HOSPITAL MANAGEMENT SYSTEM

A MINI PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report **" Hospital Management System"** is the bonafide work of **Nandini (RA2011031010003), Shivendra Bharuka (RA2011031010020), Stuti Jain (RA2011031010031)** of III Year/VI Sem B.tech(CSE) who carried out the mini project work under my supervision for the course 18CSC303J- Database Management systems in SRM Institute of Science and Technology during the academic year 2022-2023(Even sem).

28/4/23

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ABSTRACT

A Hospital Management System (HMS) is a computer-based system that manages all aspects of hospital operations, such as patient management, appointment scheduling, medical records, billing, and inventory management. The primary objective of the HMS is to enhance the quality of patient care and optimize the hospital's performance by automating its processes. The proposed HMS project aims to develop a comprehensive software system that integrates all the hospital's operations into a single platform, enabling healthcare providers to manage patient data efficiently and securely. The system will consist of several modules that perform various functions, including patient registration, appointment scheduling, laboratory and radiology management, pharmacy management, and billing. The patient registration module will allow patients to register at the hospital by providing their personal details, medical history, and insurance information. The appointment scheduling module will enable patients to book appointments with doctors, and doctors to manage their schedules and view patient appointments. The laboratory and radiology modules will provide a platform for healthcare providers to manage diagnostic tests and imaging procedures. The pharmacy management module will manage the hospital's medication inventory and provide real-time updates on stock levels. The billing module will generate bills for patient services, process insurance claims, and manage financial transactions. The HMS project will utilize the latest technologies to ensure that the system is secure, scalable, and easy to use. The system will be developed using a client-server architecture, with a web-based user interface that healthcare providers can access from any device with internet connectivity. The system will also incorporate advanced security features, such as user authentication, data encryption, and access controls, to protect patient data from unauthorized access. In conclusion, the proposed HMS project will revolutionize the way hospitals manage patient data and operations. The system will improve patient care, increase efficiency, and reduce operational costs, making it a valuable tool for healthcare providers.

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ABBREVIATIONS

DBMS: Database Management System

SQL: Structured Query Language

RDBMS: Relational Database Management System

CRUD: Create, Read, Update, Delete

DDL: Data Definition Language

DML: Data Manipulation Language

ACID: Atomicity, Consistency, Isolation, Durability

ERD: Entity-Relationship Diagram

PK: Primary Key

FK: Foreign Key

UML: Unified Modeling Language

ODBC: Open Database Connectivity

JDBC: Java Database Connectivity

ORM: Object-Relational Mapping

NOSQL: Not Only SQL

API: Application Programming Interface

GUI: Graphical User Interface

XML: Extensible Markup Language

JSON: JavaScript Object Notation

ANSI: American National Standards Institute

CHAPTER 1: INTRODUCTION

1.1 About

A Hospital Management System (HMS) is a computer-based system that manages the day-to-day operations of a hospital. It includes several modules that manage different aspects of the hospital, such as patient management, appointment scheduling, medical records, billing, and inventory management. The HMS project aims to develop a comprehensive software system that integrates all the hospital's operations into a single platform, enabling healthcare providers to manage patient data efficiently and securely.

The proposed HMS project seeks to address some of the challenges faced by healthcare providers, such as managing patient records, scheduling appointments, and managing finances. The system will provide a centralized platform that allows healthcare providers to access patient records, view appointment schedules, and manage billing and inventory. The system will be developed using a client-server architecture, with a web-based user interface that healthcare providers can access from any device with internet connectivity.

The HMS project will consist of several modules that perform various functions. The patient registration module will allow patients to register at the hospital by providing their personal details, medical history, and insurance information. The appointment scheduling module will enable patients to book appointments with doctors, and doctors to manage their schedules and view patient appointments. The laboratory and radiology module will provide a platform for healthcare providers to manage diagnostic tests and imaging procedures. The pharmacy management module will manage the hospital's medication inventory and provide real-time updates on stock levels. The billing module will generate bills for patient services, process insurance claims, and manage financial transactions.

The HMS project will utilize the latest technologies to ensure that the system is secure, scalable, and easy to use. The system will incorporate advanced security features, such as user authentication, data encryption, and access controls, to protect patient data from unauthorized access. The system will also be designed to be scalable, allowing healthcare providers to add more modules as needed to meet the hospital's evolving needs.

1.2 PROBLEM STATEMENT

The healthcare industry is facing numerous challenges that affect the quality of patient care, efficiency, and cost-effectiveness. One of the primary challenges faced by healthcare providers is managing patient data and the day-to-day operations of the hospital. Traditional paper-based systems are often prone to errors, time-consuming, and challenging to manage, leading to delays in patient care, mismanagement of resources, and increased costs.

The problem statement of the Hospital Management System (HMS) project is to address these challenges by developing a comprehensive software system that integrates all the hospital's operations into a single platform, enabling healthcare providers to manage patient data efficiently and securely. The proposed HMS project seeks to provide a centralized platform that allows healthcare providers to access patient records, view appointment schedules, and manage billing and inventory. The system will be developed using a client-server architecture, with a web-based user interface that healthcare providers can access from any device with internet connectivity.

The traditional system of managing hospital operations is cumbersome and requires a lot of manual labor, which results in errors, delay in patient care, and increased costs. This outdated system also makes it challenging to share patient data across different departments, which can result in miscommunication and inefficiencies. Additionally, it can be difficult to manage the hospital's resources, including equipment, inventory, and medication.

To address these challenges, the proposed HMS project will provide healthcare providers with an efficient and secure system that is easy to use, scalable, and cost-effective. The system will be designed to streamline patient care processes, improve resource management, and reduce operational costs, making it a valuable tool for healthcare providers. The HMS project aims to provide a comprehensive solution that can address the challenges faced by healthcare providers in managing patient data and hospital operations.

1.3 OBJECTIVES

The Hospital Management System (HMS) project aims to develop a comprehensive software system that integrates all the hospital's operations into a single platform, enabling healthcare providers to manage patient data efficiently and securely. The objectives of the HMS project are:

1. Efficient Patient Management: The HMS project aims to streamline the patient management process by providing healthcare providers with an efficient and secure platform to manage patient records, appointments, and medical history.

2. Resource Management: The project aims to improve the management of hospital resources, including equipment, inventory, and medication, by providing real-time updates on stock levels, usage patterns, and maintenance schedules.

3. Cost-effectiveness: The project aims to reduce operational costs by automating routine tasks, optimizing resource utilization, and reducing errors and inefficiencies in the healthcare delivery process.

4. Data Security: The project aims to ensure the security of patient data by incorporating advanced security features, such as user authentication, data encryption, and access controls, to protect patient data from unauthorized access.

5. Scalability: The project aims to be scalable, allowing healthcare providers to add more modules as needed to meet the hospital's evolving needs.

6. Improved Patient Care: The project aims to improve patient care by providing healthcare providers with real-time access to patient records, appointment schedules, and medical history, enabling them to provide timely and accurate care to patients.

7. Streamlined Billing and Insurance Processes: The project aims to streamline the billing and insurance processes, reducing errors and inefficiencies, and enabling healthcare providers to generate bills for patient services, process insurance claims, and manage financial transactions.

8. Regulatory Compliance: The project aims to ensure regulatory compliance by adhering to industry standards, such as HIPAA, ensuring the privacy and security of patient data.

1.4 SCOPE AND APPLICATIONS

The scope and applications of the Hospital Management System (HMS) project are vast, and it can benefit healthcare providers, patients, and other stakeholders in the healthcare industry. Some of the significant scopes and applications of the HMS project are:

1. Patient Management: The HMS project provides healthcare providers with a comprehensive platform for managing patient data, including medical history, appointments, and test results, enabling them to provide timely and accurate care to patients.

2. Resource Management: The project aims to improve the management of hospital resources, including equipment, inventory, and medication, by providing real-time updates on stock levels, usage patterns, and maintenance schedules.

3. Billing and Insurance Management: The project provides a streamlined process for managing billing and insurance claims, enabling healthcare providers to generate bills for patient services, process insurance claims, and manage financial transactions.

4. Employee Management: The project provides a platform for managing employee data, including their schedules, salaries, and benefits, making it easier to manage staff and ensure compliance with labor laws.

5. Reporting and Analytics: The project provides a platform for generating reports and analytics, enabling healthcare providers to track key performance indicators, identify areas for improvement, and make informed decisions based on data-driven insights.

6. Telemedicine: The project's platform can be integrated with telemedicine solutions, enabling healthcare providers to offer remote consultations, diagnosis, and treatment to patients, improving access to healthcare services.

7. Mobile Applications: The project's platform can be accessed through mobile applications, enabling healthcare providers to manage patient data and other hospital operations from their mobile devices.

8. Regulatory Compliance: The project ensures regulatory compliance by adhering to industry standards, such as HIPAA, ensuring the privacy and security of patient data.

1.5 GENERAL AND UNIQUE SERVICES IN THE DATABASE APPLICATION

The Hospital Management System has always been one of the most critical solutions to be implemented in a hospital. An advanced cloud based HMS can significantly boost the productivity of a hospital and save up to 50% of operational costs. A reliable hospital management system can give you more detailed insights and empower you to make better decisions in the future. But it won't be easy to get one until you become aware of a few features of HIMS that are necessary for any size hospital. During the investment decision on HMS, pick several issues that you think features of the hospital management system can fix. The decision you take here will help you not only achieve cost-saving but also save you from the false promises of several HMS providers.

GENERAL FEATURES :

Patient side features:

● There is a separate interface for patients. Patients have a separate login.

● Patients can book appointments. Patients can view/update/cancel already booked

appointments if necessary.

● Patients are able to see complete diagnoses, prescriptions, and medical histories.

Doctor side features:

● There is a separate interface for doctors. Doctors have a separate login.

● Doctors are able to access patient history and profile, and add to patient history.

● Doctors are able to give diagnosis and prescriptions.

UNIQUE FEATURES:

Patient side features:

● Patients can enter their previous medical history.

● Canceled appointments create free slots for other patients.

● The system avoids clashes of appointments with other patients. Each patient is

therefore ensured his/her slot.

● Patient medical history is only available to the doctor with whom the appointment is

booked to ensure privacy.

Doctor side features:

● The system takes into consideration doctor schedules and does not allow

appointments when a doctor is already busy or has a break.

● Doctors are able to modify diagnosis and prescriptions.

1.6 SOFTWARE REQUIREMENTS SPECIFICATION

The Hospital Management System (HMS) project is designed to automate and streamline hospital operations, including patient management, resource management, billing and insurance management, employee management, reporting and analytics, telemedicine, and regulatory compliance. This Software Requirements Specification (SRS) document outlines the functional and non-functional requirements of the HMS project.

Functional Requirements:

1. Patient Management:

- The system must allow healthcare providers to create and maintain patient records, including demographic information, medical history, allergies, and medications.

- The system must allow healthcare providers to schedule appointments, including booking, rescheduling, and canceling appointments.

- The system must allow healthcare providers to manage patient tests, including ordering, tracking, and retrieving test results.

- The system must allow healthcare providers to manage patient admissions and discharges, including room assignments, bed allocation, and discharge summaries.

2. Resource Management:

- The system must allow healthcare providers to manage hospital resources, including equipment, inventory, and medication.

- The system must allow healthcare providers to track resource usage, including stock levels, usage patterns, and maintenance schedules.

- The system must allow healthcare providers to generate purchase orders, receive goods, and manage invoices related to hospital resources.

3. Billing and Insurance Management:

- The system must allow healthcare providers to generate bills for patient services, including consultation fees, medication costs, and laboratory tests.

- The system must allow healthcare providers to process insurance claims, including verifying patient eligibility, submitting claims, and tracking claim status.

- The system must allow healthcare providers to manage financial transactions, including recording payments, issuing refunds, and generating financial reports.

4. Employee Management:

- The system must allow healthcare providers to manage employee data, including their schedules, salaries, and benefits.

- The system must allow healthcare providers to track employee attendance, including leave requests, sick days, and overtime hours.

- The system must allow healthcare providers to manage employee performance, including performance evaluations, promotions, and disciplinary actions.

5. Reporting and Analytics:

- The system must allow healthcare providers to generate reports and analytics, including patient statistics, resource usage, financial reports, and regulatory compliance reports.

- The system must allow healthcare providers to customize reports and analytics based on user preferences, including data filters, visualization options, and export formats.

6. Telemedicine:

- The system must integrate with telemedicine solutions, enabling healthcare providers to offer remote consultations, diagnosis, and treatment to patients.

- The system must allow healthcare providers to manage telemedicine appointments, including booking, rescheduling, and canceling appointments.

- The system must allow healthcare providers to record telemedicine sessions, including patient data, clinical notes, and billing information.

Non-functional Requirements:

1. Usability:

- The system must have a user-friendly interface, allowing healthcare providers to access and manage patient data and hospital operations with ease.

- The system must have a responsive design, allowing healthcare providers to access the system from multiple devices, including desktops, laptops, tablets, and mobile phones.

2. Performance:

- The system must have high availability, ensuring that healthcare providers can access patient data and hospital operations at all times.

- The system must have fast response times, allowing healthcare providers to perform tasks quickly and efficiently.

3. Security:

- The system must comply with industry standards, including HIPAA, ensuring the privacy and security of patient data.

- The system must have role-based access control, allowing healthcare providers to access patient data and hospital operations based on their job responsibilities.

- The system must have audit trail capabilities, allowing healthcare providers to track user activity and detect unauthorized access.

The Hospital Management System (HMS) project has many functional and non-functional requirements, including patient management, resource management, billing and insurance management, employee management, reporting and analytics, telemedicine, usability, performance, and security.

CHAPTER 2: LITERATURE SURVEY

A literature survey on hospital management systems reveals a significant amount of research and publications on the topic. The following are some key findings from the literature survey:

1. Hospital management systems have been studied extensively in the past decade due to their potential to improve patient outcomes and reduce costs. Researchers have explored various aspects of hospital management systems, including design, implementation, evaluation, and impact on patient care.

2. Hospital management systems have been found to improve hospital operations and patient outcomes. A study by Zeynep et al. (2020) found that the use of hospital management systems led to reduced waiting times, increased patient satisfaction, and improved clinical outcomes.

3. Implementation challenges of hospital management systems have been identified in the literature, including lack of user acceptance, insufficient training, and data integration issues. These challenges can hinder the successful implementation of hospital management systems and reduce their effectiveness.

4. The use of electronic medical records (EMR) has been found to improve patient care outcomes. EMRs allow healthcare providers to access patient information in real-time, reducing errors, improving coordination of care, and reducing healthcare costs. A study by Zhou et al. (2019) found that EMRs improved patient outcomes, including reduced length of stay and decreased mortality rates.

5. The use of mobile health (mHealth) technology in hospital management systems has been explored in recent years. mHealth technology allows healthcare providers to access patient data on their mobile devices, improving care coordination and communication. A study by Liu et al. (2020) found that the use of mHealth technology improved patient outcomes and reduced healthcare costs.

6. The literature also highlights the importance of data security and privacy in hospital management systems. Hospital management systems can be vulnerable to cyber-attacks, which can compromise patient data and hospital operations. Therefore, the implementation of robust security measures is essential to protect patient data and ensure compliance with regulatory requirements.

In conclusion, the literature survey reveals that hospital management systems have significant potential to improve patient outcomes and hospital operations. However, their successful implementation and effectiveness depend on various factors, including user acceptance, training, data integration, and data security. Further research is needed to address these challenges and improve the design and implementation of hospital management systems.

2.1 EXISTING SYSTEM

The existing system for hospital management varies depending on the hospital and the location. Some hospitals use manual systems, while others use electronic systems. The manual system involves paper-based records and documentation, which are often cumbersome, time-consuming, and prone to errors.

In contrast, electronic systems automate hospital operations, streamline workflows, and provide real-time access to patient data and hospital operations. These electronic systems include Hospital Information Systems (HIS), Electronic Medical Records (EMR), and Practice Management Systems (PMS).

HIS is a comprehensive system that manages all aspects of a hospital, including patient registration, appointment scheduling, laboratory tests, radiology, pharmacy, billing, and reporting. EMR is a system that digitizes and stores patient medical records, including diagnosis, treatment, medication, and laboratory results. PMS is a system that manages administrative tasks, including patient billing, insurance claims, and financial reporting.

Despite the benefits of electronic systems, some hospitals still use manual systems or outdated electronic systems that do not meet their current needs. These outdated systems may lack essential features, be incompatible with other systems, or have poor usability and performance. As a result, hospitals may struggle to provide quality care, optimize resources, and meet regulatory requirements.

In summary, the existing system for hospital management varies widely, with some hospitals using manual systems, while others use electronic systems. However, there is a need for hospitals to upgrade their systems to meet current needs and provide quality care.

2.2 COMPARISON OF EXISTING VS PROPOSED SYSTEM

Existing systems in hospital management vary greatly, but they are generally characterized by manual processes or outdated electronic systems that lack essential features and are incompatible with modern technology. The proposed system, on the other hand, is a modern, efficient, and comprehensive Hospital Management System that automates hospital operations and provides real-time access to patient data and hospital operations.

The following are some of the differences between the existing and proposed systems:

1. Automation: The existing system relies heavily on manual processes, which are time-consuming and prone to errors. In contrast, the proposed system automates most of the hospital's operations, including patient registration, appointment scheduling, laboratory tests, radiology, pharmacy, billing, and reporting. This automation increases efficiency, accuracy, and speed of operations.

2. Accessibility: The existing system may have limited access to patient data and hospital operations, making it difficult for healthcare providers to make informed decisions. In contrast, the proposed system provides real-time access to patient data and hospital operations, enabling healthcare providers to make timely and informed decisions.

3. Integration: The existing system may be incompatible with other systems, making it difficult to share data and collaborate with other healthcare providers. In contrast, the proposed system is designed to be compatible with other healthcare systems, enabling seamless data sharing and collaboration.

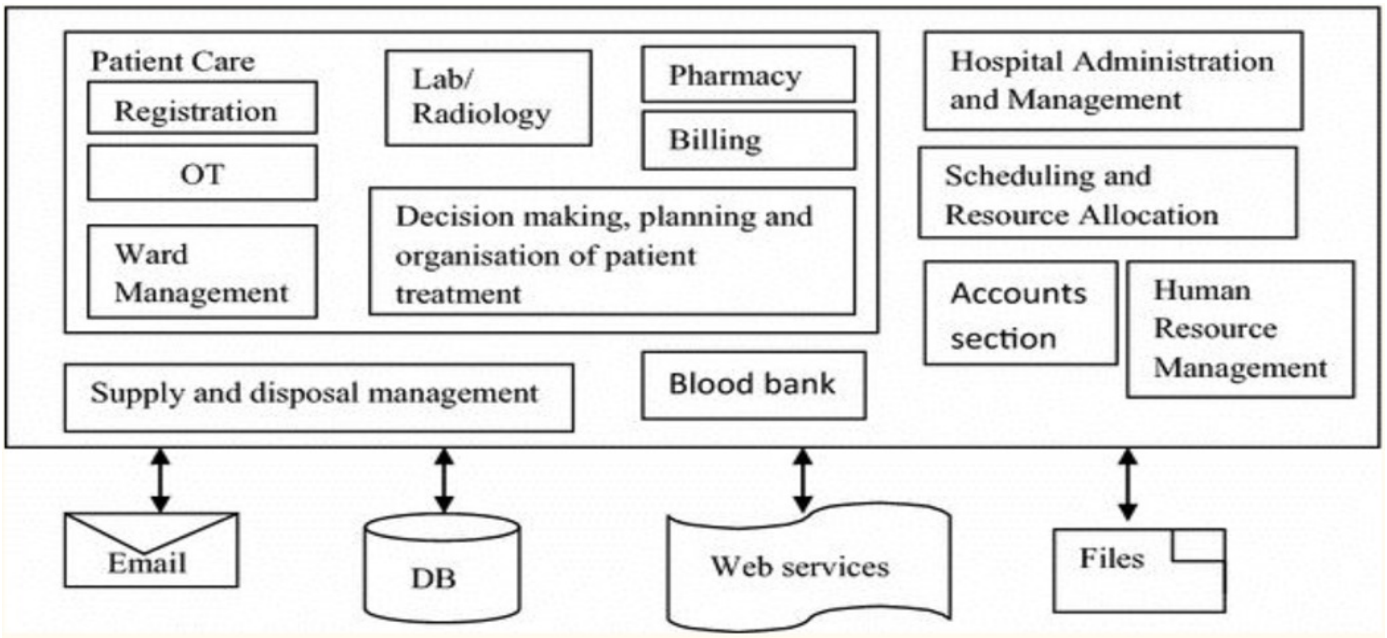
4. Security: The existing system may have weak security measures, putting patient data at risk of theft or unauthorized access. In contrast, the proposed system has robust security measures, including encryption and user authentication, to protect patient data from unauthorized access.

