

Florida International University
Knight Foundation School of Computing and Information Science

Final Deliverable

Project Title: Secure HealthPath HIPAA Edition

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Abstract

Secure HealthPath HIPAA Edition is a FIU doctor appointment booking project that was built to hold application and data security at a high standard. The project was first introduced as a pre-built application with a database configuration, frontend and backend implementations completed as well as basic features to work on and finalize. Our team made our best efforts to implement HIPAA compliant guidelines to ensure high application and data security. Additional features have been completed to provide users with a user-friendly platform to interact with the system.

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INTRODUCTION

Secure HealthPath HIPAA Edition is a web application project that is focused on doctor appointment booking for FIU. The application uses the MERN stack utilizing MongoDB for data storage and retrieval, Express for routing, middleware, restful API development and database integration, React for the client-side user interface, and Node to run JavaScript on the server-side. The application was introduced as a project that needed complete functions and additional security. The goal of the project was to make it HIPAA compliant to ensure high levels of security to protect the system from vulnerabilities and exposing sensitive user data.

CURRENT SYSTEM

The current system has been added with multiple features including HIPAA security/ breach rules and common functions seen on health-related applications. Secure HealthPath currently has features such as, user registration, login, two factor authentication, scheduling, and canceling appointments, reset password, and more.

PURPOSE OF NEW SYSTEM

The purpose of the new system is to make the application more secure by applying HIPAA compliance guidelines particularly, the security rule, privacy rule and breach notification rules that align with HIPAA constraints and follow their guidelines. The application strives to make the correspondence between the patient and the doctor as secure as possible. Securing patient's health information and the doctor's information is the essence of the application.

USER STORIES

The following section provides the detailed user stories that were implemented in this iteration of the Secure HealthPath project. These user stories served as the basis for the implementation of the project's features. This section also shows the user stories that are to be considered for development.

IMPLEMENTED USER STORIES

- User Story 1: Background Study and Research
- User Story 2: Study existing project and finding bugs
- User Story 3: Focused on notification system features, admin, and encryption
- User Story 4: Researched HIPAA guidelines to implement into the project
- User Story 5: Developed features based on HIPAA guidelines
- User Story 6: Focused on resolving conflicts with merged code
- User Story 7: Finalized the source code and design

PROJECT PLAN

This section outlines the planning process undertaken for the implementation of this project. Agile development techniques were employed, necessitating the detailed planning of sprints.

The section provides an overview of the selected components, encompassing software, that were integral to the project.

SOFTWARE RESOURCES

- MongoDB: NoSQL database storing data in a flexible, JSON-like format.
- Express.js: Web application framework for Node.js, simplifying server-side development.
- React: JavaScript library for building modular and efficient user interfaces.
- Node.js: JavaScript runtime enabling server-side execution, unifying the language throughout the stack.
- Visual Studio Code (VS Code): Lightweight and versatile source code editor with built-in support for various programming languages, extensions, and powerful debugging capabilities.

SPRINT PLANNING

Sprint Planning Meeting Minutes: Sprint 1

Project: **FIU Doctor Booking System**

Attendees: Mohammad Kazmi, Jason Eduardo Kildare, Abel Aguilera, Wenjia Wang (PO)

Start time: 9:00 AM

End time: 9:30 AM

After discussion, the velocity of the team was estimated to be **60 hours for the team**.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

- **User Story #1:** As developers, we want to familiarize ourselves with the source code and the resources for a MERN-based application so that the application can be improved and refined.
- **User Story #2:** As developers, we want to set-up the development environment and connect the application to the database, so that a working application can be tested.
- **User Story #3:** As developers, we want to identify bugs and issues in the source code and working application so that we can develop an efficient and user-friendly application.

- **User Story #4:** As a developer, I want to create an option for user registration so that the users should choose whether they are registering as a patient or as a doctor.
- **User Story #5:** Appointments are able to be made in the past. As a developer, I want to create a function so that patients are only able to make appointments in the future or on the same day.
- **User Story #6:** As a developer, I want to fix the appointment scheduling response, as appointments should be scheduled only within the timeframe of the availability of the doctor and not all the time, so that users get appointments during appropriate times.
- **User Story #7:** As a developer, I want to create a function so that the admin account has the ability to delete a user account or a doctor account if that doctor wishes to leave.
- **User Story #8:** As a developer, I want to create a profile update option for the users so that users have the ability to update their profile information such as their name, phone number, and email address.
- **User Story #9:** As a developer, I want to create and display a section for a small description about the specialization/expertise of the doctor, so that patients can book appointments according to their medical needs.
- **User Story #10:** As a developer, I want to create a search option for the user so that the user can search by the specific specialization of the doctor according to their needs.
- **User Story #11:** As a developer, I want to create a records function for the doctor, so that he/she can provide the patient with a summary of the appointment and precautionary measures they might need to take, so that the patient has an updated record.
- **User Story #12:** As a developer, I want to allow the users to update or the doctors to reschedule appointments with a patient and notify the patient, so that a smooth communication between the patient and doctor is established.
- **User Story #13:** As a developer, I want to implement Two-Factor Authentication for both Users and the Doctors, so that they can be verified and no unauthorized access is allowed to the application.
- **User Story #14:** As a developer, I want to implement a “strong password” feature for the login page so that the security and privacy standards of the web application are maintained.
- **User Story #15:** As a developer, I want to create a “Health Tips” page which shows interesting medical tips and suggestions to patients so that the web application is user-friendly and engaging.

The team members indicated their willingness to work on the following user stories.

- **Mohammad Kazmi**

- **User Story #1:** As developers, we want to familiarize ourselves with the source code and the resources for a MERN-based application so that the application can be improved and refined.

- **User Story #6:** As a developer, I want to fix the appointment scheduling response, as appointments should be scheduled only within the timeframe of the availability of the doctor and not all the time, so that users get appointments during appropriate times.

- **User Story #7:** As a developer, I want to create a function so that the admin account has the ability to delete a user account or a doctor account if that doctor wishes to leave.

- **User Story #9:** As a developer, I want to create and display a section for a small description about the specialization/expertise of the doctor, so that patients can book appointments according to their medical needs.

- **User Story #11:** As a developer, I want to create a records function for the doctor, so that he/she can provide the patient with a summary of the appointment and precautionary measures they might need to take, so that the patient has an updated record.

- **Jason Eduardo Kildare**

- **User Story #3:** As developers, we want to identify bugs and issues in the source code and working application so that we can develop an efficient and user-friendly application.

- **User Story#5:** As a developer, I want to create a function so that patients are only able to make appointments in the future or on the same day.

- **User Story#12:** As a developer, I want to allow the users to update or the doctors to reschedule appointments with a patient and notify the patient, so that a smooth communication between the patient and doctor is established.

- **User Story#13:** As a developer, I want to implement Two-Factor Authentication for both Users and the Doctors, so that they can be verified and no unauthorized access is allowed to the application.

- **User Story#15:** As a developer, I want to create a “Health Tips” page which shows interesting medical tips and suggestions to patients so that the web application is user-friendly.

Sprint Planning Meeting Minutes: Sprint 2

Project: **FIU Doctor Booking System**

Attendees: Mohammad Kazmi, Jason Eduardo Kildare, Abel Aguilera, Wenjia Wang (PO)

Start time: 9:00 AM

End time: 9:30 AM

After discussion, the velocity of the team was estimated to be **60 hours for the team**.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

- **User Story #1:** As a developer, I want to create an option for user registration so that the users should choose whether they are registering as a patient or as a doctor.
- **User Story #2:** As a user, I want to receive a confirmation email or SMS once my appointment is booked so that I have a record of it.
- **User Story #3:** As a user, I want my health information to be encrypted so that unauthorized parties can't read it. (User's info like booking record should be encrypted in database and in transit)
- **User Story #4:** As an admin, I want to have an audit trail feature that logs all access and modifications to patient data for monitoring and review purposes.
- **User Story #5:** As a doctor, I want to modify my availability so that patients can book appointments accordingly.
- **User Story #6:** As a user or doctor, I want to update the profile information such as name, phone number, email address, fee per consultation, so that current information is stored in the system.
- **User Story #7:** As a user, I want to reschedule or cancel my appointment through the system so that I don't have to call the clinic.
- **User Story #8:** As a doctor, I want to have a template/form where I can provide the summary of an appointment with the patient so that the patient can refer to it when needed.
- **User Story #9:** As a user, I want to receive a summary of the appointment in a records section, so that I have an updated record.

- **User Story #10:** As a developer, I want to implement a “strong password” feature for the login page so that the security and privacy standards of the web application are maintained.
- **User Story #11:** As a developer, I want to create a “Health Tips” page which shows interesting medical tips and suggestions to patients so that the web application is user-friendly and engaging.
- **User Story #12:** As a user, I want to check the BMI, Blood Pressure, Blood Glucose Chart so that I can keep my health in check and use it as a quick reference.

