CS 319 Term Project

PHS: Health Center Management App

Analysis Report

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1. Introduction

The app is a web application that facilitates the appointment process for Bilkenters. Users can see the available appointments in advance and make an appointment through the application. Also, the appointments created by the secretary or users can be easily followed through the application. Since the previous health examinations are recorded, it offers the patient's health history to the access of the doctors and the patient. The main purpose of this application is to provide a control mechanism for the appointment process and prevent an unnecessary occupation of the health personnel. We have added features according to the requirements of the health centre to make the application more useful and practical. Students, faculty members and health centre staff are the targets for the application. The application is approachable since it offers different features for each user.

2. Proposed System

There are five actors in the health center management system. There are "patient", " doctor", "nurse", "secretary", "admin" actors. The patient actor includes the Bilkenters, who are not health centre staff. The doctor, nurse and secretary actors are health staff in Bilkent Health Center. The admin actor includes the developers.

2.1 Functional Requirements

2.1.1 Login

The page that will greet the users is the login page that can be accessed through the website. There will be text fields on the login page to get the unique user id and the password. The password will be initially provided by the system. The system will verify the authority level if the login credentials are correct. An error message will be shown if the user's login credentials are incorrect. There will also be an admin login that will not be available to the health centre personnel and users. All account creation processes will be done through the admin account, similar to the Bilkent University STARS, to

prevent unnecessary account additions. An email that includes login credentials will be sent to the user when the user has been added to the system. In addition, there will be a panel on the login page that shows announcements about the health centre and the COVID-19 cases among Bilkent University staff and students currently followed up by the health center.

2.1.2 Display Information

The app provides different information displays for each actor. The patient will see their profile photo, COVID-19 status, age, weight and height on the left side of their dashboard. In addition to that, the patient's dashboard will display the health news and the upcoming appointments in the middle of the screen. The doctor's dashboard has the name, profile photo, COVID-19 status, and specialisation on the left side of the dashboard. Also, doctors can access the patients' health history who have an appointment that day. Health news and upcoming appointments are displayed in the middle of the doctor's dashboard. The secretary will see all the appointments created on the dashboard. The appointments will be grouped by doctors. Also, the health news appears on the dashboard. The admin name and profile photo are displayed on the left of the admin screen, and the admin can always access each patient's health history. Also, the health news appears in the middle of the admin dashboard.

2.1.3 Searching Available Appointments

The users can see available appointments when they use the search by date or doctor on this page. When the users use the search by date feature, the user will be asked to select a day from the calendar, and then the information of the available appointments on the selected date will be displayed. If the users choose the search by doctor feature, the doctor will be selected from a list of doctors then the doctor's appointments that have not yet been taken will be seen. Only available appointments will be displayed on this page, so the users will have the chance to evaluate the available options without making an appointment.

2.1.4 Booking an Appointment

The secretary will be able to make appointments for each patient actor, but patients will be able to make appointments for themselves. Patients can cancel the appointment one day before. Only the secretary is authorised to cancel the appointment when the appointment day comes.

2.1.5 Booked Appointments

The users will see their booked appointments on this page. Every appointment will have detailed information about the appointment date, place, time etc. Appointments will be displayed in order from closest to farthest. In addition, the secretary will send a reminder to the user one day before the appointment. Also, if the patient does not come to the appointment in 15 minutes, the appointment will enter the state "patient did not come".

2.1.6 Profile Page

The profile page, besides the patients' personal information, past health records of the patients, new health records, and information obtained from the preliminary examination such as height, weight, fever, etc., will be included. With the edit profile option on this page, the user will be able to upload the HES code and change the profile photo and some information about the user.

2.1.7 Patient’s Records

The doctor and the patient can view the patient's health history and profile information. The patient's profile information includes the patient's name, surname, age and gender. The patient's health history includes some information such as blood values and MRIs obtained due to previous examinations of the patient. The doctor can only view this information for that

day by clicking on the patient's name from his patient appointments that day. The patient can always view their health history and profile information by clicking the profile option on the main screen. Only the doctor and nurse can add the patient's new health information. They can do this after clicking the add examination option on their home screen and entering the patient's ID.

2.1.8 Pre-Examination and Tests

After the patient comes to his appointment, the pre-examination information such as blood pressure and fever measurement will be added to the patient's health history by the nurse. Later, the doctor can request more tests when necessary, and the information obtained as a result of the test can be added to the patient's health history by the nurse or doctor. While the patient will always have access to this information, the doctor and nurse will only have access for that day.

2.1.9 Notifications

Secretary will send a reminder for upcoming appointments via email. The content of the e-mail will contain the previously mentioned information about the appointment, and the e-mail address registered in the university system will be used. In addition, if there is a change in the appointment, a notification e-mail will be sent immediately, such as cancellation, postponement, etc.

2.2 Non-functional Requirements

2.2.1 Usability

A user-friendly interface is an important non-functional requirement to use our software effectively. Also, a user-friendly interface is necessary to reach everyone in the university. The User Interface is designed to be friendly to people of all backgrounds regardless of their understanding of technology. We aimed to prevent problems for users who will use our application for the first time by using universalised icons like in other applications. Also, related buttons are obvious and easily accessible for each action to be completed correctly by the user. Thus, we made our application both memorable and easy to learn. The app has a consistent menu design so that the user can do a task in the fastest and easiest way. We tried to combine aesthetic appeal with readability by choosing the right font size, color, etc. In addition, a good experience for all users is aimed at by adding a colorblind mode. Besides, we tried to divide the website's contents into different web pages with an intuitive logic. In the Mock-up section of this report, we tried to combine the features mentioned above with functionality and ease of use.

2.2.2 Reliability

Unless the system is shut down for maintenance by the admin, it will always work 24/7. When the system is going to shut down, everyone will be informed via email at least one day in advance. The number of people who can use the system simultaneously will depend on the university's budget, but Bilkent University has more than thirteen thousand students and the university has close to 4,000 employees. [2], [3] So, at least a quarter of users should be able to use the app simultaneously. Since the doctor and the patient must have immediate access to health information, the system's health status will be constantly monitored by BCC. Users can access their health history 98% of the time without failure. In addition, doctors and nurses can add a new health history during the day up to five times for each user without failure. Up to 30 reminder emails can be sent by one secretary in a day without any problem.

2.2.3 Safety

The admin will provide all types of users with their initial credentials (only password). The users can then change their passwords in the system, which will be saved by the system in a hashed format. Password must be at least eight characters long and contain at least one uppercase letter, one lowercase letter, one number and one special character. The system will automatically log the user out if there is no interaction for more than 20 minutes. Only the admins can view the user's Bilkent id.

2.2.4 Performance

The email containing the login credentials should be sent within 24 hours after adding the user. The email containing appointment notifications should be sent a day before the appointment. The site should load in 5 seconds when simultaneous users are more than 1000. The processing of each booking appointment request should be done within 10 seconds.

2.2.5 Maintainability

Object-oriented programming (OOP) will be used because OOP uses a shared vocabulary and a set of programming idioms that improve communication with other programmers. Also, OOP offers modularity, encapsulation, inheritance and polymorphism. In addition to that, version control tools such as Git/GitHub will be used due to the high revision frequency. If the upload health record service becomes unavailable, it can be under maintenance for approximately five hours. The system was designed using Laravel Framework to adopt future new technologies because Laravel is currently one of the latest stable frameworks. It is open-source, so it is open for development.

2.3 Pseudo Requirement

- Object-oriented programming is required. [1]

- GitHub repositories are required to store and track the codes.

- UML is required to design the system.

- HES code checking is required.

- The examination length complies with the examination length requirement of the Bilkent Health Center.

- Pre-examination is required before the examination.

2.4 System Models

2.4.1 Use Case Model

Figure 1: Use Case Diagram

1. **Use Case:** Sign In

   Participating Actor: Admin, User, Secretary, Doctor, Nurse

   Entry Condition: Actor enters the website

   Exit Condition: Actor is logged in to system

   Flow of events: - Actor enters Bilkent ID and Password.

   - Actor presses the sign-in button.
   - System authorise the actor

2. **Use Case:** Change Password

   Participating Actor: User, Nurse, Doctor, Secretary

   Entry Condition: Actor clicks forgot password on login page or user click forgot password on settings page after login.

   Exit Condition: Password is changed

   Flow of events: - Actor clicks forgot password button

   - Actor enters new password
   - Actor confirms the new password
   - System saves the new password to database

3. **Use Case:** View Profile

   Participating Actor: User, Nurse, Doctor, Secretary

   Entry Condition: Actor clicks profile button

   Exit Condition: The profile is viewed

   Flow of events: - Actor clicks profile button

   - Actor redirected to the profile page
   - System shows the profile to actor.

