctor.
- For each patient, the doctor must be able to see all the medical history and prescriptions and if there is any report, that the patient has sent.

2.2.2 Non-Functional Requirements

- Since the application must be accessible 24 hours a day, 7 days a week. So a PC with stable internet connection will be required.
- A good quality camera to ensure smooth video appointments.
- The system is accessed by multiple users simultaneously, so it has to offer a good response time (real time interaction), user interface. For that one must own a smart device or computer with good enough HD space, RAM memory, CPU etc
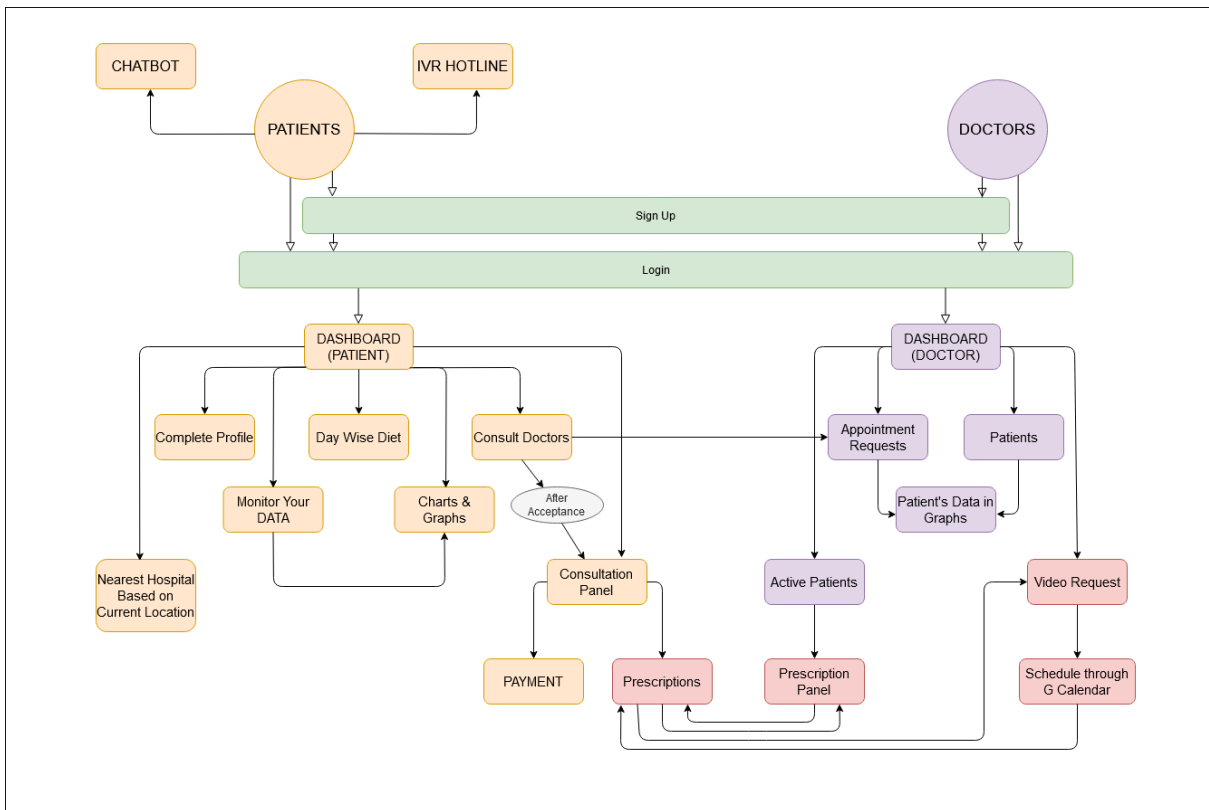
2.3 Use Case Diagram of Major Project

Figure 2.14: Use Case Diagram for cloud based telemedicine application

Use case 1: A patient will receive a unique user ID and password and a message that he has started using the application.

Once the patient has logged in, it will be able to:
- See the prescription sent by the doctor
- Schedule an appointment

Use case 2: A doctor

This doctor will be a already registered user, so after logging will be able to:
- Read the information of the patient
- Check all the data sent by a single patient
- Send an email to the patient

- View appointment statuses and schedule or reschedule an appointment.

2.4 TeleMediCare (Cloud Computing based telemedicine application) Features

- **Convenience**

  Patients no longer have to sit in the waiting area or stand in long queues to get themselves diagnosed. Instead, they can schedule an appointment on the web application with a doctor and connect at the comfort of their home. Which in turn will also help in starting the necessary treatment quickly and efficiently.

- **Medical Record Keeping**

  It makes it easier and much more convenient for doctors and patients to access patients' medical records and medical history quickly. It overcomes the interoperability problem by allowing various doctors to get access to the same data simultaneously and render patient's previous records quickly.

  Also, patients can share their medical records/history with family members, friends and doctors. There is no need to keep paper-based medical files or reports in their lockers or drawers, thus making it beneficial for the environment too.

- **Unified Patient Monitoring and Management System**

  It will help patients and doctors to remain regularly updated with prescriptions, and make any changes if required, follow up consultations, chronic disease monitoring , vitals monitoring etc.