The team members indicated their willingness to work on the following user stories.

- **Mohammad Kazmi**
 - **User Story #2:** As a user, I want to receive a confirmation email or SMS once my appointment is booked so that I have a record of it.
 - **User Story #6:** As a user or doctor, I want to update the profile information such as name, phone number, email address, fee per consultation, so that current information is stored in the system.
 - **User Story #8:** As a doctor, I want to have a template/form where I can provide the summary of an appointment with the patient so that the patient can refer to it when needed.
 - **User Story #9:** As a user, I want to receive a summary of the appointment in a records section, so that I have an updated record.
- **Jason Eduardo Kildare**
 - **User Story #1:** As a developer, I want to create an option for user registration so that the users should choose whether they are registering as a patient or as a doctor.
 - **User Story #3:** As a user, I want my health information to be encrypted so that unauthorized parties can't read it. (User's info like booking record should be encrypted in database and in transit)
 - **User Story #10:** As a developer, I want to implement a “strong password” feature for the login page so that the security and privacy standards of the web application are maintained.
 - **User Story #11:** As a developer, I want to create a “Health Tips” page which shows interesting medical tips and suggestions to patients so that the web application is user-friendly and engaging.

Sprint Planning Meeting Minutes: Sprint 3

Project: **FIU Doctor Booking System**

Attendees: Mohammad Kazmi, Jason Eduardo Kildare, Wenjia Wang (PO)

Start time: 9:00 AM

End time: 9:30 AM

After discussion, the velocity of the team was estimated to be **60 hours for the team**.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

- **User Story #1:** As a user, I want to ensure that I can consent to the collection of my health information before booking an appointment.
- **User Story #2:** As a doctor, I want to store only essential health information necessary for the booking process.
- **User Story #3:** As a user, I want to be able to view or correct my protected health information by making a request for changes or deletions on the user dashboard.
- **User Story #4:** As an admin, I want to have an audit trail feature that logs all access and modifications to patient data for monitoring and review purposes.
- **User Story #5:** As a developer, I want to implement an automated notification system both in-app and email to notify the user in the event of a breach.
- **User Story #6:** As a developer, I want to implement a “Forgot Password” feature in case a user forgets their password so a code is sent to the user via email which allows them to reset their password.
- **User Story #7:** As a user, I want to reschedule or cancel my appointment through the system so that I don't have to call the clinic.
- **User Story #8:** As a doctor, I want to have a template/form where I can provide the summary of an appointment with the patient so that the patient can refer to it when needed.
- **User Story #9:** As a user, I want to receive a summary of the appointment in a records section and in an email, so that I have an updated record.
- **User Story #10:** As a developer, I want to implement a log of all accesses and changes to electronic protected health information to keep track of unauthorized access or alterations.

- **User Story #11:** As a developer, I want to implement a strong user authentication method such as a Multi-Factor Authentication system for both doctors and patients.
- **User Story #12:** As an admin, I want to ensure that the data is being backed up regularly and both patient and doctor's information is stored.
- **User Story #13:** As a doctor, I want to receive feedback after the appointment about the services provided and ensure that it is confidential.
- **User Story #14:** As a user, I want to check the BMI, Blood Pressure, Blood Glucose Chart so that I can keep my health in check and use it as a quick reference.

The team members indicated their willingness to work on the following user stories.

- **Mohammad Kazmi**
 - **User Story #6:** As a developer, I want to implement a "Forgot Password" feature in case a user forgets their password so a code is sent to the user via email which allows them to reset their password.
 - **User Story #8:** As a doctor, I want to have a template/form where I can provide the summary of an appointment with the patient so that the patient can refer to it when needed.
 - **User Story #9:** As a user, I want to receive a summary of the appointment in a records section, so that I have an updated record.
 - **User Story #11:** As a developer, I want to implement a strong user authentication method such as a Multi-Factor Authentication system for both doctors and patients.
 - **User Story #13:** As a doctor, I want to receive feedback after the appointment about the services provided and ensure that it is confidential
- **Jason Eduardo Kildare**
 - **User Story #1:** As a user, I want to ensure that I can consent to the collection of my health information before booking an appointment.
 - **User Story #2:** As a doctor, I want to store only essential health information necessary for the booking process.
 - **User Story #3:** As a user, I want to be able to view or correct my protected health information by making a request for changes or deletions on the user dashboard.
 - **User Story #10:** As a developer, I want to implement a log of all accesses and changes to electronic protected health information to keep track of unauthorized access or alterations.
 - **User Story #7:** As a user, I want to reschedule or cancel my appointment through the system so that I don't have to call the clinic.

Sprint Planning Meeting Minutes: Sprint 4

Project: **FIU Doctor Booking System**

Attendees: Mohammad Kazmi, Jason Eduardo Kildare, Wenjia Wang (PO)

Start time: 9:00 AM

End time: 9:30 AM

After discussion, the velocity of the team was estimated to be **60 hours for the team.**

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

- **User Story #1:** As a developer, I want to implement a log of all accesses and changes to electronic protected health information to keep track of unauthorized access or alterations. **164.312(b) (Security Rule)**
- **User Story #2:** As a developer, I want to limit the number of unsuccessful login attempts in order to prevent unauthorized access to a patient or a doctor's account. **164.308(a)(5)(ii)(C) (Security Rule)**
- **User Story #3:** As a developer, I want to make the users/doctors conform to an agreement when they register their account ensuring that their medical health information is protected, but it can be used if required by verified medical personnel or law and that they refrain from illegal activities on the app. **164.308(b)(3) (Security Rule)**
- **User Story #4:** As a developer, I want to implement procedures for monitoring log-in attempts such as the time and place where the account was logged in and report/notify the patient if it was logged in from a different location. **164.308(a)(5)(ii)(C) (Security Rule)**
- **User Story #5:** As a developer, I want to implement an automated notification system both in-app and email to notify the user in the event of a breach. **164.404(a) (Breach Notification Rule)**
- **User Story #6:** As a user, I want to receive any digital verification or proof of the doctor before disclosing any personal health information to the doctor. **164.514(h) (Privacy Rule)**
- **User Story #7:** As a developer, I want to scan files (PDFs, JPGs) which can be medical documents/records uploaded by the users or digital verification/proofs uploaded by doctors for vulnerabilities to ensure the files uploaded to the system are safe. **164.308(a) (5) (ii) (B) (Security Rule)**
- **User Story #8:** As a developer I want to implement a feature to ensure that access privileges are immediately denied to terminate workforce members. **164.308(a)(3)(ii)(C) (Security Rule)**

- **User Story #9:** As a developer I want to prohibit users from reusing previously used passwords. **164.308(a)(5)(ii)(D) (Security Rule)**
- **User Story #10:** As a developer, I want to implement electronic procedures that terminate an electronic session after a predetermined time of inactivity. **164.312(a)(2)(iii) (Security Rule)**

The team members indicated their willingness to work on the following user stories.

- **Mohammad Kazmi**

- **User Story #2:** As a developer, I want to limit the number of unsuccessful login attempts in order to prevent unauthorized access to a patient or a doctor's account. **164.308(a)(5)(ii)(C) (Security Rule)**

- **User Story #3:** As a developer, I want to make the users/doctors conform to an agreement when they register their account ensuring that their medical health information is protected, but it can be used if required by verified medical personnel or law and that they refrain from illegal activities on the app. **164.308(b)(3) (Security Rule)**

- **User Story #4:** As a developer, I want to implement procedures for monitoring log-in attempts such as the time and place where the account was logged in and report/notify the patient if it was logged in from a different location. **164.308(a)(5)(ii)(C) (Security Rule)**

- **User Story #6:** As a user, I want to receive any digital verification or proof of the doctor before disclosing any personal health information to the doctor. **164.514(h) (Privacy Rule)**

- **User Story #7:** As a developer, I want to scan files (PDFs, JPGs) which can be medical documents/records uploaded by the users or digital verification/proofs uploaded by doctors for vulnerabilities to ensure the files uploaded to the system are safe. **164.308(a) (5) (ii) (B) (Security Rule)**

- **Jason Eduardo Kildare**

- **User Story #1:** As a developer, I want to implement a log of all accesses and changes to electronic protected health information to keep track of unauthorized access or alterations. **164.312(b) (Security Rule)**

- **User Story #5:** As a developer, I want to implement an automated notification system both in-app and email to notify the user in the event of a breach. **164.404(a) (Breach Notification Rule)**

- **User Story #8:** As a developer I want to implement a feature to ensure that access privileges are immediately denied to terminate workforce members. **164.308(a)(3)(ii)(C) (Security Rule)**

- **User Story #9:** As a developer I want to prohibit users from reusing previously used passwords. **164.308(a)(5)(ii)(D) (Security Rule)**
- **User Story #10:** As a developer, I want to implement electronic procedures that terminate an electronic session after a predetermined time of inactivity. **164.312(a)(2)(iii) (Security Rule)**

