



جامعة بيروت العربية  
BEIRUT ARAB UNIVERSITY

# Responsive Healthcare System Application

by

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## Project

Submitted in Partial Fulfillment of the Requirements of Software Engineering Course

Department of Electrical and Computer Engineering

Faculty of Engineering

Year 2023 - 2024



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**Supervised by**

**Dr. Iman Haidar**



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## Responsive Healthcare System Application

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# Project Description

## Project Overview

This project aims to develop a web application named "Healthcare" that utilizes Machine Learning (ML) to empower users in managing their health. The application will offer functionalities such as disease prediction based on user-reported symptoms, personalized drug recommendations, and convenient appointment scheduling with healthcare providers.

## Objectives

- Develop an ML-based disease prediction system: Analyze user-provided symptoms and medical history to predict potential diseases with associated probabilities.
- Implement a drug recommendation system: Offer personalized drug recommendations based on predicted diseases or user-specified conditions, considering potential interactions and contraindications.
- Facilitate appointment scheduling: Allow users to search for and book appointments with healthcare providers based on specialty, location, and availability.
- Provide a user-friendly interface: Design an intuitive and accessible interface for users with varying levels of technical expertise, ensuring a seamless and informative experience.

## Background

The increasing prevalence of chronic diseases, coupled with the growing demand for accessible healthcare solutions, necessitates innovative approaches to healthcare delivery. Advancements in ML and web technologies present an opportunity to develop intelligent systems that empower individuals to take charge of their health and access care more efficiently.

## Literature Review

Studies have shown the effectiveness of ML-based symptom checkers, drug recommendation systems, and appointment scheduling platforms in enhancing healthcare delivery and patient outcomes. However, challenges remain in addressing ethical considerations, ensuring data privacy, and mitigating algorithmic bias.

The integration of machine learning (ML) in healthcare applications has garnered significant attention, with research demonstrating its potential to improve disease prediction, diagnosis, and treatment optimization.

### **Symptom Analysis and Disease Prediction:**

- ML-based symptom checkers: Studies have evaluated the effectiveness of ML algorithms in analyzing patient-reported symptoms and providing potential diagnoses. For instance, Obermeyer and Emanuel (2016) explored the accuracy of a symptom checker app, highlighting its potential for preliminary assessment but also emphasizing the need for careful interpretation and physician oversight.
- Natural language processing (NLP): NLP techniques can extract valuable insights from unstructured clinical text, such as patient notes and medical reports. Wang et al. (2018) demonstrated the use of NLP for automated symptom extraction, improving the comprehensiveness of data used for disease prediction models.
- Predictive models for specific diseases: Researchers have developed ML models for predicting various diseases, utilizing clinical data, imaging, and genetic information. Kourou et al. (2015) reviewed the applications of ML in cancer prediction, highlighting the potential for personalized risk assessment and early detection.

### **Drug Recommendations and Treatment Optimization:**

- ML-based drug recommendation systems: Studies have explored using ML algorithms to suggest appropriate medications based on patient characteristics and diagnoses. Che et al. (2018) investigated the use of ML for personalized drug recommendations in hypertension management, showcasing its potential to improve treatment efficacy and safety.
- Predicting drug efficacy and side effects: ML models can analyze patient data to predict individual responses to medications and potential adverse effects. Wang et al. (2019) employed ML techniques to predict drug-induced liver injury, demonstrating the potential for preventing adverse drug reactions and personalizing treatment plans.

### **Appointment Scheduling and Healthcare Access:**

- Predictive models for appointment demand: ML models can be used to predict future appointment demand based on historical data and patient demographics. Zhuang et al. (2018) developed a model for predicting outpatient appointment no-shows, assisting healthcare facilities in optimizing scheduling and resource allocation.
- Online appointment scheduling systems: Research has explored the impact of online appointment scheduling on patient satisfaction and access to care. Laugesen and Kristiansen (2017) examined the implementation of online booking systems in Danish general practice, finding increased accessibility and patient empowerment.

**Ethical Considerations:** Several ethical considerations must be addressed when implementing ML in healthcare, including:

- Data privacy and security: Ensuring the confidentiality and security of patient data through robust encryption, anonymization techniques, and compliance with data protection regulations.
- Algorithmic bias: Mitigating potential biases in data and algorithms to avoid perpetuating healthcare disparities and ensure equitable outcomes for all users.
- Transparency and explainability: Providing clear explanations of how ML models arrive at their predictions and recommendations to build trust and enable informed decision-making.

There are several prebuilt websites that offer similar functionalities to the proposed project entitled ***Responsive Healthcare System***. Here are a few examples along with their pros and cons:

- **WebMD Symptom Checker:**

Pros: WebMD is a trusted and popular platform for symptom checking with a vast database of symptoms and conditions. It provides comprehensive information on various health topics.

Cons: The website does not provide personalized physician suggestions or appointment scheduling functionalities. It lacks integration with user accounts and medication tracking features.

- **Ada Health:**

Pros: Ada Health is an AI-driven symptom checker that offers personalized health assessments and suggestions. It provides a user-friendly interface and supports multiple languages.

Cons: Ada Health does not have a direct integration with physician suggestion or appointment scheduling functionalities. It may not have as comprehensive a database as WebMD.

- **Buoy Health:**

Pros: Buoy Health offers an interactive symptom checker that uses AI algorithms to provide personalized health information. It provides user-friendly interfaces and integrates with local healthcare providers.

Cons: The platform may have limited coverage in terms of available healthcare providers. It may not provide extensive disease suggestions or medication tracking features.

- **Isabel Healthcare:**

Pros: Isabel Healthcare is a symptom checker that focuses on providing accurate disease suggestions based on symptoms. It offers a professional version for healthcare providers and integrates with electronic health records (EHR) systems.

Cons: The platform is primarily designed for healthcare professionals and may not have a user-friendly interface for general users. It lacks direct integration with appointment scheduling functionalities.

## Applications

The developed system has various applications in the healthcare industry. It can serve as a useful tool for users to self-assess their symptoms and receive accurate disease suggestions. The system can also help users find suitable physicians based on their recommended diseases and facilitate online appointment scheduling or virtual consultations. Moreover, doctors can benefit from the system by accessing patient history, prescribing medications, and tracking patient compliance. Overall, the system enhances the efficiency and accessibility of healthcare services for both users and medical professionals.

The "Healthcare" application can benefit a wide range of users, including:

- Individuals seeking preliminary information about their symptoms.
- Patients with chronic conditions who require ongoing care and medication management.
- Individuals in underserved communities with limited access to healthcare facilities.
- Healthcare providers seeking support in diagnosis, treatment planning, and patient engagement.

## Alternative Designs

Several alternative designs were considered during the planning phase of the project. One alternative was to develop a mobile application instead of a website to provide users with a more convenient and accessible platform. Another alternative was to integrate with multiple symptom checker websites as WebMD to increase the accuracy of disease suggestions. However, considering the target audience and available resources, we considered to build a website from scratch importing symptoms checker models and building drug recommendation system with a section for physicians' appointment. We learnt a lot during this development process.

- Rule-based expert systems:

Utilizing pre-defined rules and decision trees for symptom analysis and recommendations, offering a more transparent but less adaptable approach than ML.

- Integration with existing telemedicine platforms:

Partnering with established telehealth providers to incorporate the developed functionalities within their existing systems, potentially expanding reach but limiting customization.

- Focus on specific medical specialties or conditions:

Initially targeting a specific area of healthcare, such as mental health or chronic disease management, to refine functionalities and ensure accuracy before broadening the scope.

### **Alternative 1 – Mobile Application**

Develop a mobile application instead of a website.

#### **Pros**

- Provides a more convenient and accessible platform for users
- Can leverage mobile-specific features like push notifications and location services

#### **Cons**

- Requires additional development effort and resources.
- May need to develop separate versions for different mobile operating systems (Android, iOS)

#### **Why didn't choose it?**

- Considering the target audience and available resources, a website was chosen as the primary platform.
- Developing a mobile application would require additional time, effort, and resources, which may not be feasible within the project scope.
- The website can still be accessed from mobile devices, offering a responsive design for optimal user experience.

### **Alternative 2 – Integration with Multiple Symptom Checker Websites**

Integrate with multiple symptom checker websites to enhance the accuracy of disease suggestions

#### **Pros**

- Can leverage the combined symptom and disease databases of multiple websites for more accurate results
- Provides a wider range of potential disease suggestions

#### **Cons**

- Requires complex integration with multiple APIs
- May introduce inconsistencies and discrepancies in the disease suggestions from different sources

#### **Why didn't choose it?**

Integrating with multiple symptom checker websites would significantly increase the complexity of the system. It would require managing multiple APIs, handling inconsistencies in the data, and ensuring the accuracy and reliability of the suggestions from different sources.

### **Alternative 3 – Building an AI Model from Scratch**

Develop a custom AI model for symptom analysis and disease suggestions.

#### **Pros**

- Allows for complete control and customization of the AI model
- Can potentially provide more accurate and tailored disease suggestions

#### **Cons**

- Requires extensive time and resources for AI model development, training, and validation
- May require a large amount of labeled data for training the AI model
- Carries the risk of lower accuracy and reliability compared to established models like WebMD

## *This is the design we implemented.*

### Project Planning

#### Constraints

- **Data Availability and Quality:** Acquiring sufficient high-quality medical data for training and validating ML models is crucial for ensuring accuracy and reliability.
- **Ethical Considerations:** Addressing data privacy, security, algorithmic bias, and transparency in ML model predictions is essential for responsible development and user trust.
- **Regulatory Compliance:** Adhering to relevant healthcare regulations and data protection laws, such as HIPAA, is crucial for ensuring legal and ethical compliance.
- **Technical Complexity:** Developing and integrating complex ML models with the web application requires expertise and ongoing maintenance.
- **User Adoption and Engagement:** Promoting the application and encouraging user trust and engagement are critical for its long-term success and impact.

### Implementation Environment of the Current System **Programming Language: Python**

- Web Framework: Django
- Database: MySQL
- ML Libraries: TensorFlow
- Development Tools: Git

### Partner or Collaborative Applications

- **Integration with Electronic Health Records (EHR) systems:** Enhance data availability and personalize recommendations by integrating with existing EHR systems.
- **Collaboration with healthcare institutions:** Partner with hospitals, clinics, or research organizations to access data, expertise, and user feedback.
- **Integration with pharmacies:** Facilitate prescription fulfillment and medication adherence by integrating with pharmacy databases and online ordering systems. This is for future enhancement.

### Off-the-shelf Software

- Machine Learning libraries and frameworks
- Natural Language Processing (NLP) tools
- Cloud-based services for data storage, computation, and deployment



## Anticipated Workplace Environment

- **Development team:** Comprising software engineers, data scientists, ML engineers, and UX/UI designers.
- **Collaboration with healthcare professionals:** Engaging with doctors, nurses, and other healthcare experts to ensure clinical accuracy and user-centered design.

## Schedule Constraints

- Project timeline with defined milestones and deliverables.
- Regular progress reports and team meetings.
- Agile development methodology for iterative development and flexibility.

## Budget Constraints

- Allocation of resources for development tools, data acquisition, personnel, and infrastructure.
- Cost-effective solutions and resource management strategies.

## Project Issues

- Ensuring the accuracy and reliability of ML models, particularly for rare diseases or complex cases.
- Addressing potential biases in data and algorithms to promote fair and equitable outcomes for all users.

## Issues that have been raised and do not yet have a conclusion.

- Balancing the need for transparency in ML model predictions with the complexity of the underlying algorithms.
- Maintaining user privacy and data security, especially when handling sensitive medical information.
- Encouraging user adoption and engagement with the application, particularly among individuals with limited technological literacy.

## Migration to the New Product

- Phased rollout with beta testing and user feedback.
- Data migration and integration with existing systems, ensuring data security and integrity.
- Training and support for users and healthcare providers to facilitate a smooth transition to the new platform.



## Risks

- Technical challenges in ML model development and integration.
- Potential for misdiagnosis or inaccurate recommendations, requiring clear disclaimers and emphasis on professional medical consultation.
- Data security breaches and privacy concerns, necessitating robust security measures and compliance with relevant regulations.
- Low user adoption and engagement, requiring effective marketing and user outreach strategies.

## Team Members Tasks

### Managers

- Project planning and oversight, ensuring adherence to timelines and budgets.
- Resource allocation and management.
- Communication and coordination between team members and stakeholders.

### Designers

- User interface and user experience design, creating an intuitive and visually appealing application.
- Developing style guides and branding elements.
- Conducting user research and usability testing.

### Developers

- Coding the application functionalities using Python, Django, and ML libraries.
- Implementing and optimizing machine learning models for disease prediction and drug recommendations.
- Database design and management.
- Testing and debugging the application.

## Ethical Issues

- **Data privacy and security:** Implementing robust security measures and adhering to relevant data protection regulations.
- **Algorithmic bias:** Mitigating potential biases in data and algorithms to ensure fairness and avoid perpetuating healthcare disparities.
- **Transparency and explainability:** Providing users with clear information about the limitations of the ML models and the rationale behind predictions and recommendations.
- **User autonomy and informed consent:** Ensuring users understand the purpose of the application and how their data will be used.

## Software Model Process

The project will adopt an Agile development methodology to enable iterative development, continuous feedback, and adaptation to evolving requirements. Agile principles will guide the development process, emphasizing collaboration, flexibility, and customer satisfaction. The project will be divided into sprints, each lasting 2-4 weeks, with a focus on delivering working software increments.

Key aspects of the Agile approach include:

- **Iterative Development:** The project will progress through a series of iterations, with each iteration delivering a potentially shippable product increment. This allows for frequent feedback and ensures that the project remains aligned with stakeholder expectations.
- **Continuous Feedback:** Regular feedback loops will be established with stakeholders, including healthcare providers and users, to gather input and make course corrections as needed. This feedback will be used to refine requirements and prioritize features.
- **Adaptation to Change:** Agile methodologies are well-suited to projects with evolving requirements. The project team will remain flexible and responsive to changes in technology, market conditions, and user needs, adjusting the project plan and deliverables as necessary.
- **Collaboration:** Close collaboration between team members, including developers, designers, and stakeholders, will be essential. Daily stand-up meetings, regular sprint reviews, and retrospectives will facilitate communication and alignment.
- **Emphasis on Individuals and Interactions:** Agile places a strong emphasis on the value of individuals and their interactions over processes and tools. The project team will prioritize open communication and collaboration to maximize productivity and creativity.

By embracing Agile principles, the project aims to deliver a high-quality healthcare web application that meets the needs of its users, while also being adaptable to changing requirements and market conditions.

## Feasibility Study

<i>Feasibility Aspect</i>	<i>Feasibility Status</i>	<i>Approximation</i>
---------------------------	---------------------------	----------------------

<b>Technical Feasibility</b>		
Availability of Technology	High	The team possesses or can acquire the necessary technical skills and tools.
Data Availability and Quality	Moderate to High	Relevant datasets are available, though data quality may vary.
Infrastructure	High	Cloud platforms offer scalable hosting solutions.

<b>Economic Feasibility</b>		
Development Costs	Moderate	Initial costs include licenses, tools, and personnel expenses.
Revenue Streams	Moderate to High	Potential revenue from subscriptions, in-app purchases, and partnerships.
Return on Investment	Potentially High	The project aims to provide significant value, leading to a high ROI.

<b>Operational Feasibility</b>		
Integration with Existing Systems	Moderate	Integration with EHR and pharmacy databases may require effort.
User Adoption	Moderate	User-friendly interface and usability testing aim to facilitate adoption.
Regulatory Compliance	High	Compliance with healthcare regulations is a top priority.

<b>Legal and Ethical Feasibility</b>		
Data Privacy	High	Robust measures were implemented to protect user data.
Ethical Considerations	Moderate	Bias mitigation and transparency in ML model decisions are key.



## Tools/Technology

The "Responsive Health Care System" project utilizes a variety of languages, frameworks, and tools to deliver its functionalities effectively. Below is a breakdown of the tools and technologies employed:

- **HTML5/CSS3:**

HTML5 and CSS3 are used for structuring and styling the web application's user interface, providing a visually appealing and responsive layout.