4. **Use Case:** Pre-Examination

   Participating Actor: User, Nurse

   Entry Condition: User enters health center

   Exit Condition: Pre-Examination is finish

   Flow of events: - User enters the health center

   - Nurse do pre-examination
   - Nurse enters pre-examination results
   - System saves results to database

5. **Use Case:** Additional Test

   Participating Actor: User, Doctor, Nurse

   Entry Condition: Doctor clicks additional tests button

   Exit Condition: Additional test is performed

   Flow of events: - Doctor clicks the additional tests button

   - Nurse fills the form to requested additional tests results
   - System saves the results to database

6. **Use Case:** Add Patient's Records and Information

   Participating Actor: Doctor, Nurse

   Entry Condition: Actor clicks add information button

   Exit Condition: Patient's Records and Information are added

   Flow of events: - Actor clicks patient's name

   - Actor clicks add information button
   - Actor upload new information files in pdf format

- Actor fills necessary spots to specify the information
- System saves the changes to database

7. **Use Case:** View Patient's Records and Information

   Participating Actor: User, Doctor

   Entry Condition: Actor clicks health history button

   Exit Condition: Patient's Records and Information are viewed

   Flow of events:
   - Actor clicks health history button
   - Actor redirected to related Health History Page
   - System shows patient's records and information

8. **Use Case:** View Booked Appointments

   Participating Actor: User

   Entry Condition: User clicks view appointments button

   Exit Condition: Booked appointment is viewed

   Flow of events:
   - User clicks view appointments button
   - User will get his upcoming appointments chronologically

9. **Use Case:** Manage Appointments

   Participating Actor: User, Secretary

   Entry Condition: Actor clicks manage appointments button

   Exit Condition: The appointment is changed

   Flow of events:
   - Actor clicks manage appointments button
   - Actor gets a list of upcoming appointments

- Actor selects one of the appointments
- Actor can change the information of that appointment
- Actor clicks the save changes button
- System saves the changed appointment to the database

10. Use Case: Send Reminder

Participating Actor: Secretary

Entry Condition: Secretary clicks send reminder button

Exit Condition: User gets the email

Flow of events:
- Secretary selects an appointment
- Secretary clicks send reminder button
- The email is sent

11. Use Case: Book an Appointment

Participating Actor: User, Secretary

Entry Condition: Actor clicks book an appointment button

Exit Condition: Actor has appointment

Flow of events:
- Actor clicks book an appointment button
- Actor fills the necessary information about the Appointment
- Actor clicks done button
- System add the new appointment to database

12. Use Case: Search Available Appointments

Participating Actor: User

Entry Condition: User clicks search appointments button

Exit Condition: Appointments are searched

Flow of events:
- User clicks search appointments button
- User enters the details about what to search
- User gets the results

13. Use Case: Edit Doctor/Staff

Participating Actor: Admin

Entry Condition: Admin clicks edit user button

Exit Condition: Doctor/Staff is edited

Flow of events:
- Admin clicks edit user button
- Admin clicks a user from the list
- Admin enters the new information
- Admin clicks done button
- System edits the Doctor/Staff and saves changes to database

14. Use Case: Add New User

Participating Actor: Admin

Entry Condition: Admin clicks add new user button

Exit Condition: New user is added.

Flow of events:
- Admin clicks add new user button
- Admin enters the information about the new user
- Admin clicks add button
- System adds the new user to database

15. Use Case: Change News

Participating Actor: Secretary, Admin

Entry Condition: Actor clicks change news button

Exit Condition: News is changed

Flow of events:
- Actor clicks change news button
- Actor enters new information for the news
- Actor clicks change button
- System changes the news

16. Use Case: Delete User

Participating Actor: Admin

Entry Condition: Admin clicks delete user button

Exit Condition: User is deleted

Flow of events:
- Admin clicks delete user button
- Admin enters certain id
- Admin clicks change button
- System deletes the user

17. Use Case: View All Health Records

Participating Actor: Admin

Entry Condition: Admin clicks view all health records button

Exit Condition: Health records are viewed

Flow of events:
- Admin clicks view all health records button

- System shows the all health records grouped by users

18. Use Case: Change Personal Information

Participating Actor: User, Doctor, Nurse, Secretary, Admin

Entry Condition: Actor clicks change personal information button

Exit Condition: Personal information is changed

Flow of events: - Actor clicks change personal information button

- Actor enters new information
- Actor clicks save changes button
- System changes the personal information

19. Use Case: Change Profile Photo

Participating Actor: User, Doctor, Nurse, Secretary, Admin

Entry Condition: Actor clicks change profile button

Exit Condition: Profile photo is changed

Flow of events: - Actor clicks change profile button

- Actor choose the photo
- Actor clicks save changes button
- System changes the profile photo

20. Use Case: Verify HES code

Participating Actor: User, Doctor, Nurse, Secretary

Entry Condition: Actor clicks verify HES code button

Exit Condition: HES code is verified

Flow of events: - Actor clicks verify HES code button

- Actor enters the HES code
- Actor clicks verify button
- The HES code is verified from e-nabız