5. Scalability: The existing system may be difficult to scale up as the hospital grows or changes. In contrast, the proposed system is designed to be scalable, accommodating changes in the hospital's size and operations.

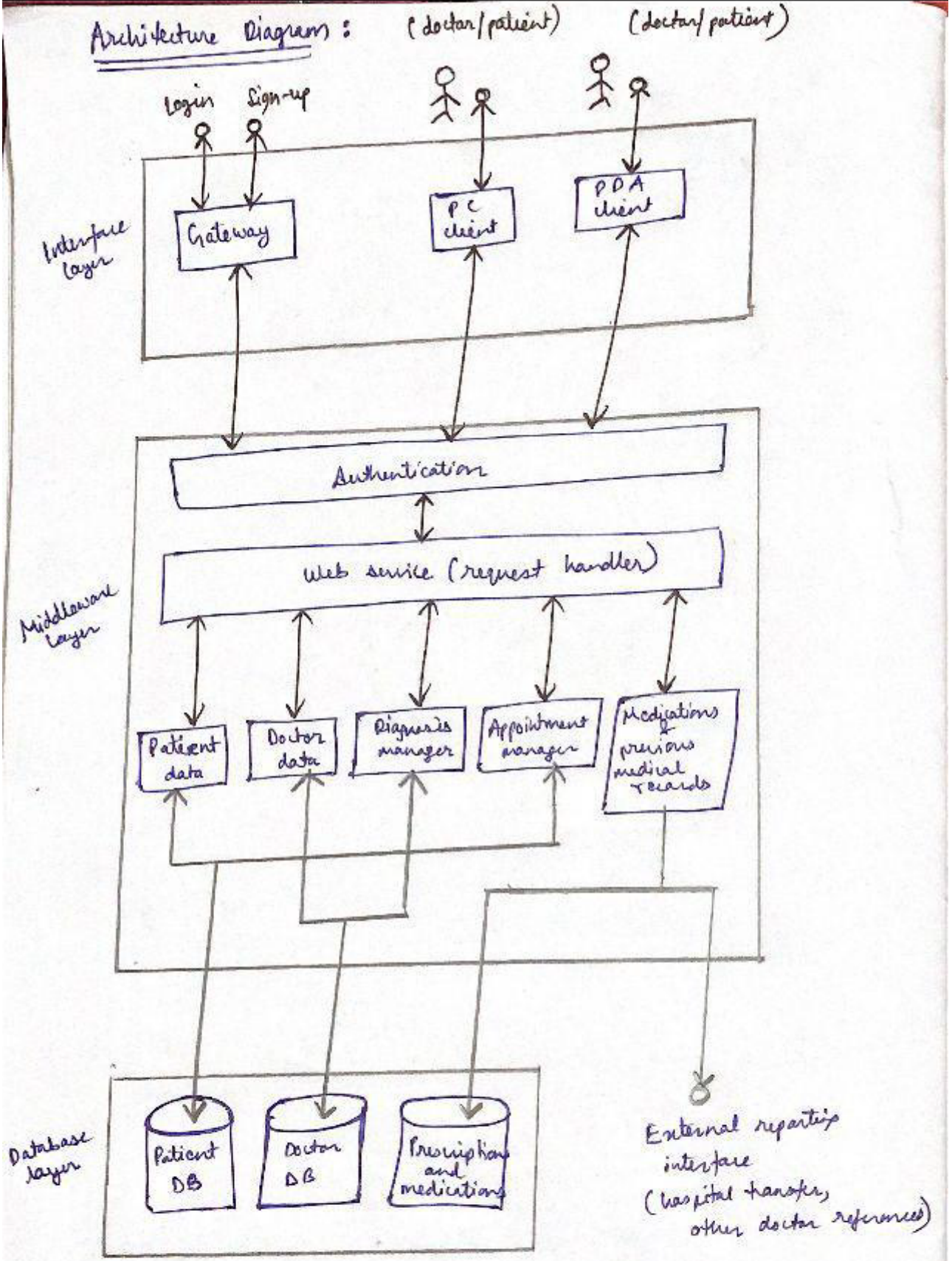
In summary, the proposed system is a significant improvement over the existing system in hospital management. It offers automation, accessibility, integration, security, and scalability, which are essential for providing quality care and meeting regulatory requirements.

CHAPTER 3: SYSTEM ARCHITECTURE AND DESIGN

3.1 Architecture Diagram:



Architecture Diagram :



The Interface layer provides the application with a program with which it can access, communicate and configure the middleware component.

● In the gateway we have a login and sign up feature where the users can sign up with existing credentials or sign up with completely new credentials by creating them first.

● The PC Client and the PDA Client are present, that is both mobile, web and other devices like tablets and iPads will be supported.

● All clients will have to go through the authentication, be it a doctor or a patient. Only upon successful authentication, the patient or the doctor can gain access to the Hospital Management System interface.

The role of the middleware layer is to enable and ease access to those back-end resources. Middleware programs will typically provide a messaging service for applications to transfer data.

● The Middleware layer has the authentication feature.

● The web service is also known as the request handler which displays the array of available services once the authentication is successful.

● Further we have the Patient Data and the Doctor data which is maintained according to the data entered, modified and retrieved by the users.

● It also works for the process of Diagnosis Manager.

● To book and manage appointments of patients and doctors, where the patients can easily book, modify and cancel their appointments

● Manages medications and previous medical records.

The database layer consists of technologies that give your Web and mobile applications the ability to store and retrieve data. Databases organize data into tables and create relationships between the data in those tables. It consists:

● The Patient Database

● The Doctor Database

● Prescription and Medication

● Patient data and Appointment manager is included under the patient database.

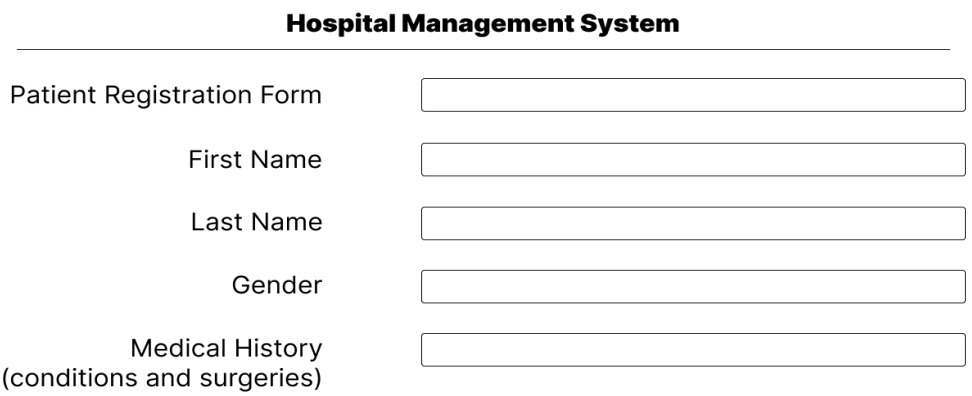
● Doctor data and Diagnosis manager comes under the doctor database.

● Prescription and medication includes medication and other previous medical records.

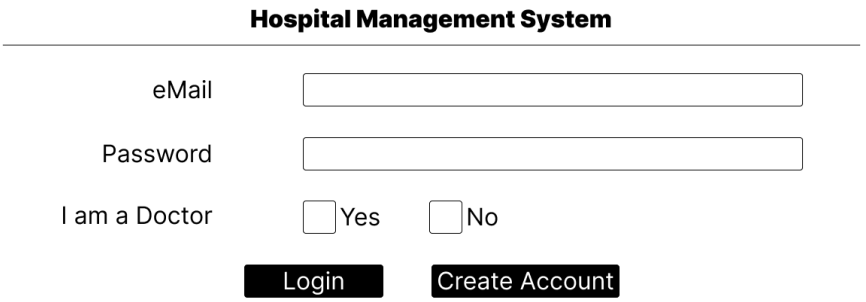
● Here, it also contains External Reporting Interface which includes any hospital transfer or other doctor references as per the patient’s health and choice.

3.1.1 Front-End UI

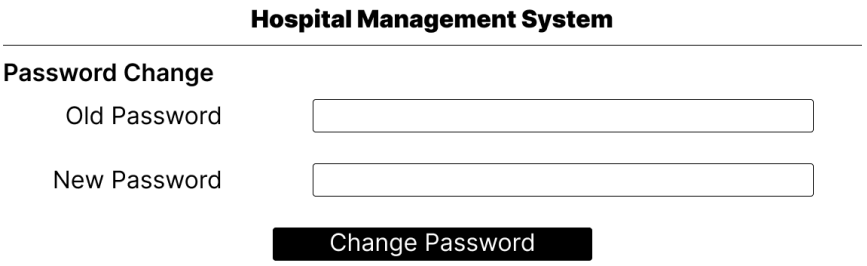
Screen-1



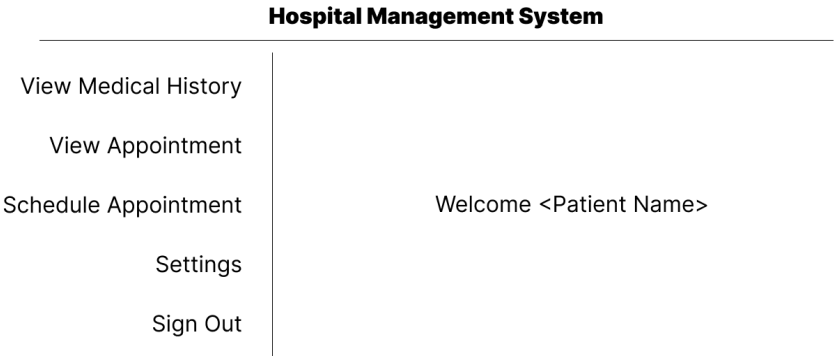
Screen-2



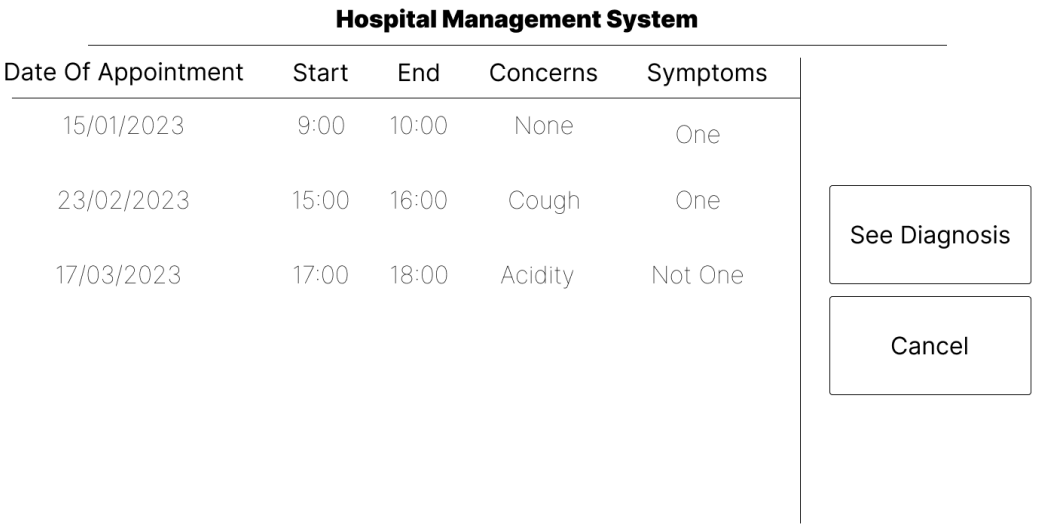
Screen-3



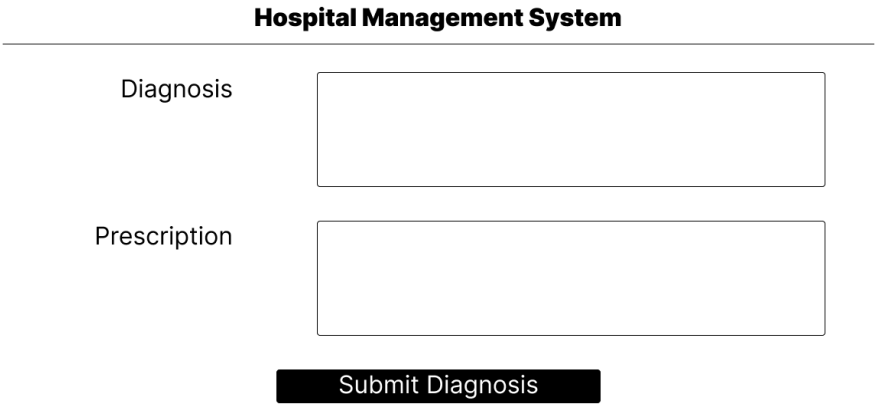
Screen-4



Screen-5



Screen-6



Screen-7

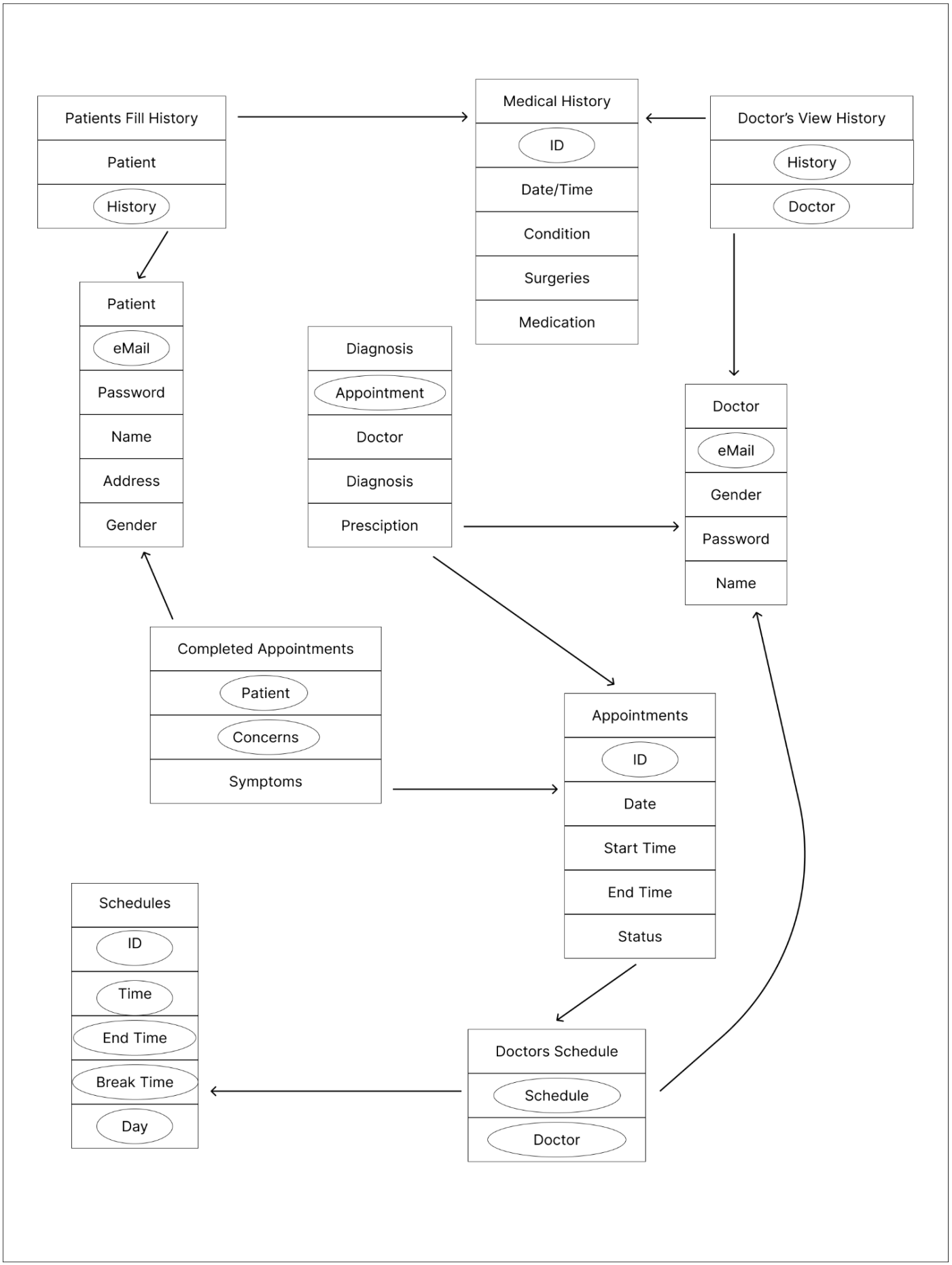
Hospital Management System

Search by Name

Submit Diagnosis

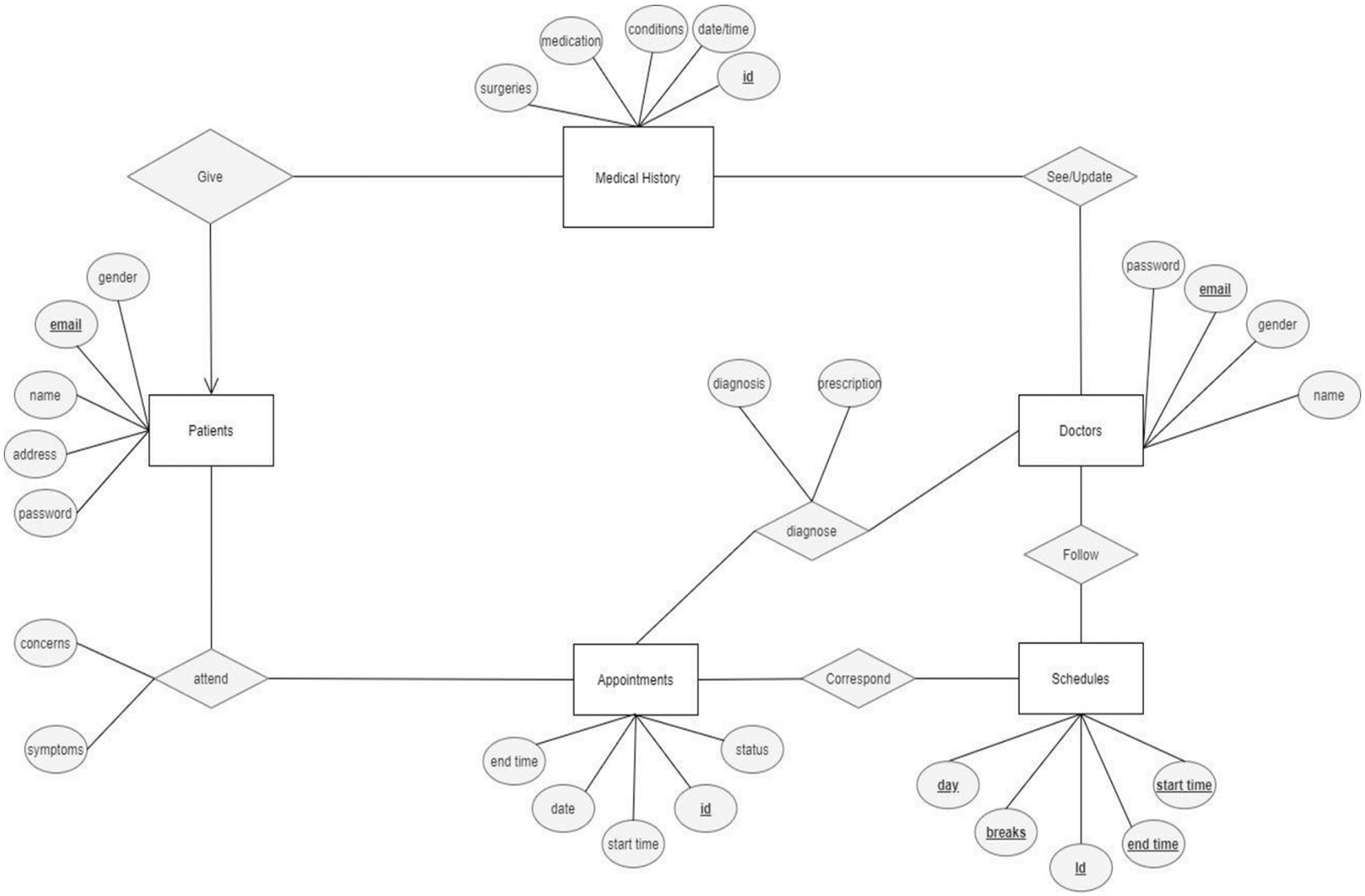
Name	Profile
Ramesh	Medical Proflie
Suresh	Medical Profile

3.1.2 Back End Database Management System:



3.2 ER Diagram & Use Case Diagram:

3.2.1 ER Diagram:



The above shown ER diagram has the following entities:

- Medical History: Id, date/time, conditions, medication and surgeries.
- Doctors: Email, password, gender and name.
- Schedules: Start time, end time, Id, breaks, and day.
- Appointments: Id, status, start time, date and end time.
- Patients: Email, gender, name, address and password.