Chapter 03: IMPLEMENTATION

3.1   Design of Problem Statement

The main purpose of this project is to use the internet and cloud features to provide healthcare facilities at the comfort of your home and helps you avoid any travelling cost and also making these health facilities available to old aged people or pregnant women, and to allow patients to use a web application to send/receive some information, and avoid or at least reduce the number of times per year that a patient must travel.

By using this application, the patients can get virtually diagnosed and the doctors can start immediate treatment. They can also send their own information to the doctor (vitals, BP,sugar etc.). Doctors will be able to access this information and study their patients. Whenever a doctor finds something odd like one of the vitals needs to be managed, effective immediately, he can send an email to the patient, thus starting the medication and asking him to come to the hospital for a checkup as soon as possible.

3.2   Flowgraph of the Major Project

We have a server application which stores and makes accessible the approaching questions from the patients. And the client is answerable for obtaining information from patients and sending them through the Internet. Medical care Administrators screen their patients utilizing the server application.

In our application script there are 6 main folders i.e, the 'data' folder which contains the data for medicine and diet, the 'client' folder contains all the scripts related to the client side for ex- the components of the application, node modules required for the client, .env file which contains react app secret key, etc, 'middleware' folder to access the request and the response object, 'controller' folder for fetching the data requested from the models, 'models' folder which contains different models according to the components of the application. They are used to save and manipulate the data.
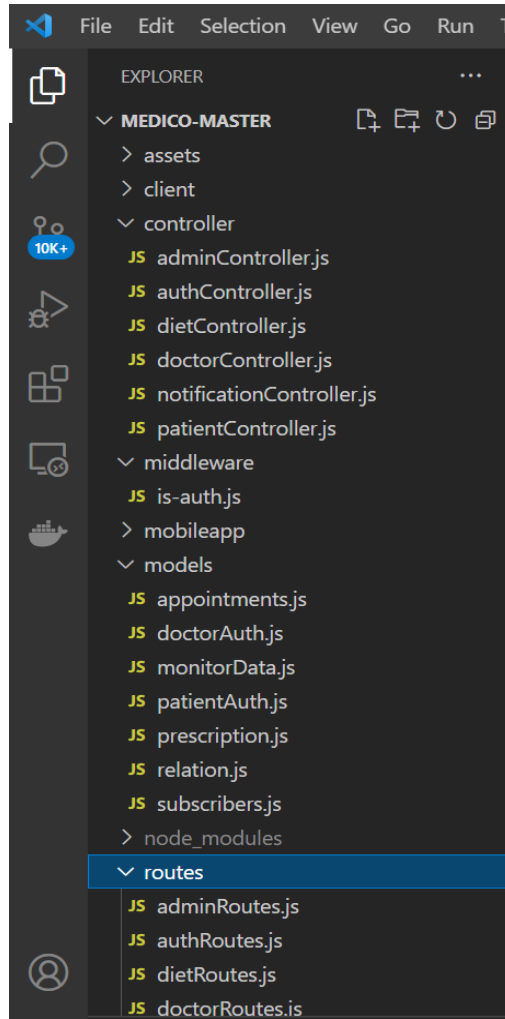
Figure 3.1: Application components