2.4.2 Dynamic Models

2.4.2.1 Creating/Modifying Appointments Sequence Diagram

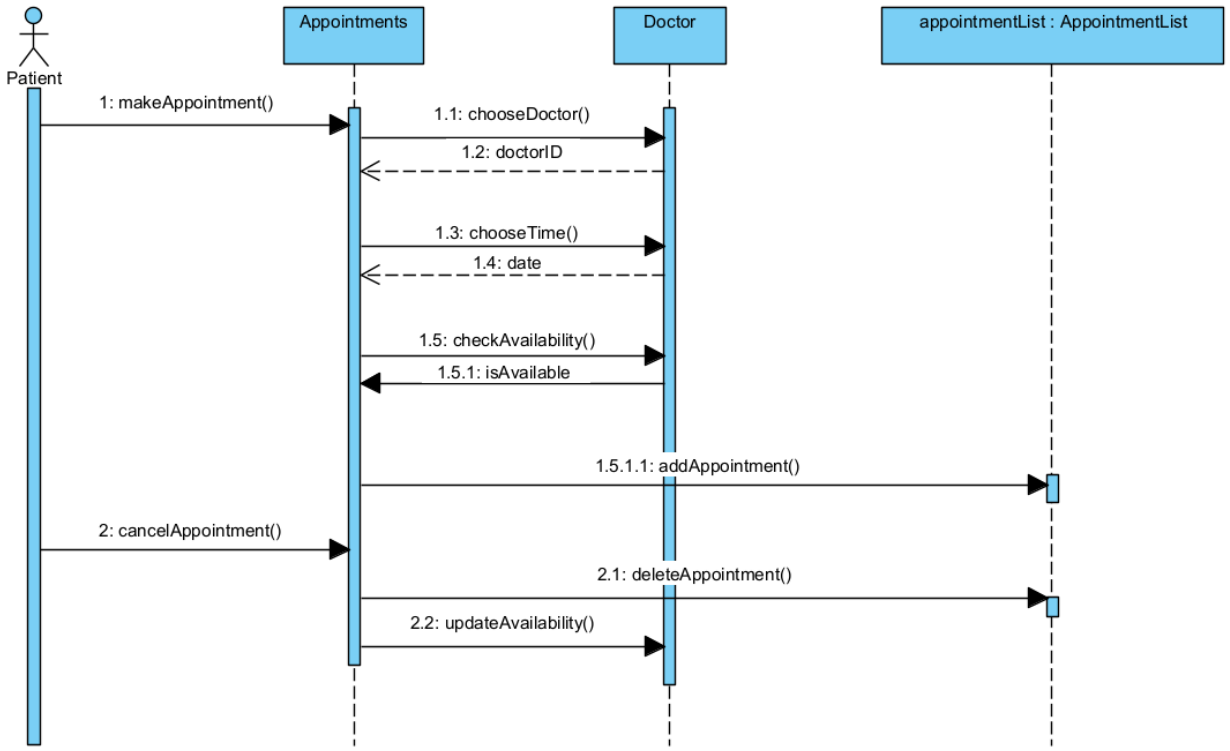

Figure 2: Creating/Canceling Appointments Sequence Diagram

2.4.2.2 Nurse Sequence Diagram

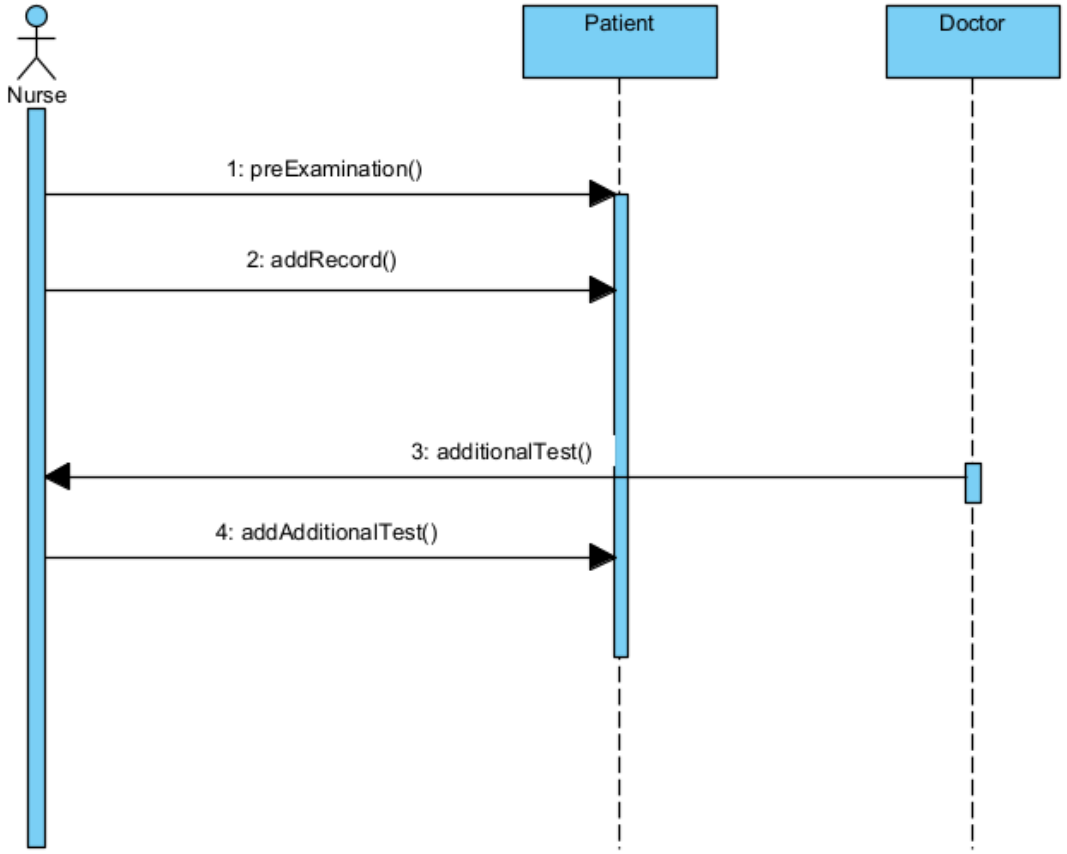

Figure 3: Nurse Sequence Diagram

2.4.2.3 Doctor State Diagram

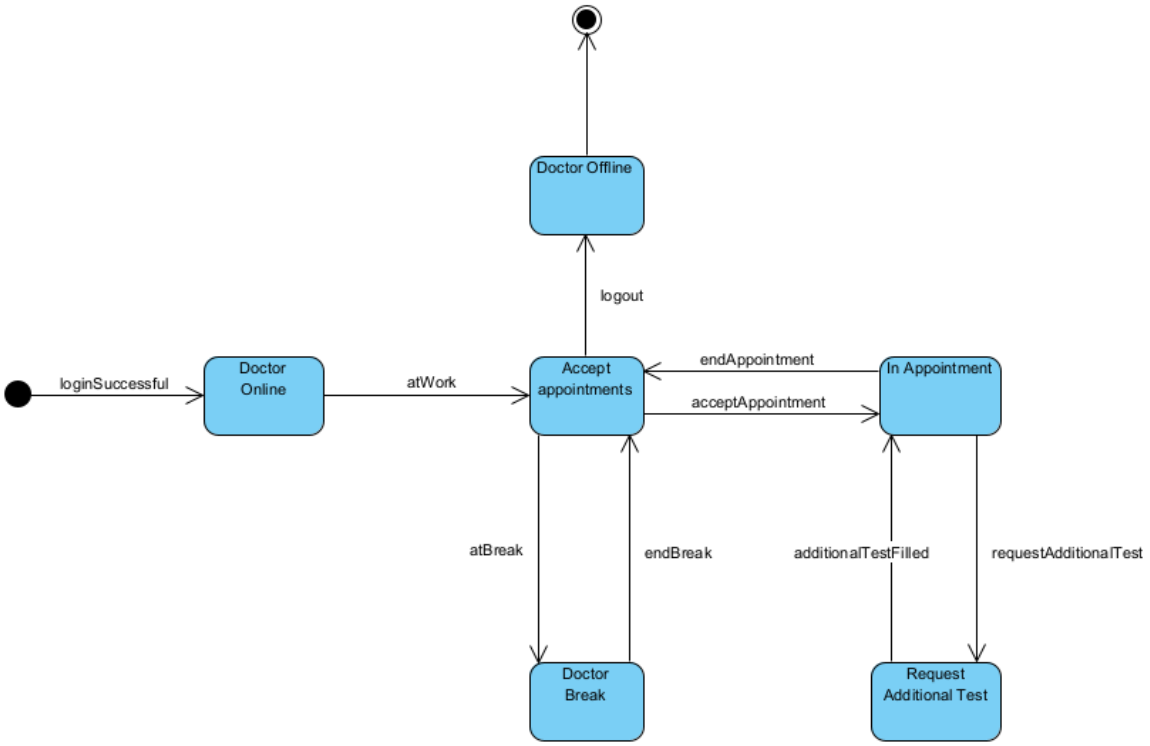

Figure 4: Doctor State Diagram

2.4.2.4 Secretary State diagram

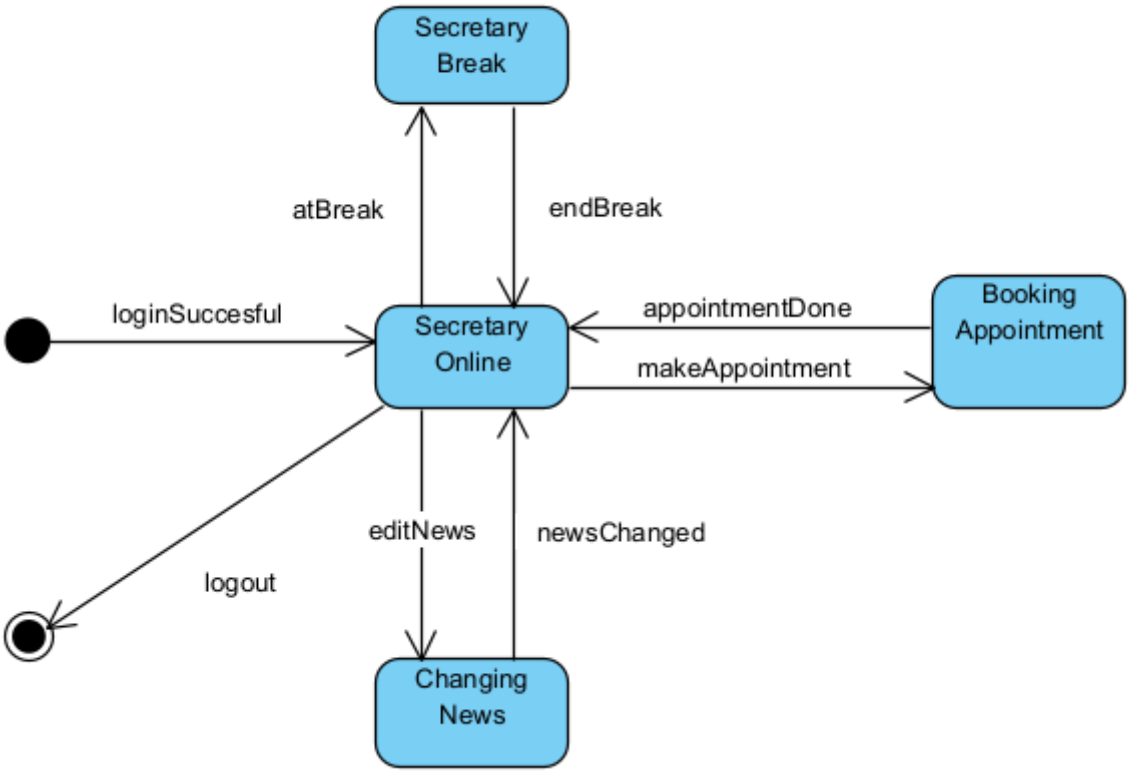

Figure 5: Secretary State Diagram

2.4.2.5 Nurse State diagram

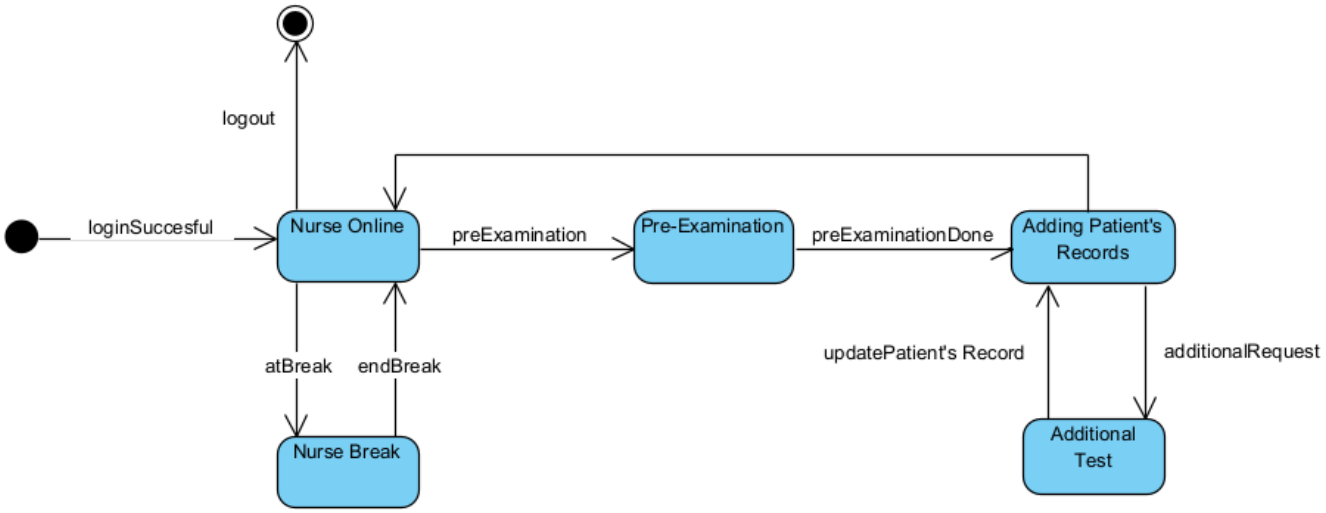

Figure 6: Nurse State Diagram