- **JavaScript:**

JavaScript is employed to enhance the interactivity and functionality of the web application, enabling dynamic content updates and user interactions.

- **Bootstrap:**

Bootstrap framework is utilized for front-end development, offering pre-designed components and responsive design features to streamline UI development.

- **XAMPP:**

XAMPP is chosen as the web server solution for hosting the application locally during development and testing phases.

- **Python, Django:**

Python programming language and Django web framework are utilized for back-end development, providing a robust and scalable architecture for implementing complex business logic and data processing tasks.

- **MySQL:**

MySQL database management system is employed for storing and managing application data, ensuring efficient data retrieval and manipulation.

## Standards

The project will adhere to established standards and best practices to ensure quality, security, and interoperability:

**Healthcare Data Security:** Compliance with HIPAA (Health Insurance Portability and Accountability Act) and other relevant data privacy regulations to protect sensitive patient information.

**Software Development:** Following industry best practices for secure coding, testing, and documentation.

**Accessibility:** Adhering to accessibility guidelines (e.g., WCAG) to ensure the application is usable by individuals with disabilities.

**Interoperability:** Utilizing standard data formats (e.g., HL7, FHIR) to facilitate data exchange with other healthcare systems.

## Milestones

The project will be divided into distinct phases with clearly defined milestones to track progress and ensure timely completion:

- Phase 1: Planning and Analysis: Conducting a feasibility study, gathering requirements, and designing the overall system architecture.
- Phase 2: Data Acquisition and Preparation: Identifying and acquiring relevant healthcare datasets, performing data cleaning and preprocessing.
- Phase 3: Model Development and Training: Developing and training machine learning models for disease prediction and drug recommendations.
- Phase 4: Application Development: Building the web application interface and integrating the ML models into the system.
- Phase 5: Testing and Validation: Conducting rigorous testing to ensure functionality, usability, and performance of the application.
- Phase 6: Deployment and Maintenance: Deploying the application to a production environment, providing ongoing maintenance, and monitoring performance.

## Requirements

### Use Case Diagram - "Healthcare" Web Application

The use case diagram illustrates the interactions between the actors and subsystems involved in the application. The main actors identified in the diagram are the "User" and the "Healthcare Web Application." The "User" interacts with the application by performing various actions such as entering symptoms, viewing medical history, specifying conditions, searching for providers, booking appointments, and accessing drug recommendations and disease predictions.

The "Healthcare Web Application" acts as the central component and facilitates the interactions between the user and the subsystems. It provides a user-friendly interface and coordinates the functionality offered by the subsystems.

The subsystems identified in the diagram include:

1. **Disease Prediction Subsystem:** This subsystem analyzes user-provided symptoms and medical history to predict potential diseases. It calculates probabilities associated with each predicted disease.
2. **Drug Recommendation Subsystem:** The drug recommendation subsystem offers personalized drug recommendations based on predicted diseases or user-specified conditions. It considers potential interactions and contraindications to provide safe and suitable recommendations.
3. **Appointment Scheduling Subsystem:** This subsystem enables users to search for healthcare providers based on specialty, location, and availability. Users can book appointments with the selected providers using this subsystem.
4. **User Interface Subsystem:** The user interface subsystem ensures a user-friendly and intuitive interface for users with varying levels of technical expertise. It displays disease predictions, drug recommendations, and provides search functionality and appointment booking features.

The use case diagram visually represents the interactions between these subsystems and the user. It showcases the flow of actions and functionalities offered by the "Healthcare" web application.

By utilizing ML and web technologies, the "Healthcare" web application addresses the increasing prevalence of chronic diseases and the need for accessible healthcare solutions. It empowers individuals to take charge of their health and provides efficient access to care.

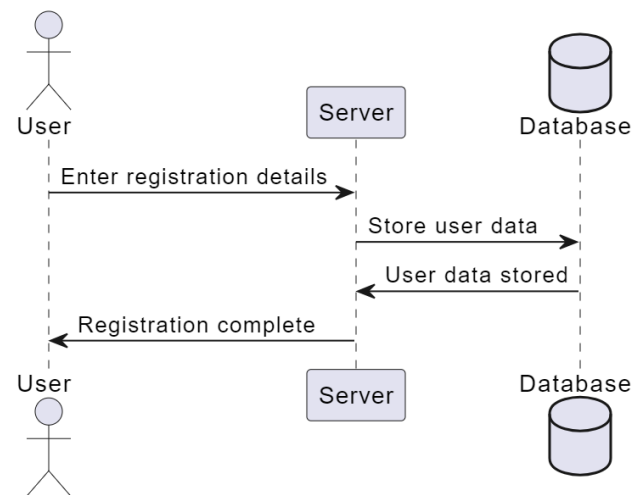


Figure 1 - Use Case Diagram 1



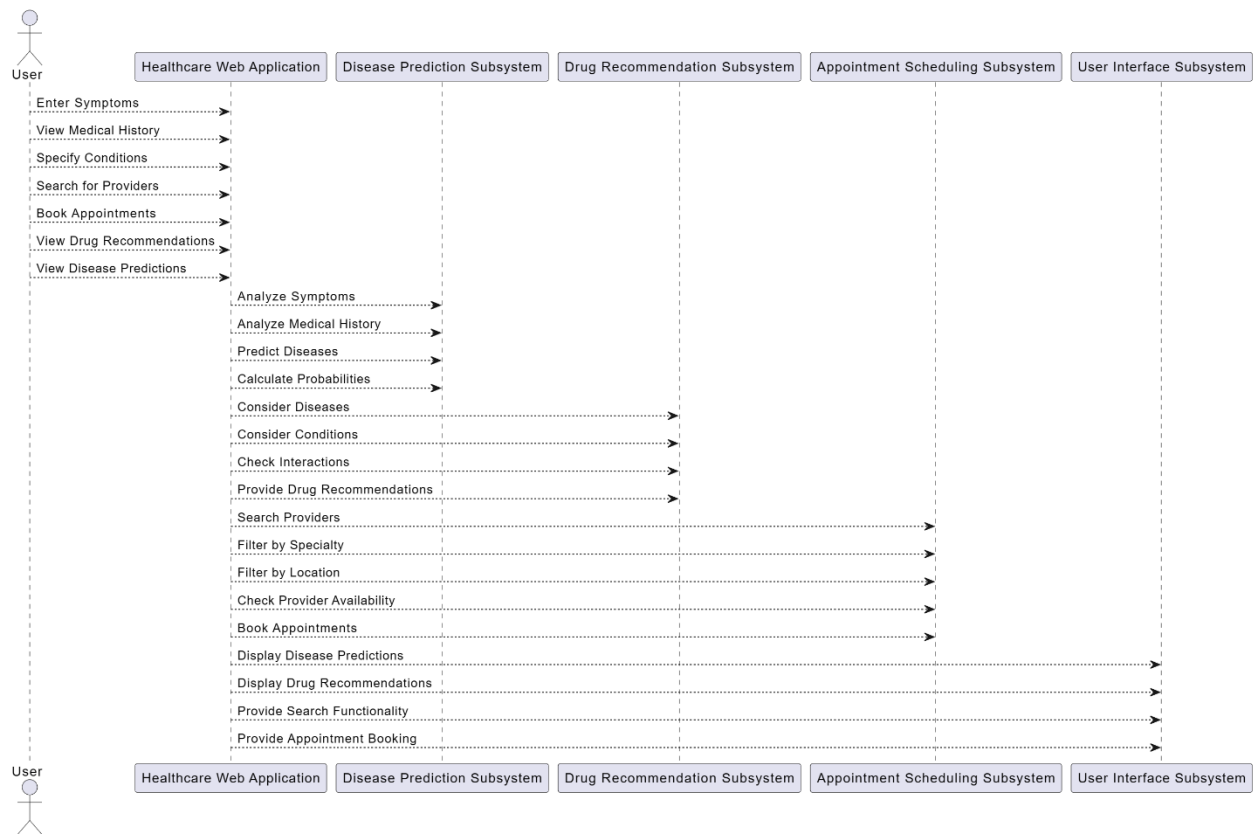


Figure 2- Use Case Diagram 2

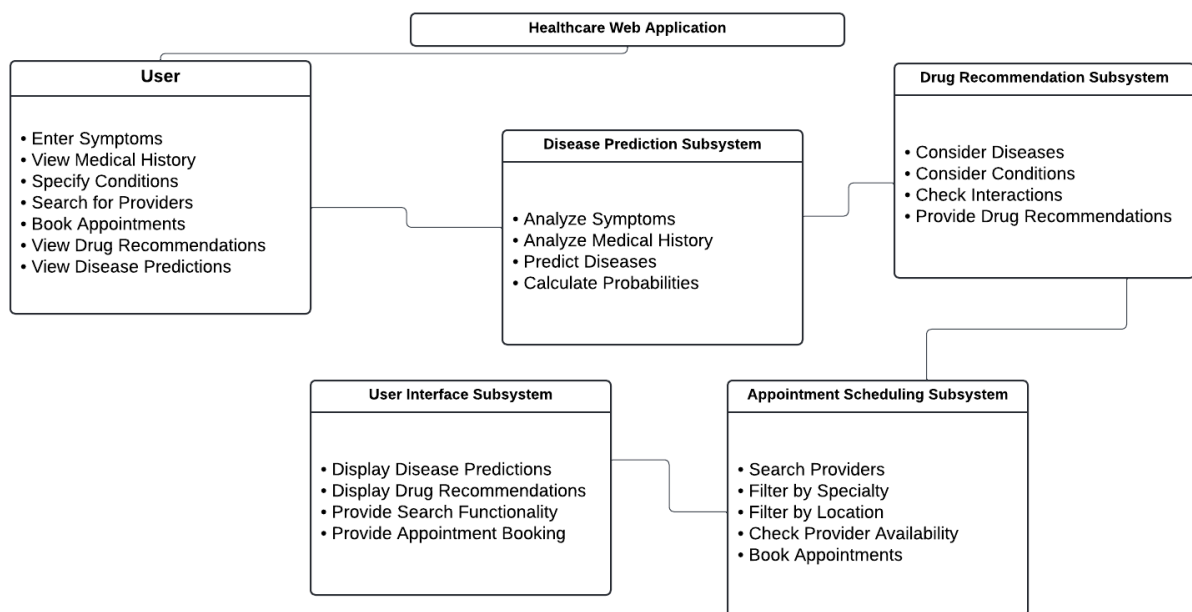


Figure 3 - Use Case Diagram 3

## Functional Requirements:

### User Management:

- User registration and account creation with personal information.
- Secure login and authentication mechanisms.
- User profile management (update information, preferences).

### Health Information Management:

- Symptom entry with details and severity levels.
- View and manage personal medical history (diagnoses, treatments, medications).
- Upload and store medical documents securely.

### Disease Prediction and Insights:

- Analyze user-entered symptoms and medical history.
- Predict potential diseases with associated probabilities.
- Offer insights and explanations for predicted diseases.

### Treatment Recommendations:

- Provide personalized drug recommendations based on predicted diseases or user-specified conditions.
- Consider potential drug interactions and contraindications.

### Healthcare Provider Interaction:

- Search for healthcare providers by specialty, location, and other criteria.
- View provider profiles and credentials.
- Book appointments online considering provider availability.

### Information Delivery:

- Clear and understandable display of disease predictions and probabilities.
- Easily accessible format for drug recommendations with dosage and usage information.
- Educational resources on predicted diseases and recommended treatments.

## Data Requirements:

- Secure storage and management of:
  - User data (personal information, medical history, preferences).
  - Symptom data (comprehensive database linked to medical conditions).
  - Medical history data (diagnoses, treatments, medications).
  - Provider data (specialties, locations, availability, contact details).
  - Drug data (indications, contraindications, interactions, dosages).
- Data security and privacy compliance with relevant regulations (e.g., HIPAA).

## Non-Functional Requirements:

### Performance:

- Fast response times to user actions.
- Scalability to handle increasing user loads and future growth.
- Efficient processing of user data for timely predictions and recommendations.

### Dependability:

- High reliability and accuracy of predictions, recommendations& appointment scheduling.
- 24/7 availability with minimal downtime.
- Robust error handling and recovery mechanisms.

### Maintainability and Supportability:

- Modular design for easier maintenance and updates.
- Comprehensive documentation for users and developers.
- Responsive support channels for user assistance.

### Security:

- Data encryption at rest and in transit.
- Strong access controls and authentication mechanisms.
- Regular security audits and vulnerability assessments.

### Usability and Humanity:

- Intuitive and user-friendly interface.
- Multilingual support for diverse users.
- Accessibility features for users with disabilities.
- Culturally sensitive design and content.

### Look and Feel:

- Appealing visual design and consistent user interface.
- Professional and trustworthy aesthetic.

### Operational and Environmental:

- Compatibility with major web browsers and operating systems.
- Defined hardware and software requirements for optimal performance.
- Environmentally friendly practices (e.g., energy efficiency).

### Legal and Compliance:

- Adherence to data protection laws and healthcare regulations.
- Respect for intellectual property rights.

### Additional Considerations:

- Integration with wearable devices and health tracking apps.
- Implementation of AI and machine learning for improved predictions and personalization
- Telehealth features for remote consultations with healthcare providers.
- Community features for user support and information sharing.

## Design

### Design Considerations for the Healthcare Web Application:

#### Class Diagrams:

- **User:** Stores user information such as name, password, medical history.
- **Symptom:** Represents a symptom, chosen from drop down menu.
- **Disease:** Includes information about a disease, such as name, symptoms, treatments.
- **Medication:** Represents a medication with attributes like name, dosage, side effects.
- **Provider:** Contains details about healthcare providers like name, specialty, availability.
- **Appointment:** Stores information about appointments, including date, time, user.

#### Relationships:

- A User can have many Symptoms.
- A Symptom can be associated with many Diseases.
- A Disease can have many possible Medications.
- A Provider can have many Appointments.
- A User can book many Appointments.

#### Dynamic Model:

- **Sequence diagrams:** Illustrate the flow of events for functionalities like user registration, symptom entry, disease prediction, and appointment booking.
- **State machine diagrams:** Represent different states of a user account (e.g., active, inactive) or an appointment (e.g., booked, canceled, completed).

#### Subsystem Decomposition:

- **User Management Subsystem:** Handles user registration, authentication, profile management.
- **Health Information Management Subsystem:** Deals with symptom entry, medical history storage and retrieval.
- **Disease Prediction Subsystem:** Analyzes symptoms and history to predict diseases.
- **Treatment Recommendation Subsystem:** Provides personalized drug recommendations.
- **Provider Search and Appointment Booking Subsystem:** Enables users to find providers and schedule appointments.

#### Software Mapping:

- **Frontend:** Web application developed using HTML, CSS.
- **Backend:** Server-side application using Python (e.g., Django) with a database, MySQL.
- **Machine Learning:** Python libraries like Scikit-learn, TensorFlow for disease prediction algorithms.

## User Interface:

- **Loading Screen:**

A screen that appears during data loading or processing to provide feedback to the user and indicate that the system is working.