Sprint Planning Meeting Minutes: Sprint 5

Project: **FIU Doctor Booking System**

Attendees: Mohammad Kazmi, Jason Eduardo Kildare, Wenjia Wang (PO)

Start time: 9:00 AM

End time: 9:30 AM

After discussion, the velocity of the team was estimated to be **60 hours for the team.**

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

- **User Story #1:** As a developer, I want to implement a log of all accesses and changes to electronic protected health information to keep track of unauthorized access or alterations. **164.312(b) (Security Rule)**
- **User Story #2:** As a user, I want to protect my personal health information using a password, so that unauthorized access to PHI can be prevented. **164.312(c)(1) (Security Rule)**
- **User Story #3:** As a developer, I want to email the user in case of an attempted breach of their personal health information and write a brief description of what happened, including the date of the breach and the date of the discovery of the breach, if known; and Any steps the individual should take to protect themselves from potential harm resulting from the breach. **164.404(c) (1) (Breach Notification Rule)**
- **User Story #4:** As an admin, I want to maintain logs of all personnel activities, such as updates to any form, any appointments booked, and their app visits during the day. **164.312(b) (Security Rule)**
- **User Story #5:** As a developer, I want to implement an automated notification system both in-app and email to notify the user in the event of a breach. **164.404(a) (Breach Notification Rule)**
- **User Story #6:** As a user, I want to receive any digital verification or proof of the doctor before disclosing any personal health information to the doctor. **164.514(h) (Privacy Rule)**

- **User Story #7:** As a developer I want to ensure that only privileged users can execute privileged functions. **Security Rule -164.312(a)(2)(i)**
- **User Story #8:** As a developer I want to ensure data is destroyed according to policy, including deleting data no longer required for business purposes, and beyond any regulated retention period. **Security Rule -164.310(d)(2)(i)**
- **User Story #9:** As a developer I want to implement procedures to verify that a person or entity seeking access to data is the one claimed. **Security Rule -164.312(d)**
- **User Story #10:** As a developer, I want to create a map of how data flows within the Organization, and in/out of the organization. Mapping data flows requires information from individual departments and users. **164.308(a) (1) (ii) (A) (Security Rule)**

The team members indicated their willingness to work on the following user stories.

- **Mohammad Kazmi**
 - **User Story #2:** As a user, I want to protect my personal health information using a password, so that unauthorized access to PHI can be prevented. **164.312(c)(1) (Security Rule)**
 - **User Story #3:** As a developer, I want to email the user in case of an attempted breach of their personal health information and write a brief description of what happened, including the date of the breach and the date of the discovery of the breach, if known; and Any steps the individual should take to protect themselves from potential harm resulting from the breach. **164.404(c) (1) (Breach Notification Rule)**
 - **User Story #4:** As an admin, I want to maintain logs of all personnel activities, such as updates to any form, any appointments booked, and their app visits during the day. **164.312(b) (Security Rule)**
 - **User Story #6:** As a user, I want to receive any digital verification or proof of the doctor before disclosing any personal health information to the doctor. **164.514(h) (Privacy Rule)**
 - **User Story #10:** As a developer, I want to create a map of how data flows within the organization, and in/out of the organization. Mapping data flows requires information from individual departments and users. **164.308(a) (1) (ii) (A) (Security Rule)**
- **Jason Eduardo Kildare**
 - **User Story #1:** As a developer, I want to implement a log of all accesses and changes to electronic protected health information to keep track of unauthorized access or alterations. **164.312(b) (Security Rule)**

- **User Story #5:** As a developer, I want to implement an automated notification system both in-app and email to notify the user in the event of a breach. **164.404(a) (Breach Notification Rule)**

- **User Story #7:** As a developer I want to ensure that only privileged users can execute privileged functions. **Security Rule -164.312(a)(2)(i)**

- **User Story #8:** As a developer I want to ensure data is destroyed according to policy, including deleting data no longer required for business purposes, and beyond any regulated retention period. **Security Rule -164.310(d)(2)(i)**

- **User Story #9:** As a developer I want to implement procedures to verify that a person or entity seeking access to data is the one claimed. **Security Rule -164.312(d)**

Sprint Planning Meeting Minutes: Sprint 6

Project: **FIU Doctor Booking System**

Attendees: Mohammad Kazmi, Jason Eduardo Kildare, Wenjia Wang (PO)

Start time: 9:00 AM

End time: 9:30 AM

After discussion, the velocity of the team was estimated to be **60 hours for the team.**

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

- **User Story #1:** As a doctor, I want to be able to send their user a summary of their appointment, so that they can have a medical summary saved as a record.
- **User Story #2:** As a user, I want to provide some feedback to the doctor and as a doctor I want to receive that feedback from the patient.
- **User Story #3:** As a doctor, I want to be presented with the necessary terms and conditions regarding the handling of personal health information of the patients and the appointments during registration.
- **User Story #4:** As an admin, I want to delete a doctor's account and all associated records if they are no longer working with FIU Health Services.
- **User Story #5:** As a developer, I want to store only the appointment information for the past 6 months and delete the rest of the information.

- **User Story #6:** As a developer, I need to fix the appointment booking time so that a patient cannot book an appointment outside of the specified time or at the same time as another patient with the same doctor.
- **User Story #7:** As an admin, I want to conduct regular risk assessments to identify and mitigate potential vulnerabilities and threats to PHI. **164.308(a)(1)(Security Rule)**
- **User Story #8:** As an admin, when I deny the user's request to make changes I want to tell them the reason and deny their request to make changes for the next 24 hours.
- **User Story #9:** As a developer I want to create a feature so a user can recover their account after unauthorized access.
- **User Story #10:** As a developer, I want to create a map of how data flows within the Organization, and in/out of the organization. Mapping data flows requires information from individual departments and users. **164.308(a) (1) (ii) (A) (Security Rule)**

The team members indicated their willingness to work on the following user stories.

- **Mohammad Kazmi**
 - **User Story #1:** As a doctor, I want to be able to send their user a summary of their appointment, so that they can have a medical summary saved as a record.
 - **User Story #2:** As a user, I want to provide some feedback to the doctor and as a doctor I want to receive that feedback from the patient.
 - **User Story #3:** As a doctor, I want to be presented with the necessary terms and conditions regarding the handling of personal health information of the patients and the appointments during registration.
 - **User Story #4:** As an admin, I want to delete a doctor's account and all associated records if they are no longer working with FIU Health Services.
 - **User Story #10:** As a developer, I want to create a map of how data flows within the organization, and in/out of the organization. Mapping data flows requires information from individual departments and users. **164.308(a) (1) (ii) (A) (Security Rule)**
- **Jason Eduardo Kildare**
 - **User Story #5:** As a developer, I want to store only the appointment information for the past 6 months and delete the rest of the information.
 - **User Story #6:** As a developer, I need to fix the appointment booking time so that a patient cannot book an appointment outside of the specified time or at the same time as another patient with the same doctor.
 - **User Story #7:** As an admin, I want to conduct regular risk assessments to identify and mitigate potential vulnerabilities and threats to PHI. **164.308(a)(1)(Security Rule)**

- **User Story #8:** As an admin, when I deny the user's request to make changes I want to tell them the reason and deny their request to make changes for the next 24 hours.
- **User Story #9:** As a developer I want to create a feature so a user can recover their account after unauthorized access.

Sprint Planning Meeting Minutes: Sprint 7

Project: **FIU Doctor Booking System**

Attendees: Mohammad Kazmi, Jason Eduardo Kildare, Wenjia Wang (PO) Start

time: 9:00 AM

End time: 9:30 AM

After discussion, the velocity of the team was estimated to be **60 hours for the team**.

The product owner chose the following user stories to be done during the next sprint. They are ordered based on their priority.

- **User Story #1:** As a developer, I want to commit all the changes in the code to the GitHub main branch.
- **User Story #2:** As a developer, I want to resolve the conflicts that arise while merging the branch in the admin, doctor, and user code files.
- **User Story #3:** As a developer, I want to create a poster presentation to show the contributions I made to the project and how useful they are to the development.
- **User Story #4:** As a developer, I want to test all the user stories on the main branch from previous Sprints to make sure everything is ready to be presented.
- **User Story #5:** As a developer, I want to demonstrate the functionality of the FIU Doctor Booking App and record videos to showcase the features developed throughout the semester.
- **User Story #6:** As a developer, I want to categorize all the user stories completed so far in the semester to security, privacy, and breach notification rules related to HIPAA constraints.

The team members indicated their willingness to work on the following user stories.