Likewise, information can be traded to XML documents. In the utilization of telemedicine, the clinical data generally should be circulated among clinical specialists and show authentic, and examination gadgets. Therefore, the server side was created fully intent on getting, putting away and dispersing the crucial sign information from patients. We have utilized React for building the front-finish of the application and have utilized express and NodeJs for the backend.
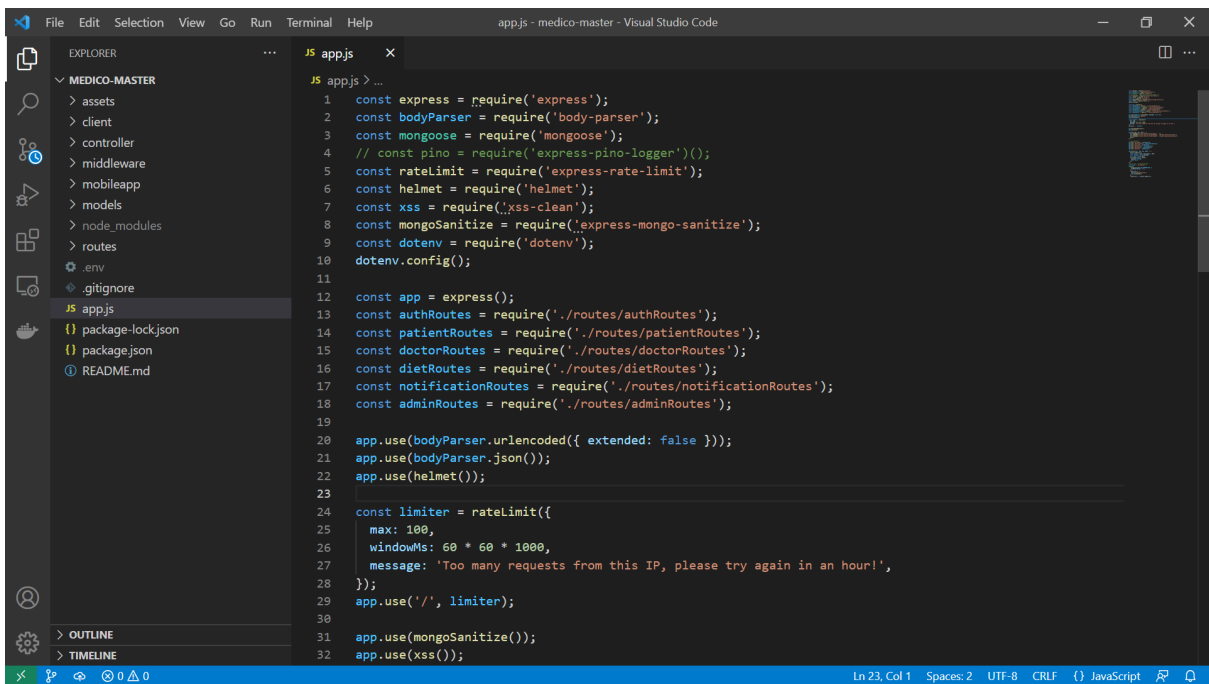
Figure 3.2: Application setup
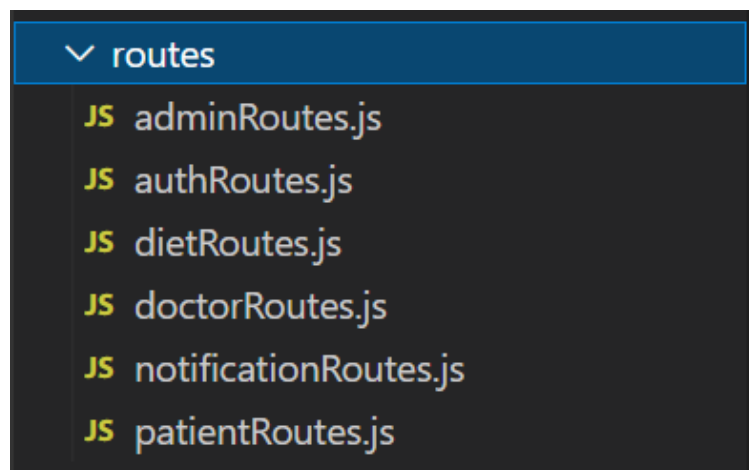
Figure 3.3: different routes available in the application
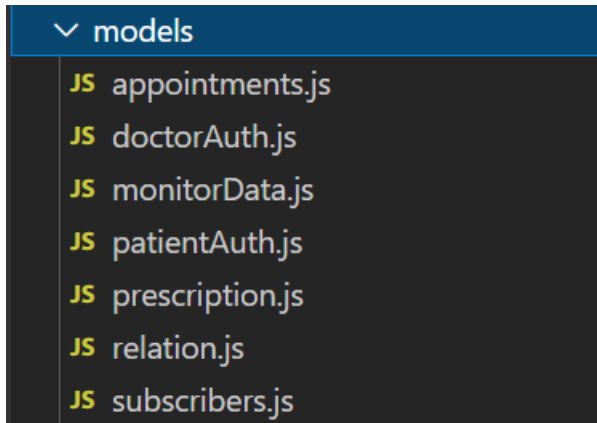
Figure 3.4: Different model scripts
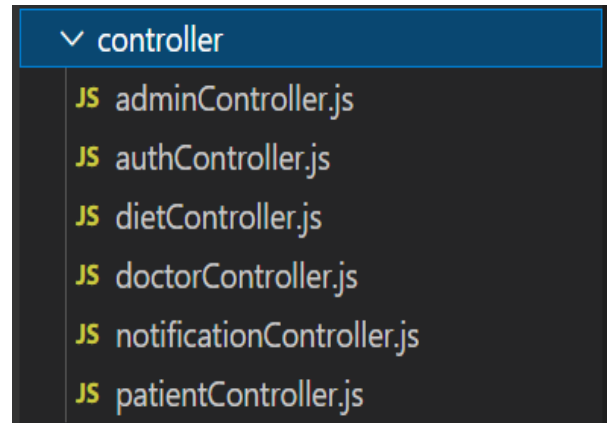
Fig 3.5: Folder for component controllers
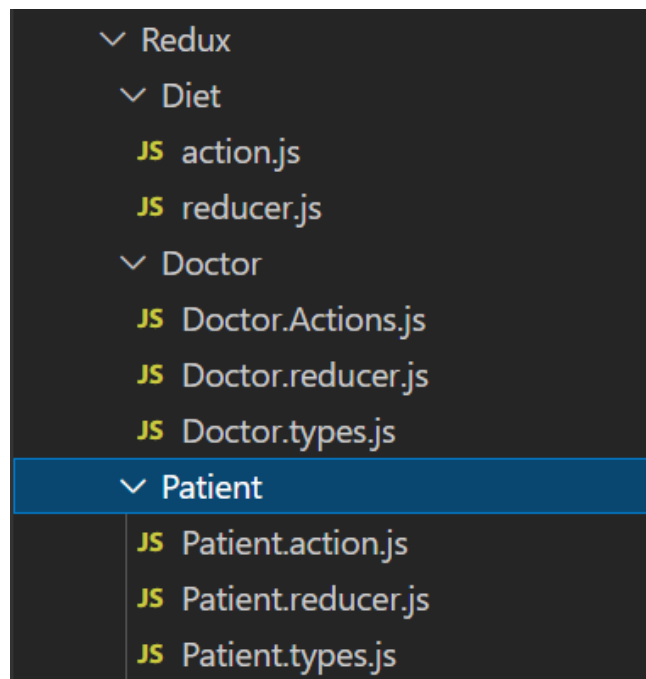
Figure 3.6: Scripts for action to be taken for doctor/patient
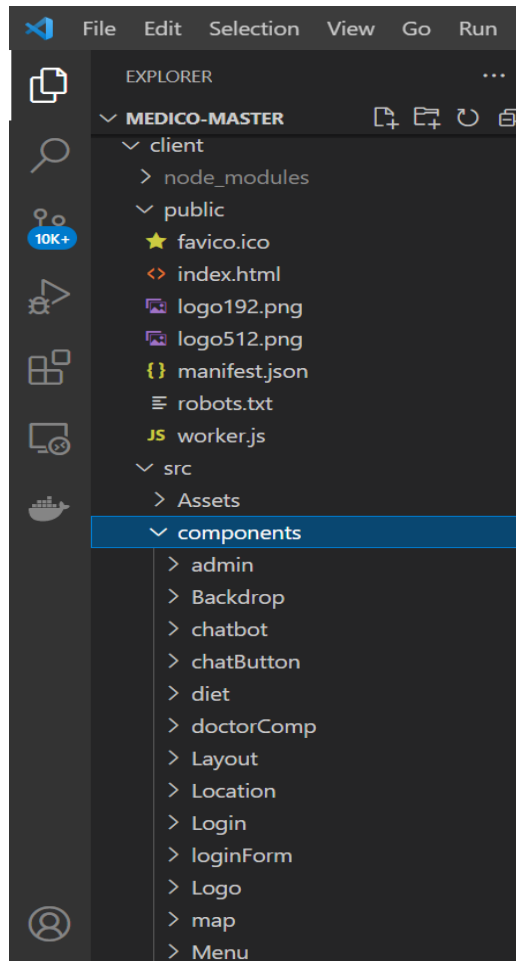
Figure 3.7: Different components in our application
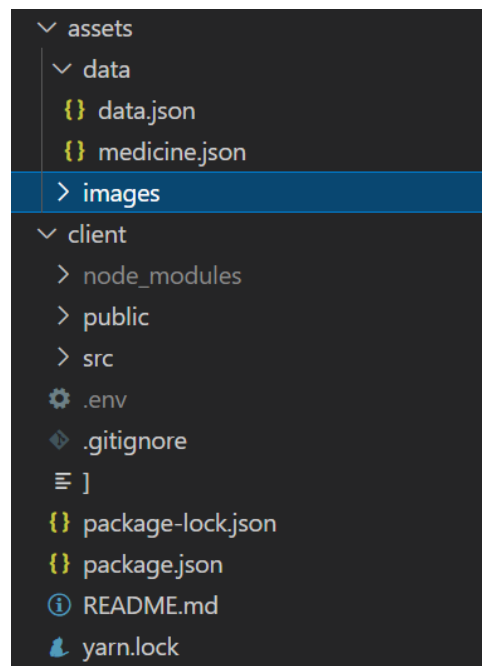
Figure 3.8: Data used for medicine and diet