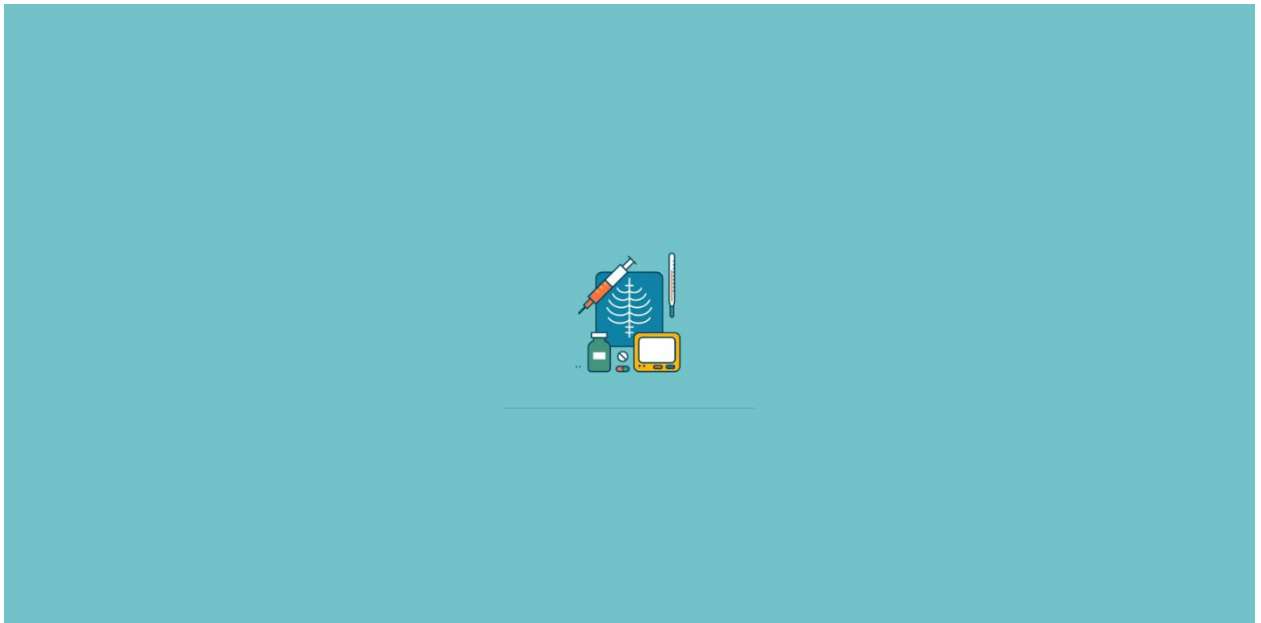


Figure 4 - Loading Screen

- **Login:**

A screen where users can enter their credentials (username/email and password) to access their account.

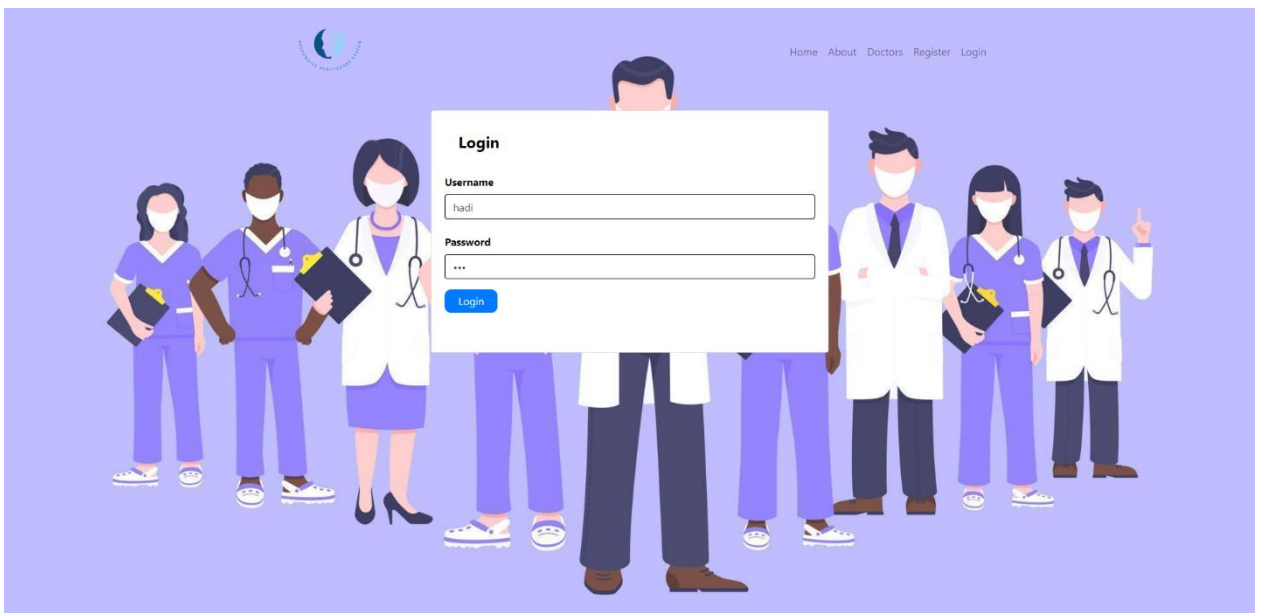
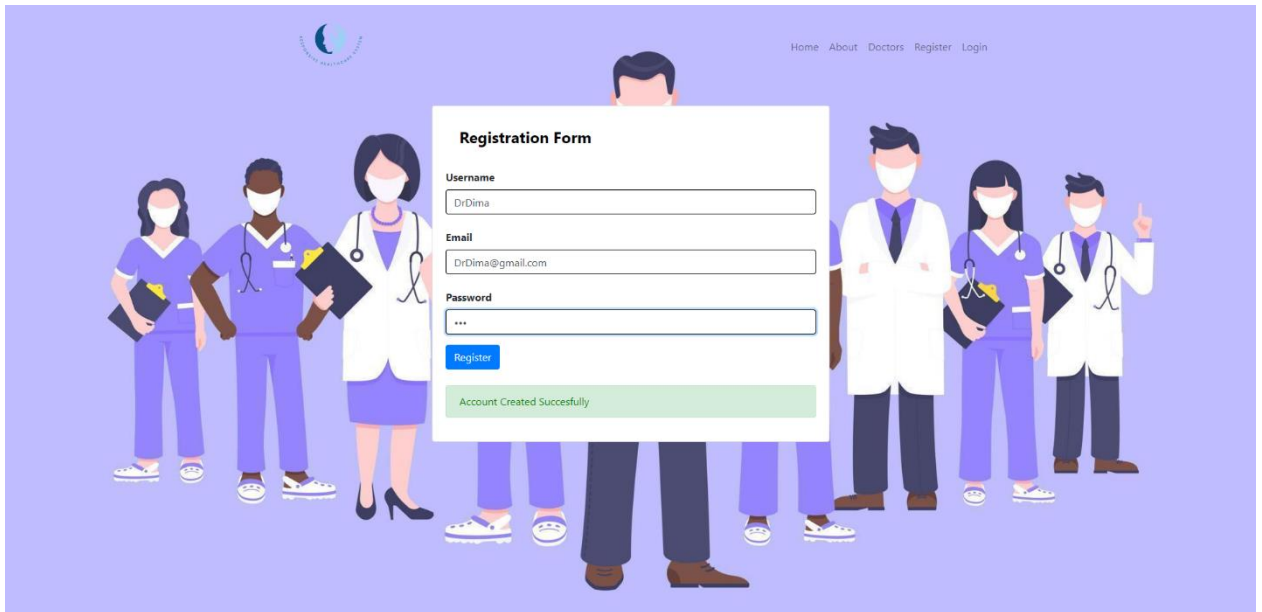


Figure 5 - Login Screen

- **Registration:**

A screen where new users can create an account by providing necessary information such as name, email, password, and possibly additional details.

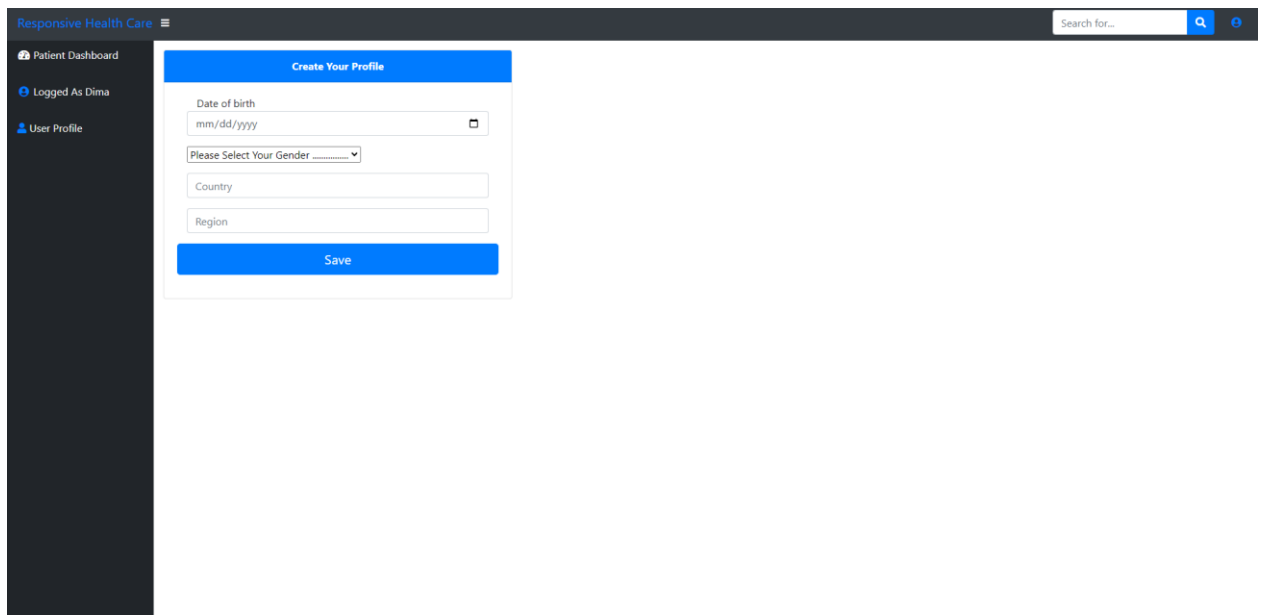


The image shows a web application registration screen with a light purple background. At the top left is a circular logo with a blue and white design. At the top right is a navigation menu with links: Home, About, Doctors, Register, and Login. In the center is a white registration form titled "Registration Form". The form contains three input fields: "Username" with the text "DrDima", "Email" with the text "DrDima@gmail.com", and "Password" with three asterisks. Below the password field is a blue "Register" button. At the bottom of the form is a green success message: "Account Created Successfully". The form is overlaid on a group of seven medical professionals (doctors and nurses) wearing masks and holding clipboards. The background is a solid light purple color.

Figure 6 - Registration Screen

- Create profile after Login

The user will create the profile by entering birthdate, selecting gender, country and region.



The screenshot shows a web application interface for 'Responsive Health Care'. On the left is a dark sidebar with navigation links: 'Patient Dashboard', 'Logged As Dima', and 'User Profile'. The main content area features a 'Create Your Profile' form. The form includes a 'Date of birth' field with a placeholder 'mm/dd/yyyy' and a calendar icon, a 'Please Select Your Gender' dropdown menu, and 'Country' and 'Region' text input fields. A blue 'Save' button is at the bottom of the form. The top of the page has a header with the application name, a search bar, and user icons.

Figure 7 - Profile Creation

users are prompted to enter information regarding their age and gender, so that the algorithm can output more accurate results.

As a smart diagnosis app, collecting data about the age and gender of users can be incredibly helpful in providing accurate and personalized health recommendations. By asking users to enter this information upon sign-up or during initial use of the app, it allows the app to tailor its recommendations based on the user's demographic information and potential health concerns associated with age and gender.

However, it's important to prioritize user privacy and make sure that all data collected is securely stored and protected. It's also crucial to make sure that the app's algorithms are not biased or discriminatory in any way based on gender or age. Overall, gathering age and gender information from users can help enhance the effectiveness and usefulness of a smart diagnosis app, but it must be done thoughtfully and responsibly.



- **Homepage:**

The main screen after login, displaying relevant information, such as a personalized dashboard showing health data, upcoming appointments, and recommendations.

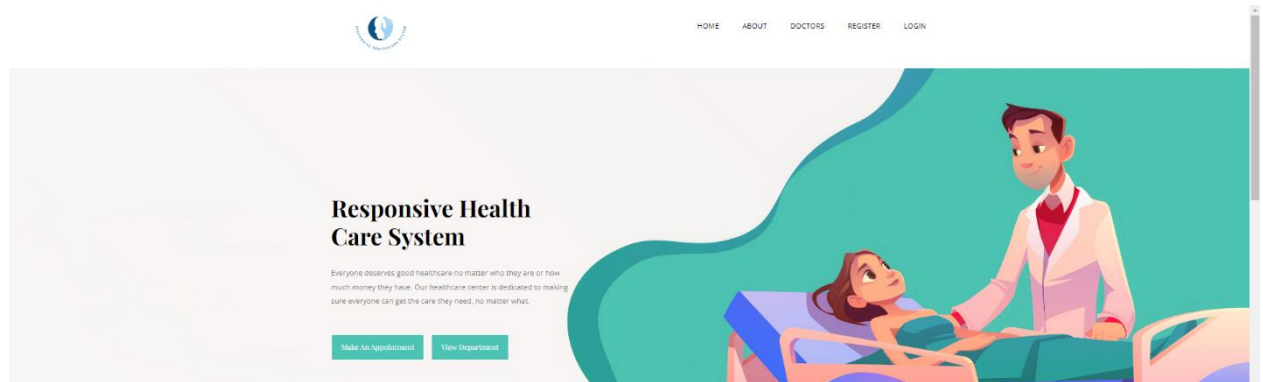


Figure 8 - Homepage (1)

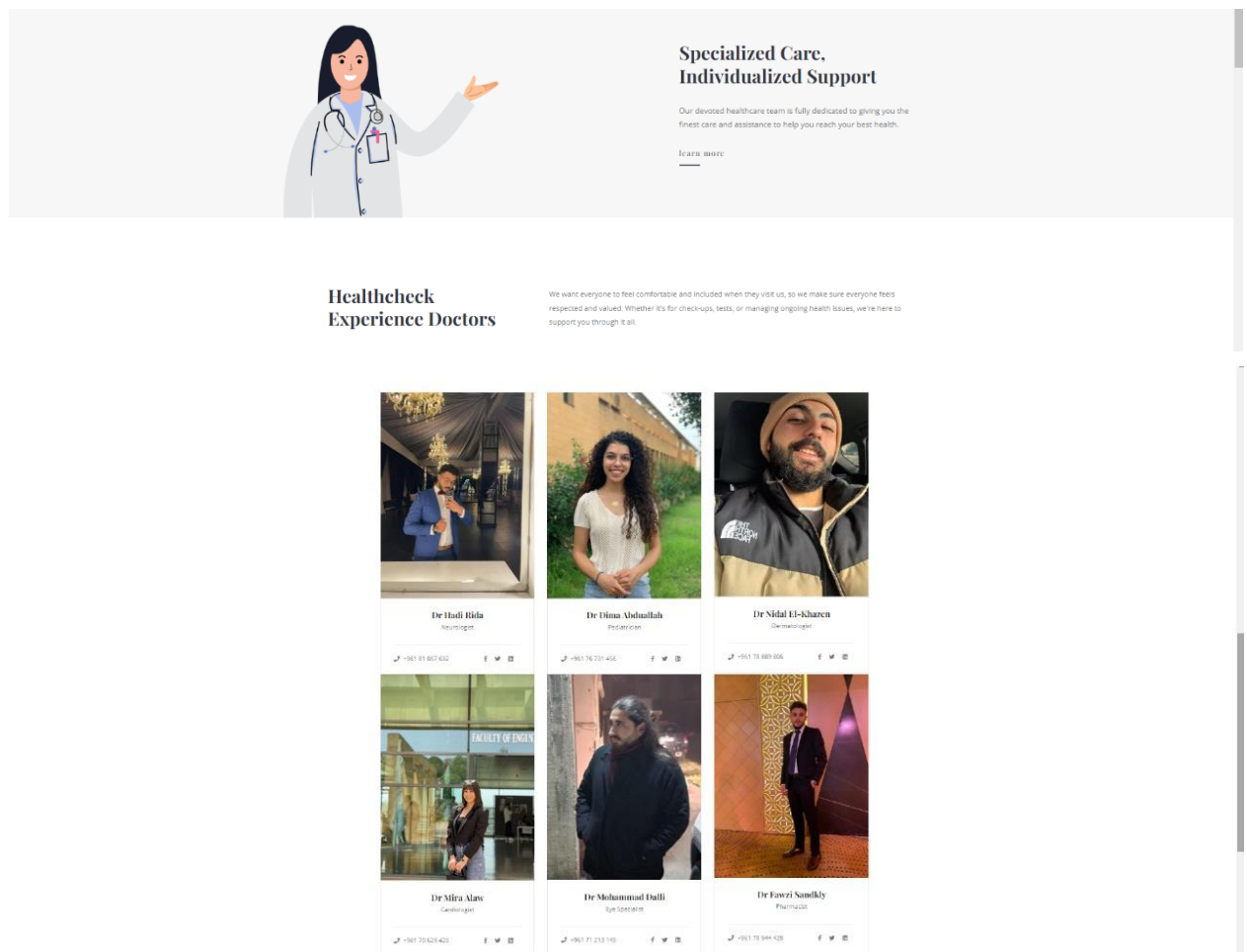


Figure 9 - Homepage (2)

Upon entering our website, users are greeted with our homepage, containing several sections such as an About Us section, which provides information about the website, its values, missions, team members, etc. In addition, it contains a section where users can book an appointment with doctors of their choice via our recommendations, and a testimonials section where we display virtual feedbacks and reviews from users of our web application, in order to build trust and credibility with future users.