2.4.2.6 User State Diagram

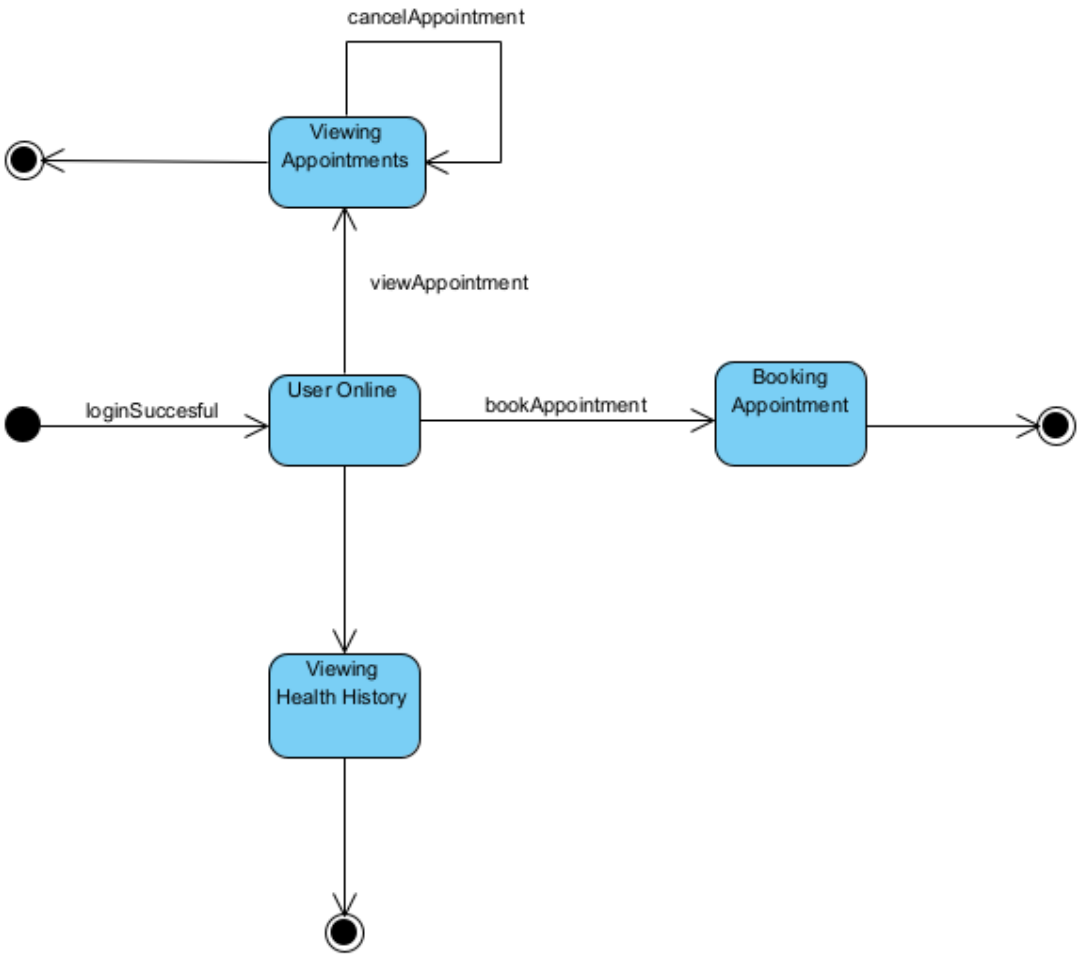

Figure 7: User State Diagram

2.4.2.7 Appointment State Diagram

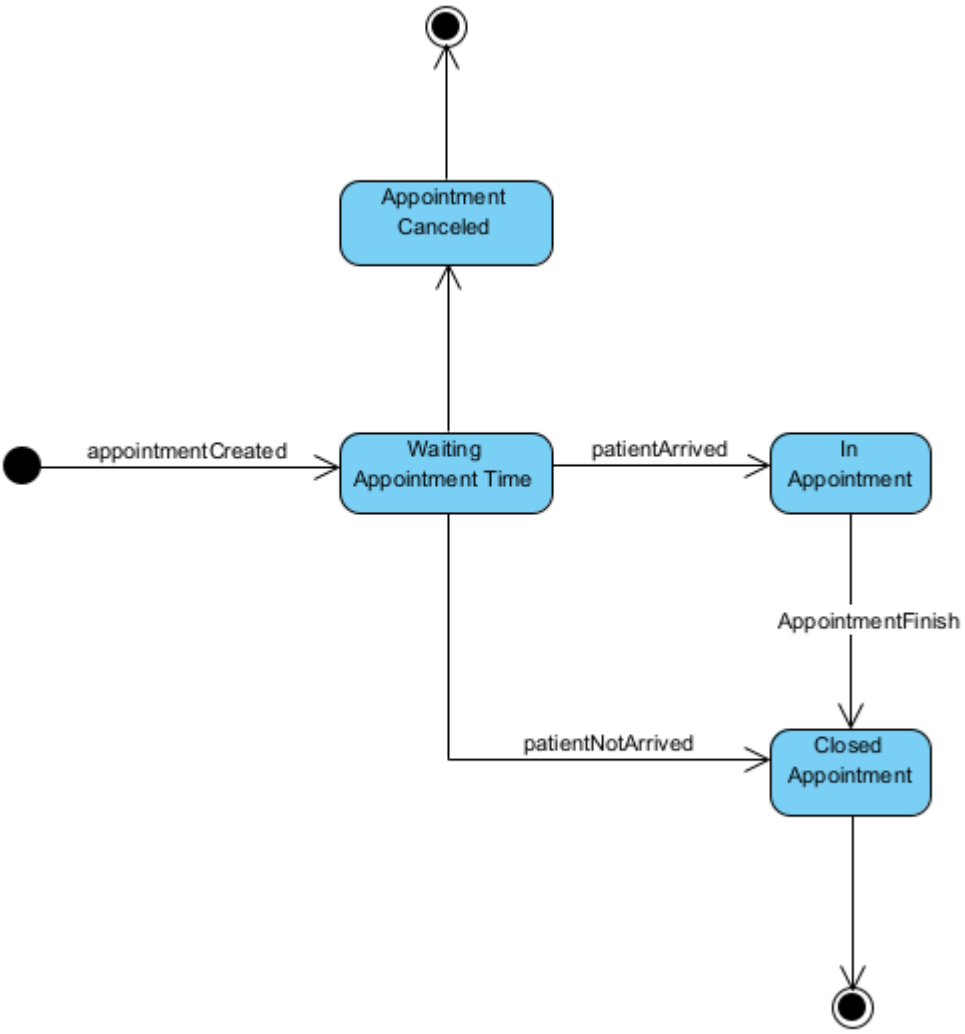

Figure 8: Appointment State Diagram

2.4.2.8 Appointment Activity Diagram

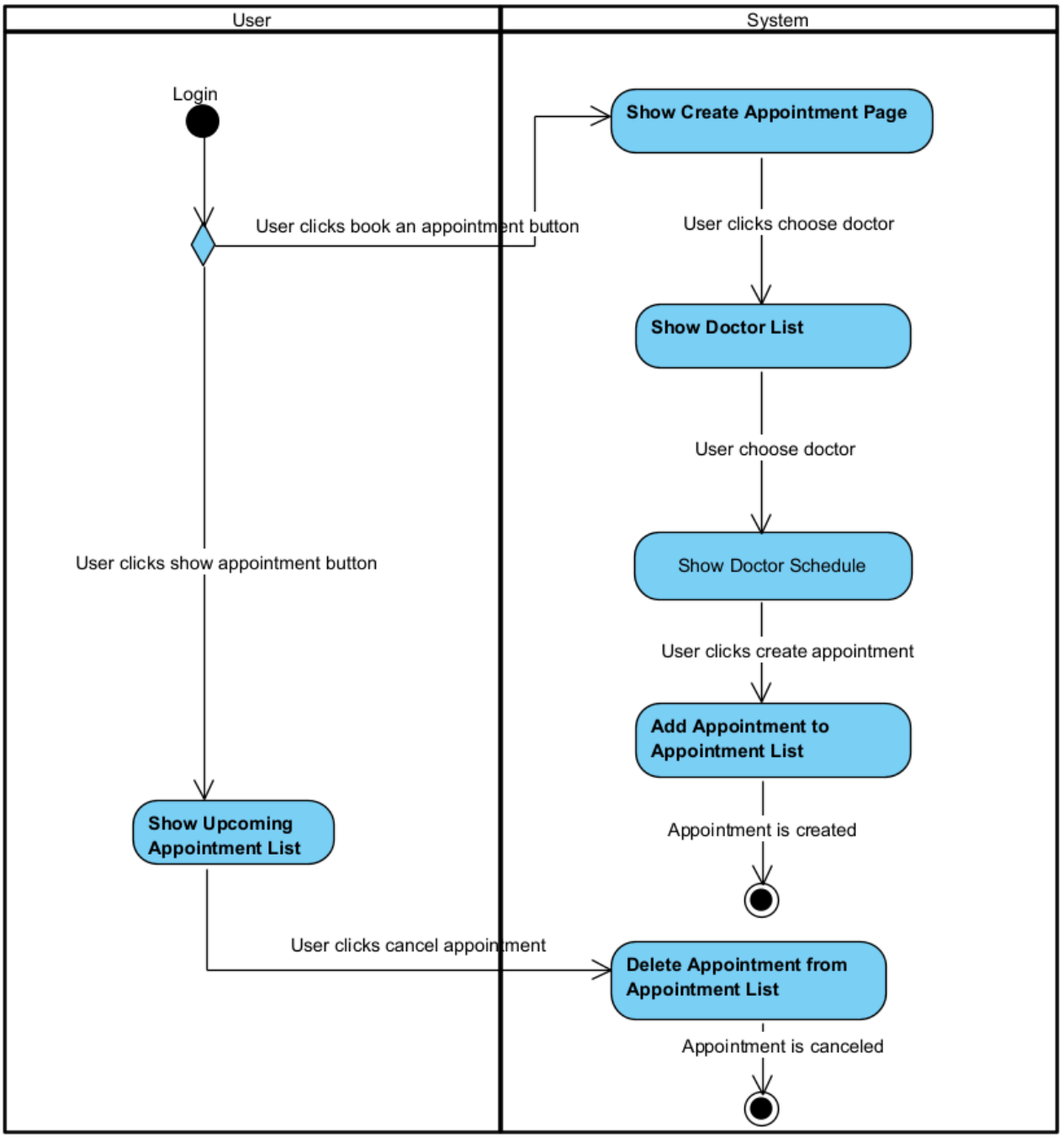

Figure 9: Appointment Activity Diagram

2.4.2.9 Additional Tests Activity Diagram

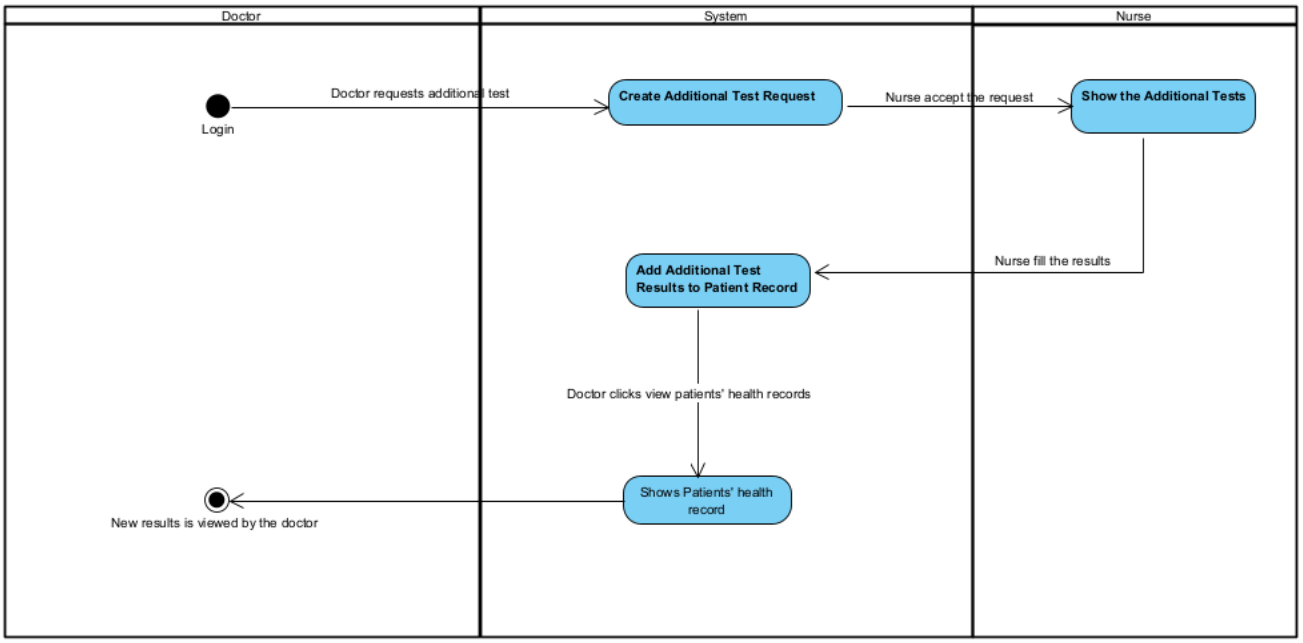

Figure 10: Additional Tests Activity Diagram

2.4.3 Object and Class Model

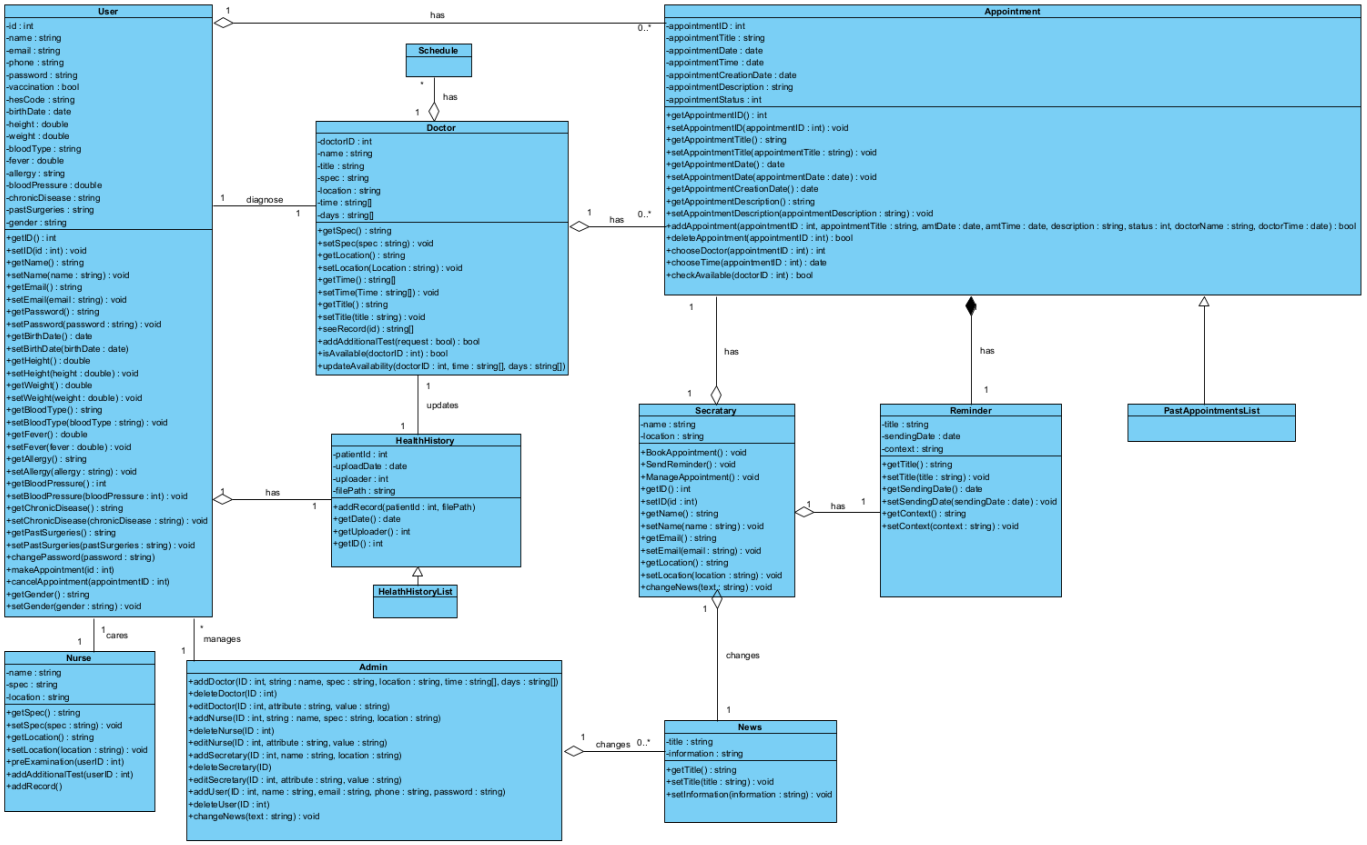

Figure 11: Class Diagram

2.4.4 User Interface - Navigational Paths and Screen Mock-ups