To connect our mongoDB database we need to create a mongoDB Atlas cluster and provide its secret key in the .env file under the project directory.
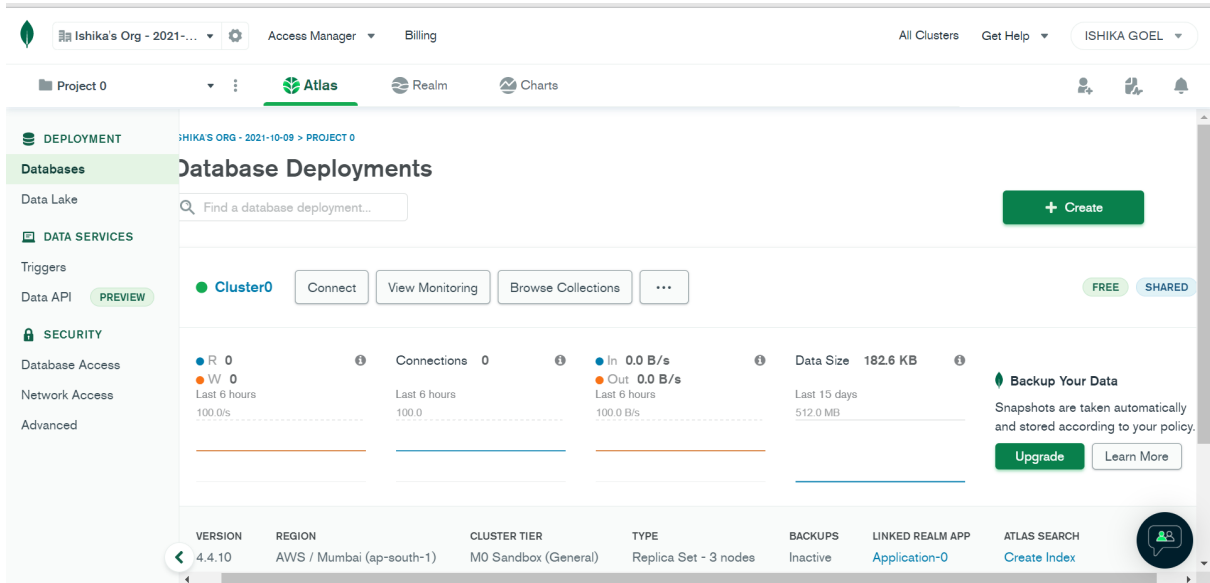