The "About Us" section is a critical part of a website that provides information about the organization or company behind the website. Typically, this section contains details about the company's history, mission, values, team members, and achievements. It may also include information about the products or services offered by the company, and any awards or recognition it has received.

A navigation menu is a key component of a website that allows visitors to easily access different pages and sections of the site. It typically appears at the top of the website or on the left-hand side and can be static or drop-down.

Our Navigation Menu header displays contact info such as a phone number and an email address so that users can efficiently contact us, in addition to links to several social media accounts such as Facebook, Twitter, LinkedIn, Instagram, and YouTube.

The menu also displays the user's username, a Logout button, and a settings button. Below this section, our clickable logo is displayed. Clicking on this logo redirects users to the homepage. To the right of our logo, there are five buttons. A Home button which displays the homepage, an About button which redirects to the About Us section, a Service page which displays the services provided by our website, a dropdown Pages page which lists the different page of our website, and a Contact page which shows different ways to contact us.

- **Privacy and Policies:**

A screen or section that informs users about the privacy policies, terms of service, and other legal information related to the application.

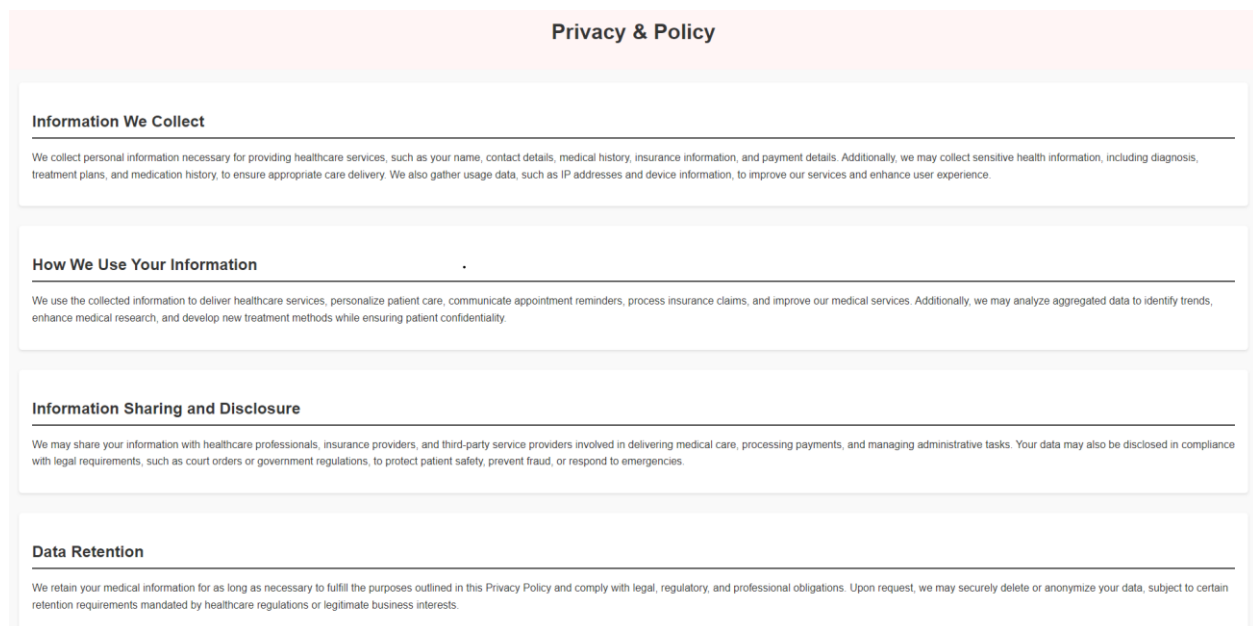


Figure 10 - Privacy & Policy Section

- **Departments Available:**

A screen or section that lists the available healthcare departments or specialties, allowing users to explore and select a specific department of interest.

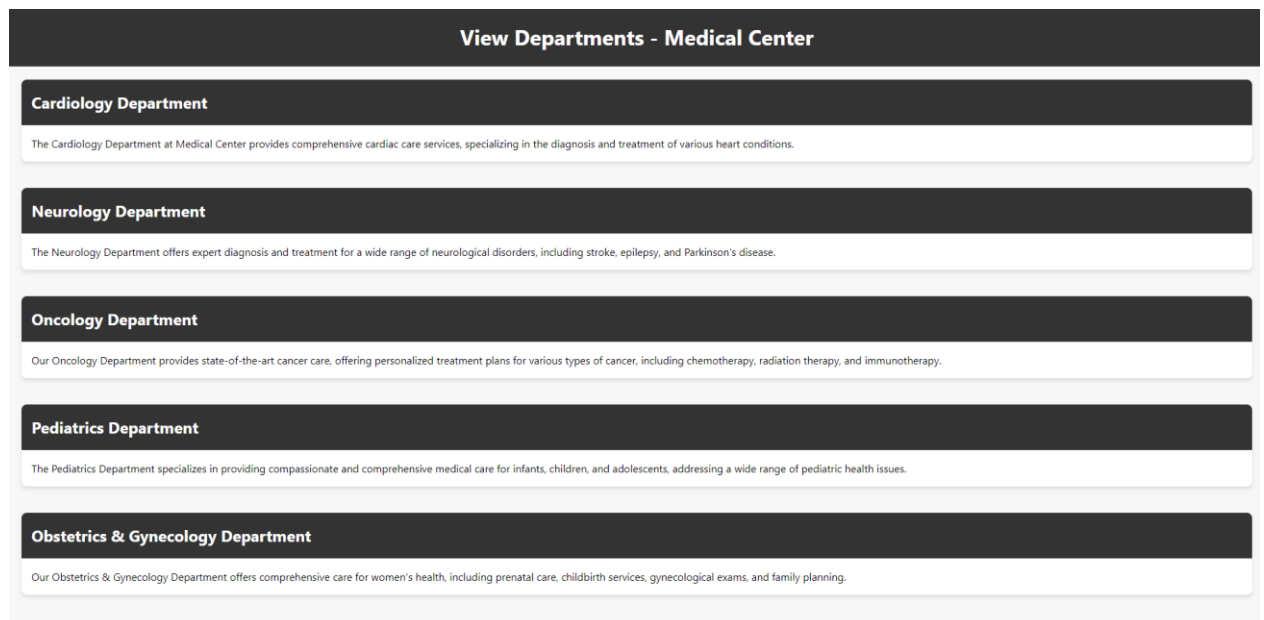


Figure 11 - Departments Available Section

- **Dashboard:**

Provides an overview of the user's health information, appointments, and recommendations.

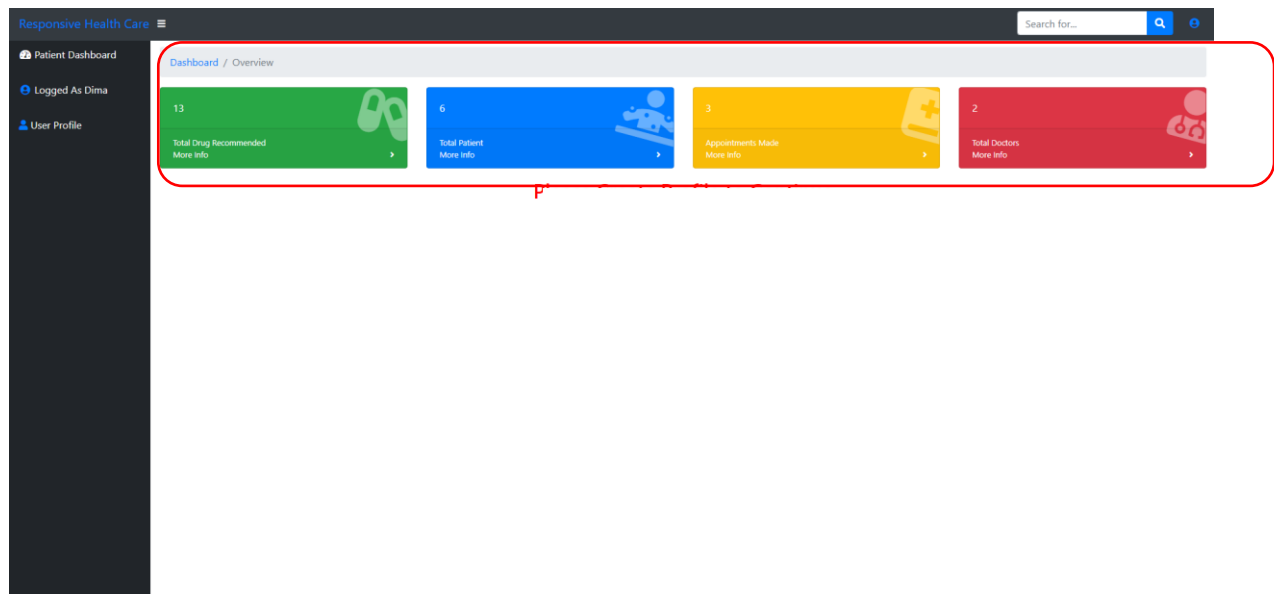


Figure 12 - Dashboard

- **Symptom Input:**

Allows users to easily input symptoms.

Figure 13 -Prompt user to Input Symptoms

Figure 14 - Drop down menu to input symptoms

By inputting information about their symptoms, the website's algorithm can provide a list of possible diagnoses and recommend appropriate medical actions. This approach can save time and effort for both the user and the medical professional and may also lead to earlier detection and treatment of health issues. However, although our website aims to provide more accessible medical care, it's important to note that smart diagnosis apps should not be used as a substitute for a medical consultation, as they can't replace the human touch and experience of a doctor's evaluation. Users should always seek professional medical advice and guidance in addition to using the website.

- Medical History:

The screenshot shows a web application titled 'Responsive Health Care'. On the left is a dark sidebar with navigation links: 'Patient Dashboard', 'Logged As Dima', 'Make Diagnosis', 'Diagnosis Results', and 'Appointment'. The main content area has a header 'Medical Check Up Panel' and a search bar. Below this is a table titled 'List Of Disease Diagnosed'. The table has five columns: 'Id', 'Name', 'Disease', 'Medicine', and 'Appointment'. Two rows of data are shown, both for a patient named 'Dima'. The 'Disease' column is highlighted with a red rectangular box. Each row has a green 'Request' button in the 'Appointment' column.

Id	Name	Disease	Medicine	Appointment
21	Dima	Malaria	Yet Recommended	<a href="#">Request</a>
22	Dima	Drug Reaction	Yet Recommended	<a href="#">Request</a>

Figure 15 - Display list of diagnosed diseases for a patient (user)

Displays a timeline of past diagnoses, treatments, and medications.

- **Disease Prediction:** Presents potential diseases.

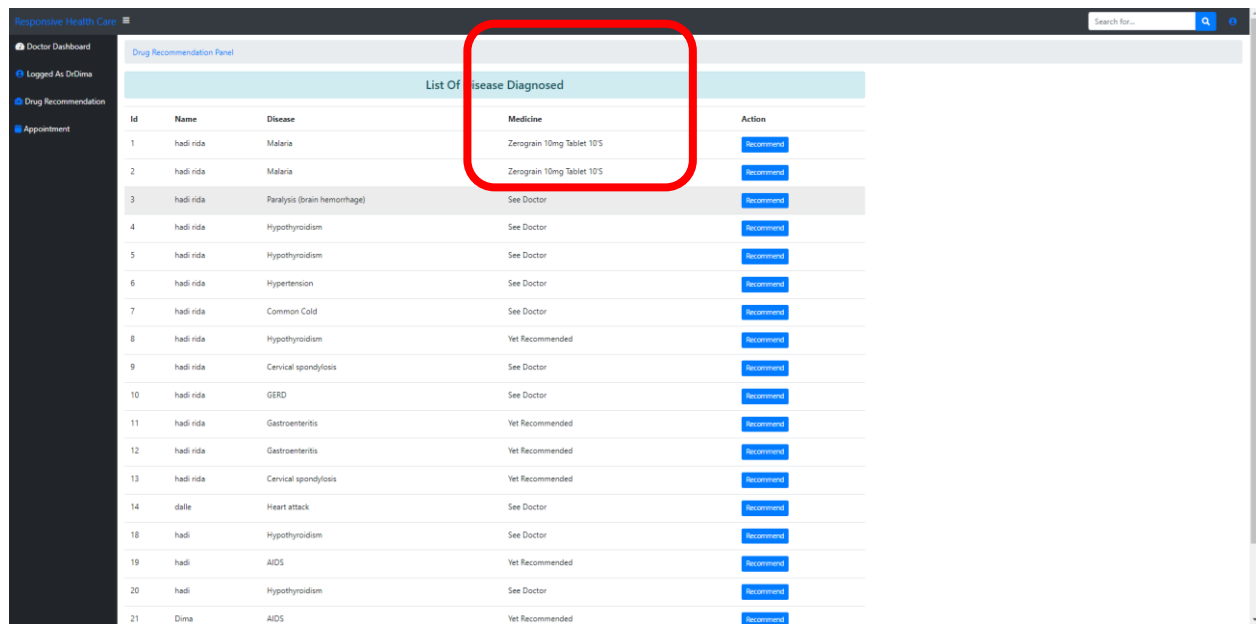
The screenshot shows a web application interface for 'Responsive Health Care'. On the left is a dark sidebar with navigation links: 'Patient Dashboard', 'Logged As Dima', 'Make Diagnosis', 'Diagnosis Results', and 'Appointment'. The main content area is titled 'Disease Prediction Panel'. It contains five input fields for symptoms: '1st Symptom' (bladder\_discomfort), '2nd Symptom' (blurred\_and\_distorted\_vision), '3rd Symptom' (bruising), '4th Symptom' (burning\_micturition), and '5th Symptom' (cold\_hands\_and\_feets). Below these fields is a blue 'Predict' button. To the right of the button, a red rectangular box highlights the text 'There Are Chances You Have Drug Reaction'.

Figure 16 - Disease Predicted for user

users are redirected to the results page that will preview possible diseases the user may suffer from, according to the provided information, along with the likelihood of each disease. Our application provides both physical and mental diagnosis. A results page in a smart diagnosis app can provide users with a list of potential medical conditions based on their input symptoms and medical history. This page can be a valuable resource for individuals looking for preliminary information about their health condition and can help guide them towards appropriate medical actions.

- Treatment Recommendations:

Offers personalized drug recommendations.



Drug Recommendation Panel				
List Of Disease Diagnosed				
Id	Name	Disease	Medicine	Action
1	hadi rida	Malaria	Zerograin 10mg Tablet 10'S	<a href="#">Recommend</a>
2	hadi rida	Malaria	Zerograin 10mg Tablet 10'S	<a href="#">Recommend</a>
3	hadi rida	Paralysis (brain hemorrhage)	See Doctor	<a href="#">Recommend</a>
4	hadi rida	Hypothyroidism	See Doctor	<a href="#">Recommend</a>
5	hadi rida	Hypothyroidism	See Doctor	<a href="#">Recommend</a>
6	hadi rida	Hypertension	See Doctor	<a href="#">Recommend</a>
7	hadi rida	Common Cold	See Doctor	<a href="#">Recommend</a>
8	hadi rida	Hypothyroidism	Yet Recommended	<a href="#">Recommend</a>
9	hadi rida	Cervical spondylosis	See Doctor	<a href="#">Recommend</a>
10	hadi rida	GERD	See Doctor	<a href="#">Recommend</a>
11	hadi rida	Gastroenteritis	Yet Recommended	<a href="#">Recommend</a>
12	hadi rida	Gastroenteritis	Yet Recommended	<a href="#">Recommend</a>
13	hadi rida	Cervical spondylosis	Yet Recommended	<a href="#">Recommend</a>
14	dalle	Heart attack	See Doctor	<a href="#">Recommend</a>
18	hadi	Hypothyroidism	See Doctor	<a href="#">Recommend</a>
19	hadi	AIDS	Yet Recommended	<a href="#">Recommend</a>
20	hadi	Hypothyroidism	See Doctor	<a href="#">Recommend</a>
21	Dima	AIDS	Yet Recommended	<a href="#">Recommend</a>

Figure 17 - Drug Recommendation Section



- **Appointment Booking:** Allows users to view provider availability and schedule appointments online.