2.4.4.1 Login Page

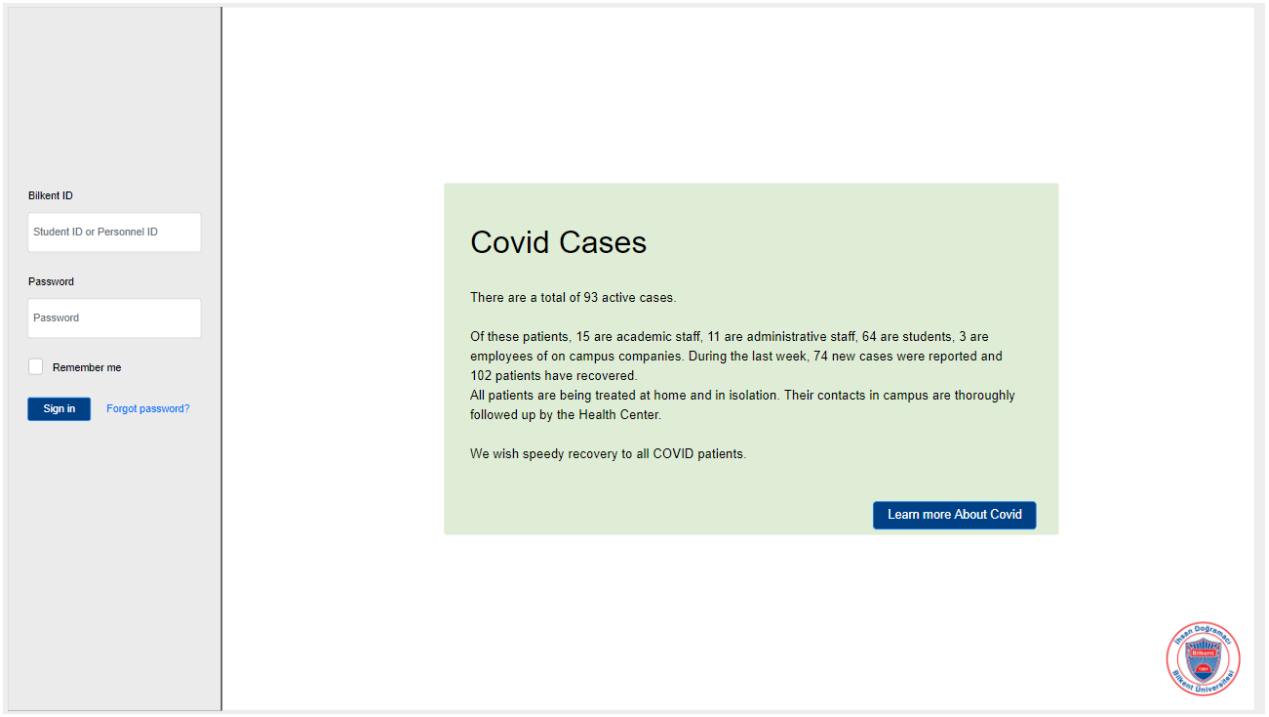

Figure 12: Login Page

The user can log in to the system by entering the user ID and password in the appropriate boxes on the left side of the screen on the login page. If the user forgets his password, "Forgot password?" You can obtain a new password by clicking the button. In the middle of the screen, there are COVID cases and more detailed information. If the "Learn more about Covid" button is clicked, the user will be directed to the "https://covid19.saglik.gov.tr/" address, and they will be able to get more detailed information about covid.