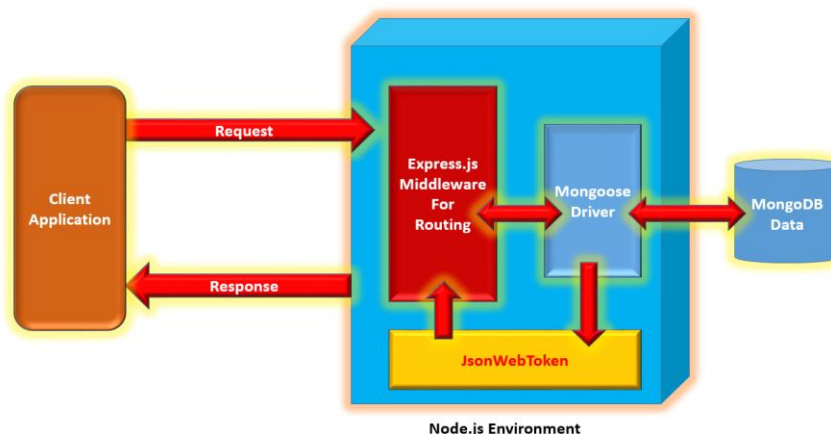
- **Mohammad Kazmi**
 - **User Story #1:** As a developer, I want to commit all the changes in the code to the GitHub main branch.
 - **User Story #2:** As a developer, I want to resolve the conflicts that arise while merging the branch in the admin, doctor, and user code files.
 - **User Story #3:** As a developer, I want to create a poster presentation to show

the contributions I made to the project and how useful they are to the development.

- **User Story #4:** As a developer, I want to test all the user stories on the main branch from previous Sprints to make sure everything is ready to be presented.
- **User Story #5:** As a developer, I want to demonstrate the functionality of the FIU Doctor Booking App and record videos to showcase the features developed throughout the semester.
- **Jason Eduardo Kildare**
 - **User Story #1:** As a developer, I want to commit all the changes in the code to the GitHub main branch.
 - **User Story #3:** As a developer, I want to create a poster presentation to show the contributions I made to the project and how useful they are to the development.
 - **User Story #4:** As a developer, I want to test all the user stories on the main branch from previous Sprints to make sure everything is ready to be presented.
 - **User Story #5:** As a developer, I want to demonstrate the functionality of the FIU Doctor Booking App and record videos to showcase the features developed throughout the semester.
 - **User Story #6:** As a developer, I want to categorize all the user stories completed so far in the semester to security, privacy, and breach notification rules related to HIPAA constraints.

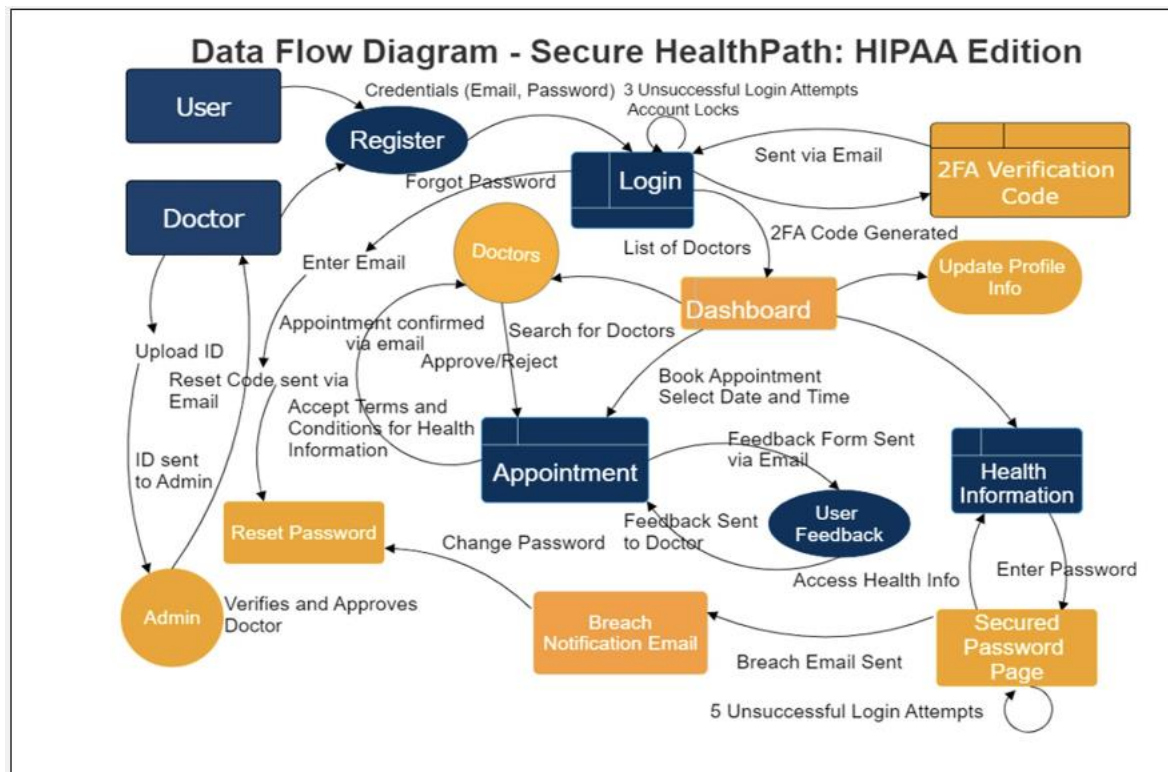
SYSTEM DESIGN

The web application was designed and implemented on the MERN (MongoDB, Express, React, NodeJS) Stack and the language of implementation was JavaScript. The MongoDB database was pre-configured and existent. Secure HealthPath Application was developed to be compliant to HIPAA rules and guidelines. Security features and functionalities aligned with the rules provided by HIPAA.



DESIGN FLOW

A complete data flow and system design of the Secure HealthPath Application showing the security features and interactions of the users and doctors with the app.



SYSTEM VALIDATION

Testing was done locally on Visual Studio 3. The testing focused on functionality, connectivity to the database, frontend and to the server. A vulnerability scanner was installed to check for system weaknesses to be resolved. This ensured that security was a priority for the overall system. No major errors or bugs were found during testing.

GLOSSARY

MongoDB:

- NoSQL Database
- Document-oriented
- JSON-like BSON data format
- Stores data in collections rather than tables

Express.js:

- Web application framework for Node.js
- Middleware support
- Routing system for defining endpoints
- Used to build RESTful APIs

React.js:

- JavaScript library for building user interfaces
- Component-based architecture
- Virtual DOM for efficient updates
- JSX syntax for writing UI components

Node.js:

- JavaScript runtime built on Chrome's V8 engine
- Server-side scripting
- Event-driven, non-blocking I/O
- npm (Node Package Manager) for package management

Frontend:**JSX:**

- JavaScript XML
- Syntax extension for React
- Allows writing HTML in JavaScript files

Component:

- Reusable, self-contained UI element
- Encapsulates logic and presentation
- Can have state and lifecycle methods

State:

- Data that changes over time within a component
- Managed internally by the component
- Changes trigger re-rendering

Props:

- Short for properties
- Data passed from parent to child component
- Immutable within the child component

Virtual DOM:

- In-memory representation of the actual DOM
- React updates the virtual DOM first, then updates the real DOM efficiently

Backend:**Middleware:**

- Functions executed during the request-response cycle
- Modify request/response objects
- Used for authentication, logging, etc.

RESTful API:

- Representational State Transfer
- Web API design architecture

- Uses standard HTTP methods (GET, POST, PUT, DELETE)
- Stateless communication between client and server

Routing:

- Process of defining endpoints in Express
- Maps HTTP methods to specific functions (handlers)
- Organizes server-side logic

Database Models:

- Represent structure and relationships of data
- Defined using Mongoose in the case of MongoDB
- Defines how data is stored and retrieved

Database (MongoDB):**Document:**

- Basic unit of data in MongoDB
- JSON-like data structure
- Key-value pairs

Collection:

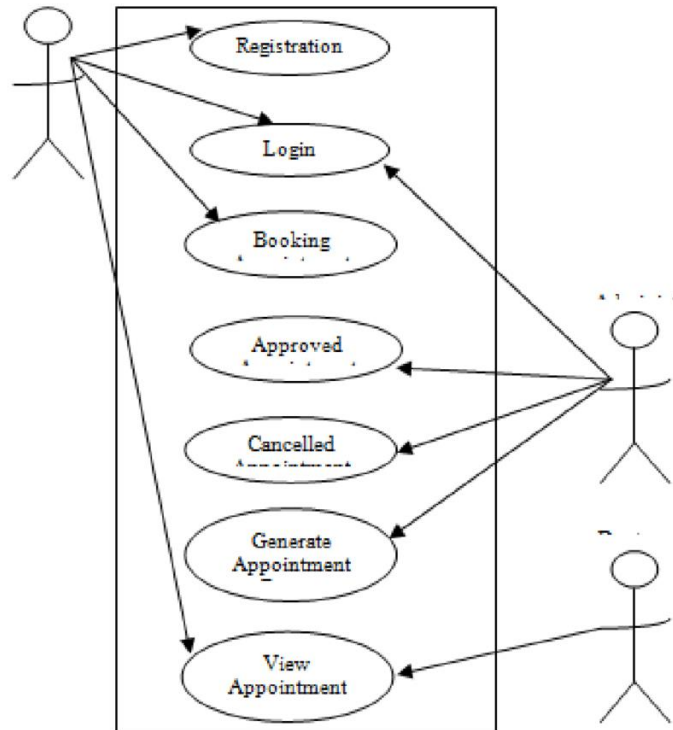
- Group of MongoDB documents
- Similar to a table in relational databases