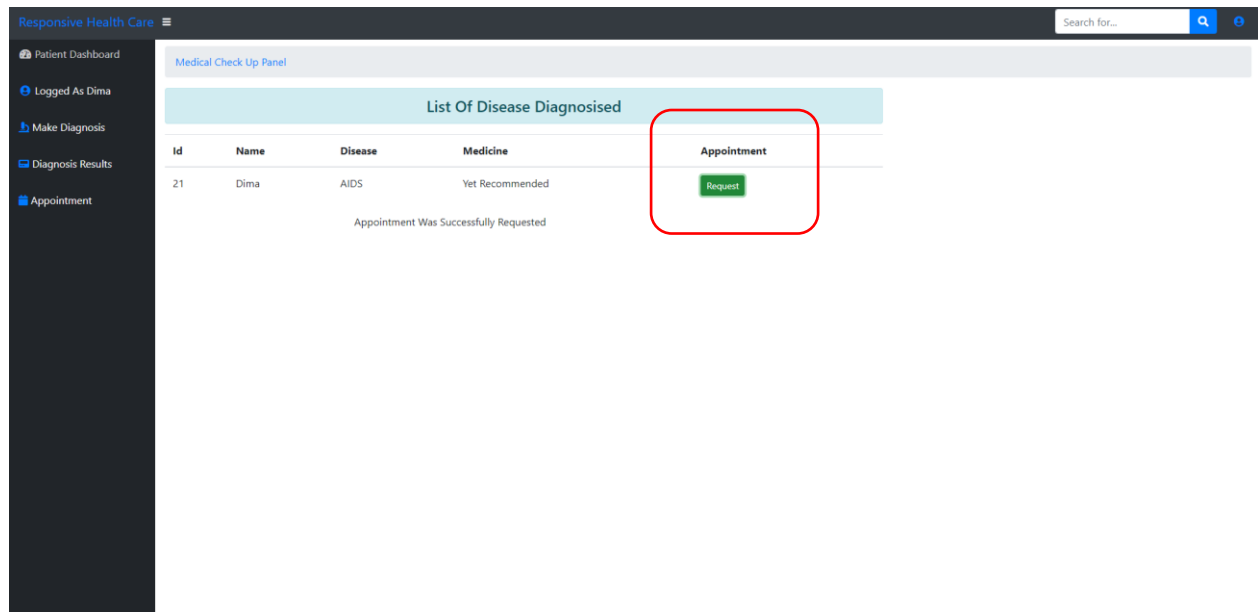


Figure 18 - Request Appointment

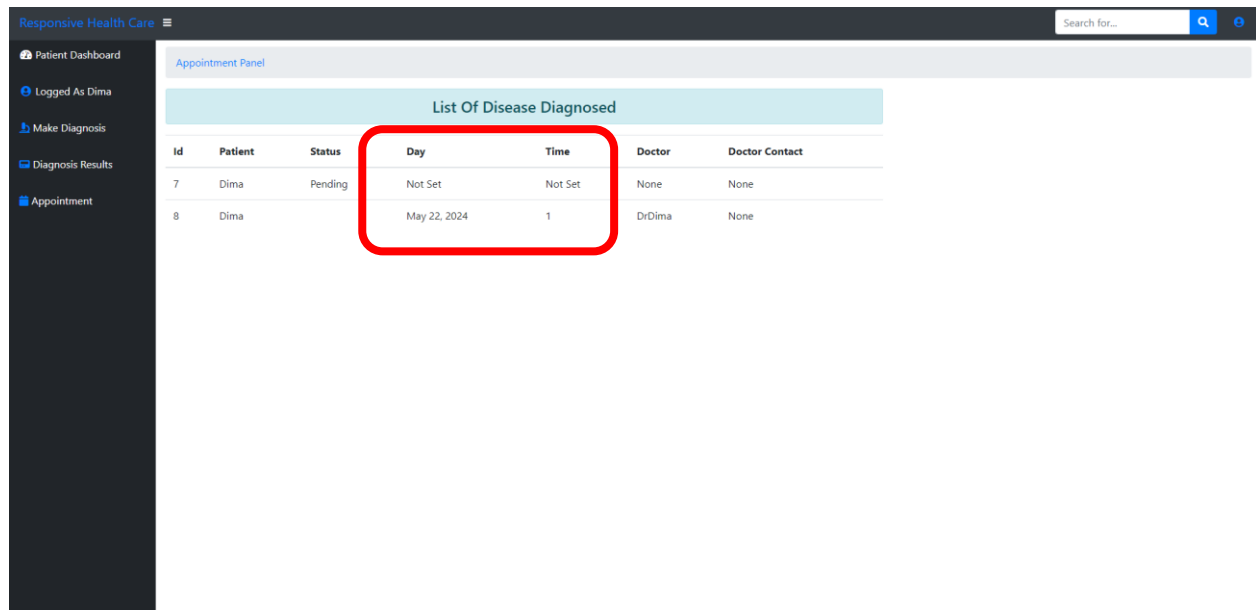
The screenshot displays a white 'Appointment Request Form' centered on a light gray background. The form is divided into two main sections. The first section, 'Contact Information', includes input fields for 'Name', 'Email', and 'Phone'. The second section, 'Appointment Information', features a date picker for 'Appointment Date' (showing 'mm/dd/yyyy'), radio buttons for 'Time interval' (Morning, Afternoon, Evening), a text area for 'Appointment details', and a question 'Would you agree to reschedule the appointment, if needed?' with 'Yes' and 'No' radio options. A blue 'SUBMIT' button is located at the bottom of the form.

Figure 19 - Appointment Form

Appointment booking on the website refers to the process of scheduling an appointment with a healthcare provider online. The website provides a platform where patients can easily and conveniently book appointments with their preferred healthcare providers, eliminating the need to physically visit a healthcare facility to book an appointment.

- **Approved patient date**

When the physician accepts and arranges a date for appointment, this is how the patient is notified, and this is its display.



The screenshot shows a web application titled "Responsive Health Care". On the left is a dark sidebar with navigation links: "Patient Dashboard", "Logged As Dima", "Make Diagnosis", "Diagnosis Results", and "Appointment". The main content area is titled "Appointment Panel" and contains a table titled "List Of Disease Diagnosed". The table has seven columns: "Id", "Patient", "Status", "Day", "Time", "Doctor", and "Doctor Contact". There are two data rows. The first row has values: 7, Dima, Pending, Not Set, Not Set, None, None. The second row has values: 8, Dima, May 22, 2024, 1, DrDima, None. A red rectangular box is drawn around the "Day" and "Time" columns of the second row.

Id	Patient	Status	Day	Time	Doctor	Doctor Contact
7	Dima	Pending	Not Set	Not Set	None	None
8	Dima		May 22, 2024	1	DrDima	None

Figure 20 - Patient receives approval for appointment with date

## Physician's Interface

### Login

There is an implemented method to prove that the logging in user is a physician, to ensure security and privacy.

### Arrange appointment for patient

The physician now can see that patient requested an appointment, then will approve and set date according to availability, user will get notified.

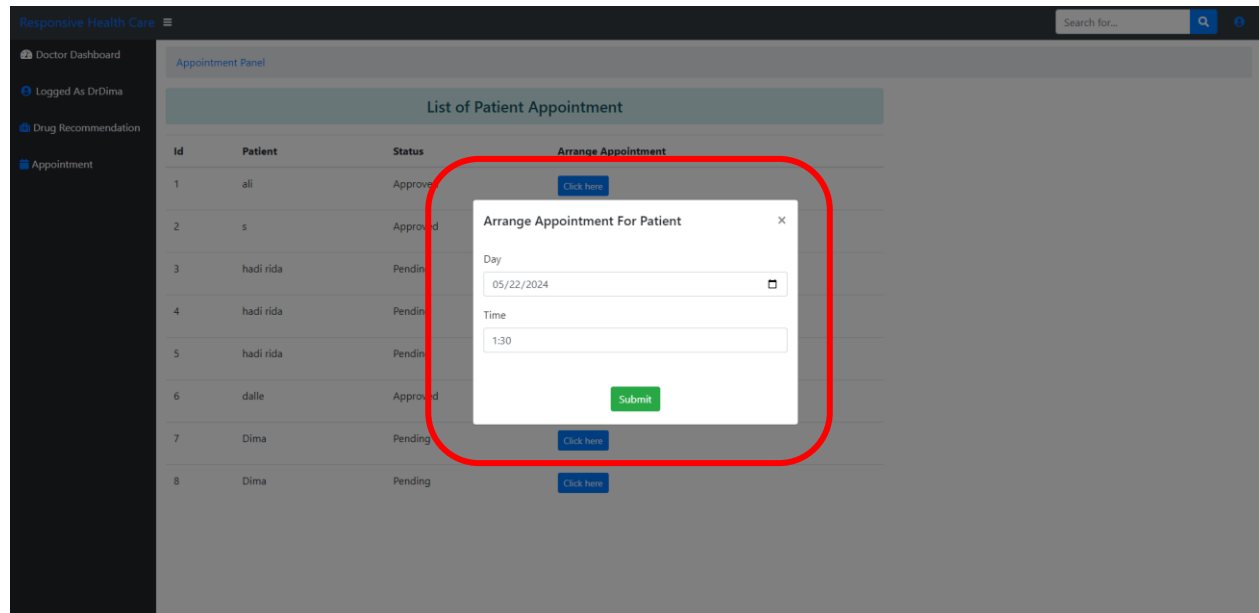


Figure 21 - Physician approves appointment

### Approved Appointments List

The physician has a list that is displayed, shows appointments he/she has approved.

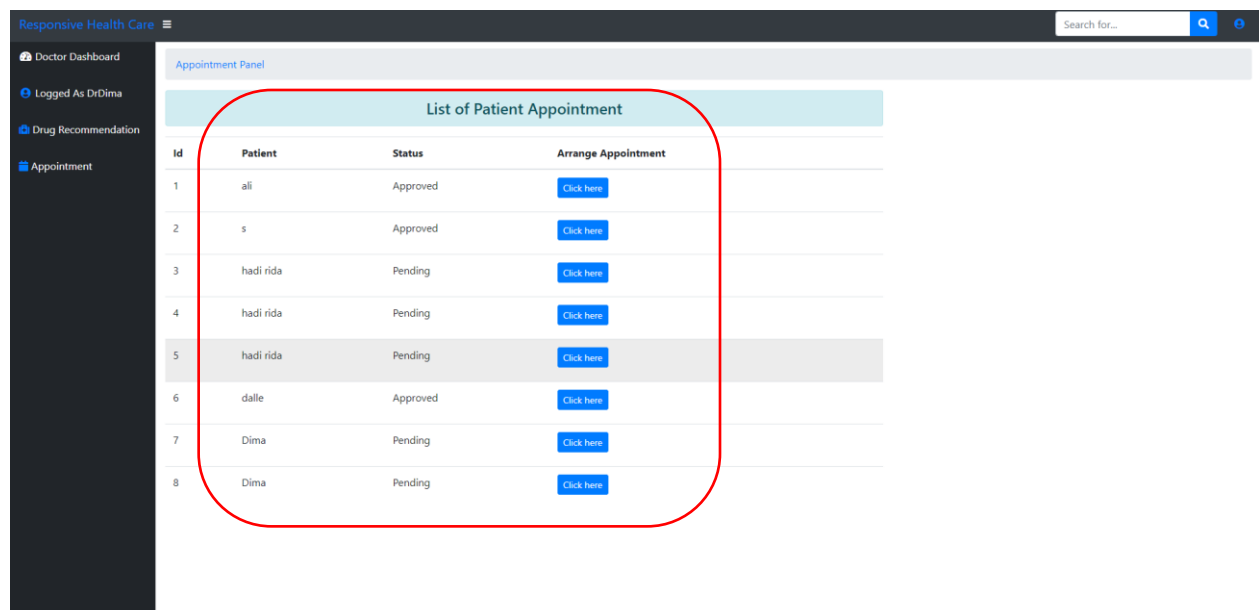


Figure 22 - Approved Appointment List

## Test Plans: Responsive Healthcare System Website

This section details the robust test plans designed for the responsive healthcare system website. It outlines key testing features, criteria, approaches, and resources that are necessary to ensure the site's functionality and quality.

### Features to be Tested

#### Core Functionality:

- User registration and login
- Appointment scheduling and management
- Patient profile management
- Medical record access and management
- Secure messaging with healthcare providers
- Online bill payment
- Prescription refill requests

#### Responsiveness:

- Cross-device adaptability (desktop, mobile, tablet)
- Optimal viewing across different resolutions and screen sizes
- Mobile-friendly interface compatibilities

#### Performance:

- Load speed and general responsiveness of the website
- Server performance during peak traffic
- Efficiency of database queries

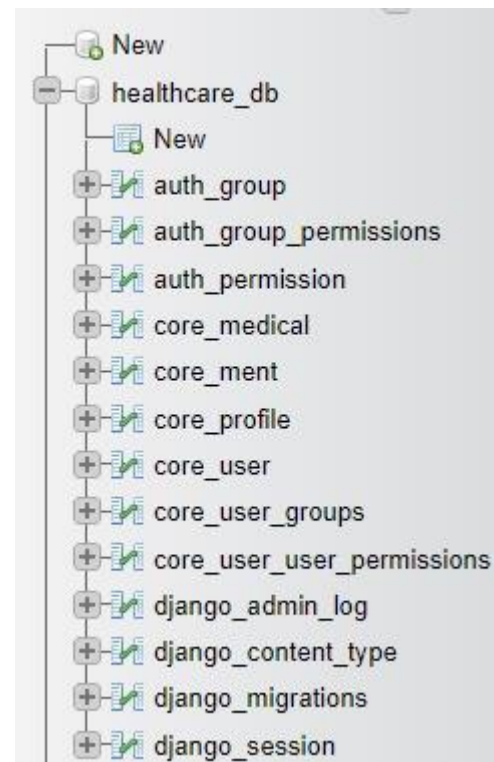


Figure 23 - Database Tables included

### Security:

- Security of sensitive patient data
- Implementation of robust authentication and authorization protocols
- Data encryption during transfer and at rest
- Comprehensive vulnerability assessments and penetration testing

## Password Encryption

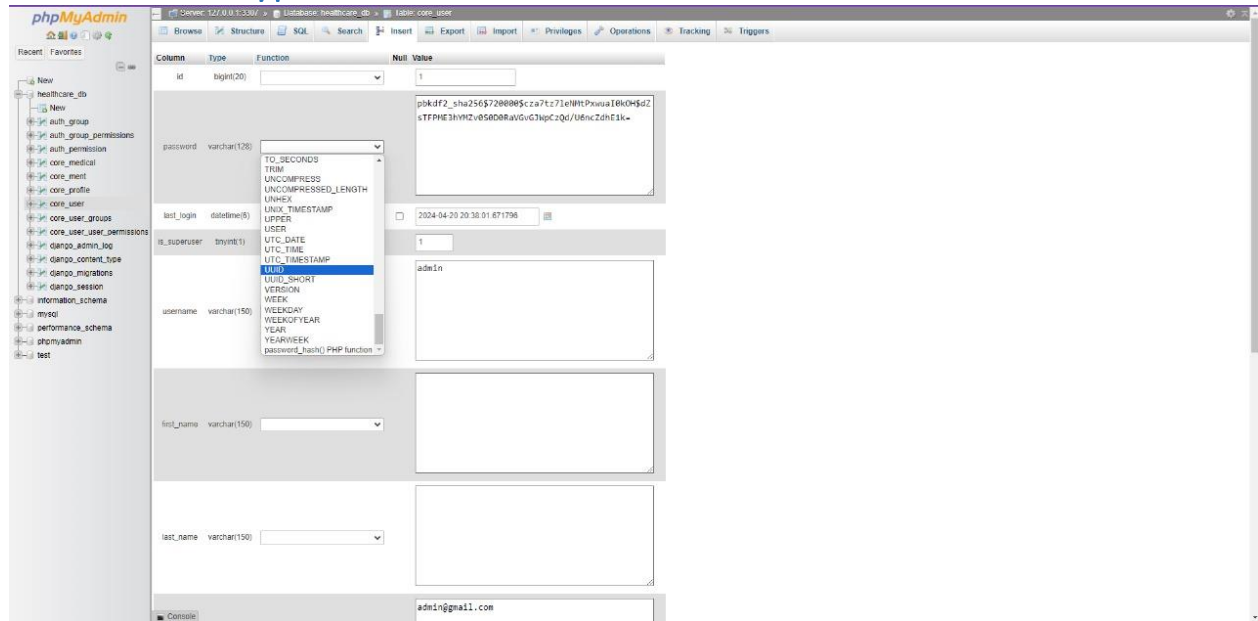


Figure 24 - Encryption of Password

In our project, we used PHP's **password\_hash()** function to securely encrypt passwords before storing them in your database.