2.4.4.2 User Main Page

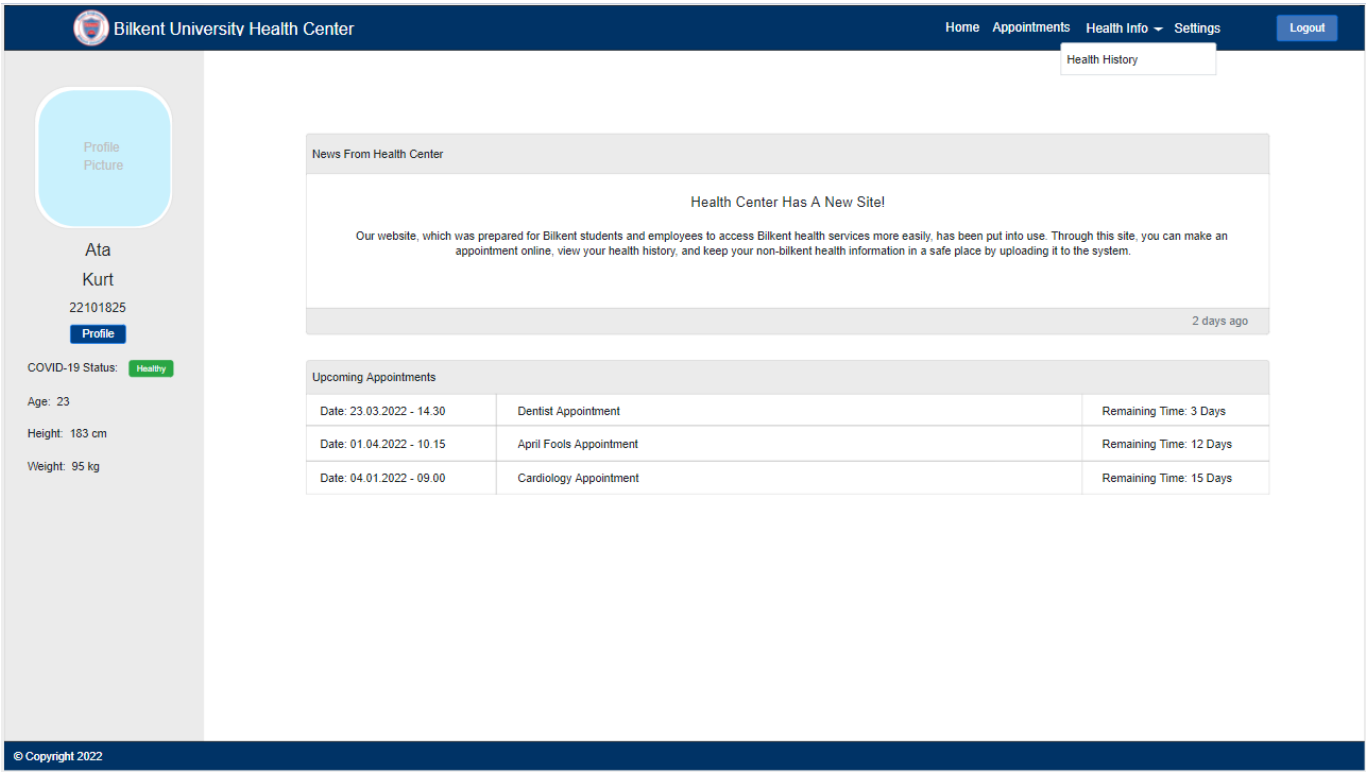

Figure 13: User Main Page

When the user logs in, he encounters the main page with his name, surname, age, height, weight, covid status, upcoming appointments, health news and buttons to guide him. The user can view his health history by clicking the "Health History" option on the "Health Info" button. "Settings" and "Profile" buttons allow users to make changes to their profile.

2.4.4.3 Doctor Main Page

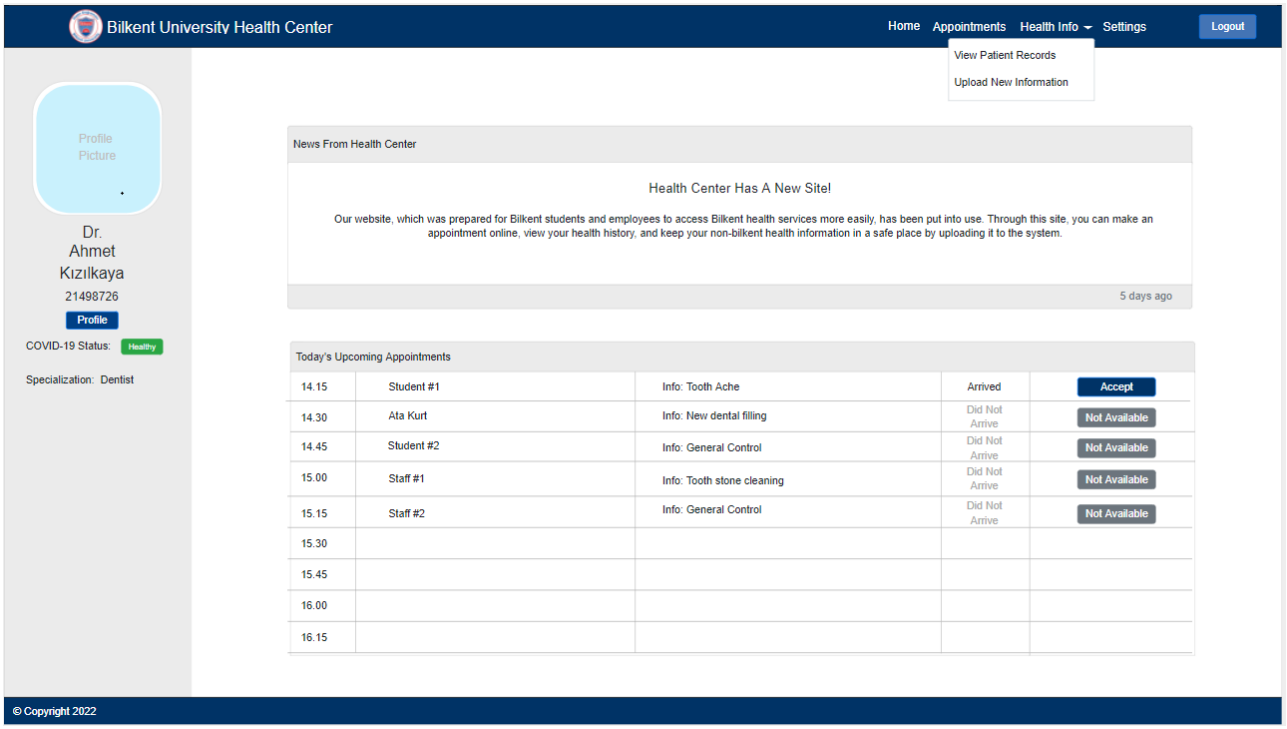

Figure 14: Doctor Main Page

When the doctor logs in, he encounters the main page with his name, surname, covid status, upcoming appointments, health news and buttons to guide him. There is also a button for doctors to accept appointments when the doctor is ready to see the patient. Secretary will call the patient when the doctor clicks the accept button. The doctor can view his patient's health history by clicking the "View Patient Records" option and add new health records for that patient by clicking the "Upload New Information" option on the "Health Info" button. "Settings" and "Profile" buttons allow the doctor to make changes to their profile.

2.4.4.4 Admin Main Page

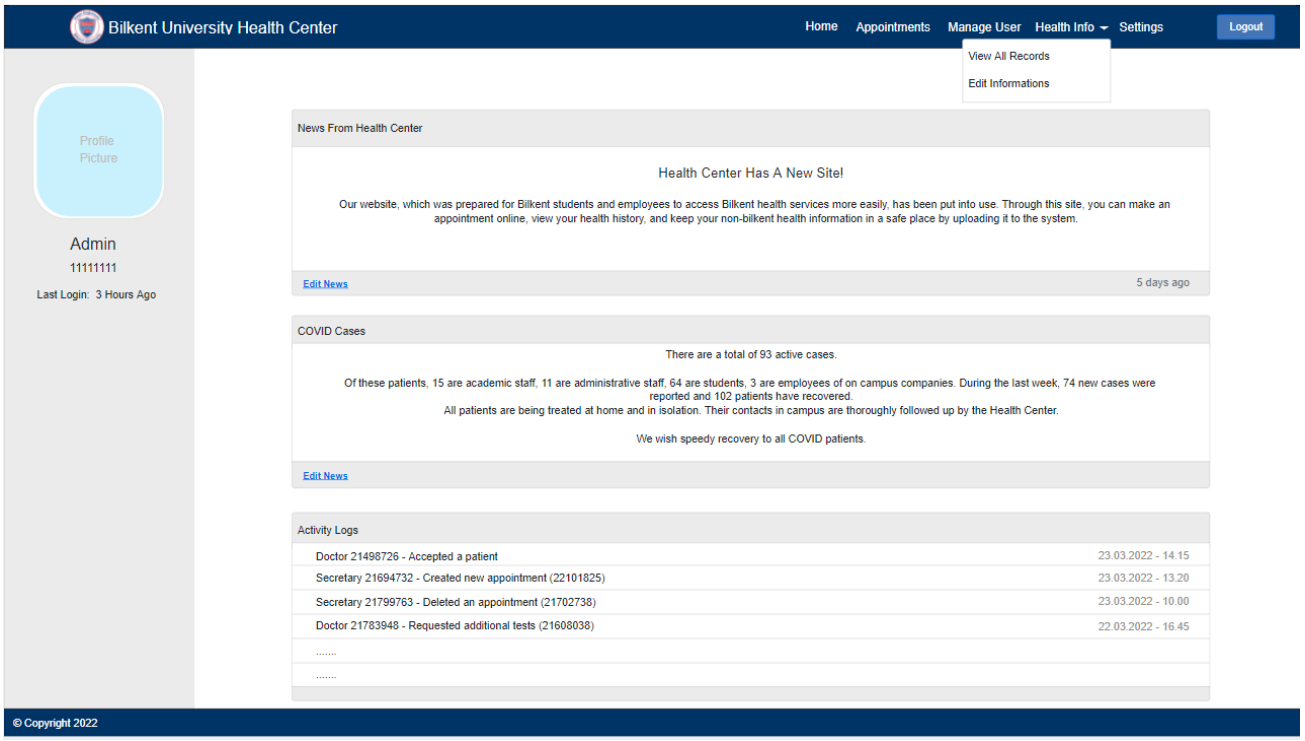

Figure 15: Admin Main Page

When the admin logs in, he encounters the main page with his name, COVID cases, health news, activity logs and buttons to guide him. There is also a button for the admin to edit news. Admin can view all patients' health history by clicking the "View All Records" option and manage health records for any patient by clicking the "Edit Information" option on the "Health Info" button. Admin also can create or delete users by clicking the "Manage User" button. "Settings" and "Profile" buttons allow admins to make changes to their profile.