Figure 3.9: Cluster created in mongoDB

Further we enabled the Google API for Google Cloud Messaging for sending the notifications on the application and Google Map API for locating the nearest hospitals from our location.

Figure 3.10: Google Map API enabled

Figure 3.11: Google Cloud Messaging enabled

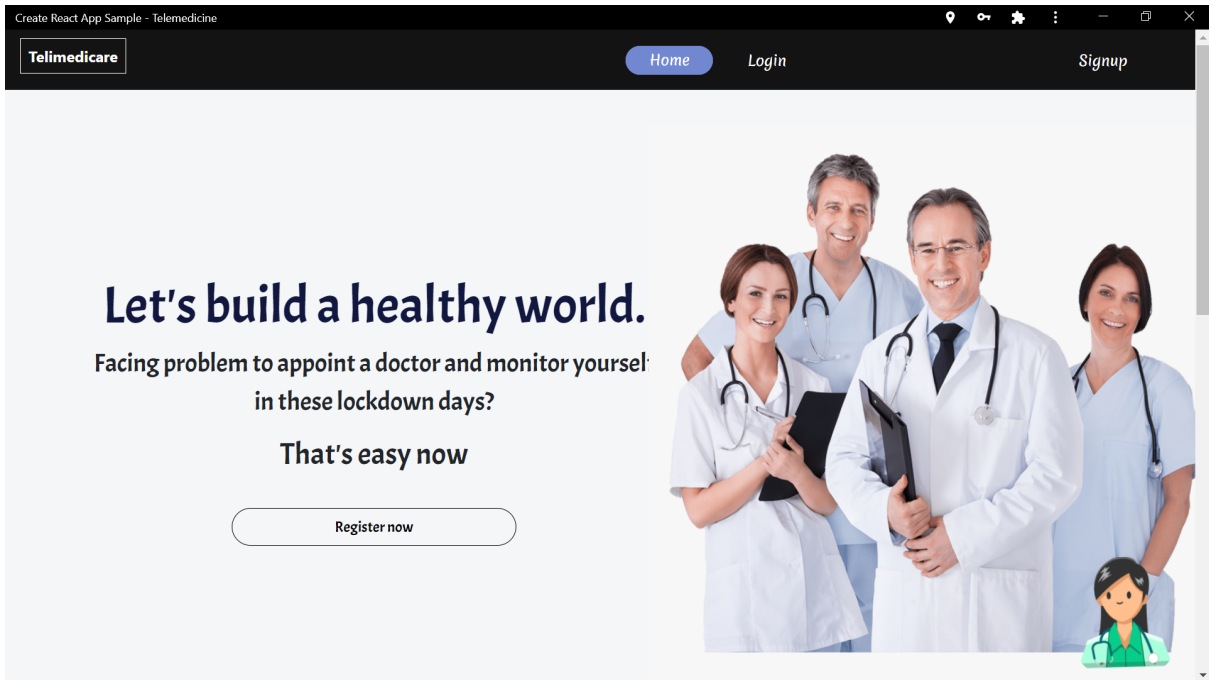## 3.3   Screenshots of the Major Project