This function automatically generates a salt and incorporates it into the hashed password, making it more secure. To verify passwords, you can use the **password\_verify()** function, which compares a given password with its hashed version.

**Hashing:** Hashing is a process of converting input data (in this case, the password) into a fixed-length string of characters, which is typically a hash value. Hashing is a one-way process, meaning you cannot reverse the hashed value back to the original input.

**Salt:** To make the hashing process more secure, a random salt is generated and added to the password before hashing. A salt is a random value added to the input data before hashing to ensure that even if two users have the same password, their hashed passwords will be different.

**Password Hashing in PHP:** The **password\_hash()** function in PHP takes the password as input and returns a hashed password. It automatically generates a salt and incorporates it into the hashed password. Here's an example of how to use it:

```
$password = "user_password";

$hashed_password = password_hash($password, PASSWORD_DEFAULT);
```

1. In this example, **PASSWORD\_DEFAULT** is a constant that specifies the default hashing algorithm to use. It is recommended to use **PASSWORD\_DEFAULT** as it automatically selects the best algorithm available.
2. **Verifying Passwords:** To verify a password, you use the **password\_verify()** function, which compares a given password with its hashed version. Here's an example:

```
$password = "user_password";  
$hashed_password = password_hash($password, PASSWORD_DEFAULT);  
  
// Assume $stored_hashed_password is the hashed password stored in the database  
if (password_verify($password, $stored_hashed_password)) {  
    // Password is correct  
} else {  
    // Password is incorrect  
}
```

This function returns **true** if the password matches the hashed password, and **false** otherwise.

By using **password\_hash()** and **password\_verify()** in your project, we can securely hash and verify passwords, protecting them from being exposed in case of a data breach.

## Features Not to be Tested (Out of Scope)

- **Third-party Integrations:** Only the primary data interfacing and functionality within the integration will be tested.
- **Advanced Accessibility Features:** Basic accessibility will be addressed while more complex compliance may be deferred.

## Pass/Fail Criteria

- **Functionality:** All features must function correctly and efficiently without malfunction or unexpected behavior.
- **Responsiveness:** Seamless adaptation to various devices and screen sizes must be maintained.
- **Performance:** Meeting pre-defined performance metrics under expected loads.
- **Security:** Strong defense against unauthorized access and potential security vulnerabilities.
- **Usability:** Ease of use for users with varied technical proficiency.

## Approach

### Testing Methodologies:

- **Black-box Testing:** Focus on user experience and functionality without internal workings.
- **White-box Testing:** Deep dive into internal code for functionality checks and issue identification.
- **Integration Testing:** Ensure efficient interaction between various system components.
- **Performance Testing:** Assess the website's operation under different load conditions.
- **Security Testing:** Detect and mitigate security threats through advanced testing techniques.

### Testing Levels:

- **Unit Testing:** Test individual components in isolation.
- **Integration Testing:** Test the interoperability of components.
- **System Testing:** Evaluate the complete system's performance.
- **Acceptance Testing:** Conduct user testing to validate the functional and business requirements.



## Suspension and Resumption

Potential Suspension Causes:

- **Critical Bugs:** Interruption due to critical functional faults.
- **Environment Instabilities:** Interruption due to hardware or software environment issues.
- **Resource Unavailability:** Interruption due to unavailable necessary personnel or tools.

Resume testing after issues are resolved and the environment is stable.

## Testing Materials

- **Hardware:** Variety of computing devices and mobile platforms with various display resolutions.
- **Software:** Multiple browsers and versions, automation frameworks, and tools for security and performance evaluations.

## Test Cases

Create detailed test scenarios for each functionality, covering both expected and extreme conditions. Prioritize test cases based on criticality and risk.

## Testing Schedule

Organize a detailed timeline for each phase of testing, include buffer periods for unexpected delays, maintain flexibility to accommodate changes.

## Reporting

Document and communicate test outcomes regularly. Prepare comprehensive reports for stakeholders detailing testing status, outcomes, and action items.

This structured testing plan is designed to ensure that the responsive healthcare system website is reliable, efficient, and secure. Applying this thorough testing strategy will help meet both the functional and quality expectations of the healthcare providers and their patients.

## Implementation

Our platform is a website built with web development tools such as HTML for structure, CSS for design, and JavaScript for creating a more interactive website. In addition, the implementation of a smart diagnoses system was incorporated with a dataset of thousands of known diseases using Python programming language. The combination of HTML, CSS, and JavaScript was used due to its simplicity and popularity in web development. The versatility of HTML was also helpful for creating the forms required to create profiles for our users. This project focuses mainly on developing a responsive e-health system framework to provide a fundamental common model that can be used by many specialized e-health applications in the future. On the one hand, the best development platform and cloud were selected.

The E-health Web Application will be created by integrating several technologies, including HTML5, CSS, and JavaScript.. The web visual style on the device is controlled by one of these technologies, CSS. In order to create a practical style transformation method, we should understand the corresponding CSS method that is already in use. We work to make sure the style can be automatically changed and applied in a way that is well-suited for various devices.

## Steps to Run the Project

The following steps outline the process of setting up and running the "Responsive Health Care System" project on your local machine:

- **Setup Environment:**

Install XAMPP web server, VS Code or Sublime Text editor, Python, and Anaconda on your machine.

- **Open Project:**

Download the project source code and open the folder in your preferred editor.

- **Start XAMPP:**

Start the Apache and MySQL services in your XAMPP control panel to enable local hosting.

- **Database Setup:**

Create a new database named 'healthcare\_db' in phpMyAdmin and import the provided SQL file to populate the database with necessary tables and data.

- **Machine Learning Model Setup:**

Create "ML Disease Prediction - Smart Doctor" and "Drug Recommendation" to create trained model.

Place the model folder inside the 'healthcare' folder. The path should be "Responisve Health Care System\healthcare\model".

- **Run Django Server:**

Open a terminal window, navigate to the project directory, and run the command: **python manage.py runserver**.

- **Troubleshooting:**

Ensure correct directory paths while executing the machine learning models to avoid any issues.

*By following these steps, you can successfully run the "Responsive Health Care System" project on your local machine for testing and development purposes.*

## Results Evaluation

This section provides a comprehensive evaluation of the testing results for the responsive healthcare system website. It highlights outcomes across key metrics to assess general quality, functionality, and user experience.

### Evaluation Process

The evaluation consisted of a systematic examination of the following components:

- **Test Case Execution Results:** Each test case was meticulously analyzed for performance adherence documenting and investigating deviations from expected outcomes.
- **Defect Reports:** A thorough analysis was conducted on all defects reported, prioritizing issues based on their severity and impact on overall system functionality for targeted resolutions.
- **Performance Metrics:** Key performance indicators, such as page load times, server response times, and resource utilization, were measured against predefined benchmarks to confirm optimal system performance.
- **Security Assessment Reports:** Comprehensive reviews of penetration tests and vulnerability scans were performed to identify and address potential security risks.
- **User Feedback:** Stakeholder and user feedback were collected through surveys, interviews, and usability tests to evaluate aspects like ease of use, intuitiveness, and general satisfaction.

### Key Findings

- **Functionality:** Most test cases demonstrated successful execution, verifying that critical features of the website function as intended. Minor defects identified are logged for further analysis and resolution.
- **Responsiveness:** The website exhibited flawless responsiveness across different devices and screen sizes, delivering a consistent and optimal viewing experience from desktops to mobile phones.
- **Performance:** Performance metrics generally met or surpassed benchmarks. Even under peak load conditions, the website maintained efficient load times and responsiveness, underscoring the system's robust traffic management capabilities.
- **Security:** The evaluation revealed several low-risk vulnerabilities, which were promptly addressed. The website upholds stringent security measures protecting against prevalent threats and complies with relevant data protection laws, ensuring user data integrity and confidentiality.
- **Usability:** Feedback indicated that the website is intuitive and user-friendly, characterized by a consistent layout, clear instructions, and accessible features.

## Overall Assessment

The responsive healthcare system website aligns well with predetermined quality and functional criteria. The extensive testing regimen effectively pinpointed and mitigated issues, culminating in a platform that is reliable, secure, and accommodating to users.

## Recommendations

- **Continuous Monitoring and Testing:** It is advised to maintain ongoing surveillance of the website's performance and security to promptly detect and rectify emerging issues.
- **Regular User Feedback Collection:** To continually refine user experience and address any usability concerns, regular collection of user feedback is recommended.
- **Technology Updates:** Staying current with the latest advancements in web development and security will help in maintaining a state-of-the-art, secure user platform.
- **Enhanced Accessibility:** Further enhancements in accessibility should be considered to accommodate users with varying abilities, adhering to the latest accessibility standards.

The testing process has validated the functionality, quality, and user-friendliness of the responsive healthcare system website. Ongoing commitment to the implementation of the recommended strategies will ensure the platform's enduring effectiveness and relevance in meeting the diverse needs of the healthcare community.

## Conclusion

In conclusion, the development of a responsive healthcare system has the potential to revolutionize the way healthcare services are delivered. By leveraging technologies such as e-health, telemedicine, and artificial intelligence, healthcare systems can become more accessible, efficient, and patient-centered.

E-health services, including telemedicine, enable remote access to healthcare professionals, allowing individuals to receive medical advice, consultations, and even treatment from the comfort of their homes. This is particularly beneficial for individuals with chronic illnesses or those residing in rural or underserved areas, as it reduces barriers to access and improves the overall quality of care.

Artificial intelligence plays a crucial role in enhancing diagnosis and treatment processes. Machine learning algorithms can analyze vast amounts of medical data, assisting healthcare professionals in making accurate and timely diagnoses, predicting disease outcomes, and developing personalized treatment plans. This not only improves patient outcomes but also optimizes resource allocation and reduces healthcare costs.

A responsive healthcare system also promotes patient empowerment by providing individuals with tools and resources to actively participate in their own care. Mobile health applications, wearable devices, and remote monitoring technologies enable patients to track their health indicators, manage chronic conditions, and engage in preventive care.

However, the implementation of a responsive healthcare system also poses challenges. Privacy and security concerns must be addressed to ensure the confidentiality and integrity of patient data. Regulatory frameworks and interoperability standards need to be established to facilitate seamless data exchange between different healthcare providers and systems. Additionally, the digital divide and technological literacy disparities must be addressed to ensure equitable access to healthcare services for all populations.

Overall, a responsive healthcare system that integrates e-health, telemedicine, and artificial intelligence has the potential to enhance access to care, improve patient outcomes, and optimize healthcare delivery. By harnessing the power of technology and prioritizing patient-centered care, healthcare systems can adapt to the evolving needs of individuals and communities, ultimately leading to a more efficient and effective healthcare ecosystem.

## Summary

In summary, the development of a responsive healthcare system has the potential to transform the delivery of healthcare services. By leveraging technologies such as e-health, telemedicine, and artificial intelligence, healthcare systems can become more accessible, efficient, and patient-centered.

E-health services, including telemedicine, enable individuals to access healthcare remotely, facilitating medical advice, consultations, and treatment from their homes. This is particularly beneficial for those with chronic illnesses or living in underserved areas, improving access to quality care.

Artificial intelligence plays a crucial role in enhancing diagnosis and treatment processes. Machine learning algorithms can analyze vast amounts of medical data, assisting healthcare professionals in making accurate diagnoses, predicting outcomes, and developing personalized treatment plans. This improves patient outcomes, optimizes resource allocation, and reduces costs.

A responsive healthcare system also empowers patients through tools like mobile health apps, wearable devices, and remote monitoring technologies. These allow individuals to track their health, manage chronic conditions, and engage in preventive care.

However, challenges such as privacy, security, interoperability, and equitable access need to be addressed. Privacy and security concerns must be managed to protect patient data. Interoperability standards are necessary for seamless data exchange between healthcare providers. Bridging the digital divide and promoting technological literacy are essential for equitable access to healthcare services.

Overall, a responsive healthcare system integrating e-health, telemedicine, and artificial intelligence can enhance access, improve outcomes, and optimize healthcare delivery. By prioritizing patient-centered care and leveraging technology, healthcare systems can adapt to evolving needs and create a more efficient and effective healthcare ecosystem.

## Novelty

The responsive healthcare system presented in this project offers several novel features and advancements that contribute to its effectiveness and patient-centered approach. These include:

**Integration of Predictive Analytics:** The system leverages predictive analytics to provide accurate predictions about diseases or health conditions. By analyzing large volumes of medical data and applying machine learning algorithms, the system can offer valuable insights into potential health issues, aiding in early detection and proactive healthcare management.



## Future Work:

While the responsive healthcare system presented in this project incorporates several innovative features, there is still room for future enhancements and expansions. Some potential areas of future work include:

### 1. **Medication Alternatives:**

Expanding the system to suggest medication alternatives that align with non-generic preferences and considerations. This feature would provide patients with a range of options while taking into account individual preferences, allergies, and potential drug interactions. We will provide a cut off for medications that support genocide, providing alternative drug.

### 2. **Promotion of Healthy Lifestyles:**

In addition to disease prediction and treatment suggestions, the system can offer personalized recommendations for healthy lifestyles. This can include guidance on nutrition, exercise, stress management, and other lifestyle factors that contribute to overall well-being.

### 3. **Current Location Tracking for Autonomous Features:**

Incorporating current location tracking capabilities can enable autonomous features in the system. By connecting to a user's smartphone and reading vital signs, the system can identify emergencies and initiate automatic actions, such as calling an ambulance or alerting emergency contacts.

### 4. **Display Accuracy of Prediction for Patients:**

Continuously improving and displaying the accuracy of predictions can provide patients with valuable information about the reliability of the system's insights. This transparency helps patients make informed decisions and fosters trust in the system.

### 5. **Regional Considerations in Prediction:**

Building upon the system's regional considerations, further work can be done to incorporate additional regional health data and tailor predictions based on specific geographical factors. This can enhance the accuracy and relevance of predictions for patients in different regions.

### 6. **Display Information about Predicted Disease:**

Expanding the system's capabilities to display comprehensive information about predicted diseases or conditions would empower patients with knowledge about symptoms, treatment options, potential complications, and preventive measures. This information promotes patient education and engagement in their healthcare journey.

### **7. Privacy and Sensitivity:**

Implementing mechanisms to hide predictions in case of sensitivity or emotional distress is crucial to secure patient privacy and emotional well-being. The system should provide options for patients to control the visibility of certain predictions or sensitive information.

### **8. Nearby Hospitals:**

Enhancing the system with an integrated database of nearby hospitals, their specialties, and emergency services can facilitate prompt access to appropriate healthcare facilities. This feature would help users easily locate and navigate to the nearest hospitals.