Mongoose:

- MongoDB object modeling for Node.js
- Provides a schema-based solution
- Simplifies interactions with MongoDB

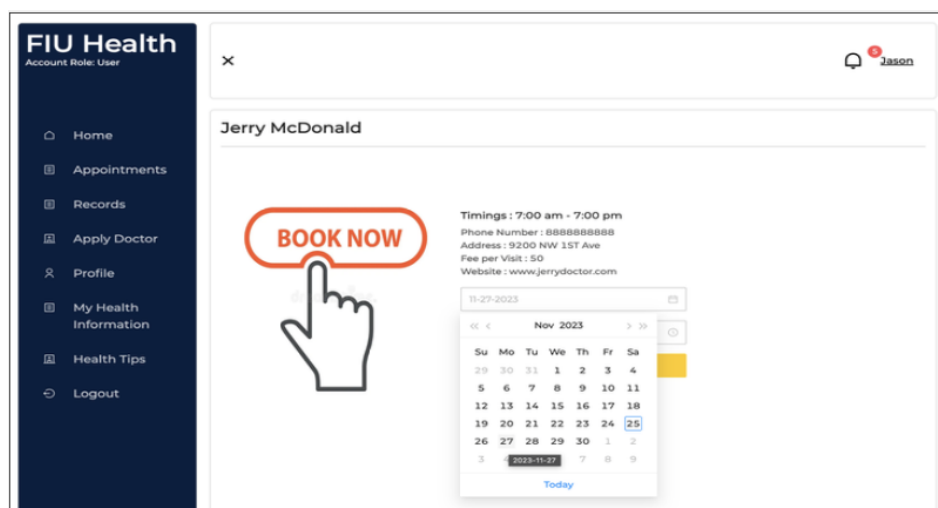
APPENDIX

Appendix A – UML Diagram

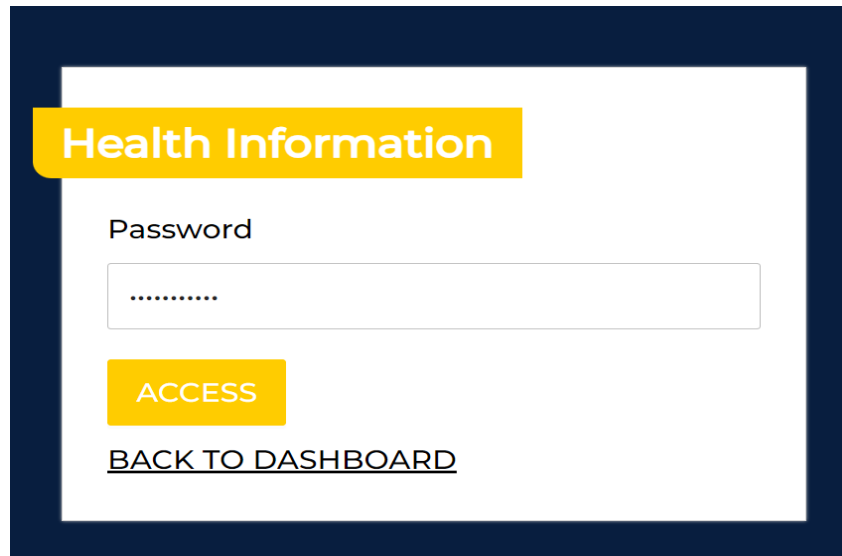


Appendix B - User Interface

Appointment Booking Page:

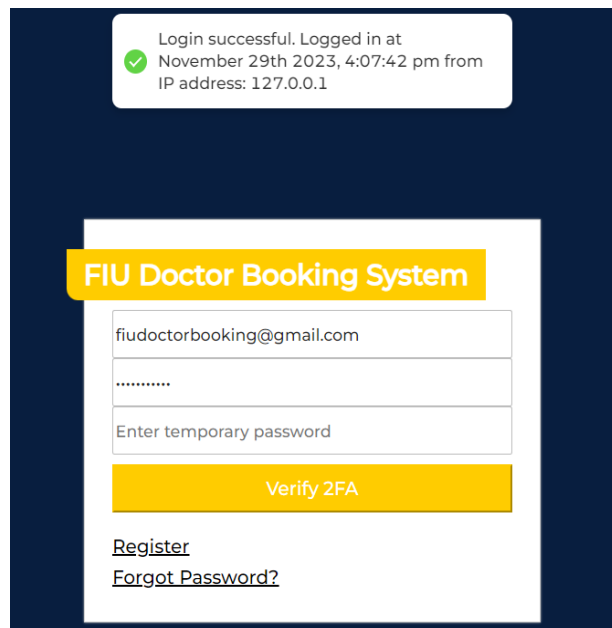


Health Information Page – Password Protected:



The screenshot shows a dark blue background with a white rectangular area in the center. At the top of the white area is a yellow banner with the text "Health Information". Below the banner is the label "Password" followed by a text input field containing seven asterisks. Under the input field is a yellow button labeled "ACCESS". At the bottom of the white area is a link labeled "BACK TO DASHBOARD".

Login Page:



The screenshot shows a dark blue background. At the top, there is a white notification box with a green checkmark icon and the text: "Login successful. Logged in at November 29th 2023, 4:07:42 pm from IP address: 127.0.0.1". Below the notification is a white rectangular area containing the login form. The form has a yellow banner at the top with the text "FIU Doctor Booking System". Below the banner are three text input fields: the first contains "fiudocorbooking@gmail.com", the second contains seven asterisks, and the third is labeled "Enter temporary password". Below the input fields is a yellow button labeled "Verify 2FA". At the bottom of the white area are two links: "Register" and "Forgot Password?".

Appendix C – Sprint Review Reports

Review Meeting Minutes - Sprint 1

Project: **FIU Doctor Booking System**

Attendees: Mohammad Kazmi, Jason Eduardo Kildare, Abel Aguilera, Wenjia Wang (PO)

Start time: 9:00 AM

End time: 9:30 AM

After a show and tell presentation, the implementation of the following user stories was accepted by the product owners: All.

- **User Story #1:** As developers, we want to familiarize ourselves with the source code and the resources for a MERN-based application so that the application can be improved and refined.
- **User Story #2:** As developers, we want to set-up the development environment and connect the application to the database, so that a working application can be tested.
- **User Story #3:** As developers, we want to identify bugs and issues in the source code and working application so that we can develop an efficient and user-friendly application.
- **User Story #4:** As a developer, I want to fix the appointment scheduling response, as appointments should be scheduled only within the timeframe of the availability of the doctor and not all the time, so that users get appointments during appropriate times.
- **User Story #5:** Appointments are able to be made in the past. As a developer, I want to create a function so that patients are only able to make appointments in the future or on the same day.
- **User Story #6:** As a developer, I want to create a function so that the admin account has the ability to delete a user account or a doctor account if that doctor wishes to leave.
- **User Story #7:** As a developer, I want to create and display a section for a small description about the specialization/expertise of the doctor, so that patients can book appointments according to their medical needs.
- **User Story #8:** As a developer, I want to implement Two-Factor Authentication for both Users and the Doctors, so that they can be verified and no unauthorized access is allowed to the application.
- **User Story #9:** As a developer, I want to create a profile update option for the users so that users have the ability to update their profile information such as their name, phone number, and email address.

The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting.

- **User Story #10:** As a developer, I want to create a search option for the user so that the user can search by the specific specialization of the doctor according to their needs.
- **User Story #11:** As a developer, I want to create a records function for the doctor, so that he/she can provide the patient with a summary of the appointment and precautionary measures they might need to take, so that the patient has an updated

record.

- **User Story #12:** As a doctor, I want to set or modify my availability so that patients can book appointments accordingly.
- **User Story #13:** As a user, I want to reschedule or cancel my appointment through the system so that I don't have to call the clinic.
- **User Story #14:** As a developer, I want to implement a “strong password” feature for the login page so that the security and privacy standards of the web application are maintained.
- **User Story #15:** As a developer, I want to create a “Health Tips” page which shows interesting medical tips and suggestions to patients so that the web application is user-friendly and engaging.
 - How this should be reflected in the user story definition in Mingle:
 - These user stories need to be developed and tested by the team so they have been pushed back to the next sprint and will be completed along with other functionalities.