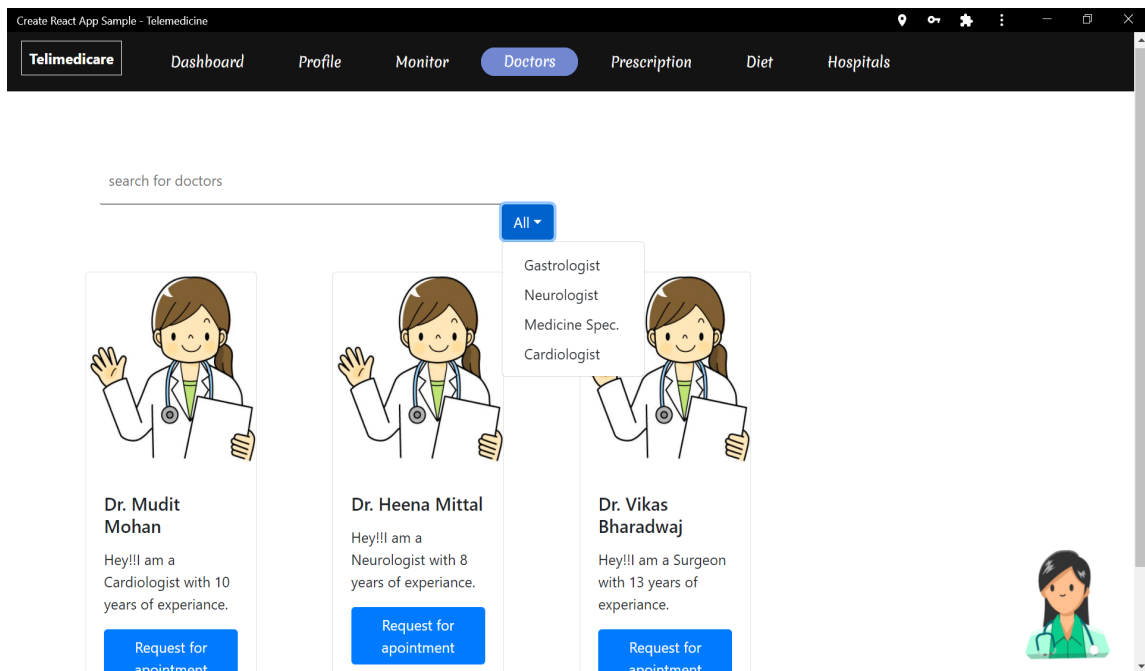Figure 3.12: Home Page of Telemedicine application

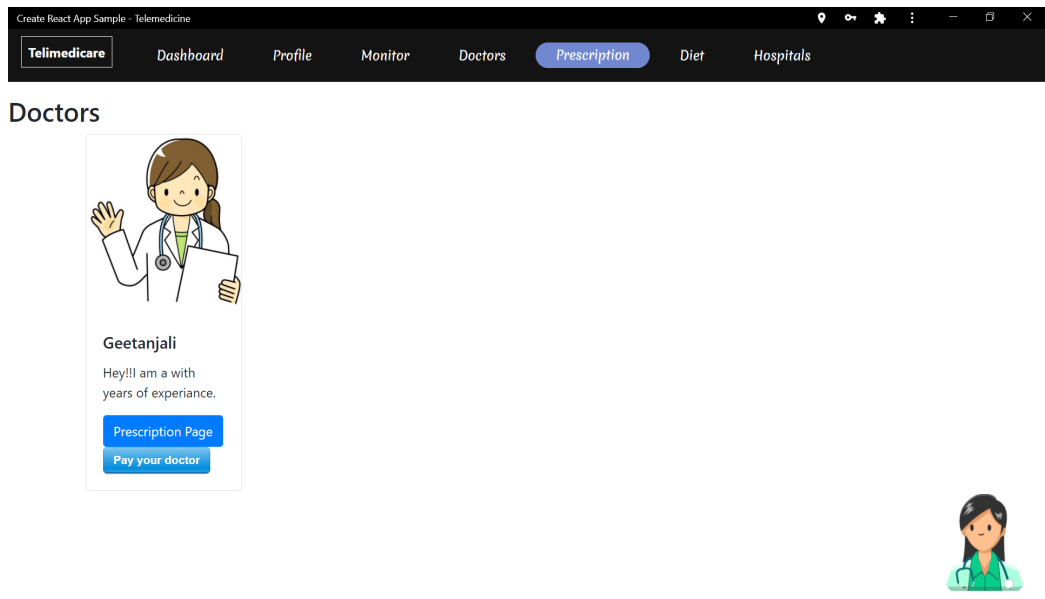

Figure 3.13: List of doctors available

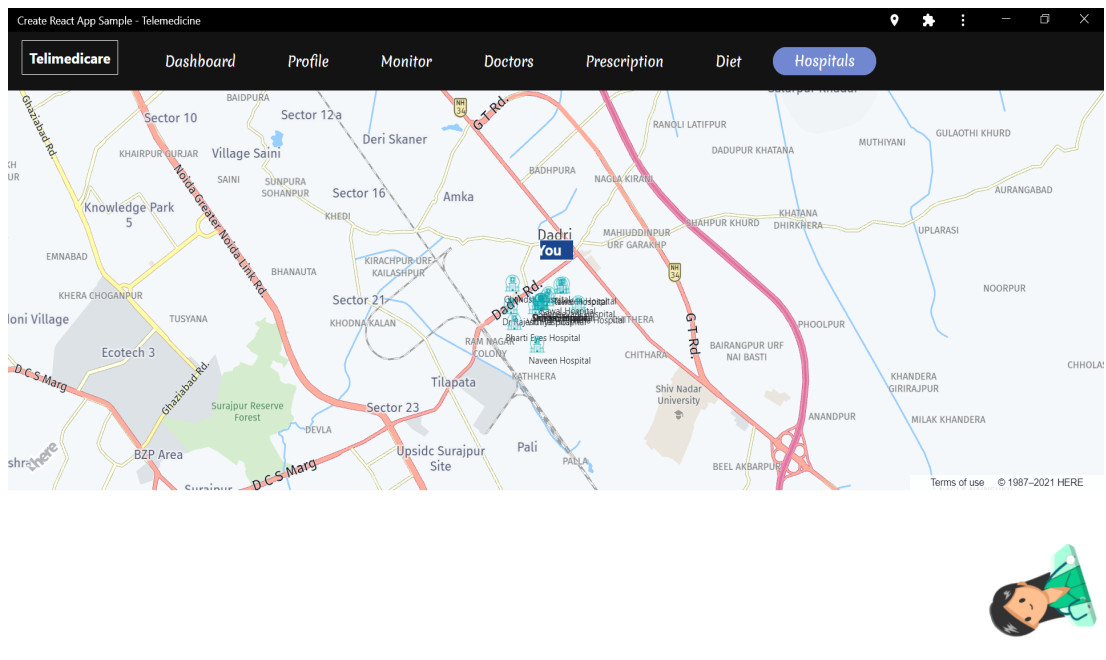Figure 3.14: Patient can read the prescription and pay to the doctor