2.4.4.5 User Profile Page

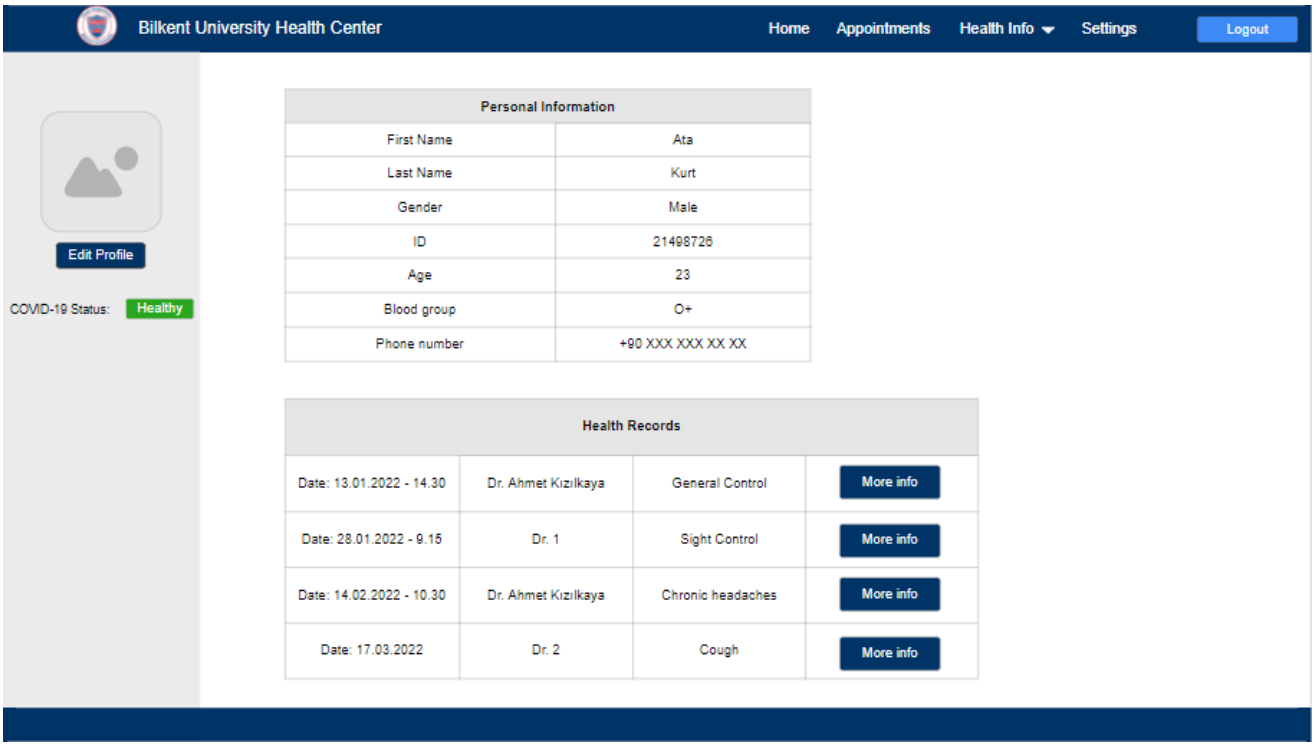

Figure 16: User Profile Page

When the actor clicks on the "Profile" button, he will be redirected to his profile page. On the left side of this page, there is the profile photo of the person, the "Edit Profile" button below it, and the COVID-19 Status below it. In the middle of the page, there is personal information and health history. However, this health history section can only display the last four records. The actor can change his personal information by clicking the "Edit Profile" button. The actor can view his health history in more detail by clicking the "More Info" button.

2.4.4.6 Appointments Page

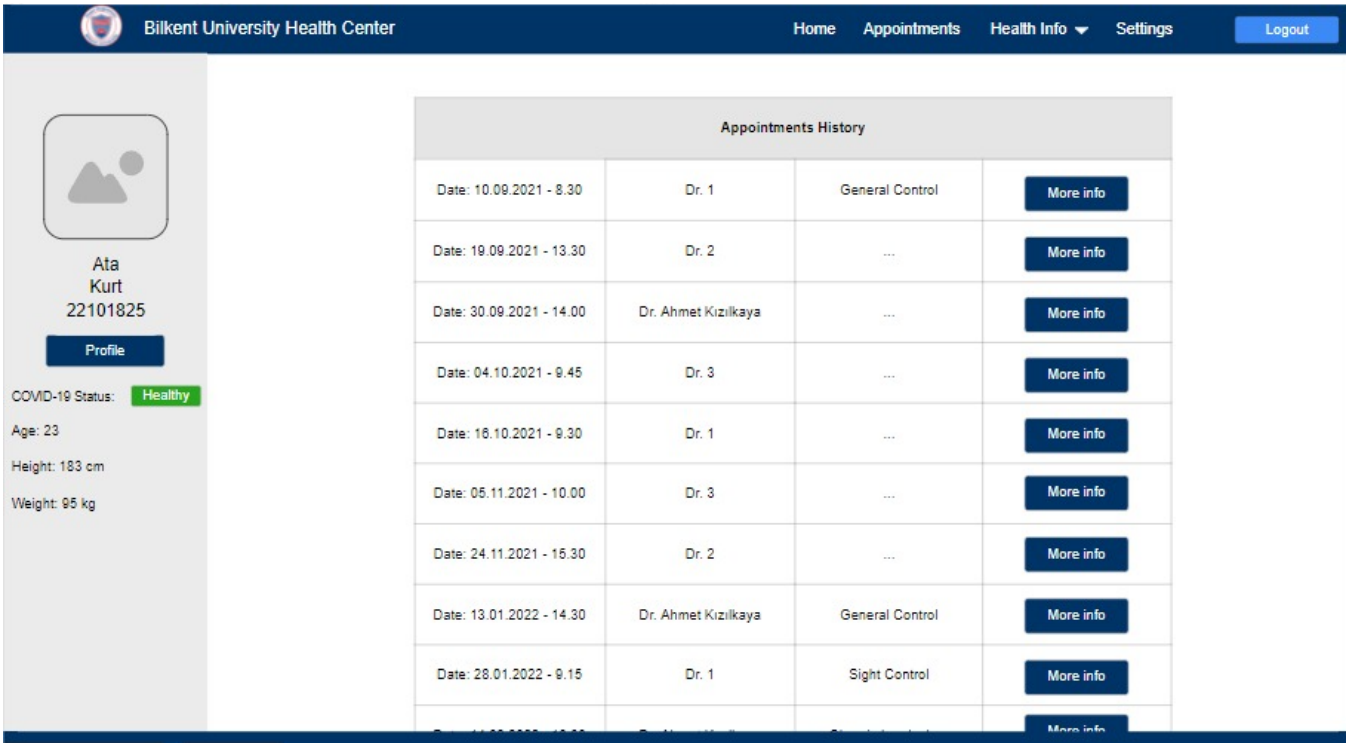

Figure 17: Appointment Page

On the appointment page, the user can see the list of appointments he has booked before, and if he wants to examine these appointments in more detail, he can use the "More Info" buttons.

2.4.4.7 Health Records Page

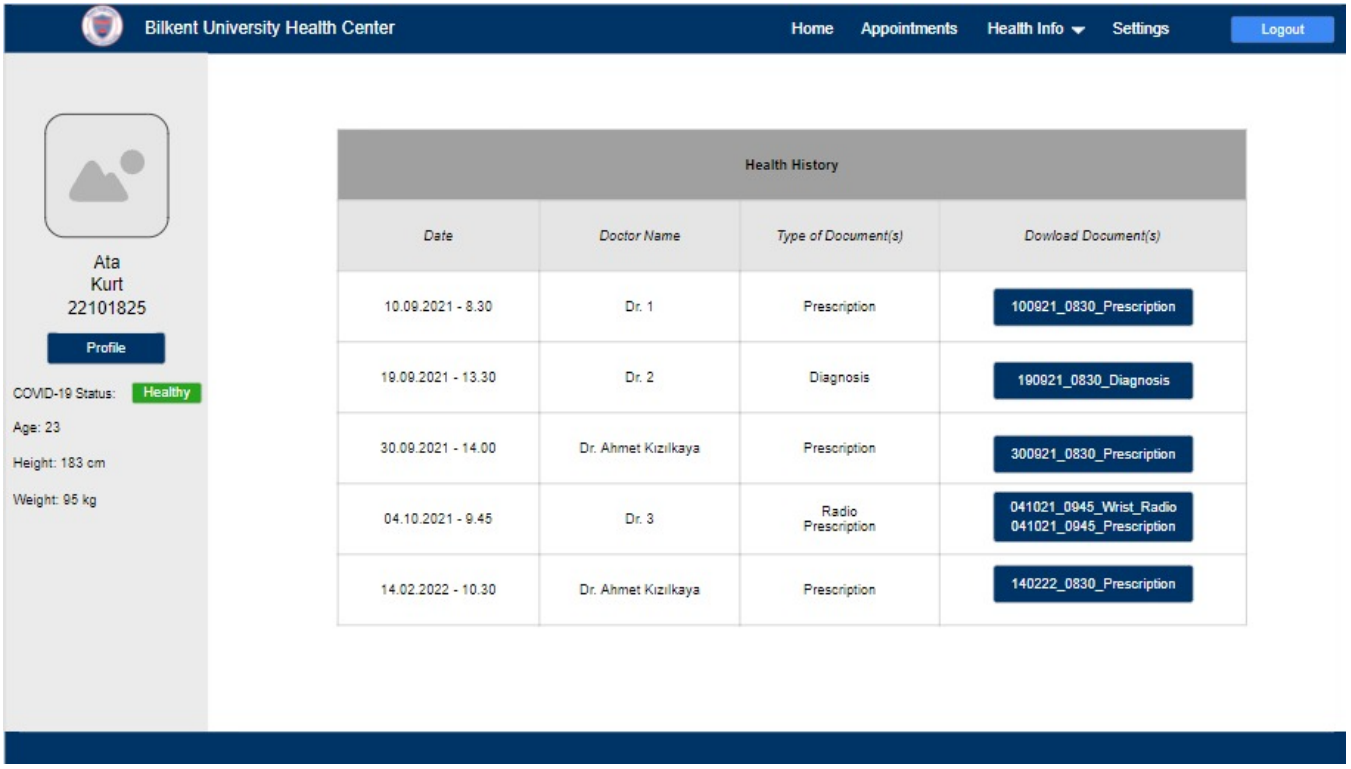

Figure 18: Health Records Page

The health records page, accessed from the "Health Info" button, also makes the health histories that are not on the profile page visible. The user can download the files by clicking the file names in the "Downloads Document(s)" section.