The above ER diagram has the following relationships:

- Give: Patients give the medical history.
- See/Update: Doctors see or update the medical history of the patient.
- Follow: Doctors follow schedules.
- Correspond: Appointments correspond to schedules.
- Diagnose: Doctors diagnose patients in the appointments.
- Attend: Patients attend the appointments

The first step is to identify the entity sets. As per the requirements, we will have some main

entities. For example, if we are required to observe which patient goes to which hospital or whether they have a previous record or not, or if you simply want to analyze the number of patients a doctor treats.

The second step is to map out the attributes of the entities, (including the identification of key attributes). The key attributes for each entity have been listed below:

Medical History: Id, date/time, conditions, medication, and surgeries.

Doctors: email, password, gender, and name.

Schedules: start time, end time, Id, breaks, and day.

Appointments: ID, status, start time, date, and end time.

Patients: email, gender, name, address, and password.

Identify the type of relationship that exists between the entities. This can be done by identifying primary and foreign keys. For example, if the hospital table makes a foreign key reference to the patient ID of the patient table, then both of them will be joined together.

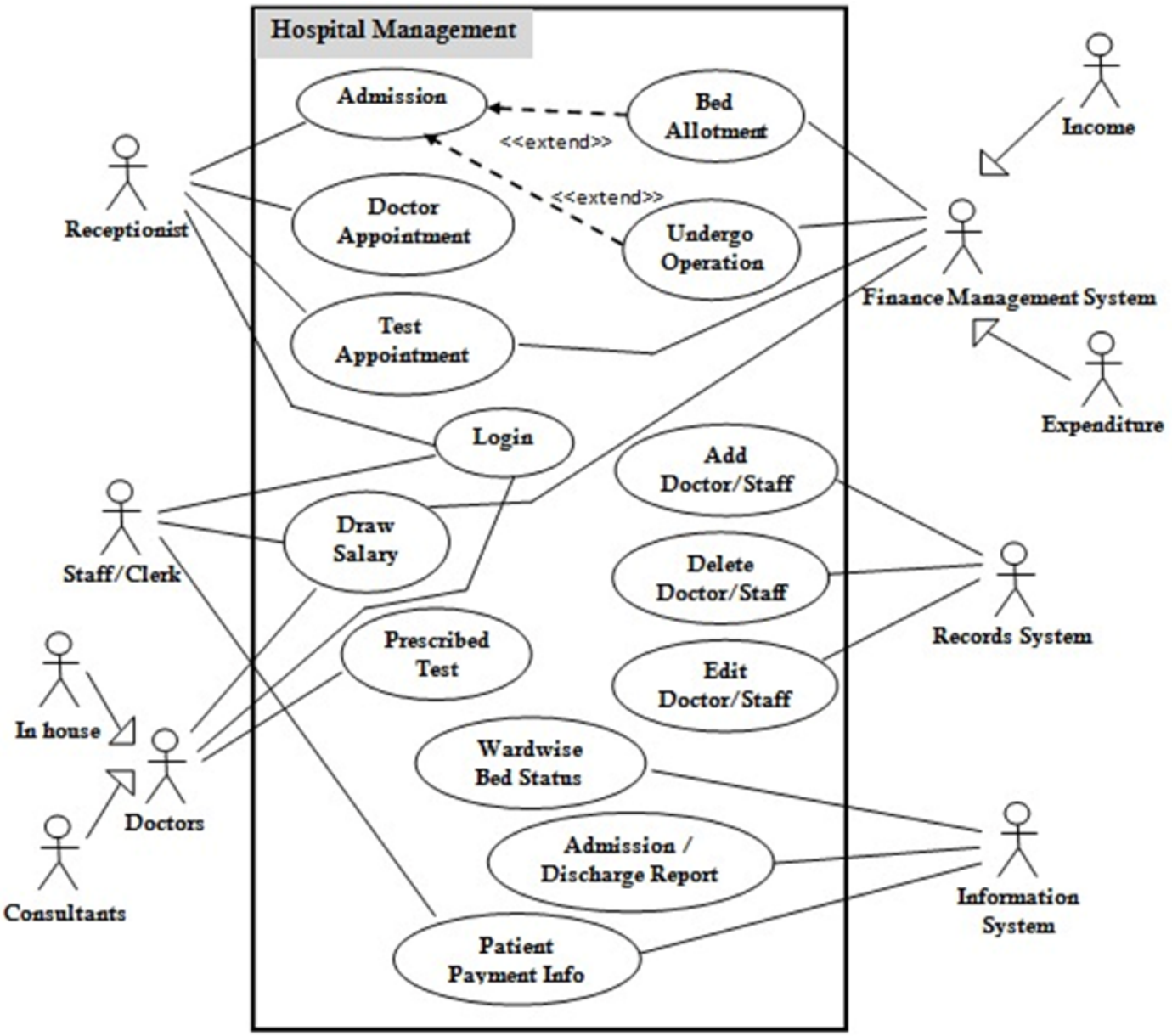
Based on the cardinalities, you have to place the appropriate sign.

Once we have identified all the relationships, it is time to map out the lines.

- Since a hospital has multiple patients, it is a one-to-many relationship.
- Since a single hospital has many doctors, the relationship that exists is one-to-many.
- Since a doctor is associated with many patients, it is a one-to-many relationship.
- Since a single patient has multiple medical records, it is a one-to-many relationship.

The last step is to combine all the relationships and draw a complete ER diagram.

3.2.2 Use-Case Diagram:



A use case diagram is a visual representation of the interactions between actors (users) and the system to achieve specific goals or tasks. In the context of a hospital management system, a use case diagram would illustrate the various interactions between the hospital staff, patients, and the system to perform tasks related to hospital management. Here is an example of a use case diagram for a hospital management system:

In this diagram, there are three primary actors: the patient, the hospital staff, and the system administrator. The use case diagram shows how these actors interact with the system to achieve specific tasks.

1. Patient Use Cases: The patient can interact with the system to perform tasks such as registering, making appointments, viewing medical reports, and paying bills.

2. Hospital Staff Use Cases: The hospital staff can interact with the system to perform tasks such as managing patient records, scheduling appointments, ordering laboratory tests, administering medication, and generating reports.

3. System Administrator Use Cases: The system administrator can interact with the system to perform tasks such as managing user accounts, maintaining system security, and updating the system.

Each use case is represented as an oval shape in the diagram, and the lines connecting the actors and use cases show the interactions between them. For example, the patient actor can interact with the system to perform the 'Register' use case, which involves providing personal information and creating a patient record in the system.

Overall, a use case diagram for a hospital management system helps to illustrate the various interactions between the actors and the system to perform specific tasks, providing a clear and concise overview of the system's functionality.

CHAPTER-4

MODULES AND FUNCTIONALITIES

4.1 Modules:

- Patient registering on the system
- Doctor registering on the system
- Log In Screen
- Password Reset Screen
- Patient Home Screen
- Patient Viewing History
- Patient Viewing Appointments
- Patient Scheduling Appointment
- Doctor Home Screen
- Doctor Viewing Appointment
- Doctor Giving Diagnosis
- Doctor Viewing Patient History

4.1.1 Functionalities

A hospital management system (HMS) is a software application designed to help healthcare providers manage various aspects of hospital operations. Some of the key functionalities of an HMS include:

1. Patient Management: The HMS should have the capability to manage patient data, including patient registration, appointment scheduling, and medical history. The system should also allow for easy access to patient data for doctors, nurses, and other healthcare providers.
2. Electronic Medical Records (EMR): The HMS should be able to store and manage electronic medical records (EMR) for all patients, including medical history, diagnosis, treatment plans, medication orders, and lab results.
3. Billing and Payment: The HMS should be able to handle billing and payment processes, including insurance claims processing, invoice generation, and payment tracking.
4. Inventory Management: The HMS should be able to manage hospital inventory, including medical supplies, drugs, and equipment. This includes tracking inventory levels, ordering supplies when necessary, and maintaining a record of inventory usage.
5. Scheduling and Resource Management: The HMS should be able to manage hospital resources, including staff scheduling, room allocation, and equipment availability.
6. Reporting and Analytics: The HMS should be able to generate reports and analytics on various aspects of hospital operations, including patient outcomes, resource utilization, and financial performance.
7. Security and Compliance: The HMS should be able to ensure compliance with various regulatory

requirements, including data security, privacy, and confidentiality of patient information.

Overall, an HMS should provide healthcare providers with a comprehensive suite of tools to manage hospital operations efficiently, while also ensuring the highest quality of patient care.

4.2 Connectivity used for Database Access:

Database connectivity acts as the communication interface between the software and the underlying database of the application.

In this project, we are using the relational database connectivity which is used to publish data from a relational database or to deliver data to a relational database. Relational database connection types use ODBC or native database drivers to access data at run time, and they use JDBC to access metadata at design time.

Any of the following connections can be used:

- Microsoft SQL Server. Connects to databases through ODBC or through the native
- database driver.
- Oracle. Connects to databases through the native database driver. (most probably we will use Oracle server connection as it is being implemented in the lab as well)
- IBM DB2. Connects to databases through the native database driver.

4.3 Tables

4.3.1. Administrator Table:

Fields	Data Type	Relationships
a_id	int(50	Primary Key
a_name	varchar(20)	Not Null
gender	varchar(10)	Not Null

4.3.2. Doctor Table:

Fields	Data Type	Relationships
Doctor_id	int(5)	Primary Key
Doctor_name	varchar(20)	Not Null
Dept	varchar(15)	Not Null
a_id	int(5)	Foreign Key

4.3.3. Staff Table:

Fields	Data Type	Relationships
s_name	varchar(15)	Not Null
s_id	int(5)	Primary Key
NID	int(12)	Not Null
salary	int(5)	Not Null
a_id	int(5)	Foreign Key

4.3.4. Lab Table:

Fields	Data Type	Relationships
lab_no	int(5)	Primary Key
Patient_id	int(5)	Not Null
weight	int	Not Null
Doctor_id	int(5)	Foreign Key
date	Date/Time[6]	Not Null
category	varchar(15)	Not Null
patient_type	varchar(15)	Not Null
amount	int(10)	Not Null

4.3.5. Inpatient Table:

Fields	Data Type	Relationships
Patient_id	int(5)	Primary Key
name	varchar(20)	Not Null
gender	varchar(10)	Not Null
address	varchar(20)	Not Null
room_no	int(5)	Not Null
date_of_admit	Date/Time[6]	Not Null
date_of_discharge	Date/Time[6]	Not Null
advance	int(10)	Not Null
lab_no	int(5)	Foreign Key
Doctor_id	int(5)	Foreign Key

4.3.6.Outpatient Table:

Fields	Data Type	Relationships
Patient_id	int(5)	Primary Key
date	Date/Time	Not Null
lab_no	int(5)	Foreign Key

4.3.7.Room Table:

Fields	Data Type	Relationships
room_no	int(5)	Primary Key
room_type	varchar(10)	Not Null
status	varchar(10)	Not Null
Patient_id	int(5)	Foreign Key

4.3.8.Bill Table:

Fields	Data type	Relationship
bill_no	int(50)	Primary Key
Patient_id	int(5)	Foreign Key
patient_type	Varchar(10)	Allow Null
doctor_charge	int	Not Null
medicine_charge	int	Not Null
room_charge	int	Not Null
operation_charge	int	Allow Null
number_of_days	int	Allow Null
nursing_charge	int	Allow Null
advance	int	Allow Null
health_card	Varchar(50)	Allow Null
lab_charge	int	Allow Null
bill	int	Not Null

CHAPTER-5
CODING AND TESTING

Frontend:

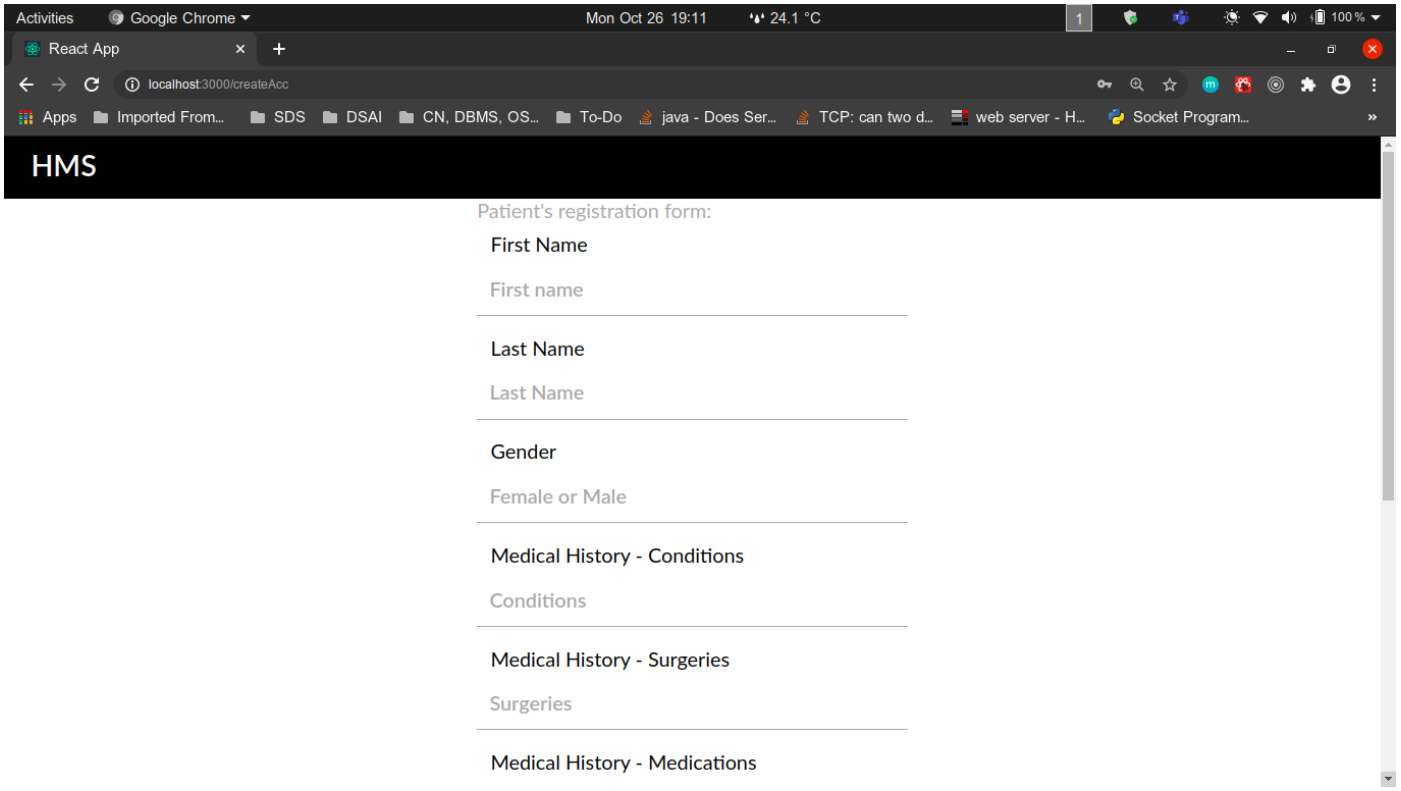
App.js

```
import React,{useEffect, useState} from "react";
import {
  BrowserRouter as Router,
  Switch,
  Route
} from "react-router-dom";
import Home from './Home';
import LogIn from './logIn.js';
import CreateAccount from './CreateAccount.js';
import SchedulingAppt from './schedulingAppt.js';
import ViewMedHist from './ViewMedHist.js';
import DocHome from './DocHome.js';
import ViewOneHistory from './ViewOneHistory.js';
import Settings from './Settings.js';
import DocSettings from './DocSettings.js';
import PatientsViewAppt from './PatientsViewAppt.js';
import NoMedHistFound from './NoMedHistFound.js';
import DocViewAppt from './DocViewAppt.js';
import MakeDoc from './MakeDoc.js';
import Diagnose from './Diagnose.js';
import ShowDiagnoses from './ShowDiagnoses.js';

export default function App() {
  let [component, setComponent] = useState(<LogIn />)
  useEffect(()=>{
    fetch("http://localhost:3001/userInSession")
      .then(res => res.json())
      .then(res => {
      let string_json = JSON.stringify(res);
      let email_json = JSON.parse(string_json);
      let email = email_json.email;
```

```
    let who = email_json.who;
    if(email === ""){
      setComponent(<LogIn />)
    }
    else{
      if(who==="pat"){
        setComponent(<Home />)
      }
      else{
        setComponent(<DocHome />)
      }
    }
  });
}, [])
return (
  <Router>
    <div>
      <Switch>
        <Route path="/NoMedHistFound">
          <NoMedHistFound />
        </Route>
        <Route path="/MakeDoc">
          <MakeDoc />
        </Route>
        <Route path="/Settings">
          <Settings />
        </Route>
        <Route path="/MedHistView">
          <ViewMedHist />
        </Route>
        <Route path="/scheduleAppt">
          <SchedulingAppt />
        </Route>
        <Route path="/showDiagnoses/:id" render={props=><ShowDiagnoses {...props} />} />
        <Route path="/Diagnose/:id" render={props=><Diagnose {...props} />} />
          <Route name="onehist" path="/ViewOneHistory/:email" render={props=><ViewOneHistory {...props}
/>}/>
```

```
        <Route path="/Home">
          <Home />
        </Route>
        <Route path="/createAcc">
          <CreateAccount />
        </Route>
        <Route path="/DocHome">
          <DocHome />
        </Route>
        <Route path="/PatientsViewAppt">
          <PatientsViewAppt />
        </Route>
        <Route path="/DocSettings">
          <DocSettings />
        </Route>
        <Route path="/ApptList">
          <DocViewAppt />
        </Route>
        <Route path="/">
          {component}
        </Route>
      </Switch>
    </div>
  </Router>
 );
}
```