Review Meeting Minutes - Sprint 2

Project: **FIU Doctor Booking System**

Attendees: Mohammad Kazmi, Jason Eduardo Kildare, Abel Aguilera, Wenjia Wang (PO)

Start time: 9:00 AM

End time: 9:30 AM

After a show and tell presentation, the implementation of the following user stories was accepted by the product owners: All.

- **User Story #1:** As a developer, I want to create a profile update option for the users so that users have the ability to update their profile information such as their name, phone number, and email address.
- **User Story #2:** As a developer, I want to implement a “strong password” feature for the login page so that the security and privacy standards of the web application are maintained.
- **User Story #3:** As a developer, I want to create a “Health Tips” page which shows interesting medical tips and suggestions to patients so that the web application is user-friendly and engaging.
- **User Story #4:** As a user, I want to receive a confirmation email or SMS once my appointment is booked so that I have a record of it.

- **User Story #5:** As a user, I want my health information to be encrypted so that unauthorized parties can't read it. (User's info like booking record should be encrypted in database and in transit)
- **User Story #6:** As a doctor, I want to have a template/form where I can provide the summary of an appointment with the patient so that the patient can refer to it when needed.
- **User Story #7:** As a developer, I want to create an option for user registration so that the users should choose whether they are registering as a patient or as a doctor.

The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting.

- **User Story #10:** As an admin, I want to have an audit trail feature that logs all access and modifications to patient data for monitoring and review purposes.
- **User Story #11:** As a user, I want to reschedule or cancel my appointment through the system so that I don't have to call the clinic.
- **User Story #12:** As a user, I want to check the BMI, Blood Pressure, Blood Glucose Chart so that I can keep my health in check and use it as a quick reference.
- **User Story #13:** As a user, I want to receive a summary of the appointment in a records section, so that I have an updated record.
 - How this should be reflected in the user story definition in Mingle:
 - These user stories need to be developed and tested by the team so they have been pushed back to the next sprint and will be completed along with other functionalities.

Review Meeting Minutes - Sprint 3

Project: FIU Doctor Booking System

Attendees: Mohammad Kazmi, Jason Eduardo Kildare, Wenjia Wang (PO)

Start time: 9:00 AM

End time: 9:30 AM

After a show and tell presentation, the implementation of the following user stories was accepted by the product owners: All.

- **User Story #1:** As a user, I want to ensure that I can consent to the collection of my health information before booking an appointment.
- **User Story #2:** As a doctor, I want to store only essential health information necessary for the booking process.
- **User Story #3:** As a user, I want to be able to view or correct my protected health information by making a request for changes or deletions on the user dashboard.
- **User Story #4:** As a developer, I want to implement a “Forgot Password” feature in case a user forgets their password so a code is sent to the user via email which allows them to reset their password.
- **User Story #5:** As a doctor, I want to have a template/form where I can provide the summary of an appointment with the patient so that the patient can refer to it when needed.
- **User Story #6:** As a user, I want to receive a summary of the appointment in a records section and in an email, so that I have an updated record.
- **User Story #7:** As a developer, I want to implement a strong user authentication method such as a Multi-Factor Authentication system for both doctors and patients.
- **User Story #8:** As a doctor, I want to receive feedback after the appointment about the services provided and ensure that it is confidential.
- **User Story #9:** As an admin, I want to ensure that the data is being backed up regularly and both patient and doctor’s information is stored.

The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting.

- **User Story #10:** As an admin, I want to implement a log of all accesses and changes to electronic protected health information to keep track of unauthorized access or alterations.
- **User Story #11:** As a user, I want to reschedule or cancel my appointment through the system so that I don't have to call the clinic.
- **User Story #12:** As a developer, I want to implement an automated notification system both in-app and email to notify the user in the event of a breach.

- How this should be reflected in the user story definition in Mingle:
 - These user stories need to be developed and tested by the team so they have been pushed back to the next sprint and will be completed along with other functionalities. The audit trail feature requires collaboration and the team has prioritized this user story for the next sprint.

Review Meeting Minutes - Sprint 4

Project: FIU Doctor Booking System

Attendees: Mohammad Kazmi, Jason Eduardo Kildare, Wenjia Wang (PO)

Start time: 9:00 AM

End time: 9:30 AM

After a show and tell presentation, the implementation of the following user stories was accepted by the product owners: All.

- **User Story #1:** As a developer, I want to limit the number of unsuccessful login attempts in order to prevent unauthorized access to a patient or a doctor's account. **164.308(a)(5)(ii)(C) (Security Rule)**
- **User Story #2:** As a developer, I want to make the users/doctors conform to an agreement when they register their account ensuring that their medical health information is protected, but it can be used if required by verified medical personnel or law and that they refrain from illegal activities on the app. **164.308(b)(3) (Security Rule)**
- **User Story #3:** As a developer, I want to implement procedures for monitoring log-in attempts such as the time and place where the account was logged in and report/notify the patient if it was logged in from a different location. **164.308(a)(5)(ii)(C) (Security Rule)**
- **User Story #4:** As a developer, I want to scan files (PDFs, JPGs) which can be medical documents/records uploaded by the users or digital verification/proofs uploaded by doctors for vulnerabilities to ensure the files uploaded to the system are safe. **164.308(a)(5)(ii)(B) (Security Rule)**
- **User Story #5:** As a developer I want to implement a feature to ensure that access privileges are immediately denied to terminate workforce members. **164.308(a)(3)(ii)(C) (Security Rule)**
- **User Story #6:** As a developer, I want to implement electronic procedures that terminate an electronic session after a predetermined time of inactivity. **164.312(a)(2)(iii) (Security Rule)**

- **User Story #7:** As a developer I want to prohibit users from reusing previously used passwords. **164.308(a)(5)(ii)(D) (Security Rule)**
- **User Story #8:** As a developer I want to ensure that a written vulnerability management plan is developed and implemented. **164.308(a)(1)(ii)(A) (Security Rule)**
- **User Story #9:** As a developer, I want to perform vulnerability scans to identify vulnerabilities within the application. **164.308(a)(1)(ii)(A) (Security Rule)**

The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting.

- **User Story #10:** As an admin, I want to implement a log of all accesses and changes to electronic protected health information to keep track of unauthorized access or alterations.
- **User Story #11:** As a user, I want to receive any digital verification or proof of the doctor before disclosing any personal health information to the doctor. **164.514(h) (Privacy Rule)**
- **User Story #12:** As a developer, I want to implement an automated notification system both in-app and email to notify the user in the event of a breach.
- How this should be reflected in the user story definition in Mingle:
 - These user stories need to be developed and tested by the team so they have been pushed back to the next sprint and will be completed along with other functionalities. The audit trail feature requires collaboration and the digital proof verification for the doctor is under development and the team has prioritized these user stories for the next sprint.
 -

Review Meeting Minutes - Sprint 5

Project: **FIU Doctor Booking System**

Attendees: Mohammad Kazmi, Jason Eduardo Kildare, Wenjia Wang (PO)Start

time: 9:00 AM

End time: 9:30 AM

After a show and tell presentation, the implementation of the following user stories was accepted by the product owners: All.

- **User Story #1:** As a developer, I want to implement a log of all accesses and changes to electronic protected health information to keep track of unauthorized access or alterations. **164.312(b) (Security Rule)**

- **User Story #2:** As a user, I want to protect my personal health information using a password, so that unauthorized access to PHI can be prevented. **164.312(c)(1) (Security Rule)**
- **User Story #3:** As a developer, I want to email the user in case of an attempted breach of their personal health information and write a brief description of what happened, including the date of the breach and the date of the discovery of the breach, if known; and Any steps the individual should take to protect themselves from potential harm resulting from the breach. **164.404(c) (1) (Breach Notification Rule)**
- **User Story #4:** As an admin, I want to maintain logs of all personnel activities, such as updates to any form, any appointments booked, and their app visits during the day. **164.312(b) (Security Rule)**
- **User Story #5:** As a developer, I want to implement an automated notification system both in-app and email to notify the user in the event of a breach. **164.404(a) (Breach Notification Rule)**
- **User Story #6:** As a user, I want to receive any digital verification or proof of the doctor before disclosing any personal health information to the doctor. **164.514(h) (Privacy Rule)**
- **User Story #7:** As a developer I want to ensure that only privileged users can execute privileged functions. **Security Rule -164.312(a)(2)(i)**
- **User Story #8:** As a developer I want to ensure data is destroyed according to policy, including deleting data no longer required for business purposes, and beyond any regulated retention period. **Security Rule -164.310(d)(2)(i)**
- **User Story #9:** As a developer I want to implement procedures to verify that a person or entity seeking access to data is the one claimed. **Security Rule -164.312(d)**

The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting.

- **User Story #10:** As a developer, I want to create a map of how data flows within the Organization, and in/out of the organization. Mapping data flows requires information from individual departments and users. **164.308(a) (1) (ii) (A) (Security Rule)**
 - How this should be reflected in the user story definition in Mingle:
 - Only one user story needs to be developed and tested by the team so they have been pushed back to the next sprint and will be completed along with other functionalities and user stories. A data flow map will be created once the

team finalizes that there is no other additional information or data to be transferred among the User, Doctor, and Admin Accounts.