2.4.4.8 Make Appointment Page

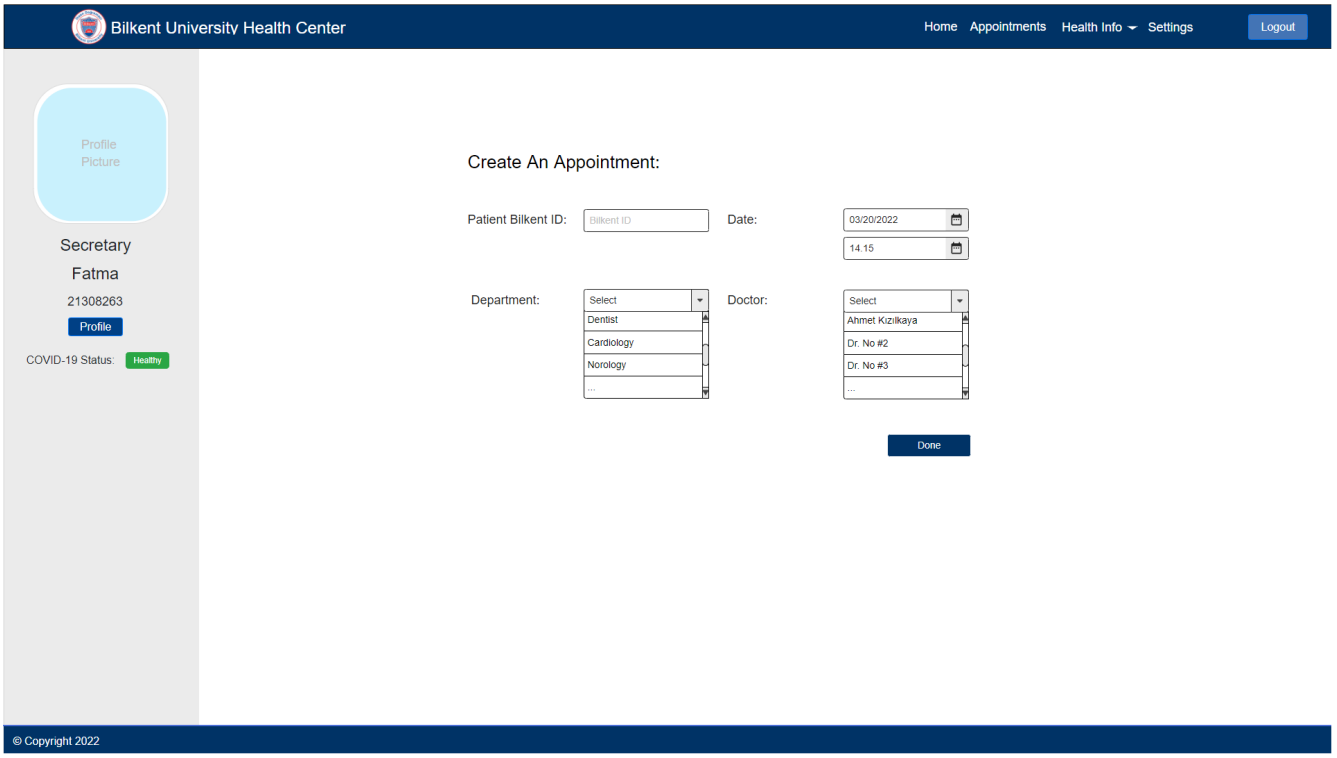

Figure 19: Make Appointment Page

The secretary and the patients can create an appointment on this page by clicking the "Done" button after filling in the patient's ID, appointment date and time, the patient's department, and the appointment doctor in the appropriate boxes.

2.4.4.9 Admin Page

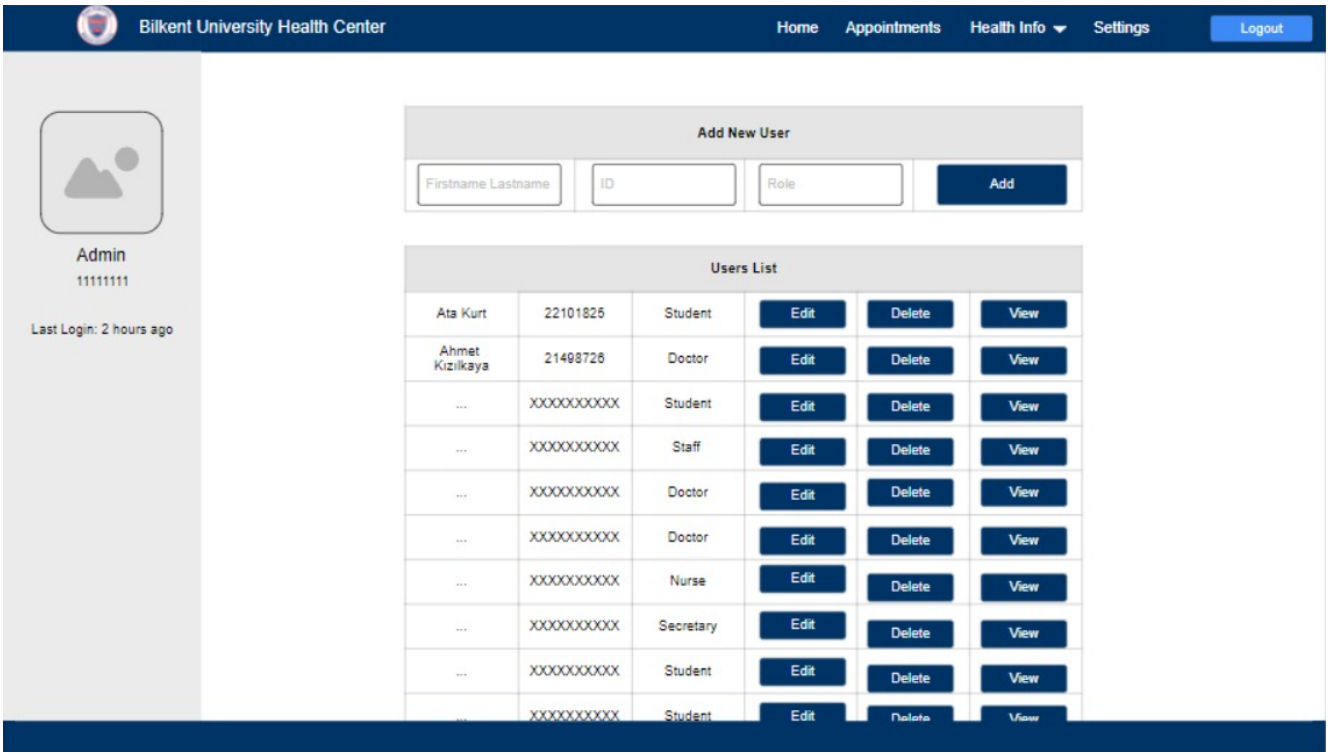

Figure 20: Admin Page

The admin creates the user on this page by entering the new user's name, surname, id, and password in the appropriate boxes and pressing the "Add" button. When he wants to delete a user, he must press the "Delete" button in the "User List" section. Admin should click the "View" button to view users' information and health records. Admin can edit the user information later by clicking the "Edit" button.

3 Improvements and Summary

3.1 General

- Organisation errors have been fixed
- Spelling mistakes have been fixed
- Paragraph alignments have been changed
- Table of contents mistakes have been fixed

3.2 Functional Requirements

- Actors have been identified
- Requirements have been grouped by type
- Appointment system has been changed

3.3 Non-functional Requirements

- Usability has been rewrited
- Reliability has been rewrited
- The paragraph alignments have been changed

3.4 Pseudo Requirement

- Pseudo Requirement has been rewrited

3.5 Use Case Model

- New use cases have been added
- Some of the cases have been changed according to system changes
- Some of the cases have been expanded according to system changes
- Textual use case descriptions have been changed

3.6 Sequence Diagrams

- All diagrams have been redrawn

3.7 State Diagrams

- All diagrams have been redrawn
- Appointment diagram has been added

3.8 Activity Diagrams

- Activity diagrams have been added

3.9 Class Diagram

- Cardinality errors have been fixed
- New classes have been added

4 Glossary & references

[1]"What is object-oriented programming? OOP explained in depth," *Educative.io,* Apr 15, 2020. [Online]. Available: https://www.educative.io/blog/object-oriented-programming. [Accessed: Mar. 12, 2022].

[2]"Bilkent Hakkında," *Bilkent Üniversitesi*. [Online]. Available: https://w3.bilkent.edu.tr/www/bilkent-hakkinda/. [Accessed: Apr. 28, 2022].

[3]"Rakamlarla Bilkent," *Bilkent Üniversitesi*. [Online]. Available: https://w3.bilkent.edu.tr/www/rakamlarla-bilkent/#:~:text=Bilkent%20Cyberpark%2C%20ar%2Dge%20ve,%C3%9Cniversitenin%20mezun%20say%C4%B1s%C4%B1%2055.000'dir. [Accessed: Apr. 28, 2022].