Patients registering on the system:




```
import React, { Component} from 'react';
import {
  Box,
  Button,
  Heading,
  Grommet,
  FormField,
  Form,
  Text
} from 'grommet';

import './App.css';

const theme = {
  global: {
    colors: {
      brand: '#000000',
      focus: '#000000'
    },
    font: {
      family: 'Lato',
```

```
    },
  },
};

const AppBar = (props) => (
  <Box
    tag='header'
    direction='row'
    align='center'
    justify='between'
    background='brand'
    pad={{ left: 'medium', right: 'small', vertical: 'small' }}
    style={{ zIndex: '1' }}
    {...props} />
);
export class CreateAccount extends Component {
  constuctor() {
  }

  render() {

    return (
      <Grommet theme={theme} full>
        <AppBar>
                        <a style={{ color: 'inherit', textDecoration: 'inherit'}} href="/"><Heading level='3'
margin='none'>HMS</Heading></a>
        </AppBar>
        <Box fill align="center" justify="top">
          <Box width="medium">
          <Text color = "#AAAAAA">Patient's registration form:</Text>
            <Form
              onReset={event => console.log(event)}
              method="post"
              onSubmit={({ value }) => {
                console.log("Submit", value);

                fetch("http://localhost:3001/checkIfPatientExists?email=" + value.email)
```

```
            .then(res => res.json())
            .then(res => {
              console.log(res.data[0]);

              if ((res.data[0])) {
                window.alert("An account is already associated with that email.");
                console.log("no user found");
              } else {
                        fetch("http://localhost:3001/makeAccount?name=" + value.firstName + "&lastname=" +
value.lastName + "&email=" + value.email
                  + "&password=" + value.password + "&address=" + value.address + "&gender=" + value.gender
                   + "&conditions=" + value.conditions + "&medications=" + value.medications + "&surgeries=" +
value.surgeries);
                window.location = "/Home";
              }
            });
          }}>
          <FormField
            label="First Name"
            name="firstName"
            placeholder="First name"
            required
            validate={{ regexp: /^[a-z]/i }} />
          <FormField
            label="Last Name"
            name="lastName"
            required
            placeholder="Last Name"
            validate={{ regexp: /^[a-z]/i }} />
          <FormField
            label="Gender"
            name="gender"
            placeholder="Female or Male"
            required />
          <FormField
            label="Medical History - Conditions"
            name="conditions"
```

```
          placeholder="Conditions"
         />
        <FormField
          label="Medical History - Surgeries"
          name="surgeries"
          placeholder="Surgeries"
         />
        <FormField
          label="Medical History - Medications"
          name="medications"
          placeholder="Medications"
         />
        <FormField
          label="Address"
          name="address"
          placeholder="Address"
          required />
        <FormField
          label="Email"
          name="email"
          type="email"
          placeholder="Email"
          required />
        <FormField
          label="Password"
          name="password"
          placeholder="Password"
          required
           validate={{ regexp: /^(?=.{8,})(?=.*[0-9]{2})/, message: "@ least 8 characters containing 2 digits" }}
/>
        <Box direction="row" align="center" >
          <Button
            style={{ textAlign: 'center' }}
            label="Cancel"
            fill="horizontal"
            href="/" />
          <Button
```

```
              label="Sign Up"
              fill="horizontal"
              type="submit"
              primary />
            </Box>
            <Box
              align="center" pad="small">
              <Text>Are you a doctor?</Text>
              <Button
                primary
                label="I'm a doctor"
                href="/MakeDoc" />
            </Box>
          </Form>
        </Box>
      </Box>
    </Grommet>
  );
 }
}

export default CreateAccount;
```

Doctors registering on the system:

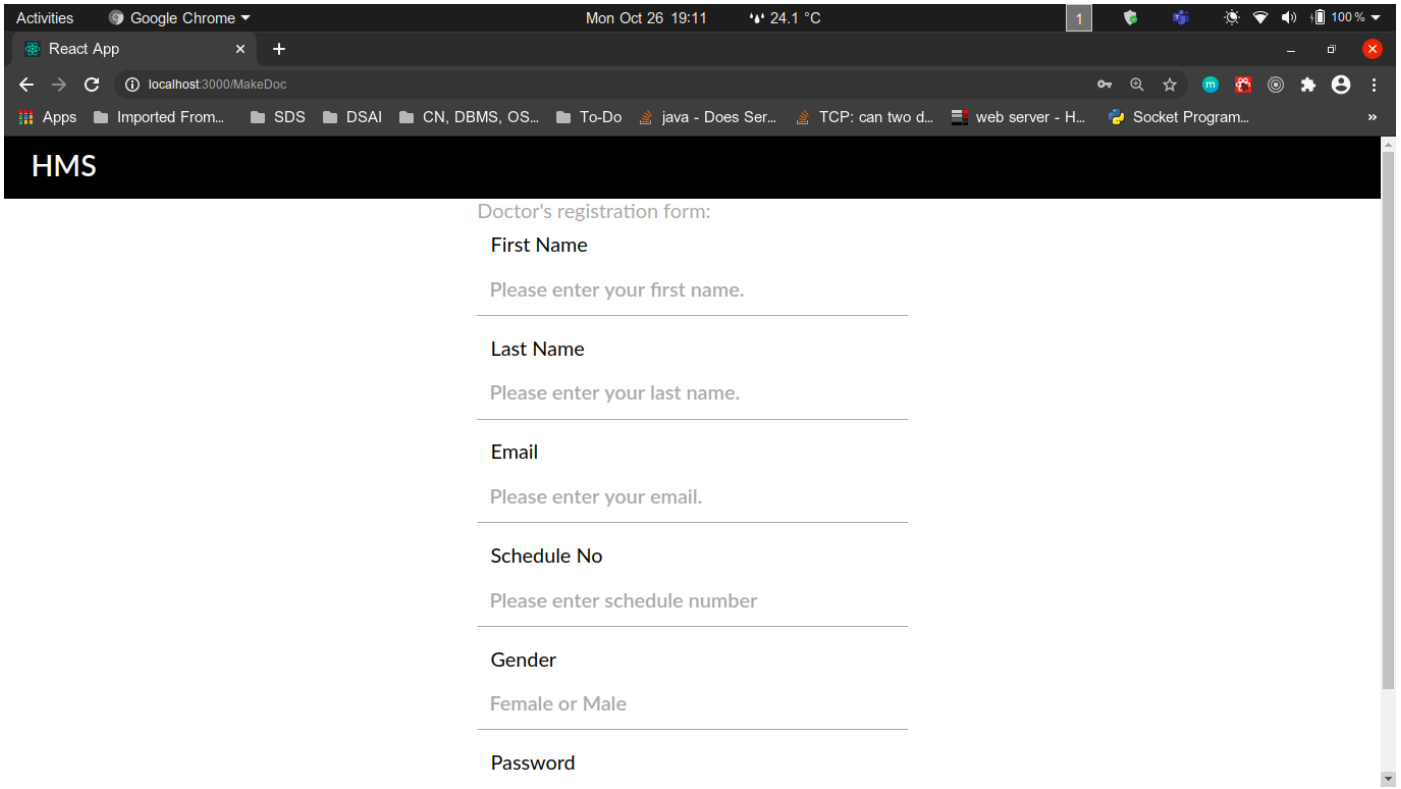
```
import React, { Component, useState } from 'react';
import {
  Box,
  Button,
  Heading,
  Grommet,
  Grid,
  Text,
} from 'grommet';

import './App.css';
```

```
const theme = {
  global: {
    colors: {
      brand: '#000000',
      focus: '#000000'
    },
    font: {
      family: 'Lato',
    },
  },
};

const SidebarButton = ({ label, ...rest }) => (
  <Button plain {...rest}>
    {({ hover }) => (
      <Box
        background={hover ? "#DADADA" : undefined}
        pad={{ horizontal: "large", vertical: "medium" }}
      >
        <Text size="large">{label}</Text>
      </Box>
    )}
  </Button>
);

const SidebarButtons = () => {
  const [active, setActive] = useState();
  return (
    <Grommet full theme={theme}>
      <Box fill direction="row">
        <Box background="brand">
          {["Appointments", "View Patients", "Settings", "Sign Out"].map(label => (
            <SidebarButton
              key={label}
              label={label}
              active={label === active}
              onClick={() => {
```

```
                    if (label === "Appointments") {
                        window.location = "/ApptList"
                    }
                    else if (label === "Sign Out") {
                        fetch("http://localhost:3001/endSession");
                        window.location = "/"
                    }
                    else if (label === "Settings") {
                        window.location = "/DocSettings"
                    }
                    else if (label === "View Patients") {
                        window.location = "/MedHistView"
                    }
                    setActive(label);
                }}
            />
        ))}

        </Box>
      </Box>
    </Grommet>
  );
};

export class DocHome extends Component {
  componentDidMount() {
  }

  render() {
    const Header = () => (
      <Box
        tag='header'
        background='brand'
        pad='small'
        elevation='small'
        justify='between'
        direction='row'
```

```
        align='center'
        flex={false}
        style={{borderBottom:"1px solid grey"}}
      >
                        <a style={{ color: 'inherit', textDecoration: 'inherit'}} href="/"><Heading level='3' margin='none'>HMS</Heading></a>

      </Box>
    );

    return (
      <Grommet full={true}
        theme={theme}>
        <Box align="left">
          <Header/>
          <Grid
            fill
            rows={['auto', 'flex']}
            columns={['auto', 'flex']}
            areas={[
              { name: 'sidebar', start: [0, 1], end: [0, 1] },
              { name: 'main', start: [1, 1], end: [1, 1] },
            ]}>
            <Box
            gridArea="sidebar"
            width="small"
            animation={[
            { type: 'fadeIn', duration: 300 },
            { type: 'slideRight', size: 'xlarge', duration: 150 },
            ]}
            >
              <SidebarButtons />
            </Box>
            <Box
              gridArea="main"
              justify="top"
              align="center">
```

```
                    <Box align="center" pad="large">
                      <Heading
                        color="#000000">Welcome Doctor
                      </Heading>
                    </Box>
                  </Box>
                </Grid>
              </Box>
            </Grommet>
        );
    }
}

export default DocHome;
```



Log in screen:

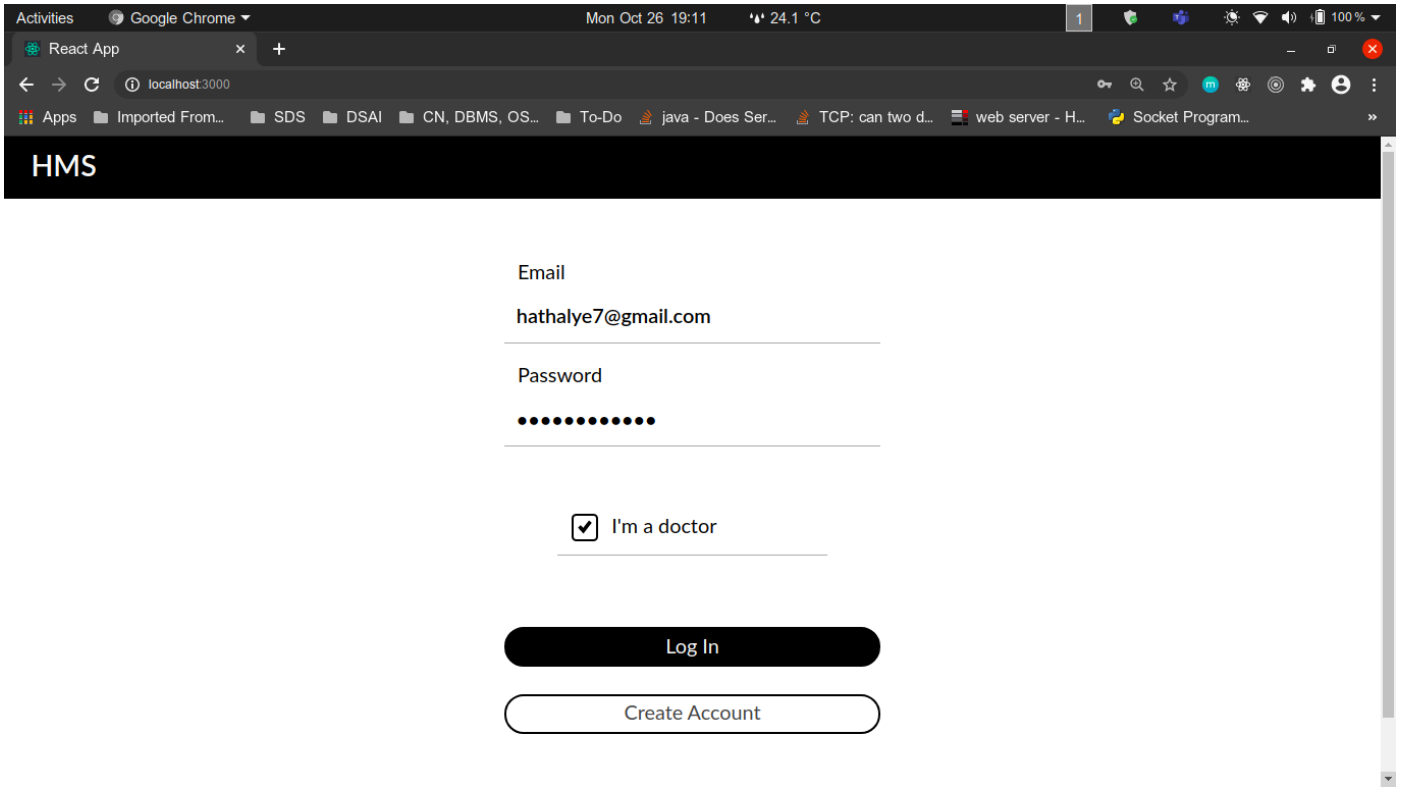
```
import React, { Component} from 'react';
import { withRouter } from 'react-router-dom';
import {
  Box,
```

```
  Button,
  Heading,
  Grommet,
  FormField,
  Form,
  CheckBox,
} from 'grommet';

import './App.css';

const theme = {
  global: {
    colors: {
      brand: '#000000',
      focus: "#000000",
      active: "#000000",
    },
    font: {
      family: 'Lato',
    },
  },
};

const AppBar = (props) => (
  <Box
    tag='header'
    direction='row'
    align='center'
    justify='between'
    background='brand'
    pad={{ left: 'medium', right: 'small', vertical: 'small' }}
    style={{ zIndex: '1' }}
    {...props} />
);

class LogIn extends Component {
  state = { isDoctor: false }
```

```
  constuctor() {
    this.routeChange = this.routeChange.bind(this);
  }

  routeChange() {
    let path = '/Home';
    this.props.history.push(path);
  }

  render() {
    const { isDoctor } = this.state; // If doctor, will query from doctor table

    return (
      <Grommet theme={theme} full>
        <AppBar>
                        <a style={{ color: 'inherit', textDecoration: 'inherit'}} href="/"><Heading level='3'
margin='none'>HMS</Heading></a>
        </AppBar>

        <Box
          fill
          align="center"
          justify="top"
          pad="medium">
          <Box
            width="medium"
            pad="medium">
            <Form

              onReset={event => console.log(event)}
              onSubmit={({ value }) => {
                console.log("Submit", value);
                if (value.isDoc === true) {
                  fetch("http://localhost:3001/checkDoclogin?email=" + value.email +
                    "&password=" + value.password)
                    .then(res => res.json())
```

```
      .then(res => {
        if (res.data.length === 0) {
          window.alert("Invalid Log In");
        } else {
          window.location = "DocHome";
          console.log(res.data);
        }
      });
    } else {
     fetch("http://localhost:3001/checklogin?email=" + value.email +
      "&password=" + value.password)
      .then(res => res.json())
      .then(res => {
        if (res.data.length === 0) {
          window.alert("Invalid Log In");
        } else {
          window.location = "/Home";
          console.log(res.data);
        }
      });
    }
  }
  }>
  <FormField
    color="#00739D"
    label="Email"
    name="email"
    type="email"
    placeholder = "Please enter your email."
    required />
  <FormField
    color="#00739D"
    type='password'
    label="Password"
    name="password"
    placeholder = "Please enter your password."
    required />
```

```
            <FormField
              component={CheckBox}
              checked={isDoctor}
              margin="large"
              label="I'm a doctor"
              name="isDoc"
              onChange={(event) => {
                this.setState({ isDoctor: event.target.checked })
              }}
            />
            <Box direction="column" align="center" >
              <Button style={{ textAlign: 'center' , margin:'1rem'}}
               type="submit" label="Log In" fill="horizontal" primary />
              <Button label="Create Account"
                style={{ textAlign: 'center' , margin:'0.5rem'}}
                fill="horizontal"
                href="/createAcc" />
            </Box>
          </Form>
        </Box>
      </Box>
    </Grommet>
  );
 }
}
export default withRouter(LogIn);
```



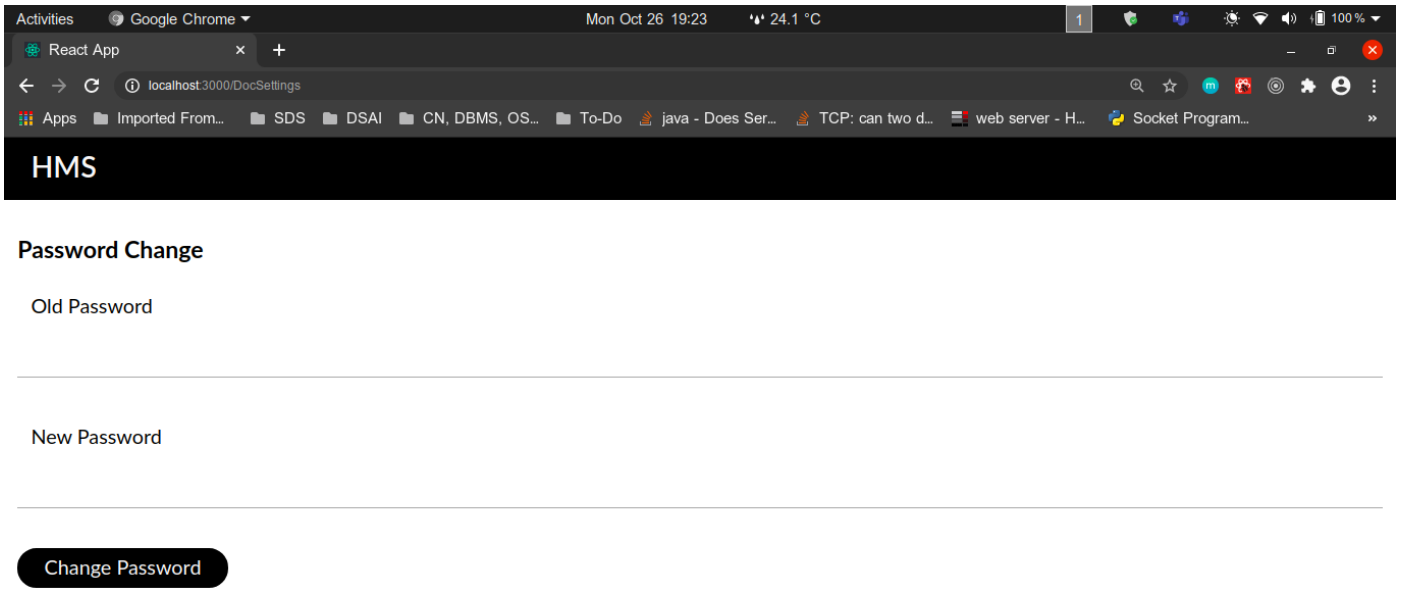
Password Reset Screen:

```
import React, { Component} from 'react';

import {
    Box,
    Button,
    Heading,
    Grommet,
    FormField,
    Form,
} from 'grommet';

import './App.css';

const theme = {
    global: {
        colors: {
            brand: '#000000',
            focus: '#000000'
        },
        font: {
```

```
        family: 'Lato',
      },
    },
};

const AppBar = (props) => (
  <Box
    tag='header'
    direction='row'
    align='center'
    justify='between'
    background='brand'
    pad={{ left: 'medium', right: 'small', vertical: 'small' }}
    style={{ zIndex: '1' }}
    {...props} />
);
export class Settings extends Component {
  constuctor() {
  }
  render() {
    return (
      <Grommet theme={theme} full>
        <Box >
          <AppBar>
                    <a style={{ color: 'inherit', textDecoration: 'inherit'}} href="/"><Heading level='3' margin='none'>HMS</Heading></a>
          </AppBar>
          <Box pad="small">
          <Form
          onSubmit={({ value }) => {
            let email_in_use = "";
            console.log(value);
            fetch("http://localhost:3001/userInSession")
              .then(res => res.json())
              .then(res => {
                var string_json = JSON.stringify(res);
                var email_json = JSON.parse(string_json);
```

```
      email_in_use = email_json.email;
      console.log(email_in_use);
      console.log("eg");
    fetch("http://localhost:3001/resetPasswordPatient?email=" +
    email_in_use + "&oldPassword=" + value.oldPassword + "&newPassword=" +
    value.newPassword, {method: 'POST'})
    .then(res => res.json())
    .then(res => {
      let didUpdate = res.data.affectedRows;
      if(didUpdate === 0) {
         window.alert("Entered your old password incorrectly");
      } else {
         window.alert("Password Reset Successful");
      }
    });
    });
}}>
  <h3>Password Change</h3>
  <FormField
    type='password'
    label="Old password"
    name="oldPassword"
    required
  />
  <br />
  <FormField
    label="New password"
    name="newPassword"
    required
  />
  <br />
  <Button
    type="submit"
    label="Change Password"
    primary
  />
</Form>
```

```
            </Box>
          </Box>
        </Grommet>
      );
    }
}
export default Settings;
```