Figure 3.15: Get the details of nearest hospitals from you location
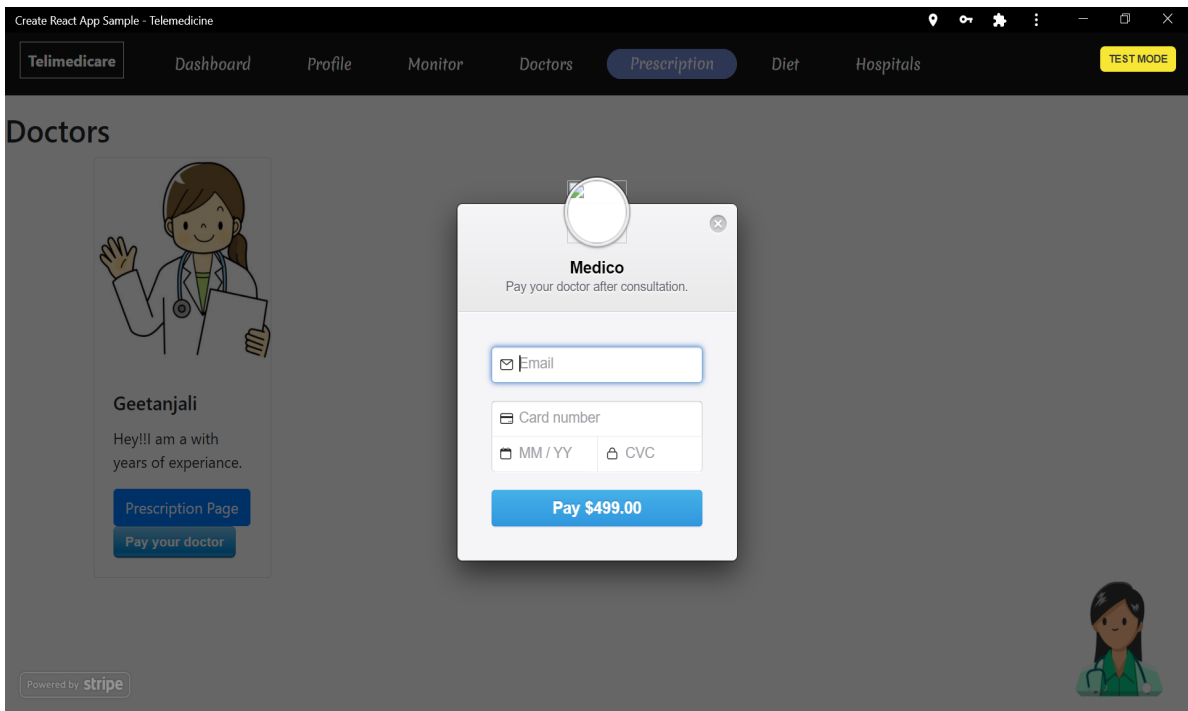
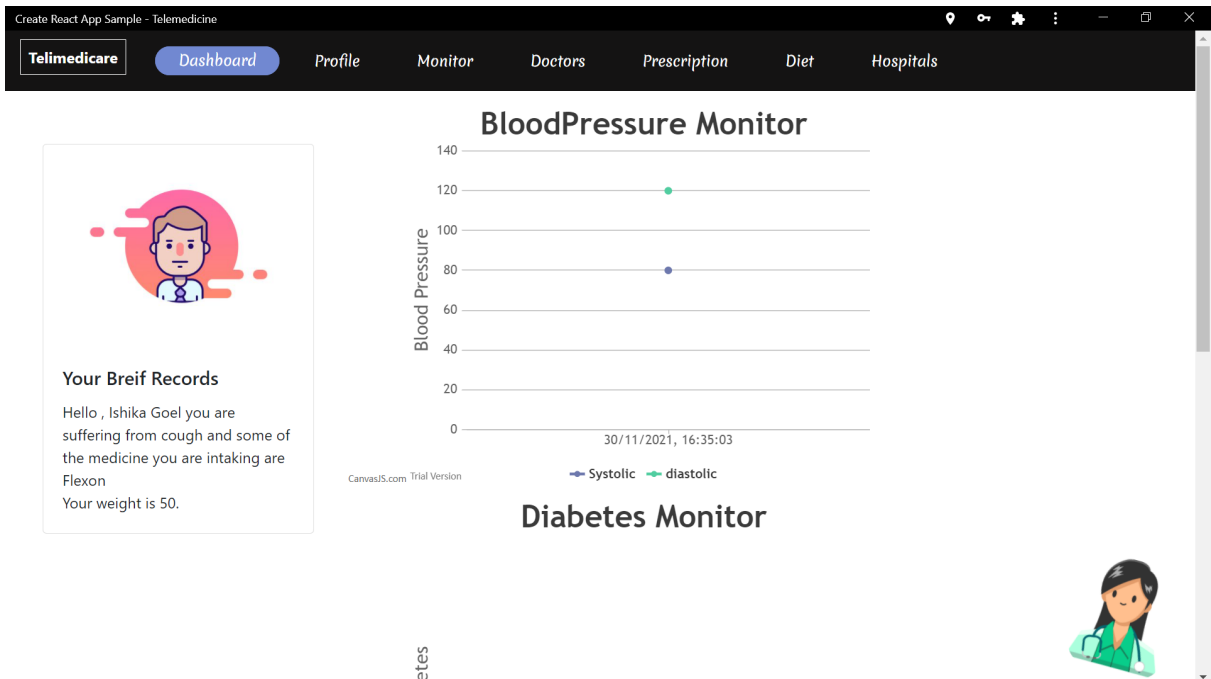Figure 3.16: Patient can make payment by either credit/debit card