Review Meeting Minutes - Sprint 6

Project: **FIU Doctor Booking System**

Attendees: Mohammad Kazmi, Jason Eduardo Kildare, Wenjia Wang (PO)

Start time: 9:00 AM

End time: 9:30 AM

After a show and tell presentation, the implementation of the following user stories was accepted by the product owners: All.

- **User Story #1:** As a doctor, I want to be able to send their user a summary of their appointment, so that they can have a medical summary saved as a record.
- **User Story #2:** As a user, I want to provide some feedback to the doctor and as a doctor I want to receive that feedback from the patient.
- **User Story #3:** As a doctor, I want to be presented with the necessary terms and conditions regarding the handling of personal health information of the patients and the appointments during registration.
- **User Story #4:** As an admin, I want to delete a doctor's account and all associated records if they are no longer working with FIU Health Services.
- **User Story #5:** As a developer, I want to store only the appointment information for the past 6 months and delete the rest of the information.
- **User Story #6:** As a developer, I need to fix the appointment booking time so that a patient cannot book an appointment outside of the specified time or at the same time as another patient with the same doctor.
- **User Story #7:** As an admin, I want to conduct regular risk assessments to identify and mitigate potential vulnerabilities and threats to PHI. **164.308(a)(1)(Security Rule)**
- **User Story #8:** As an admin, when I deny the user's request to make changes I want to tell them the reason and deny their request to make changes for the next 24 hours.
- **User Story #9:** As a developer I want to create a feature so a user can recover their account after unauthorized access.
- **User Story #10:** As a developer, I want to create a map of how data flows within the Organization, and in/out of the organization. Mapping data flows requires information from individual departments and users. **164.308(a) (1) (ii) (A) (Security Rule)**

The following ones were rejected and moved back to the product backlog to be assigned to a future sprint at a future Sprint Planning meeting.

- All user stories were completed in this sprint as it was the last development sprint
- How this should be reflected in the user story definition in Mingle:
 - All of the user stories have been completed now only the work towards git merge and debugging is left and the documentation, posters and demo of the application remains to be completed.

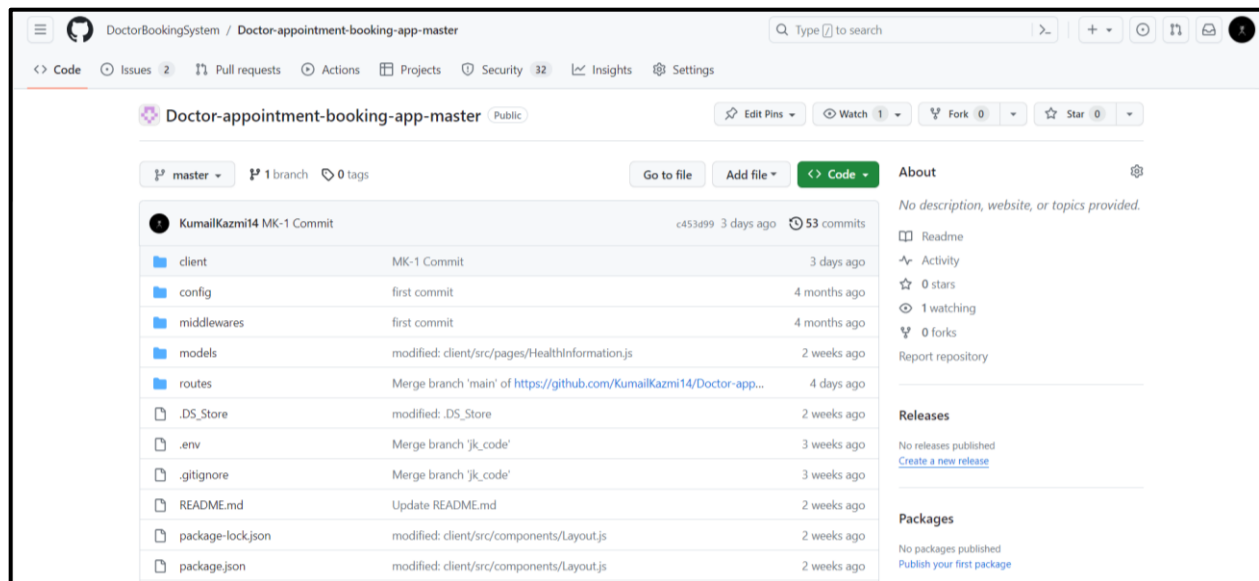
Appendix D – User Manual Installation/Maintenances Document, Shortcomings/Wishlist Document and other documents

User Manual Installation/Maintenance

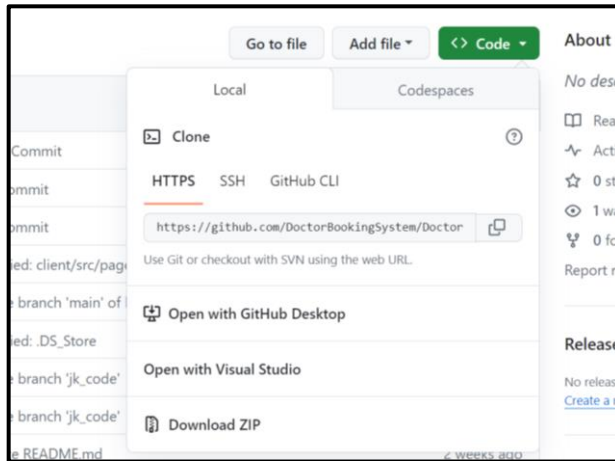
STEP 1: GITHUB AND VS CODE PROJECT SETUP

1. Open this GitHub Repository Link:

<https://github.com/DoctorBookingSystem/Doctor-appointment-booking-app-master>



2. Click on Code to see a link appear. Copy the link.



3. Open VS Code in a New Window
4. Click on Clone Git Repository
5. Paste the link and press Enter
6. Create a project folder in your local machine and the project folder will be created in VS Code with all the files and folders for the code.

STEP 2: MongoDB DATABASE CONNECTION AND SETUP

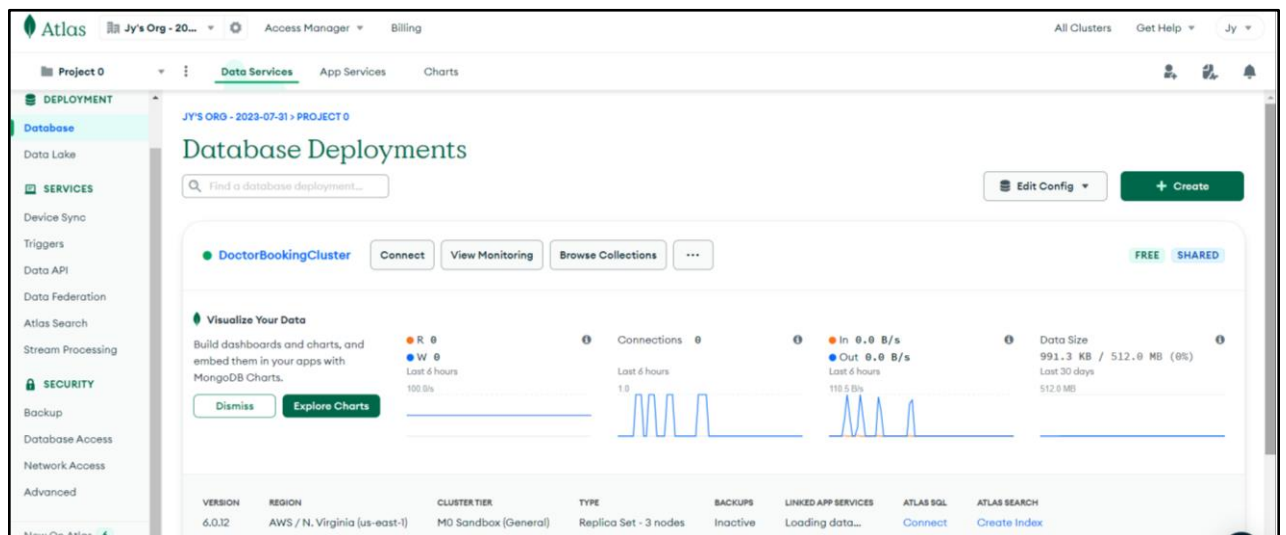
1. Open the following MongoDB Account Link:
<https://account.mongodb.com/account/login?n=https%3A%2F%2Fcloud.mongodb.com%2Fv2%2F64c812e3f8a16564f546c8c1&nextHash=%23clusters&signedOut=true>