### **9. Physicians Recommendation According to Ratings:**

Incorporating physician ratings and reviews into the system can assist patients in selecting healthcare providers. This feature provides transparency and helps patients make informed decisions about their choice of physicians.

### **10. Speech Input:**

Expanding the system's capabilities to support speech input would enhance accessibility for individuals with limited mobility or visual impairments. This feature enables users to interact with the system using voice commands, making it more inclusive and user-friendly.

### **11. Website for Critical Needs and Disabilities:**

Creating a dedicated website or section within the system specifically designed to support individuals with critical needs and disabilities would provide tailored assistance and resources. This can include accessibility options, emergency contacts, and specialized support services to ensure equitable access to healthcare.

### **12. Customized Health Plans and Lifestyle Suggestions:**

Expanding the system to provide personalized health plans, including meal suggestions and recommendations for healthy lifestyles, empowers individuals to make positive changes. This feature promotes preventive care and supports long-term well-being.

### **13. Daily Motivation and Psychological Assistance:**

Integrating features such as daily motivational messages and access to psychological assistance can contribute to holistic healthcare. By addressing mental health and providing emotional support, the system promotes overall well-being and resilience.

#### **14. Multilingual Support:**

The system goes beyond language barriers by offering a multilingual website. This feature enables individuals from diverse linguistic backgrounds to access and benefit from the healthcare services provided, promoting inclusivity and accessibility.

#### **15. Enhanced Personalization:**

Future work can aim to make the system even more personalized by considering individual patient characteristics, such as genetic information, lifestyle factors, and medical history. By tailoring recommendations based on specific patient attributes, the system can provide more precise and effective healthcare guidance.

#### **16. Advanced Decision Support:**

Expanding the decision support capabilities of the system can empower healthcare providers by offering comprehensive information about predicted diseases, including treatment options, potential complications, and evidence-based guidelines. This can assist in clinical decision-making and improve patient outcomes.

#### **17. Integration with Internet of Things (IoT):**

Future work can explore the integration of IoT devices, such as wearable health trackers and smart home technologies, into the healthcare system. This would enable real-time monitoring of patients' health indicators, facilitating preventive care, and early intervention.

#### **18. Expansion of Support Services:**

In addition to the existing features, future work can include the integration of additional support services, such as psychological assistance, daily motivation, and access to support groups. This holistic approach would address the mental and emotional well-being of patients, promoting overall health and quality of life.

#### **19. Collaboration with Healthcare Providers:**

Further collaboration with healthcare providers, researchers, and regulatory bodies can contribute to the system's improvement and adoption. This can involve gathering feedback, conducting user studies, and ensuring compliance with healthcare standards and regulations.

By pursuing these avenues of future work, the responsive healthcare system can continue to evolve and adapt to the changing needs of patients and healthcare providers, ultimately improving the delivery and outcomes of healthcare services.

## Integrity and Values:

Integrity and values play a crucial role in the development and implementation of a responsive healthcare system. They serve as guiding principles to ensure ethical conduct, patient-centered care, and the overall well-being of individuals. Here are some key aspects related to integrity and values in a healthcare system:

- **Patient-Centered Approach:**

A responsive healthcare system should prioritize the well-being and interests of patients above all. It should be designed to provide personalized care, respect patient autonomy, and empower individuals to make informed decisions about their health. Upholding the values of empathy, compassion, and dignity ensures that patients are at the center of healthcare delivery.

- **Privacy and Confidentiality:**

Maintaining the privacy and confidentiality of patient data is of utmost importance. A trustworthy healthcare system is built on a foundation of strong privacy and security measures, ensuring that sensitive medical information is protected from unauthorized access, breaches, or misuse. Respecting patient privacy builds trust and fosters a safe environment for individuals to seek healthcare services.

- **Evidence-Based Medicine:**

The integrity of a healthcare system lies in its commitment to evidence-based medicine. It should rely on the best available scientific research, clinical guidelines, and validated data to inform decision-making and provide accurate and effective healthcare recommendations. Adhering to evidence-based practices ensures that patients receive high-quality care based on sound scientific principles.

- **Transparency and Accountability:**

A responsive healthcare system should operate with transparency and accountability. This includes clear communication with patients about the system's functionalities, limitations, and potential risks. Additionally, healthcare providers and system developers should be accountable for their actions and decisions, fostering a culture of responsibility and trust.

- **Equity and Accessibility:**

Upholding the values of equity and accessibility is essential in a responsive healthcare system. It should strive to eliminate healthcare disparities and ensure that all individuals, regardless of their socio-economic status, geographic location, or personal circumstances, have equal access to quality healthcare services. Addressing barriers to access and promoting inclusivity are fundamental to upholding these values.

- **Continuous Improvement:**

A responsive healthcare system should continually seek to improve and adapt to the evolving needs of patients and healthcare providers. This involves gathering feedback, conducting research, and embracing innovation to enhance the system's performance, accuracy, and user experience. A commitment to continuous improvement demonstrates a dedication to providing the best possible care.

- **Ethical Considerations:**

Ethical principles, such as respect for autonomy, beneficence, non-maleficence, and justice, should guide the development and operation of a responsive healthcare system. Ethical decision-making frameworks should be employed to navigate complex situations and ensure that the system's actions align with ethical standards and societal values.

By upholding integrity and values, a responsive healthcare system can inspire trust, promote patient well-being, and contribute to the overall improvement of healthcare delivery. These principles serve as a compass to guide the system's development, implementation, and ongoing enhancements, ultimately benefiting individuals and society as a whole.

## Bibliography

### Web Development and Technologies:

- **MDN Web Docs:** A comprehensive resource for web development technologies, including HTML, CSS, JavaScript, and web APIs. (<https://developer.mozilla.org/>)
- **W3Schools Online Web Tutorials:** Tutorials and references covering various web development topics. (<https://www.w3schools.com/>)
- **Responsive Web Design (RWD) Frameworks:** Resources for popular responsive design frameworks like Bootstrap, Foundation, and Materialize.

### Testing Methodologies and Tools:

- **ISTQB - International Software Testing Qualifications Board:** Provides information on software testing certifications and best practices. (<https://www.istqb.org/>)
- **Selenium WebDriver:** A popular open-source framework for web application testing. (<https://www.selenium.dev/>)
- **JMeter:** An open-source tool for performance testing and load testing web applications. (<https://jmeter.apache.org/>)
- **OWASP - Open Web Application Security Project:** Resources and tools for web application security testing. (<https://owasp.org/>)

### Healthcare Technology and Standards:

- **HIPAA - Health Insurance Portability and Accountability Act:** Regulations related to the privacy and security of protected health information (PHI). (<https://www.hhs.gov/hipaa/>)
- **HL7 - Health Level Seven International:** Standards for the exchange, integration, sharing, and retrieval of electronic health information. (<https://www.hl7.org/>)
- **FHIR - Fast Healthcare Interoperability Resources:** A standard for exchanging healthcare information electronically. (<https://www.hl7.org/fhir/>)

### Additional Resources:

- **Academic journals and publications** related to healthcare technology, software engineering, and human-computer interaction.
- **Industry reports and white papers** on trends in healthcare technology and digital transformation.
- **Books and online courses** on web development, software testing, and healthcare informatics.

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## Appendix

### Glossary | Naming Conventions and Definitions

1. **Responsive Healthcare System:** A healthcare management system designed to enhance patient care and streamline administrative processes through a user-friendly and adaptable interface that can be accessed on various devices.
2. **HTML5:** HyperText Markup Language version 5, the latest iteration of the standard markup language for creating web pages and applications.
3. **CSS3:** Cascading Style Sheets version 3, the latest standard for styling web pages, allowing for greater control over the appearance and layout of content.
4. **JavaScript:** A programming language commonly used to create interactive effects within web browsers, enhancing user experience and functionality.
5. **Bootstrap:** A front-end framework for developing responsive and mobile-first websites, providing pre-designed templates and components to expedite development.
6. **Django:** A high-level Python web framework that encourages rapid development and clean, pragmatic design, favored for its scalability and security features.
7. **MySQL:** An open-source relational database management system (RDBMS) that uses Structured Query Language (SQL) for managing and manipulating data.
8. **Password Hashing:** The process of converting a password into a cryptographic hash, ensuring the security of passwords by making them difficult to reverse-engineer.
9. **PHP:** Hypertext Preprocessor, a server-side scripting language widely used for web development to create dynamic web pages and applications.
10. **XAMPP:** Cross-Platform (X), Apache (A), MySQL (M), PHP (P), and Perl (P), a free and open-source cross-platform web server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTP Server, MariaDB database, and interpreters for scripts written in PHP and Perl.
11. **VS Code:** Visual Studio Code, a source-code editor developed by Microsoft for Windows, Linux, and macOS, offering built-in support for JavaScript, TypeScript, and Node.js.
12. **Sublime Text:** A proprietary cross-platform source code editor with a Python application programming interface (API), enabling customization and extension.
13. **Machine Learning:** A subset of artificial intelligence (AI) that utilizes statistical techniques to enable computer systems to learn and improve from experience without being explicitly programmed.
14. **Disease Prediction:** The process of using historical data and machine learning algorithms to predict the likelihood of an individual developing a particular disease.



- 15. Drug Recommendation:** The process of using machine learning algorithms to suggest appropriate medications based on a patient's medical history and condition.
- 16. Responsive Interface:** A user interface that adjusts dynamically to various screen sizes and orientations, ensuring optimal user experience across devices.
- 17. Healthcare Management:** The organization and coordination of medical services to ensure the efficient delivery of healthcare to individuals and communities.
- 18. Appointments:** Scheduled meetings between patients and healthcare providers for medical consultations, examinations, or treatments.
- 19. Records:** Documentation of a patient's medical history, including diagnoses, treatments, medications, and outcomes, maintained for reference and continuity of care.
- 20. Diagnosis:** The identification of a disease or condition based on symptoms, medical history, and diagnostic tests.
- 21. Providers:** Healthcare professionals or organizations that deliver medical services, such as doctors, nurses, clinics, and hospitals.
- 22. Patients:** Individuals seeking medical care or treatment from healthcare providers for illness, injury, or preventive services.
- 23. User Interface (UI):** The visual elements and layout of a software application that users interact with, including buttons, menus, and forms.
- 24. User Experience (UX):** The overall experience of a user when interacting with a product, including ease of use, efficiency, and satisfaction.
- 25. Front-end:** The part of a software application that users interact with directly, often referred to as the client-side, including the user interface and user experience.
- 26. Back-end:** The part of a software application that is not directly accessed by users, often referred to as the server-side, including the database and server logic.
- 27. CRUD Operations:** Create, Read, Update, Delete operations, referring to the basic functions of a persistent storage system, such as a database, in a software application.
- 28. API (Application Programming Interface):** A set of rules and protocols for building and interacting with software applications, allowing different software systems to communicate with each other.
- 29. Authentication:** The process of verifying the identity of a user, often requiring a username and password, to access a secure system or application.
- 30. Authorization:** The process of granting or denying access to resources or services based on the authenticated user's permissions.

- 31. Dashboard:** A visual display of data and information, often in the form of charts, graphs, and widgets, providing an overview of key metrics and performance indicators.
- 32. Data Visualization:** The representation of data in a visual format, such as charts, graphs, and maps, to facilitate understanding and analysis.
- 33. Scalability:** The ability of a software application to handle increasing amounts of work or its potential to accommodate growth without sacrificing performance.
- 34. Security:** Measures taken to protect a software application from unauthorized access, data breaches, and other potential threats.
- 35. HIPAA (Health Insurance Portability and Accountability Act):** A US legislation that establishes national standards for the protection of health information, ensuring its confidentiality, integrity, and availability.
- 36. Telemedicine:** The use of telecommunications technology to provide remote healthcare services, including consultations, monitoring, and education.
- 37. Electronic Health Record (EHR):** A digital version of a patient's paper chart, containing the patient's medical history, diagnoses, medications, treatment plans, immunization dates, allergies, radiology images, and laboratory test results.
- 38. Patient Portal:** A secure online website that gives patients convenient 24-hour access to personal health information from anywhere with an internet connection.

## Code and links

Scan the following QR code to get to the GitHub repository that contains:

- Source code
- Instructions for running the website
- Report in PDF format
- Demo video
- Animated PowerPoint presentation with voice-over



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Last updated April 22, 2024

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Your Contributions are not unsolicited or unauthorized advertising, promotional materials, pyramid schemes, chain letters, spam, mass mailings, or other forms of solicitation.

Your Contributions are not obscene, lewd, lascivious, filthy, violent, harassing, libelous, slanderous, or otherwise objectionable (as determined by us).

Your Contributions do not ridicule, mock, disparage, intimidate, or abuse anyone.

Your Contributions are not used to harass or threaten (in the legal sense of those terms) any other person and to promote violence against a specific person or class of people.

Your Contributions do not violate any applicable law, regulation, or rule.

Your Contributions do not violate the privacy or publicity rights of any third party.

Your Contributions do not violate any applicable law concerning child pornography, or otherwise intended to protect the health or well-being of minors.

Your Contributions do not include any offensive comments that are connected to race, national origin, gender, sexual preference, or physical handicap.

Your Contributions do not otherwise violate, or link to material that violates, any provision of these Legal Terms, or any applicable law or regulation.

Any use of the Services in violation of the foregoing violates these Legal Terms and may result in, among other things, termination or suspension of your rights to use the Services.

## 7. CONTRIBUTION LICENSE

By posting your Contributions to any part of the Services or making Contributions accessible to the Services by linking your account from the Services to any of your social networking accounts, you automatically grant, and you represent and warrant that you have the right to grant, to us an unrestricted, unlimited, irrevocable, perpetual, non-exclusive, transferable, royalty-free, fully-paid, worldwide right, and license to host, use, copy, reproduce, disclose, sell, resell, publish, broadcast, retitle, archive, store, cache, publicly perform, publicly display, reformat, translate, transmit, excerpt (in whole or in part), and distribute such Contributions (including, without limitation, your image and voice) for any purpose, commercial, advertising, or otherwise, and to prepare derivative works of, or incorporate into other works, such Contributions, and grant and authorize sublicenses of the foregoing. The use and distribution may occur in any media formats and through any media channels.

This license will apply to any form, media, or technology now known or hereafter developed, and includes our use of your name, company name, and franchise name, as applicable, and any of the trademarks, service marks, trade names, logos, and personal and commercial images you provide. You waive all moral rights in your Contributions, and you warrant that moral rights have not otherwise been asserted in your Contributions.

We do not assert any ownership over your Contributions. You retain full ownership of all of your Contributions and any intellectual property rights or other proprietary rights associated with your Contributions. We are not liable for any statements or representations in your Contributions provided by you in any area on the Services. You are solely responsible for your Contributions to the Services and you expressly agree to exonerate us from any and all responsibility and to refrain from any legal action against us regarding your Contributions.

We have the right, in our sole and absolute discretion, (1) to edit, redact, or otherwise change any Contributions; (2) to re-categorize any Contributions to place them in more appropriate locations on the Services; and (3) to pre-screen or delete any Contributions at any time and for any reason, without notice. We have no obligation to monitor your Contributions.

## 8. GUIDELINES FOR REVIEWS

We may provide you areas on the Services to leave reviews or ratings. When posting a review, you must comply with the following criteria: (1) you should have firsthand experience with the person/entity being reviewed; (2) your reviews should not contain offensive profanity, or abusive, racist, offensive, or hateful language; (3) your reviews should not contain discriminatory references based on religion, race, gender, national origin, age, marital status, sexual orientation, or disability; (4) your reviews should not contain references to illegal activity; (5) you should not be affiliated with competitors if posting negative reviews; (6) you should not make any conclusions as to the legality of conduct; (7) you may not post any false or misleading statements; and (8) you may not organize a campaign encouraging others to post reviews, whether positive or negative.