Figure 3.17: Patient can monitor his/her daily progress

Chapter 04: RESULTS

4.1 Discussion

The evolution of the healthcare industry has had a significant impact leading to exponential growth, primarily due to digitalisation and telecare of treatment and consultation. Consumer is at ease, the service provider also has advantages and thus overall, its a win - win for all concerned.

The importance of Telehealth technologies is from the fact that it is able to make a positive impact in the healthcare lives of patients by optimizing Time factor, convenience and availability in remote areas. It now ensures convenient health care on the patient's time and convenience, saving travel time, plus reaching deeper into rural areas. Larger impact is on lowering the cost of treatment for the needy and easier access to specialists for patients, which till now has been limited to big cities. Video consultancy on mobile apps, and some additional tech tools such as sensors and monitors, are now adding quality in healthcare in the World, thus ensuring life-saving efforts and preventative healthcare to all.

Cloud computing systems has played a significant role in streamlining the digital / virtual healthcare as compared to in-house client-server systems by driving economical, operational, and functional advantages in the industry. Not only lowering the costs, cloud computing also brings in much needed scalability and flexibility in operations. Additionally, it brings in much better data security and privacy, which is the need of the hour and a larger threat in society. These benefits will have far reaching impact for the healthcare industry in accelerating its growth and protecting lives of citizens

This cloud based telemedicine application technology is a fairly new concept and improving by the day and hour. Backed by more and advanced research on the risks and benefits, healthcare professionals and patients will be equipped with more information and will be educated on how Telemedicine can change their lifestyle.

To conclude, multiple technologies can be experimented to empower patients to have larger control of their healthcare, but the depth of current research needs much deeper investigation and research to explore all of the possibilities that emerging technology can

offer to society at large. The goal of the project was to deep dive into the new technologies which are being created on a daily basis, but also discover how to transform patients' mindset to a different form of healthcare backed by the power of technology.

4.2 Application of the Major Project

There are several practical applications that can be used, some of these are as mentioned below:

- Digital Connect : This App will entice new tech-savvy customer groups and digitally connect healthcare with customers.

- Monitoring healthcare: An Eagle's Eye View for Medical Organizations to monitor each and every action taken.

- Patient Records and Monitoring: Doctors can see patients' history of medication and test reports, thereby reducing time and cost with effective treatment.

- Ease and Convenience: Ease for doctors to Monitor daily data and improvements of a chronic patient.

- Treatment Cost: No Extra costs of keeping a patient on observation in hospitals.

- Customisation based on demographics: Say custom diet based on **Location**, **Age**, **Sex** and other parameters.

- Authenticity: Prescriptions will be authentic and be provided at our platform only so that people can purchase medicines from their locality itself.

4.3 Limitations of the Major Project

The only security measure offered currently in this project is the login process. It needs further security checks and controls. Currently, only users with a valid username and password will be able to access the private sections of the application. It does not check if the values or parameters entered by the patient are in the required range or not. For example when a patient is going to insert some information, there should be a mechanism to control that the values that the patient is adding are correct. The system currently checks if all the parameters have been filled in, but does not highlight / control if there is a value out of

normal range. For example, if a patient enters a weight value of 780 kilos, the system should prompt an error.

● Performance: It is likely to be a victim of higher latency thus lowering and creating performance bottlenecks while accessing data.

● Data security and governance: Larger threat is on Data Privacy and safety and exposing it to hackers. There may be compliance issues also when certain types of data end up in cloud systems.

4.4 Future work

● Launching of this application for the benefit of mankind and larger society, specially those in rural and inaccessible locations.

● Collaborating with different Medical Organizations and NGOs to drive better healthcare

● Enhancing the Security of the Storage Servers - encryption, double layer security, etc..

● Improving all in all interaction and verification of the specialists on-board.

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