Patient Home Screen:

```
import React, { Component, useState } from 'react';
import {
  Box,
  Button,
  Heading,
  Grommet,
  Text,
  Grid
} from 'grommet';

import './App.css';

const theme = {
  global: {
```

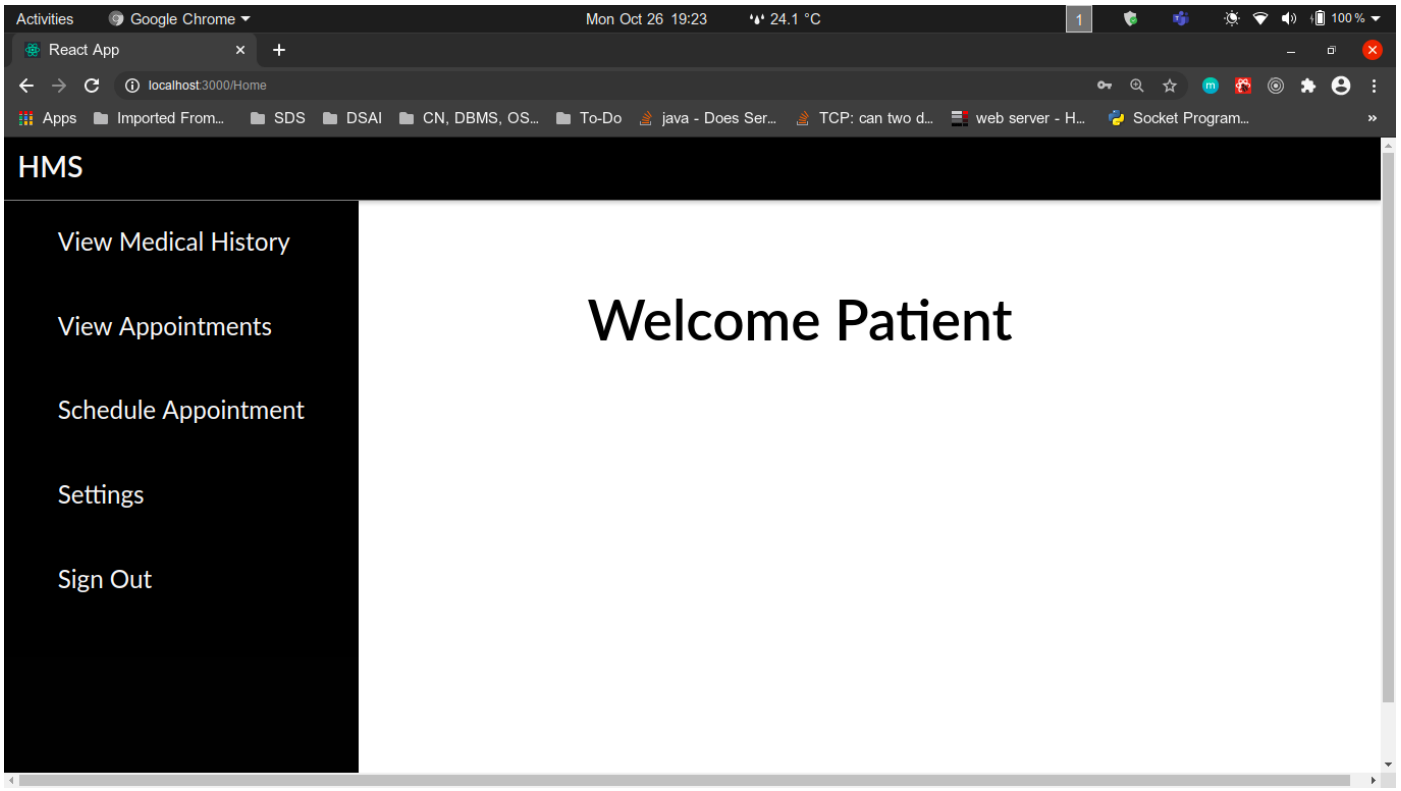
```
    colors: {
      brand: '#000000',
      focus: '#000000'
    },
    font: {
      family: 'Lato',
    },
  },
};

const SidebarButton = ({ label, ...rest }) => (
  <Button plain {...rest}>
    {({ hover }) => (
      <Box
        background={hover ? "#DADADA" : undefined}
        pad={{ horizontal: "large", vertical: "medium" }}
      >
        <Text size="large">{label}</Text>
      </Box>
    )}
  </Button>
);

const SidebarButtons = () => {
  const [active, setActive] = useState();
  return (
    <Grommet full theme={theme}>
      <Box fill direction="row">
        <Box background="brand">
                {["View Medical History", "View Appointments", "Schedule Appointment", "Settings", "Sign Out"].map(label => (
            <SidebarButton
              key={label}
              label={label}
              active={label === active}
              onClick={() => {
                if (label === "Schedule Appointment") {
```

```
            window.location = "/scheduleAppt"
          }
          else if (label === "Sign Out") {
            fetch("http://localhost:3001/endSession");
            window.location = "/"
          }
          else if (label === "View Appointments") {
            window.location = "/PatientsViewAppt"
          }
          else if (label === "View Medical History") {
            let email_in_use = "";
            fetch("http://localhost:3001/userInSession")
              .then(res => res.json())
              .then(res => {
                var string_json = JSON.stringify(res);
                var email_json = JSON.parse(string_json);
                email_in_use = email_json.email;
                console.log("Email In Use Is :" + email_in_use);
                window.location = "/ViewOneHistory/" + email_in_use;
              });
          }
          else if (label === "Settings") {
            window.location = "/Settings"
          }
          setActive(label);
        }}
      />
    ))}
    </Box>
  </Box>
 </Grommet>
 );
};
export class Home extends Component {
 renderName = ({ name, email }) => <div key={email}>{name} {name}</div>

 render() {
```

```
const Header = () => (
  <Box
    tag='header'
    background='brand'
    pad='small'
    elevation='small'
    justify='between'
    direction='row'
    align='center'
    flex={false}
    style={{borderBottom:"1px solid grey"}}
  >
                    <a style={{ color: 'inherit', textDecoration: 'inherit'}} href="/"><Heading level='3' margin='none'>HMS</Heading></a>
  </Box>
);

return (
  <Grommet full={true}
    theme={theme} >
    <Box fill={true}>
      <Header/>
      <Grid
        fill
        rows={['auto', 'flex']}
        columns={['auto', 'flex']}
        areas={[
          { name: 'sidebar', start: [0, 1], end: [0, 1] },
          { name: 'main', start: [1, 1], end: [1, 1] },
        ]}>
        <Box
          gridArea="sidebar"
          width="small"
          animation={[
            { type: 'fadeIn', duration: 300 },
            { type: 'slideRight', size: 'xlarge', duration: 150 },
          ]}
```

```
          >
            <SidebarButtons />
          </Box>
          <Box
            gridArea="main"
            justify="top"
            align="center">
            <Box align="center" pad="large">
              <Heading
                color="#000000">Welcome Patient
              </Heading>
            </Box>
          </Box>
        </Grid>
      </Box>
    </Grommet>
  );
 }
}
```

export default Home;



Patient Viewing History:

```
import React, { Component} from 'react';

import {
    Box,
    Heading,
    Grommet,
    Table,
    TableBody,
    TableCell,
    TableRow
} from 'grommet';

import './App.css';

const theme = {
    global: {
        colors: {
            brand: '#000000',
            focus: '#000000'
        },
        font: {
            family: 'Lato',
        },
    },
};

export class ViewOneHistory extends Component {
    state = { medhiststate: [], medhiststate2: []}
    componentDidMount() {
        const { email } = this.props.match.params;
        this.allDiagnoses(email);
        this.getHistory(email);
    }

    getHistory(value) {
        let email = "'" + value + "'";
        fetch('http://localhost:3001/OneHistory?patientEmail='+ email)
```

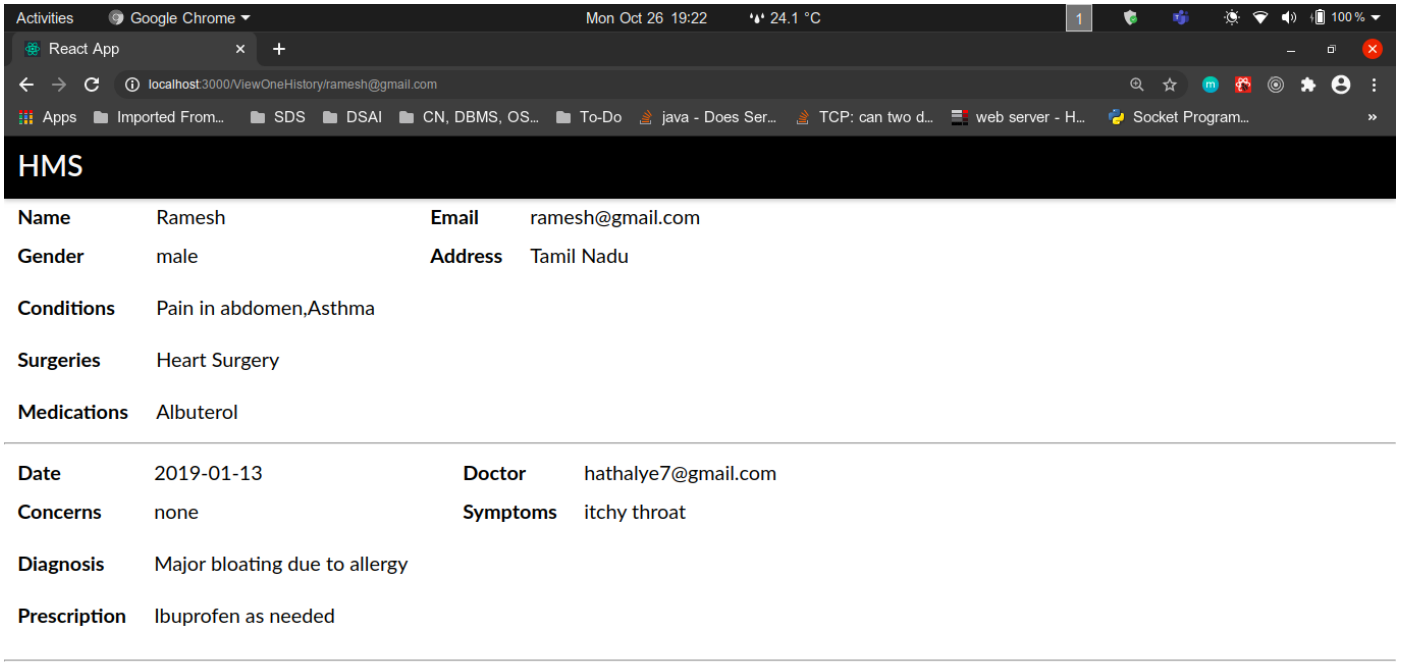
```
    .then(res => res.json())
      .then(res => this.setState({ medhiststate: res.data }));
  }

  allDiagnoses(value) {
    let email = "'" + value + "'";
    fetch('http://localhost:3001/allDiagnoses?patientEmail='+ email)
    .then(res => res.json())
    .then(res => this.setState({ medhiststate2: res.data }));
  }

  render() {
    const { medhiststate } = this.state;
    const { medhiststate2 } = this.state;
    const Header = () => (
      <Box
        tag='header'
        background='brand'
        pad='small'
        elevation='small'
        justify='between'
        direction='row'
        align='center'
        flex={false}
      >
                    <a style={{ color: 'inherit', textDecoration: 'inherit'}} href="/"><Heading level='3' margin='none'>HMS</Heading></a>
      </Box>
    );
    const Body = () => (
      <div className="container">
        <div className="panel panel-default p50 uth-panel">
          {medhiststate.map(patient =>
            <Table>
              <TableBody>
                <TableRow>
                  <TableCell scope="row">
```

```
        <strong>Name</strong>
    </TableCell>
    <TableCell>{patient.name}</TableCell>
    <TableCell></TableCell>
    <TableCell><strong>Email</strong></TableCell>
    <TableCell>{patient.email}</TableCell>
</TableRow>
<TableRow>
    <TableCell scope="row">
        <strong>Gender</strong>
    </TableCell>
    <TableCell>
        {patient.gender}
    </TableCell>
    <TableCell />
    <TableCell>
        <strong>Address</strong>
    </TableCell>
    <TableCell>{patient.address}</TableCell>
</TableRow>
<TableRow>
    <TableCell scope="row">
    </TableCell>
</TableRow>
<TableRow>
    <TableCell>
        <strong>Conditions</strong>
    </TableCell>
    <TableCell>{patient.conditions}
        </TableCell>
</TableRow>
<TableRow>
    <TableCell scope="row">
    </TableCell>
</TableRow>
<TableRow>
    <TableCell>
```

```
                        <strong>Surgeries</strong>
                      </TableCell>
                      <TableCell>{patient.surgeries}
                      </TableCell>
                    </TableRow>
                    <TableRow>
                      <TableCell scope="row">
                      </TableCell>
                    </TableRow>
                    <TableRow>
                      <TableCell>
                        <strong>Medications</strong>
                      </TableCell>
                      <TableCell>{patient.medication}
                      </TableCell>
                    </TableRow>
                  </TableBody>
                </Table>
              )}
            </div>
            <hr />
          </div>
);
const Body2 = () => (
  <div className="container">
    <div className="panel panel-default p50 uth-panel">
      {medhiststate2.map(patient =>
        <div>
        <Table>
          <TableBody>
            <TableRow>
              <TableCell scope="row">
                <strong>Date</strong>
              </TableCell>
              <TableCell>{patient.date.split('T')[0]}</TableCell>
              <TableCell></TableCell>
              <TableCell><strong>Doctor</strong></TableCell>
```

```
    <TableCell>{patient.doctor}</TableCell>
  </TableRow>
  <TableRow>
    <TableCell scope="row">
      <strong>Concerns</strong>
    </TableCell>
    <TableCell>
      {patient.concerns}
    </TableCell>
    <TableCell />
    <TableCell>
      <strong>Symptoms</strong>
    </TableCell>
    <TableCell>{patient.symptoms}</TableCell>
  </TableRow>
  <TableRow>
    <TableCell scope="row">
    </TableCell>
  </TableRow>
  <TableRow>
    <TableCell>
      <strong>Diagnosis</strong>
    </TableCell>
    <TableCell>{patient.diagnosis}
      </TableCell>
  </TableRow>
  <TableRow>
    <TableCell scope="row">
    </TableCell>
  </TableRow>
  <TableRow>
    <TableCell>
      <strong>Prescription</strong>
    </TableCell>
    <TableCell>{patient.prescription}
    </TableCell>
  </TableRow>
```

```
                        <TableRow>
                            <TableCell scope="row">
                            </TableCell>
                        </TableRow>
                    </TableBody>
                </Table>
                <hr />
                </div>
            )}
        </div>
    </div>
    );
    return (
        <Grommet full={true} theme={theme}>
            <Box fill={true}>
                <Header />
                <Body />
                <Body2 />
            </Box>
        </Grommet>
    );
  }
}
export default ViewOneHistory;
```



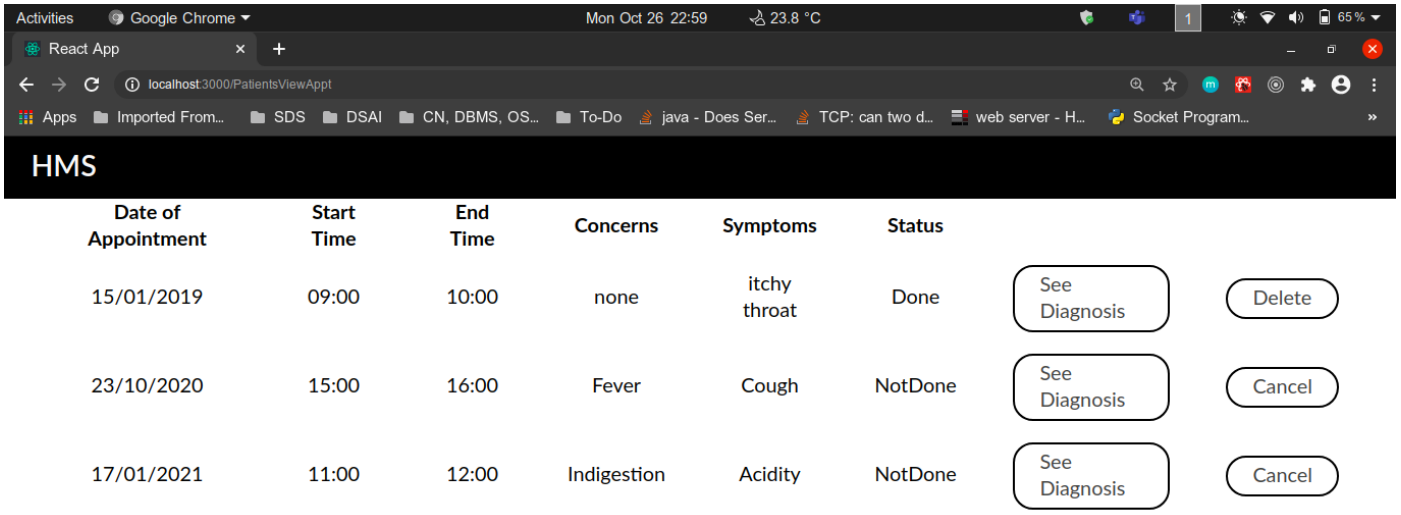
Patient Viewing Appointments

```
import React, { Component} from 'react';

import {
   Box,
   Heading,
   Grommet,
   Button
} from 'grommet';

import './App.css';

const theme = {
   global: {
      colors: {
         brand: '#000000',
         focus: '#000000'
      },
```

```
      font: {
        family: 'Lato',
      },
    },
};

const AppBar = (props) => (
  <Box
    tag='header'
    direction='row'
    align='center'
    justify='between'
    background='brand'
    pad={{ left: 'medium', right: 'small', vertical: 'small' }}
    style={{ zIndex: '1' }}
    {...props} />
);

export class PatientsViewAppointments extends Component {
  state = { appointmentsState: [] }
  componentDidMount() {
    this.getNames("");
  }
  getNames(value) {
    let patName = value;
    console.log(patName);
    fetch("http://localhost:3001/userInSession")
      .then(res => res.json())
      .then(res => {
        var string_json = JSON.stringify(res);
        var email_json = JSON.parse(string_json);
        let email_in_use = email_json.email;
        fetch('http://localhost:3001/patientViewAppt?email=' + email_in_use)
          .then(res => res.json())
          .then(res => {
            this.setState({ appointmentsState: res.data });
          });
```

```
        });
    }
    render() {
        const { appointmentsState } = this.state;
        const Body = () => (
            <div className="container">
                <div className="panel panel-default p50 uth-panel">
                    <table className="table table-hover">
                        <thead>
                            <tr>
                            <th>Date of Appointment</th>
                                <th>Start Time</th>
                                <th>End Time</th>
                                <th>Concerns</th>
                                <th>Symptoms</th>
                                <th>Status</th>
                            </tr>
                        </thead>
                        <tbody>
                            {appointmentsState.map(patient =>
                                <tr key={patient.user}>
                                    <td align="center" >
                                        {new Date(patient.theDate).toLocaleDateString().substring(0, 10)}
                                    </td>
                                    <td align="center" >{patient.theStart.substring(0, 5)}</td>
                                    <td align="center" >{patient.theEnd.substring(0, 5)}</td>
                                    <td align="center">{patient.theConcerns} </td>
                                    <td align="center">{patient.theSymptoms}</td>
                                    <td align="center">{patient.status}</td>
                                    <td>
                                        <Button label="See Diagnosis"
                                        href={`/showDiagnoses/${patient.ID}`}
                                        ></Button>
                                    </td>
                                    <td>
                                    {   patient.status==="NotDone"?
                                        <Button label="Cancel"
```

```
                        onClick = {() => {
                            fetch('http://localhost:3001/deleteAppt?uid='+ patient.ID)
                            window.location.reload()
                        }}
                        ></Button>
                        :
                        <Button label="Delete"
                        onClick = {() => {
                            fetch('http://localhost:3001/deleteAppt?uid='+ patient.ID)
                            window.location.reload()
                        }}
                        ></Button>
                    }
                    </td>
                </tr>
            )}
        </tbody>
    </table>
</div>
</div>
);
return (
<Grommet theme={theme} full>
<Box >
<AppBar>
                    <a style={{ color: 'inherit', textDecoration: 'inherit'}} href="/"><Heading level='3' margin='none'>HMS</Heading></a>
</AppBar>
<Body />
</Box>
</Grommet>
);
}
}

export default PatientsViewAppointments;
```