2. Enter the following credentials:

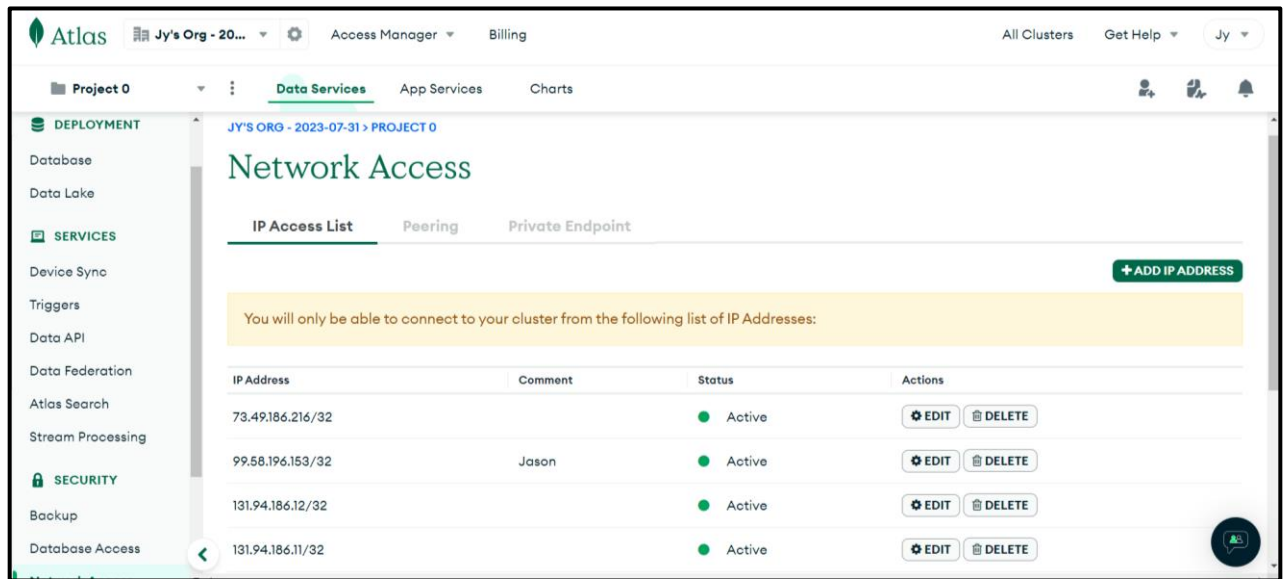
Email Address: pudongkobe@gmail.com

Password: iVzzw)E8#7qazRc

3. On the left menu, go to Network Access under Security



- Click on Add IP Address on the upper right corner to add your IP address



- You will be connected to the MongoDB database. If you want to see the actual data and tables. Download MongoDB Atlas: <https://www.mongodb.com/try/download/shell>
- In the code, go to the **.env** file and copy the Mongo URL:

```
'mongodb+srv://pudongkobe:qWvQcJIiEbEegRFM@doctorbookingcluster.borwwfm.mongodb.net/MERN_DoctorBooking'
```

- Paste it in MongoDB Atlas GUI and you will be able to see the tables and the database.

STEP 3: STARTING THE APPLICATION

NOTE: MAKE SURE YOU HAVE NOTHING RUNNING ON PORT 6000 BEFORE FOLLOWING THESE STEPS.

Open a New Terminal in VS Code and Enter the following commands

BACK-END

In the root directory, run:

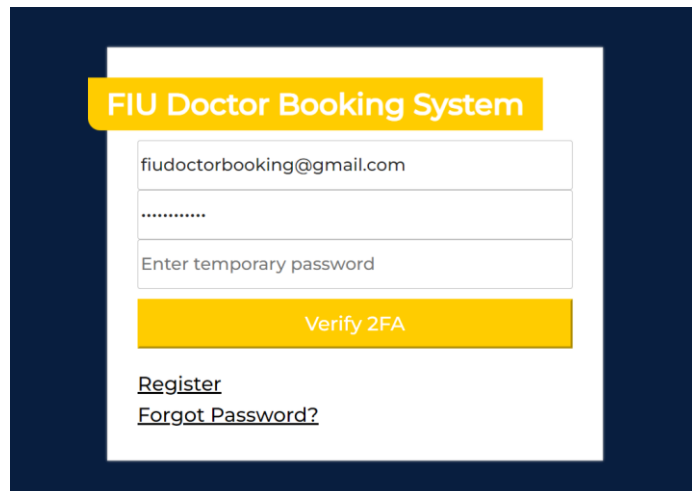
```
npm install  
node server.js
```

FRONT-END

Navigate to the client folder and run:

```
npm install  
npm start
```

This will start the application and a React App tab will open in Google Chrome



The image shows a login form for the 'FIU Doctor Booking System'. The form is white and centered on a dark blue background. It contains a yellow header bar with the text 'FIU Doctor Booking System'. Below the header, there are three input fields: the first contains the email address 'fiudoctorbooking@gmail.com', the second contains a masked password '*****', and the third is labeled 'Enter temporary password'. A yellow button labeled 'Verify 2FA' is positioned below the input fields. At the bottom of the form, there are two links: 'Register' and 'Forgot Password?'.

Enter the email address: fiudoctorbooking@gmail.com

Password: Password@123

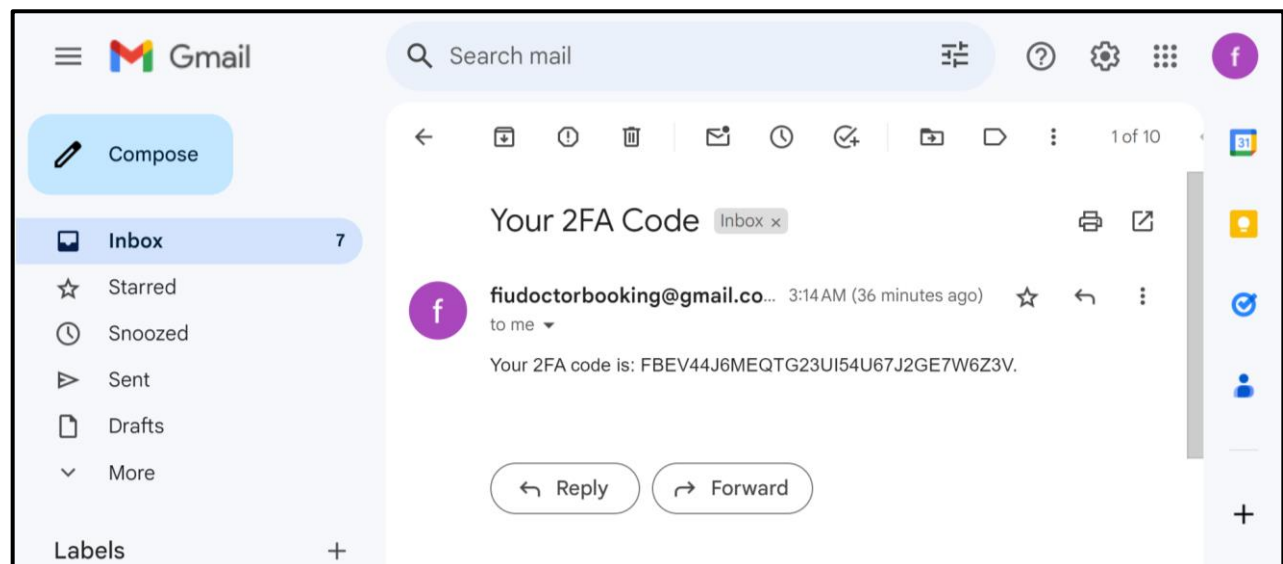
This is the **User Account**

You will receive the 2FA Verification Code in the terminal for the back-end, copy the code and paste it in the box, click Verify 2FA to Log-in.

Alternatively, open Gmail and enter the **fiudoctorbooking@gmail.com** email address and the following

Password: fiudoctorbookingpw

You will then see the emails with the 2FA Verification Code and can paste the code from there



For the **doctor's account**:

Email Address: jerrym@test.com

Password: Password123!

You will receive the 2FA Verification Code in the terminal for the back-end, copy the code and paste it in the box, click Verify 2FA to Log-in.

For the **admin's account**:

Email Address: admin@gmail.com

Password: password

Follow the same instructions for the 2FA Code

You can then explore the application and its functionalities.

RUN VULNERABILITY SCANNER (OPTIONAL)

Navigate outside of the projects dictionary

Run command: bearer scan Doctor-appointment-booking-app-master

Shortcomings

Although our team has developed and implemented several HIPAA compliant features into the application, we were not able to make the entire application HIPAA compliant. Future teams will be able to add additional features as well as follow the HIPAA guidelines to make the application and the correspondence between the doctor and the patients completely secure. Features such as adding appointment to calendar, locking accounts when health information password is incorrect, and verifying the ID of the doctor are security features that can be added by future groups.

REFERENCES

What is The mern stack? introduction & examples. MongoDB. (n.d.).
<https://www.mongodb.com/mern-stack>