Patient Scheduling Appointment:

```
import React, { Component, useState, useEffect } from 'react';
import {
  Schedule,
} from 'grommet-icons';
import {
  Box,
  Button,
  Heading,
  Form,
  Text,
  TextArea,
  Grommet,
  Calendar,
  DropButton,
  MaskedInput,
  Keyboard,
  Select
} from 'grommet';
import './App.css';
const theme = {
  global: {
```

```
    colors: {
      brand: '#000000',
      focus: "#000000",
      active: "#000000",
    },
    font: {
      family: 'Lato',
    },
  },
};
var theDate;
var theTime;
var endTime;
var theConcerns;
var theSymptoms;
var theDoc;
const AppBar = (props) => (
  <Box
    tag='header'
    direction='row'
    align='center'
    justify='between'
    background='brand'
    pad={{ left: 'medium', right: 'small', vertical: 'small' }}
    style={{ zIndex: '1' }}
    {...props} />
);

const DropContent = ({ date: initialDate, time: initialTime, onClose }) => {
  const [date, setDate] = React.useState();
  const [time, setTime] = React.useState();

  const close = () => {
    theDate = date;
    theTime = time;

    //time is string, store it as [hour, min]
```

```
  let parsedTime = theTime.split(":");

  //parse hr string to in and add one hour to start hour
  let startHour = parseInt(parsedTime[0], 10);
  let endHour = startHour + 1;

  //rejoin into string
  endTime = `${endHour}:00`;

  console.log(endTime);
  console.log(theDate)
  console.log(theTime);
  onClose(date || initialDate, time || initialTime);
};

return (
  <Box align="center">
    <Calendar
      animate={false}
      date={date || initialDate}
      onSelect={setDate}
      showAdjacentDays={false}
      required
    />
    <Box flex={false} pad="medium" gap="small">
      <Keyboard
        required
        onEnter={event => {
          event.preventDefault(); // so drop doesn't re-open
          close();
        }}
      >
        <MaskedInput
          mask={[
            {
              length: [1, 2],
              options: [
```

```
    "0",
    "1",
    "2",
    "3",
    "4",
    "5",
    "6",
    "7",
    "8",
    "9",
    "10",
    "11",
    "12",
    "13",
    "14",
    "15",
    "16",
    "17",
    "18",
    "19",
    "20",
    "21",
    "22",
    "23",

  ],
  regexp: /^1[1-2]$|^[0-9]$/,
  placeholder: "hh"
},
{ fixed: ":" },
{
  length: 2,
  options: ["00"],
  regexp: /^[0-5][0-9]$|^[0-9]$/,
  placeholder: "mm"
}
]}
```

```
          value={time || initialTime}
          name="maskedInput"
          onChange={event => setTime(event.target.value)}
          required
        />
      </Keyboard>
      <Box flex={false}>
        <Button label="Done" onClick={close} color="#00739D" />
      </Box>
    </Box>
  </Box>
 );
};

const DateTimeDropButton = () => {
 const [date, setDate] = React.useState();
 const [time, setTime] = React.useState("");
 const [open, setOpen] = React.useState();

 const onClose = (nextDate, nextTime) => {
  setDate(nextDate);
  setTime(nextTime);
  setOpen(false);
  setTimeout(() => setOpen(undefined), 1);
 };

 return (
  <Grommet theme={theme}>
   <Box align="center" pad="large">
    <DropButton
     open={open}
     onClose={() => setOpen(false)}
     onOpen={() => setOpen(true)}
     dropContent={
      <DropContent date={date} time={time} onClose={onClose} />
     }
    >
```

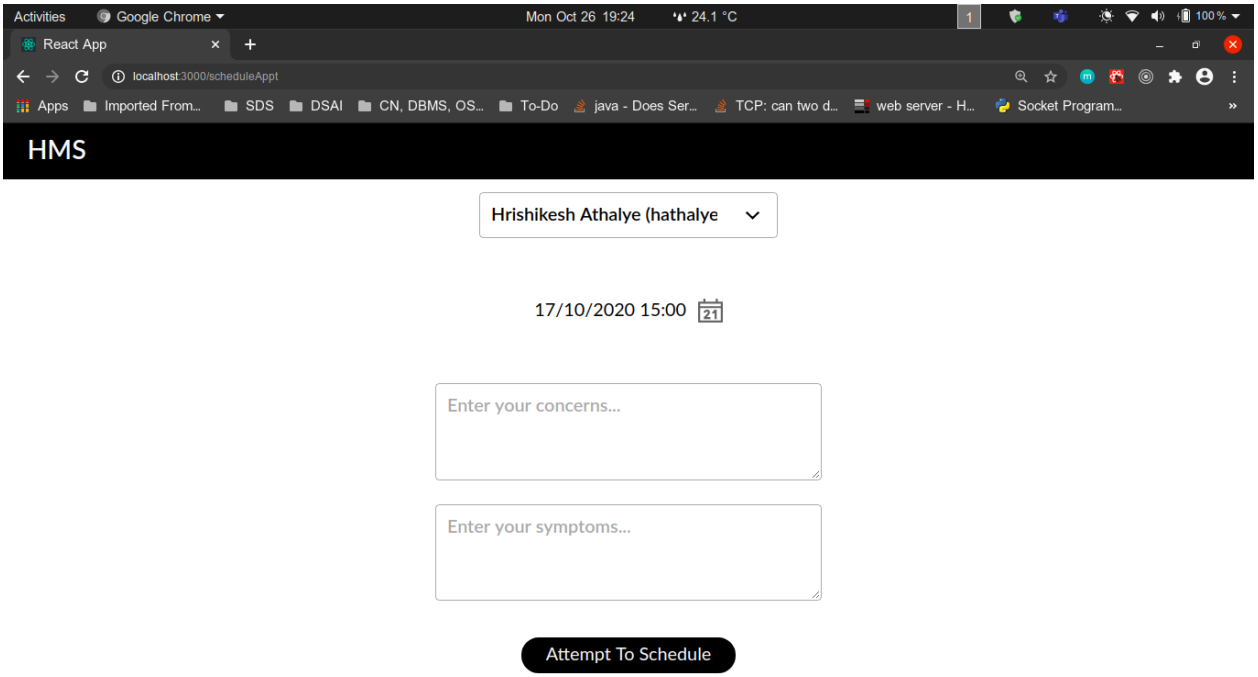
```
        <Box direction="row" gap="small" align="center" pad="small">
          <Text color={date ? undefined : "dark-5"}>
            {date
              ? `${new Date(date).toLocaleDateString()} ${time}`
              : "Select date & time"}
          </Text>
          <Schedule />
        </Box>
      </DropButton>
    </Box>
  </Grommet>
 );
};

const ConcernsTextArea = () => {
 const [value, setValue] = React.useState("");

 const onChange = event => {
  setValue(event.target.value);
  theConcerns = event.target.value;
 };

 return (
  <Grommet theme={theme}>
    <Box
      width="medium"
      height="xsmall"
    >
    <TextArea
      placeholder="Enter your concerns..."
      value={value}
      onChange={onChange}
      fill
      required />
    </Box>
  </Grommet>
 );
```

```
};

const SymptomsTextArea = () => {
  const [value, setValue] = React.useState("");

  const onChange = event => {
    setValue(event.target.value);
    theSymptoms = event.target.value;
  };

  return (
    <Grommet theme={theme}>
      <Box
        width="medium"
        height="xsmall"
      >
        <TextArea
          placeholder="Enter your symptoms..."
          value={value}
          onChange={onChange} fill
          required />
      </Box>
    </Grommet>
  );
};

function DoctorsDropdown() {
  const [value, setValue] = useState();
  const [doctorsList, setList] = useState([]);
  useEffect(() => {
    fetch("http://localhost:3001/docInfo")
    .then(res => res.json())
    .then(res => {
      let arr = []
      res.data.forEach(i => {
        let tmp = `${i.name} (${i.email})`;
        arr.push(tmp);
```

```
      });
      setList(arr);
    });
  }, []);
  const onChange = event => {
    setValue(event.value);
    let doc = event.value.match(/\((.*)\)/)[1];
    theDoc = doc;
  };
  return (
    <Select
      options={doctorsList}
      value={value}
      placeholder="Select Doctor"
      onChange={onChange} fill
      required
    />
  );
}


export class SchedulingAppt extends Component {
  constuctor() {
  }
  render() {
    return (
      <Grommet theme={theme} full>
        <AppBar>
                        <a style={{ color: 'inherit', textDecoration: 'inherit'}} href="/"><Heading level='3'
margin='none'>HMS</Heading></a>
        </AppBar>
        <Box align="center" pad="small" gap="small">
          <Form
            onSubmit={({ value }) => {
              //probably fetch uid here, add one
              fetch("http://localhost:3001/userInSession")
                .then(res => res.json())
```

```
          .then(res => {
            var string_json = JSON.stringify(res);
            var email_json = JSON.parse(string_json);
            let email_in_use = email_json.email;
             fetch("http://localhost:3001/checkIfApptExists?email=" + email_in_use + "&startTime=" + theTime
+ "&date=" + theDate + "&docEmail=" + theDoc)
            .then(res => res.json())
            .then(res => {
             if ((res.data[0])) {
               window.alert("Appointment Clash! Try another doctor or date/time");
             } else {
              fetch("http://localhost:3001/genApptUID")
               .then(res => res.json())
               .then(res => {
                var string_json = JSON.stringify(res);
                var uid_json = JSON.parse(string_json);
                let gen_uid = uid_json.id;
                console.log(gen_uid);
                fetch("http://localhost:3001/schedule?time=" + theTime + "&endTime=" + endTime +
                 "&date=" + theDate + "&concerns=" + theConcerns + "&symptoms=" + theSymptoms +
                 "&id=" + gen_uid + "&doc=" + theDoc).then((x)=>{
                       fetch("http://localhost:3001/addToPatientSeeAppt?email=" + email_in_use + "&id=" +
gen_uid +
                  "&concerns=" + theConcerns + "&symptoms=" + theSymptoms).then((x)=>{
                   window.alert("Appointment successfully scheduled!");
                  });
                 })
                });
             }
            });
          });
        }}
      >
        <Box align="center" gap="small">
         <DoctorsDropdown />
        </Box>
        <DateTimeDropButton>
```

```
          </DateTimeDropButton>
          <ConcernsTextArea />
          <br />
          <SymptomsTextArea />
          <br />
          <Box align="center" pad="small" gap="small">
            <Button
              label="Attempt To Schedule"
              type="submit"
              primary
            />
          </Box>
        </Form>
      </Box>
    </Grommet>
  );
 }
}
export default SchedulingAppt;
```



Doctor Home Screen:

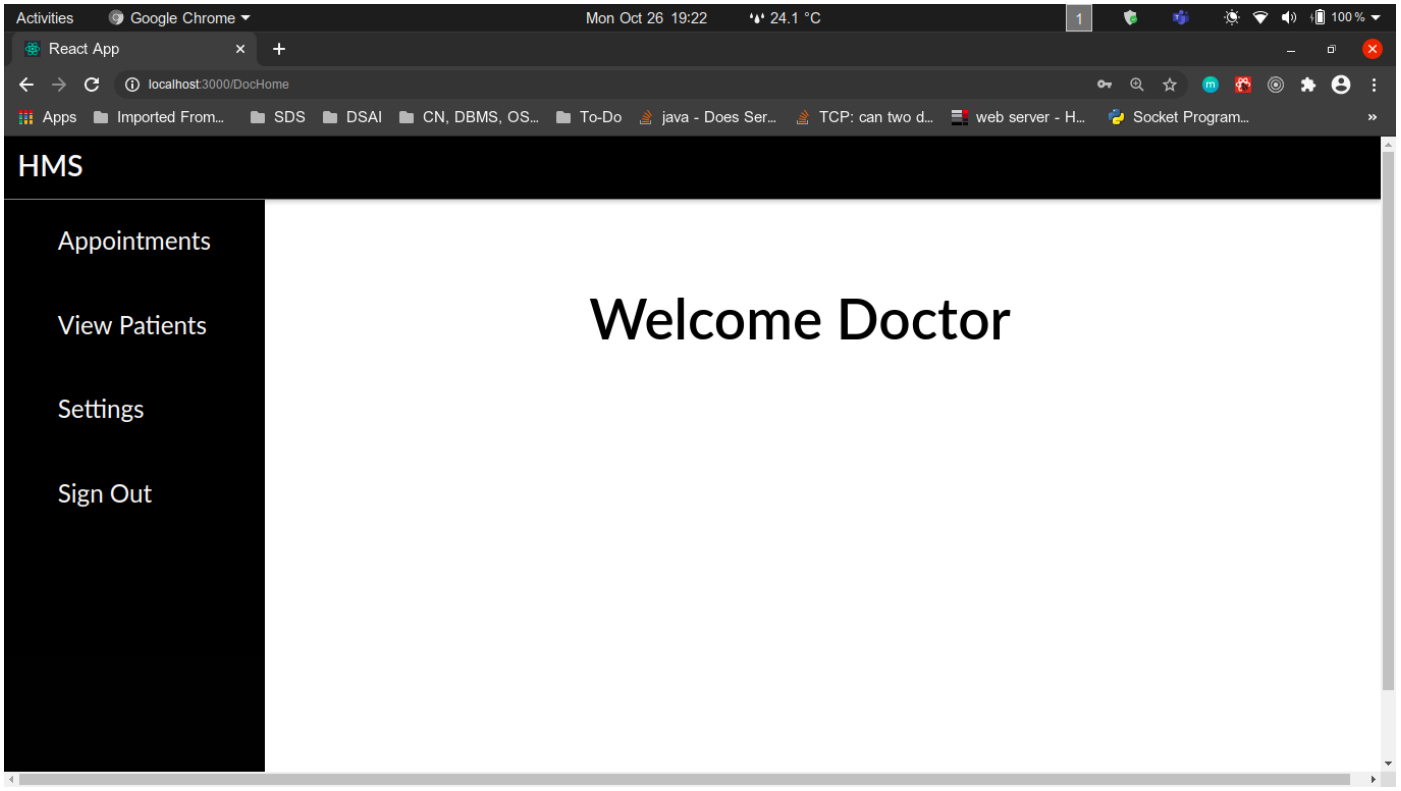
```
import React, { Component, useState } from 'react';
import {
```

```
  Box,
  Button,
  Heading,
  Grommet,
  Grid,
  Text,
} from 'grommet';

import './App.css';

const theme = {
  global: {
    colors: {
      brand: '#000000',
      focus: '#000000'
    },
    font: {
      family: 'Lato',
    },
  },
};

const SidebarButton = ({ label, ...rest }) => (
  <Button plain {...rest}>
    {({ hover }) => (
      <Box
        background={hover ? "#DADADA" : undefined}
        pad={{ horizontal: "large", vertical: "medium" }}
      >
        <Text size="large">{label}</Text>
      </Box>
    )}
  </Button>
);

const SidebarButtons = () => {
  const [active, setActive] = useState();
```

```
    return (
      <Grommet full theme={theme}>
        <Box fill direction="row">
          <Box background="brand">
            {["Appointments", "View Patients", "Settings", "Sign Out"].map(label => (
              <SidebarButton
                key={label}
                label={label}
                active={label === active}
                onClick={() => {
                  if (label === "Appointments") {
                    window.location = "/ApptList"
                  }
                  else if (label === "Sign Out") {
                    fetch("http://localhost:3001/endSession");
                    window.location = "/"
                  }
                  else if (label === "Settings") {
                    window.location = "/DocSettings"
                  }
                  else if (label === "View Patients") {
                    window.location = "/MedHistView"
                  }
                  setActive(label);
                }}
              />
            ))}

          </Box>
        </Box>
      </Grommet>
    );
};

export class DocHome extends Component {
    componentDidMount() {
    }
```

```
  render() {
    const Header = () => (
      <Box
        tag='header'
        background='brand'
        pad='small'
        elevation='small'
        justify='between'
        direction='row'
        align='center'
        flex={false}
        style={{borderBottom:"1px solid grey"}}
      >
                        <a style={{ color: 'inherit', textDecoration: 'inherit'}} href="/"><Heading level='3' margin='none'>HMS</Heading></a>

      </Box>
    );

    return (
      <Grommet full={true}
        theme={theme}>
        <Box align="left">
          <Header/>
          <Grid
            fill
            rows={['auto', 'flex']}
            columns={['auto', 'flex']}
            areas={[
              { name: 'sidebar', start: [0, 1], end: [0, 1] },
              { name: 'main', start: [1, 1], end: [1, 1] },
            ]}>
            <Box
            gridArea="sidebar"
            width="small"
            animation={[
```

```
                { type: 'fadeIn', duration: 300 },
                { type: 'slideRight', size: 'xlarge', duration: 150 },
                ]}
                >
                  <SidebarButtons />
                </Box>
                <Box
                  gridArea="main"
                  justify="top"
                  align="center">
                  <Box align="center" pad="large">
                    <Heading
                      color="#000000">Welcome Doctor
                    </Heading>
                  </Box>
                </Box>
              </Grid>
            </Box>
          </Grommet>
        );
    }
}

export default DocHome;
```



Doctor Viewing Appointment:

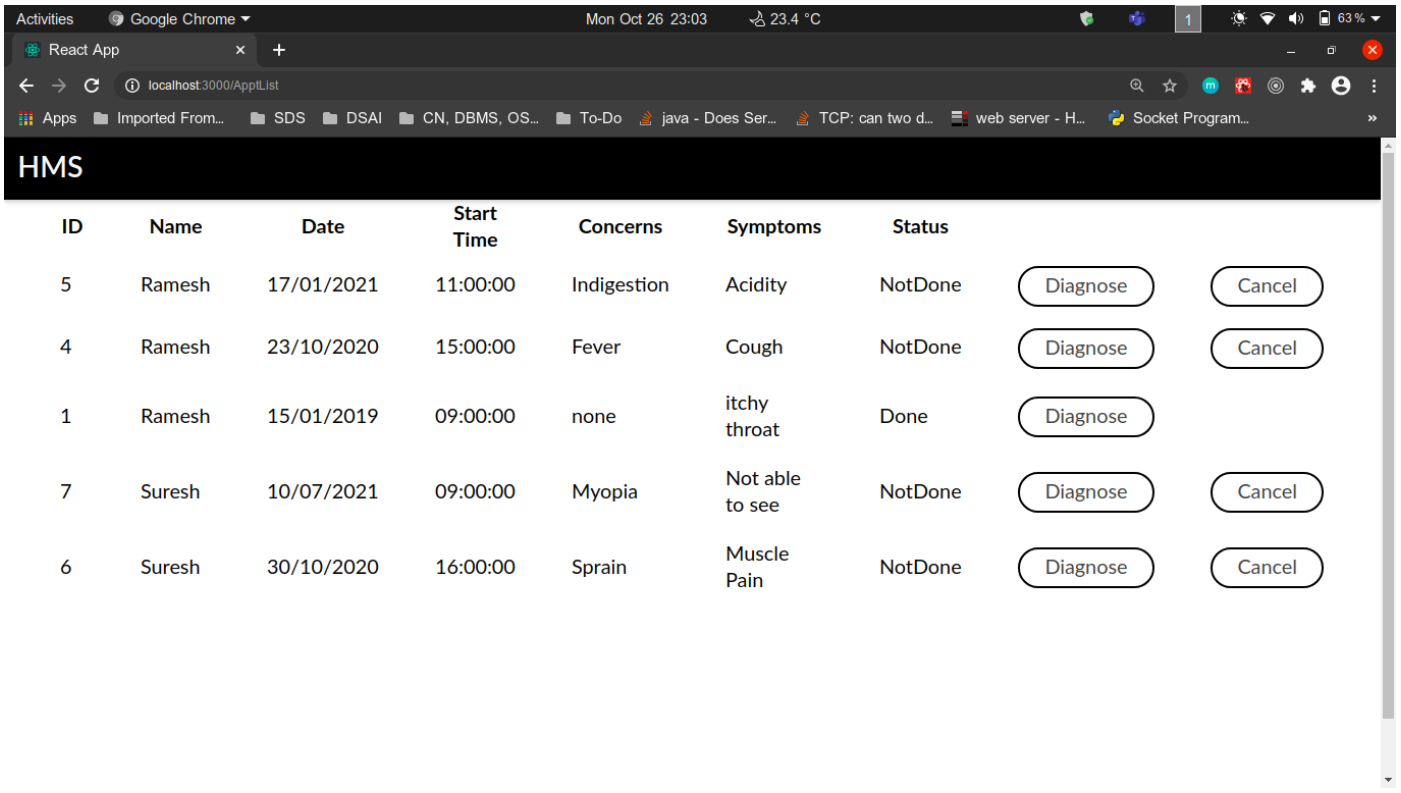
```
import React, { Component} from 'react';
import {
   Box,
   Button,
   Heading,
   Grommet,
} from 'grommet';

import './App.css';

const theme = {
   global: {
     colors: {
       brand: '#000000',
       focus: '#000000'
     },
     font: {
       family: 'Lato',
     },
```

```
  },
};

export class DocViewAppt extends Component {
  state = { apptlist: [] }

  componentDidMount() {
    this.getNames();
  }

  getNames() {
    fetch('http://localhost:3001/doctorViewAppt')
    .then(res => res.json())
    .then(res => this.setState({ apptlist: res.data }));
  }

  render() {
    const { apptlist } = this.state;
    const Header = () => (
      <Box
        tag='header'
        background='brand'
        pad='small'
        elevation='small'
        justify='between'
        direction='row'
        align='center'
        flex={false}
      >
                    <a style={{ color: 'inherit', textDecoration: 'inherit'}} href="/"><Heading level='3' margin='none'>HMS</Heading></a>
      </Box>
    );

    const Body = () => (
      <div className="container">
        <div className="panel panel-default p50 uth-panel">
```

```
<table className="table table-hover">
  <thead>
    <tr>
      <th>ID</th>
      <th>Name</th>
      <th>Date</th>
      <th>Start Time</th>
      <th>Concerns</th>
      <th>Symptoms</th>
      <th>Status</th>
    </tr>
  </thead>
  <tbody>
    {apptlist.map(appt =>
      <tr key={appt.name}>
        <td>{appt.id}</td>
        <td>{appt.name}</td>
        <td>{new Date(appt.date).toLocaleDateString().substring(0,10)} </td>
        <td>{appt.starttime}</td>
        <td>{appt.concerns}</td>
        <td>{appt.symptoms}</td>
        <td>{appt.status}</td>
        <td>
          <Button label="Diagnose"
          href={`/Diagnose/${appt.id}`}
          ></Button>
        </td>
        <td>
          {appt.status === "NotDone"?
            <Button label="Cancel"
            onClick = {() => {
              fetch('http://localhost:3001/deleteAppt?uid='+ appt.id)
              window.location.reload();
            }}
            ></Button>
          :<div></div>}
        </td>
```

```
                    </tr>
                )}
            </tbody>
        </table>
    </div>
</div>

);
return (
    <Grommet full={true}
    theme = {theme}>
        <Header />
        <Box fill={true}>
            <Body />
        </Box>
    </Grommet>
);
}
}
```

export default DocViewAppt;



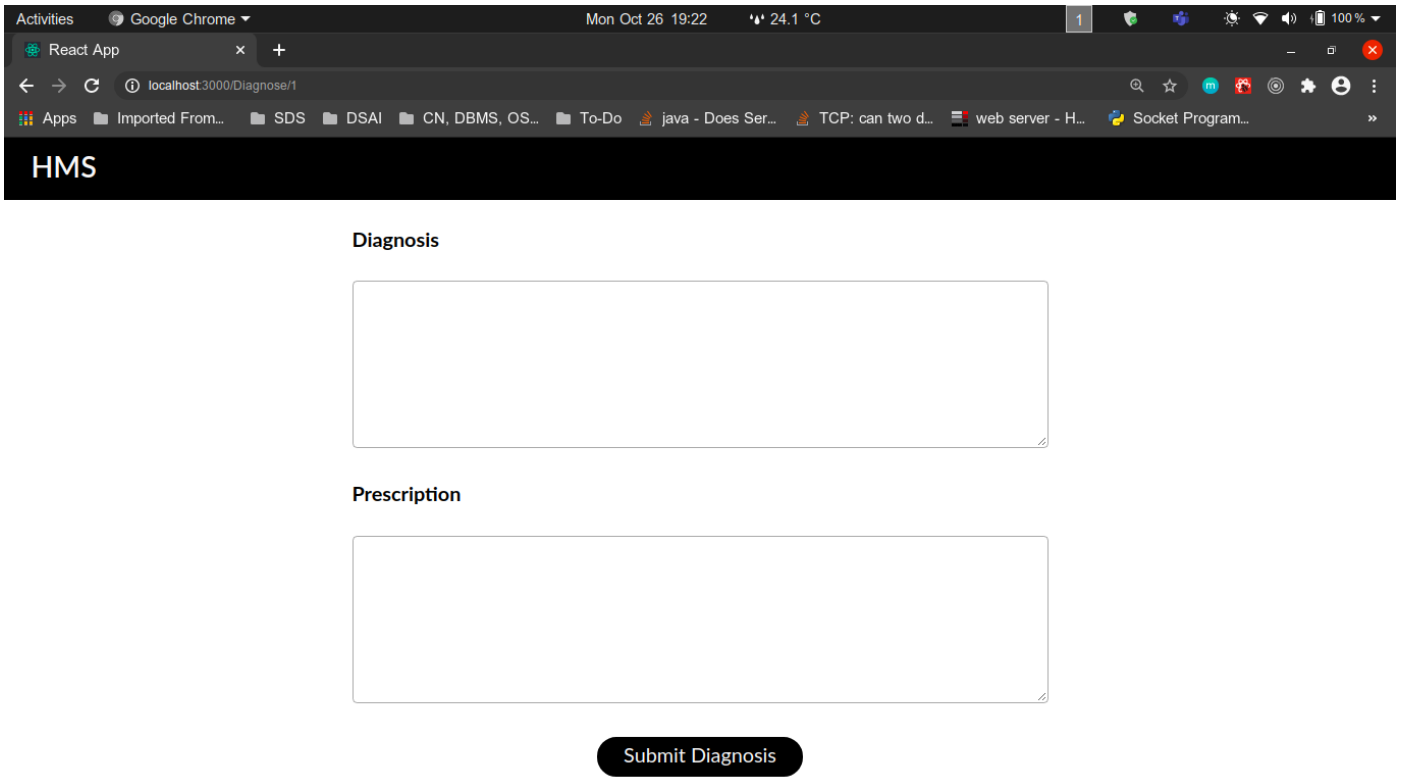
Doctor giving diagnosis:

```
import React, { Component } from 'react';
import {
  Box,
  Button,
  Heading,
  Form,
  TextArea,
  Grommet
} from 'grommet';
import './App.css';
const theme = {
  global: {
    colors: {
      brand: '#000000',
      focus: "#000000",
      active: "#000000",
    },
    font: {
      family: 'Lato',
    },
  },
};
var diagnosis;
var prescription;
var id;
const AppBar = (props) => (
  <Box
    tag='header'
    direction='row'
    align='center'
    justify='between'
    background='brand'
    pad={{ left: 'medium', right: 'small', vertical: 'small' }}
    style={{ zIndex: '1' }}
    {...props} />
);
```

```
const DiagnosisTextArea = () => {
  const [value, setValue] = React.useState(" ");

  const onChange = event => {
    setValue(event.target.value);
    diagnosis = event.target.value;
  };

  return (
    <Grommet theme={theme}>
      <h4>Diagnosis</h4>
      <TextArea
        placeholder="Enter Diagnosis"
        label="Enter Diagnosis"
        value={value}
        onChange={onChange}
        style={{width:"50vw", height:"12vw"}}
        fill
        required />
    </Grommet>
  );
};

const PrescriptionTextArea = () => {
  const [value, setValue] = React.useState(" ");
  const onChange = event => {
    setValue(event.target.value);
    prescription = event.target.value;
  };
  return (
    <Grommet theme={theme}>
        <h4>Prescription</h4>
        <TextArea
          placeholder="Enter Prescription"
          label="Enter Prescription"
          value={value}
          style={{width:"50vw", height:"12vw"}}
```

```
        onChange={onChange} fill
        required />
    </Grommet>
  );
};

export class Diagnose extends Component {
  constructor(props) {
    super(props);
    id = props.match.params.id;
  }
  render() {
    return (
      <Grommet theme={theme} full>
        <AppBar>
                        <a style={{ color: 'inherit', textDecoration: 'inherit'}} href="/"><Heading level='3' margin='none'>HMS</Heading></a>
        </AppBar>
        <Box align="center" gap="small">
          <Form
            onSubmit={({ value }) => {
              fetch("http://localhost:3001/diagnose?diagnosis=" + diagnosis + "&prescription=" + prescription
              + "&id=" + id).then(()=>{
              })
              window.alert("Diagnosis Submitted!");
            }}
          >
            <DiagnosisTextArea />
            <PrescriptionTextArea />
            <br />
            <Box align="center">
            <Button
              label="Submit Diagnosis"
              type="submit"
              primary
            />
            </Box>
```

```
        </Form>
      </Box>
    </Grommet>
  );
 }
}
export default Diagnose;
```



Doctor Viewing Patient History:

```
import React, { Component} from 'react';

import {
   Box,
   Heading,
   Grommet,
   Table,
   TableBody,
   TableCell,
   TableRow
} from 'grommet';

import './App.css';
```

```
const theme = {
    global: {
        colors: {
            brand: '#000000',
            focus: '#000000'
        },
        font: {
            family: 'Lato',
        },
    },
};

export class ViewOneHistory extends Component {
    state = { medhiststate: [], medhiststate2: []}
    componentDidMount() {
        const { email } = this.props.match.params;
        this.allDiagnoses(email);
        this.getHistory(email);
    }

    getHistory(value) {
        let email = "'" + value + "'";
        fetch('http://localhost:3001/OneHistory?patientEmail='+ email)
        .then(res => res.json())
            .then(res => this.setState({ medhiststate: res.data }));
    }

    allDiagnoses(value) {
        let email = "'" + value + "'";
        fetch('http://localhost:3001/allDiagnoses?patientEmail='+ email)
        .then(res => res.json())
        .then(res => this.setState({ medhiststate2: res.data }));
    }

    render() {
        const { medhiststate } = this.state;
```

```
const { medhiststate2 } = this.state;
const Header = () => (
  <Box
    tag='header'
    background='brand'
    pad='small'
    elevation='small'
    justify='between'
    direction='row'
    align='center'
    flex={false}
  >
                    <a style={{ color: 'inherit', textDecoration: 'inherit'}} href="/"><Heading level='3' margin='none'>HMS</Heading></a>
  </Box>
);
const Body = () => (
  <div className="container">
    <div className="panel panel-default p50 uth-panel">
      {medhiststate.map(patient =>
        <Table>
          <TableBody>
            <TableRow>
              <TableCell scope="row">
                <strong>Name</strong>
              </TableCell>
              <TableCell>{patient.name}</TableCell>
              <TableCell></TableCell>
              <TableCell><strong>Email</strong></TableCell>
              <TableCell>{patient.email}</TableCell>
            </TableRow>
            <TableRow>
              <TableCell scope="row">
                <strong>Gender</strong>
              </TableCell>
              <TableCell>
                {patient.gender}
```

```
    </TableCell>
    <TableCell />
    <TableCell>
      <strong>Address</strong>
    </TableCell>
    <TableCell>{patient.address}</TableCell>
  </TableRow>
  <TableRow>
    <TableCell scope="row">
    </TableCell>
  </TableRow>
  <TableRow>
    <TableCell>
      <strong>Conditions</strong>
    </TableCell>
    <TableCell>{patient.conditions}
      </TableCell>
  </TableRow>
  <TableRow>
    <TableCell scope="row">
    </TableCell>
  </TableRow>
  <TableRow>
    <TableCell>
      <strong>Surgeries</strong>
    </TableCell>
    <TableCell>{patient.surgeries}
    </TableCell>
  </TableRow>
  <TableRow>
    <TableCell scope="row">
    </TableCell>
  </TableRow>
  <TableRow>
    <TableCell>
      <strong>Medications</strong>
    </TableCell>
```

```
                    <TableCell>{patient.medication}
                    </TableCell>
                  </TableRow>
                </TableBody>
              </Table>
            )}
        </div>
        <hr />
    </div>
);
const Body2 = () => (
    <div className="container">
        <div className="panel panel-default p50 uth-panel">
            {medhiststate2.map(patient =>
                <div>
                <Table>
                    <TableBody>
                        <TableRow>
                            <TableCell scope="row">
                                <strong>Date</strong>
                            </TableCell>
                            <TableCell>{patient.date.split('T')[0]}</TableCell>
                            <TableCell></TableCell>
                            <TableCell><strong>Doctor</strong></TableCell>
                            <TableCell>{patient.doctor}</TableCell>
                        </TableRow>
                        <TableRow>
                            <TableCell scope="row">
                                <strong>Concerns</strong>
                            </TableCell>
                            <TableCell>
                                {patient.concerns}
                            </TableCell>
                            <TableCell />
                            <TableCell>
                                <strong>Symptoms</strong>
                            </TableCell>
```

```
                    <TableCell>{patient.symptoms}</TableCell>
                  </TableRow>
                  <TableRow>
                    <TableCell scope="row">
                    </TableCell>
                  </TableRow>
                  <TableRow>
                    <TableCell>
                      <strong>Diagnosis</strong>
                    </TableCell>
                    <TableCell>{patient.diagnosis}
                      </TableCell>
                  </TableRow>
                  <TableRow>
                    <TableCell scope="row">
                    </TableCell>
                  </TableRow>
                  <TableRow>
                    <TableCell>
                      <strong>Prescription</strong>
                    </TableCell>
                    <TableCell>{patient.prescription}
                    </TableCell>
                  </TableRow>
                  <TableRow>
                    <TableCell scope="row">
                    </TableCell>
                  </TableRow>
                </TableBody>
              </Table>
              <hr />
              </div>
            )}
          </div>
        </div>
    );
    return (
```

```
        <Grommet full={true} theme={theme}>
          <Box fill={true}>
            <Header />
            <Body />
            <Body2 />
          </Box>
        </Grommet>
      );
    }
}
export default ViewOneHistory;
```

Backend:

App.js

```
var createError = require('http-errors');
var express = require('express');
var path = require('path');
//Logger that was used for debugging, commented later
// var logger = require('morgan');
var mysql = require('mysql');
var cors = require('cors');
var port = 3001

//Connection Info
var con = mysql.createConnection({
  host: 'localhost',
  user: 'hathalye7',
  password: 'hrishikesh',
  database: 'HMS',
  multipleStatements: true
});

//Connecting To Database
con.connect(function (err) {
  if (err) throw err;
  console.log("Connected to MySQL");
});
```

```
//Variables to keep state info about who is logged in
var email_in_use = "";
var password_in_use = "";
var who = "";

var app = express();

app.set('views', path.join(__dirname, 'views'));
app.set('view engine', 'jade');

// app.use(logger('dev'));
app.use(express.json());
app.use(express.urlencoded({ extended: false }));
app.use(express.static(path.join(__dirname, 'public')));
app.use(cors());

//Signup, Login, Password Reset Related Queries

//Checks if patient exists in database
app.get('/checkIfPatientExists', (req, res) => {
  let params = req.query;
  let email = params.email;
  let statement = `SELECT * FROM Patient WHERE email = "${email}"`;
  console.log(statement);
  con.query(statement, function (error, results, fields) {
    if (error) throw error;
    else {
      return res.json({
        data: results
      })
    };
  });
});

//Creates User Account
app.get('/makeAccount', (req, res) => {
  let query = req.query;
```

```
let name = query.name + " " + query.lastname;
let email = query.email;
let password = query.password;
let address = query.address;
let gender = query.gender;
let medications = query.medications;
let conditions = query.conditions;
let surgeries = query.surgeries;
if(medications===undefined){
  medications="none"
}
if(conditions===undefined){
  conditions="none"
}
if(!surgeries===undefined){
  surgeries="none"
}
let sql_statement = `INSERT INTO Patient (email, password, name, address, gender)
                    VALUES ` + `("${email}", "${password}", "${name}", "${address}", "${gender}")`;
console.log(sql_statement);
con.query(sql_statement, function (error, results, fields) {
  if (error) throw error;
  else {
    email_in_use = email;
    password_in_use = password;
    who="pat";
    return res.json({
      data: results
    })
  };
});
sql_statement='SELECT id FROM MedicalHistory ORDER BY id DESC LIMIT 1;';
console.log(sql_statement)
con.query(sql_statement, function (error, results, fields) {
  if (error) throw error;
  else {
    let generated_id = results[0].id + 1;
```

```
    let sql_statement = `INSERT INTO MedicalHistory (id, date, conditions, surgeries, medication)
    VALUES ` + `("${generated_id}", curdate(), "${conditions}", "${surgeries}", "${medications}")`;
    console.log(sql_statement);
    con.query(sql_statement, function (error, results, fields) {
      if (error) throw error;
      else {
        let sql_statement = `INSERT INTO PatientsFillHistory (patient, history)
        VALUES ` + `("${email}",${generated_id})`;
        console.log(sql_statement);
        con.query(sql_statement, function (error, results, fields) {
          if (error) throw error;
          else {};
        });
      };
    });
  };
 });
});

//Checks If Doctor Exists
app.get('/checkIfDocExists', (req, res) => {
 let params = req.query;
 let email = params.email;
 let statement = `SELECT * FROM Doctor WHERE email = "${email}"`;
 console.log(statement);
 con.query(statement, function (error, results, fields) {
  if (error) throw error;
  else {
   return res.json({
    data: results
   })
  };
 });
});

//Makes Doctor Account
app.get('/makeDocAccount', (req, res) => {
```

```
  let params = req.query;
  let name = params.name + " " + params.lastname;
  let email = params.email;
  let password = params.password;
  let gender = params.gender;
  let schedule = params.schedule;
  let sql_statement = `INSERT INTO Doctor (email, gender, password, name)
                      VALUES ` + `("${email}", "${gender}", "${password}", "${name}")`;
  console.log(sql_statement);
  con.query(sql_statement, function (error, results, fields) {
    if (error) throw error;
    else {
      let sql_statement = `INSERT INTO DocsHaveSchedules (sched, doctor)
                      VALUES ` + `(${schedule}, "${email}")`;
      console.log(sql_statement);
      con.query(sql_statement, function(error){
        if (error) throw error;
      })
      email_in_use = email;
      password_in_use = password;
      who = 'doc';
      return res.json({
        data: results
      })
    };
  });
});

//Checks if patient is logged in
app.get('/checklogin', (req, res) => {
  let params = req.query;
  let email = params.email;
  let password = params.password;
  let sql_statement = `SELECT * FROM Patient
                      WHERE email="${email}"
                      AND password="${password}"`;
  console.log(sql_statement);
```

```
  con.query(sql_statement, function (error, results, fields) {
    if (error) {
      console.log("error");
      return res.status(500).json({ failed: 'error ocurred' })
    }
    else {
      if (results.length === 0) {
      } else {
        var string = JSON.stringify(results);
        var json = JSON.parse(string);
        email_in_use = email;
        password_in_use = password;
        who = "pat";
      }
      return res.json({
        data: results
      })
    };
  });
});

//Checks if doctor is logged in
app.get('/checkDoclogin', (req, res) => {
  let params = req.query;
  let email = params.email;
  let password = params.password;
  let sql_statement = `SELECT *
                      FROM Doctor
                      WHERE email="${email}" AND password="${password}"`;
  console.log(sql_statement);
  con.query(sql_statement, function (error, results, fields) {
    if (error) {
      console.log("eror");
      return res.status(500).json({ failed: 'error ocurred' })
    }
    else {
      if (results.length === 0) {
```

```
    } else {
      var string = JSON.stringify(results);
      var json = JSON.parse(string);
      email_in_use = json[0].email;
      password_in_use = json[0].password;
      who="doc";
      console.log(email_in_use);
      console.log(password_in_use);
    }
    return res.json({
      data: results
    })
  };
 });
});

//Resets Patient Password
app.post('/resetPasswordPatient', (req, res) => {
 let something = req.query;
 let email = something.email;
 let oldPassword = "" + something.oldPassword;
 let newPassword = "" + something.newPassword;
 let statement = `UPDATE Patient
          SET password = "${newPassword}"
          WHERE email = "${email}"
          AND password = "${oldPassword}";`;
 console.log(statement);
 con.query(statement, function (error, results, fields) {
  if (error) throw error;
  else {
   return res.json({
    data: results
   })
  };
 });
});
```

```
//Resets Doctor Password
app.post('/resetPasswordDoctor', (req, res) => {
  let something = req.query;
  let email = something.email;
  let oldPassword = "" + something.oldPassword;
  let newPassword = "" + something.newPassword;
  let statement = `UPDATE Doctor
                  SET password = "${newPassword}"
                  WHERE email = "${email}"
                  AND password = "${oldPassword}";`;
  console.log(statement);
  con.query(statement, function (error, results, fields) {
    if (error) throw error;
    else {
      return res.json({
        data: results
      })
    };
  });
});

//Returns Who is Logged in
app.get('/userInSession', (req, res) => {
  return res.json({ email: `${email_in_use}`, who:`${who}`});
});

//Logs the person out
app.get('/endSession', (req, res) => {
  console.log("Ending session");
  email_in_use = "";
  password_in_use = "";
});

//Appointment Related

//Checks If a similar appointment exists to avoid a clash
app.get('/checkIfApptExists', (req, res) => {
```

```
let cond1, cond2, cond3 = ""
let params = req.query;
let email = params.email;
let doc_email = params.docEmail;
let startTime = params.startTime;
let date = params.date;
let ndate = new Date(date).toLocaleDateString().substring(0, 10)
let sql_date = `STR_TO_DATE('${ndate}', '%d/%m/%Y')`;
//sql to turn string to sql time obj
let sql_start = `CONVERT('${startTime}', TIME)`;
let statement = `SELECT * FROM PatientsAttendAppointments, Appointment
WHERE patient = "${email}" AND
appt = id AND
date = ${sql_date} AND
starttime = ${sql_start}`
console.log(statement)
con.query(statement, function (error, results, fields) {
 if (error) throw error;
 else {
  cond1 = results;
  statement=`SELECT * FROM Diagnose d INNER JOIN Appointment a
  ON d.appt=a.id WHERE doctor="${doc_email}" AND date=${sql_date} AND status="NotDone"
  AND ${sql_start} >= starttime AND ${sql_start} < endtime`
  console.log(statement)
  con.query(statement, function (error, results, fields) {
   if (error) throw error;
   else {
    cond2 = results;
    statement = `SELECT doctor, starttime, endtime, breaktime, day FROM DocsHaveSchedules
    INNER JOIN Schedule ON DocsHaveSchedules.sched=Schedule.id
    WHERE doctor="${doc_email}" AND
    day=DAYNAME(${sql_date}) AND
                (DATE_ADD(${sql_start},INTERVAL +1 HOUR) <= breaktime OR ${sql_start} >=
DATE_ADD(breaktime,INTERVAL +1 HOUR));`
    //not in doctor schedule
    console.log(statement)
    con.query(statement, function (error, results, fields) {
```

```
        if (error) throw error;
        else {
          if(results.length){
            results = []
          }
          else{
            results = [1]
          }
          return res.json({
            data: cond1.concat(cond2,results)
          })
        };
      });
    };
  });
  //doctor has appointment at the same time - Your start time has to be greater than all prev end times
});

//Returns Date/Time of Appointment
app.get('/getDateTimeOfAppt', (req, res) => {
  let tmp = req.query;
  let id = tmp.id;
  let statement = `SELECT starttime as start,
                        endtime as end,
                        date as theDate
                  FROM Appointment
                  WHERE id = "${id}"`;
  console.log(statement);
  con.query(statement, function (error, results, fields) {
    if (error) throw error;
    else {
      console.log(JSON.stringify(results));
      return res.json({
        data: results
      })
```

```
    };
  });
});

//Patient Info Related

//to get all doctor names
app.get('/docInfo', (req, res) => {
  let statement = 'SELECT * FROM Doctor';
  console.log(statement);
  con.query(statement, function (error, results, fields) {
    if (error) throw error;
    else {
      return res.json({
        data: results
      })
    };
  });
});

//To return a particular patient history
app.get('/OneHistory', (req, res) => {
  let params = req.query;
  let email = params.patientEmail;
  let statement = `SELECT gender,name,email,address,conditions,surgeries,medication
                   FROM PatientsFillHistory,Patient,MedicalHistory
                   WHERE PatientsFillHistory.history=id
                   AND patient=email AND email = ` + email;
  console.log(statement);
  con.query(statement, function (error, results, fields) {
    if (error) throw error;
    else {
      return res.json({
        data: results
      })
    }
  })
```

```
});

//To show all patients whose medical history can be accessed
app.get('/MedHistView', (req, res) => {
  let params = req.query;
  let patientName = "'%" + params.name + "%'";
  let secondParamTest = "" + params.variable;
  let statement = `SELECT name AS 'Name',
                  PatientsFillHistory.history AS 'ID',
                  email FROM Patient,PatientsFillHistory
                  WHERE Patient.email = PatientsFillHistory.patient
                  AND Patient.email IN (SELECT patient from PatientsAttendAppointments
                  NATURAL JOIN Diagnose WHERE doctor="${email_in_use}")`;
  if (patientName != "'")
    statement += " AND Patient.name LIKE " + patientName
  console.log(statement)
  con.query(statement, function (error, results, fields) {
    if (error) throw error;
    else {
      return res.json({
        data: results
      })
    };
  });
});

//Returns Appointment Info To patient logged In
app.get('/patientViewAppt', (req, res) => {
  let tmp = req.query;
  let email = tmp.email;
  let statement = `SELECT PatientsAttendAppointments.appt as ID,
                  PatientsAttendAppointments.patient as user,
                  PatientsAttendAppointments.concerns as theConcerns,
                  PatientsAttendAppointments.symptoms as theSymptoms,
                  Appointment.date as theDate,
                  Appointment.starttime as theStart,
                  Appointment.endtime as theEnd,
```

```
            Appointment.status as status
            FROM PatientsAttendAppointments, Appointment
            WHERE PatientsAttendAppointments.patient = "${email}" AND
            PatientsAttendAppointments.appt = Appointment.id`;
  console.log(statement);
  con.query(statement, function (error, results, fields) {
    if (error) throw error;
    else {
      return res.json({
        data: results
      })
    };
  });
});

//Checks if history exists
app.get('/checkIfHistory', (req, res) => {
    let params = req.query;
    let email = params.email;
    let statement = "SELECT patient FROM PatientsFillHistory WHERE patient = " + email;
    console.log(statement)
    con.query(statement, function (error, results, fields) {
        if (error) throw error;
        else {
            return res.json({
                data: results
            })
        };
    });
});

//Adds to PatientsAttendAppointment Table
app.get('/addToPatientSeeAppt', (req, res) => {
  let params = req.query;
  let email = params.email;
  let appt_id = params.id;
  let concerns = params.concerns;
```

```
  let symptoms = params.symptoms;
  let sql_try = `INSERT INTO PatientsAttendAppointments (patient, appt, concerns, symptoms)
                VALUES ("${email}", ${appt_id}, "${concerns}", "${symptoms}")`;
  console.log(sql_try);
  con.query(sql_try, function (error, results, fields) {
    if (error) throw error;
    else{
      return res.json({
        data: results
      })
    }
  });

});

//Schedules Appointment
app.get('/schedule', (req, res) => {
  let params = req.query;
  let time = params.time;
  let date = params.date;
  let id = params.id;
  let endtime = params.endTime;
  let concerns = params.concerns;
  let symptoms = params.symptoms;
  let doctor = params.doc;
  let ndate = new Date(date).toLocaleDateString().substring(0, 10)
  let sql_date = `STR_TO_DATE('${ndate}', '%d/%m/%Y')`;
  //sql to turn string to sql time obj
  let sql_start = `CONVERT('${time}', TIME)`;
  //sql to turn string to sql time obj
  let sql_end = `CONVERT('${endtime}', TIME)`;
  let sql_try = `INSERT INTO Appointment (id, date, starttime, endtime, status)
                VALUES (${id}, ${sql_date}, ${sql_start}, ${sql_end}, "NotDone")`;
  console.log(sql_try);
  con.query(sql_try, function (error, results, fields) {
    if (error) throw error;
    else {
```

```
    let sql_try = `INSERT INTO Diagnose (appt, doctor, diagnosis, prescription)
            VALUES (${id}, "${doctor}", "Not Yet Diagnosed" , "Not Yet Diagnosed")`;
    console.log(sql_try);
    con.query(sql_try, function (error, results, fields) {
      if (error) throw error;
      else{
        return res.json({
          data: results
        })
      }
    });
  }
 });
});

//Generates ID for appointment
app.get('/genApptUID', (req, res) => {
 let statement = 'SELECT id FROM Appointment ORDER BY id DESC LIMIT 1;'
 con.query(statement, function (error, results, fields) {
  if (error) throw error;
  else {
   let generated_id = results[0].id + 1;
   return res.json({ id: `${generated_id}` });
  };
 });
});

//To fill diagnoses
app.get('/diagnose', (req, res) => {
 let params = req.query;
 let id = params.id;
 let diagnosis = params.diagnosis;
 let prescription = params.prescription;
  let statement = `UPDATE Diagnose SET diagnosis="${diagnosis}", prescription="${prescription}" WHERE
appt=${id};`;
 console.log(statement)
 con.query(statement, function (error, results, fields) {
```

```
    if (error) throw error;
    else {
      let statement = `UPDATE Appointment SET status="Done" WHERE id=${id};`;
      console.log(statement)
      con.query(statement, function (error, results, fields){
        if (error) throw error;
      })
    };
  });
});

//To show diagnoses
app.get('/showDiagnoses', (req, res) => {
  let id = req.query.id;
  let statement = `SELECT * FROM Diagnose WHERE appt=${id}`;
  console.log(statement);
  con.query(statement, function (error, results, fields) {
    if (error) throw error;
    else {
      return res.json({
        data: results
      })
    };
  });
});

//To show appointments to doctor
app.get('/doctorViewAppt', (req, res) => {
  let a = req.query;
  let email = a.email;
  let statement = `SELECT a.id,a.date, a.starttime, a.status, p.name, psa.concerns, psa.symptoms
  FROM Appointment a, PatientsAttendAppointments psa, Patient p
  WHERE a.id = psa.appt AND psa.patient = p.email
  AND a.id IN (SELECT appt FROM Diagnose WHERE doctor="${email_in_use}")`;
  console.log(statement);
  con.query(statement, function (error, results, fields) {
    if (error) throw error;
```

```
    else {
      return res.json({
        data: results
      })
    };
  });
});

//To show diagnoses to patient
app.get('/showDiagnoses', (req, res) => {
  let id = req.query.id;
  let statement = `SELECT * FROM Diagnose WHERE appt=${id}`;
  console.log(statement);
  con.query(statement, function (error, results, fields) {
    if (error) throw error;
    else {
      return res.json({
        data: results
      })
    };
  });
});

//To Show all diagnosed appointments till now
app.get('/allDiagnoses', (req, res) => {
  let params = req.query;
  let email = params.patientEmail;
  let statement =`SELECT date,doctor,concerns,symptoms,diagnosis,prescription FROM
  Appointment A INNER JOIN (SELECT * from PatientsAttendAppointments NATURAL JOIN Diagnose
  WHERE patient=${email}) AS B ON A.id = B.appt;`
  console.log(statement);
  con.query(statement, function (error, results, fields) {
    if (error) throw error;
    else {
      return res.json({
        data: results
      })
```

```
    };
  });
});

//To delete appointment
app.get('/deleteAppt', (req, res) => {
  let a = req.query;
  let uid = a.uid;
  let statement = `SELECT status FROM Appointment WHERE id=${uid};`;
  console.log(statement);
  con.query(statement, function (error, results, fields) {
    if (error) throw error;
    else {
      results = results[0].status
      if(results == "NotDone"){
        statement = `DELETE FROM Appointment WHERE id=${uid};`;
        console.log(statement);
        con.query(statement, function (error, results, fields) {
          if (error) throw error;
        });
      }
      else{
        if(who=="pat"){
          statement = `DELETE FROM PatientsAttendAppointments p WHERE p.appt = ${uid}`;
          console.log(statement);
          con.query(statement, function (error, results, fields) {
            if (error) throw error;
          });
        }
      }
    };
  });
  return;
});

// If 404, forward to error handler
app.use(function (req, res, next) {
```

```
  next(createError(404));
});

// error handler
app.use(function (err, req, res, next) {
  // set locals, only providing error in development
  res.locals.message = err.message;
  res.locals.error = req.app.get('env') === 'development' ? err : {};

  // render the error page
  res.status(err.status || 500);
  res.render('error');
});
module.exports = app;
```

CHAPTER 6
RESULTS AND DISCUSSIONS

6.1 Results

Our Hospital Management System project aimed to develop a software application that would streamline hospital operations and improve patient care. The system we developed includes functionalities such as patient registration, appointment scheduling, medical records management, billing and payment management, inventory management, reporting and analytics, electronic prescribing, laboratory management, online patient portal, and staff management.

We conducted a comprehensive testing and validation process to ensure that the system is working as expected. This included unit testing, integration testing, and user acceptance testing. The testing revealed a few minor bugs, which we were able to address promptly, resulting in a robust and reliable system.

Comparing our Hospital Management System with other similar systems currently in use in the healthcare industry, we found that our system offers several advantages. First, our system includes an electronic prescribing feature that allows doctors to prescribe medication electronically and send the prescription directly to a pharmacy, reducing errors and improving patient safety. Second, our system includes an online patient portal that allows patients to view their medical records, request prescription refills, and communicate with medical professionals, improving patient engagement and satisfaction. Finally, our system includes reporting and analytics features that provide hospital administrators with valuable insights into hospital operations, patient outcomes, and financial performance.

Feedback from users who tested our system was overwhelmingly positive. Users found the system easy to use, intuitive, and effective. They appreciated the various features of the system, including the patient portal and electronic prescribing, which helped improve patient care and reduce administrative burdens.

6.2 Discussions

Based on our findings, we believe that our Hospital Management System has the potential to significantly improve hospital operations and patient care. In particular, our system can reduce errors, increase efficiency, improve patient engagement and satisfaction, and provide valuable insights into hospital operations and financial performance. However, we recognize that there are limitations to our project, such as scalability issues and the need for additional features, which we plan to address in future work.

We acknowledge that there are other hospital management systems available in the market, but our system offers several unique advantages over these systems, such as the electronic prescribing feature and the patient portal. These features improve the patient experience, reduce the risk of errors, and increase efficiency in hospital operations.

In conclusion, our Hospital Management System project has been a success, and we believe that it has the potential to make a significant impact on the healthcare industry. We hope that our system will be adopted by

hospitals and medical facilities around the world, leading to improved patient care and better health outcomes. The positive feedback from users and the advantages our system offers over other similar systems demonstrate the potential of our Hospital Management System to revolutionize the healthcare industry.

CHAPTER-7

CONCLUSION AND FUTURE ENHANCEMENTS

7.1 Conclusion

In conclusion, effective database management is crucial for hospitals to provide quality healthcare services to patients. The use of a hospital management system can help healthcare providers streamline their processes, improve patient outcomes, and reduce healthcare costs. The integration of emerging technologies such as AI-powered chatbots, wearable health devices, and blockchain can enhance the functionality of a hospital management system and improve the overall patient experience. Additionally, advanced scheduling algorithms, automated inventory management, and real-time location tracking can help optimize resource utilization and reduce waste and inefficiencies. By continually improving and updating their database management processes, hospitals can ensure that they are providing the highest quality of care to their patients.

7.2 Future Enhancements

There are several potential enhancements that could be implemented in a hospital management system to improve its efficiency and effectiveness. Here are a few suggestions:

1. Integration with wearable health devices: With the rise of wearable health devices such as fitness trackers, smartwatches, and medical sensors, integrating these devices into a hospital management system can provide valuable health data to physicians and other healthcare professionals. This data can be used to monitor patients remotely and make more informed treatment decisions.
2. Implementation of AI-powered chatbots: AI-powered chatbots can help automate routine tasks such as appointment scheduling and patient inquiries. This can free up hospital staff to focus on more complex tasks and improve the overall patient experience.
3. Electronic Health Records (EHR) with blockchain technology: Blockchain technology can improve data security, privacy, and interoperability by providing a tamper-resistant, decentralized database that can securely store and share EHR data between different healthcare providers and stakeholders.
4. Telemedicine capabilities: Telemedicine enables patients to connect with healthcare providers remotely, which can be particularly useful for patients who live in remote or underserved areas. Integrating telemedicine capabilities into a hospital management system can help improve access to care and reduce healthcare costs.
5. Predictive analytics and data visualization tools: By analyzing large amounts of patient data, predictive analytics can help identify patients at high risk of developing certain conditions or diseases. Data visualization tools can then be used to present this information in a clear and actionable format, allowing healthcare professionals to take proactive measures to prevent or manage these conditions.
6. IoT-enabled medical devices: IoT-enabled medical devices can be used to monitor patients remotely, gather real-time health data, and automate certain tasks. Integrating these devices into a hospital management system can help improve patient outcomes, reduce hospital readmissions, and optimize

resource utilization.

7. Patient engagement tools: Implementing patient engagement tools, such as patient portals or mobile apps, can help patients become more involved in their own care. These tools can allow patients to access their health records, schedule appointments, communicate with healthcare providers, and receive health education resources.
8. Advanced scheduling algorithms: Advanced scheduling algorithms can optimize the use of hospital resources such as operating rooms, medical equipment, and staff schedules. By taking into account factors such as patient acuity, physician availability, and equipment availability, these algorithms can help reduce wait times and improve patient outcomes.
9. Automated inventory management: Automating inventory management can help hospitals more accurately track and manage their supplies and equipment. By using RFID or other tracking technologies, hospitals can streamline their supply chain processes and reduce waste and inefficiencies.
10. Virtual reality training for healthcare professionals: Virtual reality training can provide healthcare professionals with realistic, hands-on training experiences in a safe and controlled environment. This can be particularly useful for high-stress, high-risk scenarios such as surgical procedures.
11. Real-time location tracking: Real-time location tracking can be used to track patients, staff, and equipment within a hospital. This can help improve patient safety, reduce wait times, and optimize resource utilization.
12. Patient-centered care pathways: Patient-centered care pathways can help ensure that patients receive the appropriate care at the appropriate time, while minimizing unnecessary tests or procedures. By taking into account patient preferences, values, and goals, these pathways can help improve patient outcomes and reduce healthcare costs.

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