We may accept, reject, or remove reviews in our sole discretion. We have absolutely no obligation to screen reviews or to delete reviews, even if anyone considers reviews objectionable or inaccurate. Reviews are not endorsed by us, and do not necessarily represent our opinions or the views of any of our affiliates or partners. We do not assume liability for any review or for any claims, liabilities, or losses resulting from any review. By posting a review, you hereby grant to us a perpetual, non-exclusive, worldwide, royalty-free, fully paid, assignable, and sublicensable right and license to reproduce, modify, translate, transmit by any means, display, perform, and/or distribute all content relating to review.

## 9. SOCIAL MEDIA

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As part of the functionality of the Services, you may link your account with online accounts you have with third-party service providers (each such account, a "Third-Party Account") by either: (1) providing your Third-Party Account login information through the Services; or (2) allowing us to access your Third-Party Account, as is permitted under the applicable terms and conditions that govern your use of each Third-Party Account. You represent and warrant that



you are entitled to disclose your Third-Party Account login information to us and/or grant us access to your Third-Party Account, without breach by you of any of the terms and conditions that govern your use of the applicable Third-Party Account, and without obligating us to pay any fees or making us subject to any usage limitations imposed by the third-party service provider of the Third-Party Account. By granting us access to any Third-Party Accounts, you understand that (1) we may access, make available, and store (if applicable) any content that you have provided to and stored in your Third-Party Account (the "Social Network Content") so that it is available on and through the Services via your account, including without limitation any friend lists and (2) we may submit to and receive from your Third-Party Account additional information to the extent you are notified when you link your account with the Third-Party Account. Depending on the Third-Party Accounts you choose and subject to the privacy settings that you have set in such Third-Party Accounts, personally identifiable information that you post to your Third-Party Accounts may be available on and through your account on the Services. Please note that if a Third-Party Account or associated service becomes unavailable or our access to such Third-Party Account is terminated by the third-party service provider, then Social Network Content may no longer be available on and through the Services. You will have the ability to disable the connection between your account on the Services and your Third-Party Accounts at any time. PLEASE NOTE THAT YOUR RELATIONSHIP WITH THE THIRD-PARTY SERVICE PROVIDERS ASSOCIATED WITH YOUR THIRD-PARTY ACCOUNTS IS GOVERNED SOLELY BY YOUR AGREEMENT(S) WITH SUCH THIRD-PARTY SERVICE PROVIDERS. We make no effort to review any Social Network Content for any purpose, including but not limited to, for accuracy, legality, or non-infringement, and we are not responsible for any Social Network Content. You acknowledge and agree that we may access your email address book associated with a Third-Party Account and your contacts list stored on your mobile device or tablet computer solely for purposes of identifying and informing you of those contacts who have also registered to use the Services. You can deactivate the connection between the Services and your Third-Party Account by contacting us using the contact information below or through your account settings (if applicable). We will attempt to delete any information stored on our servers that was obtained through such Third-Party Account, except the username and profile picture that become associated with your account.

#### 10. SERVICES MANAGEMENT

We reserve the right, but not the obligation, to: (1) monitor the Services for violations of these Legal Terms; (2) take appropriate legal action against anyone who, in our sole discretion, violates the law or these Legal Terms, including without limitation, reporting such user to law enforcement authorities; (3) in our sole discretion and without limitation, refuse, restrict access to, limit the availability of, or disable (to the extent technologically feasible) any of your Contributions or any portion thereof; (4) in our sole discretion and without limitation, notice, or liability, to remove from the Services or otherwise disable all files and content that are excessive in size or are in any way burdensome to our systems; and (5) otherwise manage the Services in a manner designed to protect our rights and property and to facilitate the proper functioning of the Services.

#### 11. PRIVACY POLICY

We care about data privacy and security. Please review our Privacy Policy: <http://127.0.0.1:8000/privacy.html>. By using the Services, you agree to be bound by our Privacy Policy, which is incorporated into these Legal Terms. Please be advised the Services are hosted in Lebanon. If you access the Services from any other region of the world with laws or other requirements governing personal data collection, use, or disclosure that differ from applicable laws in Lebanon, then through your continued use of the Services, you are transferring your data to Lebanon, and you expressly consent to have your data transferred to and processed in Lebanon.

#### 12. TERM AND TERMINATION

These Legal Terms shall remain in full force and effect while you use the Services. WITHOUT LIMITING ANY OTHER PROVISION OF THESE LEGAL TERMS, WE RESERVE THE RIGHT TO, IN OUR SOLE DISCRETION AND WITHOUT NOTICE OR LIABILITY, DENY ACCESS TO AND USE OF THE SERVICES (INCLUDING BLOCKING CERTAIN IP ADDRESSES), TO ANY PERSON FOR ANY REASON OR FOR NO REASON, INCLUDING WITHOUT LIMITATION FOR BREACH OF ANY REPRESENTATION, WARRANTY, OR COVENANT CONTAINED IN THESE LEGAL TERMS OR OF ANY APPLICABLE LAW OR REGULATION. WE MAY TERMINATE YOUR USE OR PARTICIPATION IN THE SERVICES OR DELETE YOUR ACCOUNT AND ANY CONTENT OR INFORMATION THAT YOU POSTED AT ANY TIME, WITHOUT WARNING, IN OUR SOLE DISCRETION.

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If we terminate or suspend your account for any reason, you are prohibited from registering and creating a new account under your name, a fake or borrowed name, or the name of any third party, even if you may be acting on behalf of the third party. In addition to terminating or suspending your account, we reserve the right to take appropriate legal action, including without limitation pursuing civil, criminal, and injunctive redress.

### 13. MODIFICATIONS AND INTERRUPTIONS

We reserve the right to change, modify, or remove the contents of the Services at any time or for any reason at our sole discretion without notice. However, we have no obligation to update any information on our Services. We will not be liable to you or any third party for any modification, price change, suspension, or discontinuance of the Services.

We cannot guarantee the Services will be available at all times. We may experience hardware, software, or other problems or need to perform maintenance related to the Services, resulting in interruptions, delays, or errors. We reserve the right to change, revise, update, suspend, discontinue, or otherwise modify the Services at any time or for any reason without notice to you. You agree that we have no liability whatsoever for any loss, damage, or inconvenience caused by your inability to access or use the Services during any downtime or discontinuance of the Services. Nothing in these Legal Terms will be construed to obligate us to maintain and support the Services or to supply any corrections, updates, or releases in connection therewith.

### 14. GOVERNING LAW

These Legal Terms shall be governed by and defined following the laws of Lebanon. Responsive Health Care System and yourself irrevocably consent that the courts of Lebanon shall have exclusive jurisdiction to resolve any dispute which may arise in connection with these Legal Terms.

### 15. DISPUTE RESOLUTION

#### Informal Negotiations

To expedite resolution and control the cost of any dispute, controversy, or claim related to these Legal Terms (each a "Dispute" and collectively, the "Disputes") brought by either you or us (individually, a "Party" and collectively, the "Parties"), the Parties agree to first attempt to negotiate any Dispute (except those Disputes expressly provided below) informally for at least \_\_\_\_ days before initiating arbitration. Such informal negotiations commence upon written notice from one Party to the other Party.

#### Binding Arbitration

Any dispute arising out of or in connection with these Legal Terms, including any question regarding its existence, validity, or termination, shall be referred to and finally resolved by the International Commercial Arbitration Court under the European Arbitration Chamber (Belgium, Brussels, Avenue Louise, 146) according to the Rules of this ICAC, which, as a result of referring to it, is considered as the part of this clause. The number of arbitrators shall be \_\_\_\_\_. The seat, or legal place, or arbitration shall be \_\_\_\_\_. The language of the proceedings shall be \_\_\_\_\_. The governing law of these Legal Terms shall be substantive law of \_\_\_\_\_.

#### Restrictions

The Parties agree that any arbitration shall be limited to the Dispute between the Parties individually. To the full extent permitted by law, (a) no arbitration shall be joined with any other proceeding; (b) there is no right or authority for any Dispute to be arbitrated on a class-action basis or to utilize class action procedures; and (c) there is no right or authority for any Dispute to be brought in a purported representative capacity on behalf of the general public or any other persons.

#### Exceptions to Informal Negotiations and Arbitration

The Parties agree that the following Disputes are not subject to the above provisions concerning informal negotiations binding arbitration: (a) any Disputes seeking to enforce or protect, or concerning the validity of, any of the intellectual property rights of a Party; (b) any Dispute related to, or arising from, allegations of theft, piracy, invasion of privacy, or unauthorized use; and (c) any claim for injunctive relief. If this provision is found to be illegal or unenforceable, then neither Party will elect to arbitrate any Dispute falling within that portion of this provision found to be illegal or unenforceable and such Dispute shall be decided by a court of competent jurisdiction within the courts listed for jurisdiction above, and the Parties agree to submit to the personal jurisdiction of that court.

### 16. CORRECTIONS

There may be information on the Services that contains typographical errors, inaccuracies, or omissions, including descriptions, pricing, availability, and various other information. We reserve the right to correct any errors, inaccuracies, or omissions and to change or update the information on the Services at any time, without prior notice.

#### 17. DISCLAIMER

THE SERVICES ARE PROVIDED ON AN AS-IS AND AS-AVAILABLE BASIS. YOU AGREE THAT YOUR USE OF THE SERVICES WILL BE AT YOUR SOLE RISK. TO THE FULLEST EXTENT PERMITTED BY LAW, WE DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, IN CONNECTION WITH THE SERVICES AND YOUR USE THEREOF, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT. WE MAKE NO WARRANTIES OR REPRESENTATIONS ABOUT THE ACCURACY OR COMPLETENESS OF THE SERVICES' CONTENT OR THE CONTENT OF ANY WEBSITES OR MOBILE APPLICATIONS LINKED TO THE SERVICES AND WE WILL ASSUME NO LIABILITY OR RESPONSIBILITY FOR ANY (1) ERRORS, MISTAKES, OR INACCURACIES OF CONTENT AND MATERIALS, (2) PERSONAL INJURY OR PROPERTY DAMAGE, OF ANY NATURE WHATSOEVER, RESULTING FROM YOUR ACCESS TO AND USE OF THE SERVICES, (3) ANY UNAUTHORIZED ACCESS TO OR USE OF OUR SECURE SERVERS AND/OR ANY AND ALL PERSONAL INFORMATION AND/OR FINANCIAL INFORMATION STORED THEREIN, (4) ANY INTERRUPTION OR CESSATION OF TRANSMISSION TO OR FROM THE SERVICES, (5) ANY BUGS, VIRUSES, TROJAN HORSES, OR THE LIKE WHICH MAY BE TRANSMITTED TO OR THROUGH THE SERVICES BY ANY THIRD PARTY, AND/OR (6) ANY ERRORS OR OMISSIONS IN ANY CONTENT AND MATERIALS OR FOR ANY LOSS OR DAMAGE OF ANY KIND INCURRED AS A RESULT OF THE USE OF ANY CONTENT POSTED, TRANSMITTED, OR OTHERWISE MADE AVAILABLE VIA THE SERVICES. WE DO NOT WARRANT, ENDORSE, GUARANTEE, OR ASSUME RESPONSIBILITY FOR ANY PRODUCT OR SERVICE ADVERTISED OR OFFERED BY A THIRD PARTY THROUGH THE SERVICES, ANY HYPERLINKED WEBSITE, OR ANY WEBSITE OR MOBILE APPLICATION FEATURED IN ANY BANNER OR OTHER ADVERTISING, AND WE WILL NOT BE A PARTY TO OR IN ANY WAY BE RESPONSIBLE FOR MONITORING ANY TRANSACTION BETWEEN YOU AND ANY THIRD-PARTY PROVIDERS OF PRODUCTS OR SERVICES. AS WITH THE PURCHASE OF A PRODUCT OR SERVICE THROUGH ANY MEDIUM OR IN ANY ENVIRONMENT, YOU SHOULD USE YOUR BEST JUDGMENT AND EXERCISE CAUTION WHERE APPROPRIATE.

#### 18. LIMITATIONS OF LIABILITY

IN NO EVENT WILL WE OR OUR DIRECTORS, EMPLOYEES, OR AGENTS BE LIABLE TO YOU OR ANY THIRD PARTY FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, EXEMPLARY, INCIDENTAL, SPECIAL, OR PUNITIVE DAMAGES, INCLUDING LOST PROFIT, LOST REVENUE, LOSS OF DATA, OR OTHER DAMAGES ARISING FROM YOUR USE OF THE SERVICES, EVEN IF WE HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. NOTWITHSTANDING ANYTHING TO THE CONTRARY CONTAINED HEREIN, OUR LIABILITY TO YOU FOR ANY CAUSE WHATSOEVER AND REGARDLESS OF THE FORM OF THE ACTION, WILL AT ALL TIMES BE LIMITED TO THE LESSER OF THE AMOUNT PAID, IF ANY, BY YOU TO US OR . CERTAIN US STATE LAWS AND INTERNATIONAL LAWS DO NOT ALLOW LIMITATIONS ON IMPLIED WARRANTIES OR THE EXCLUSION OR LIMITATION OF CERTAIN DAMAGES. IF THESE LAWS APPLY TO YOU, SOME OR ALL OF THE ABOVE DISCLAIMERS OR LIMITATIONS MAY NOT APPLY TO YOU, AND YOU MAY HAVE ADDITIONAL RIGHTS.

#### 19. INDEMNIFICATION

You agree to defend, indemnify, and hold us harmless, including our subsidiaries, affiliates, and all of our respective officers, agents, partners, and employees, from and against any loss, damage, liability, claim, or demand, including reasonable attorneys' fees and expenses, made by any third party due to or arising out of: (1) your Contributions; (2) use of the Services; (3) breach of these Legal Terms; (4) any breach of your representations and warranties set forth in these Legal Terms; (5) your violation of the rights of a third party, including but not limited to intellectual property rights; or (6) any overt harmful act toward any other user of the Services with whom you connected via the Services. Notwithstanding the foregoing, we reserve the right, at your expense, to assume the exclusive defense and control of any matter for which you are required to indemnify us, and you agree to cooperate, at your expense, with our defense of such claims. We will use reasonable efforts to notify you of any such claim, action, or proceeding which is subject to this indemnification upon becoming aware of it.

#### 20. USER DATA

We will maintain certain data that you transmit to the Services for the purpose of managing the performance of the Services, as well as data relating to your use of the Services. Although we perform regular routine backups of data, you are solely responsible for all data that you transmit or that relates to any activity you have undertaken using the Services. You agree that we shall have no liability to you for any loss or corruption of any such data, and you hereby waive any right of action against us arising from any such loss or corruption of such data.

#### 21. ELECTRONIC COMMUNICATIONS, TRANSACTIONS, AND SIGNATURES

Visiting the Services, sending us emails, and completing online forms constitute electronic communications. You consent to receive electronic communications, and you agree that all agreements, notices, disclosures, and other

communications we provide to you electronically, via email and on the Services, satisfy any legal requirement that such communication be in writing. YOU HEREBY AGREE TO THE USE OF ELECTRONIC SIGNATURES, CONTRACTS, ORDERS, AND OTHER RECORDS, AND TO ELECTRONIC DELIVERY OF NOTICES, POLICIES, AND RECORDS OF TRANSACTIONS INITIATED OR COMPLETED BY US OR VIA THE SERVICES. You hereby waive any rights or requirements under any statutes, regulations, rules, ordinances, or other laws in any jurisdiction which require an original signature or delivery or retention of non-electronic records, or to payments or the granting of credits by any means other than electronic means.

## 22. MISCELLANEOUS

These Legal Terms and any policies or operating rules posted by us on the Services or in respect to the Services constitute the entire agreement and understanding between you and us. Our failure to exercise or enforce any right or provision of these Legal Terms shall not operate as a waiver of such right or provision. These Legal Terms operate to the fullest extent permissible by law. We may assign any or all of our rights and obligations to others at any time. We shall not be responsible or liable for any loss, damage, delay, or failure to act caused by any cause beyond our reasonable control. If any provision or part of a provision of these Legal Terms is determined to be unlawful, void, or unenforceable, that provision or part of the provision is deemed severable from these Legal Terms and does not affect the validity and enforceability of any remaining provisions. There is no joint venture, partnership, employment or agency relationship created between you and us as a result of these Legal Terms or use of the Services. You agree that these Legal Terms will not be construed against us by virtue of having drafted them. You hereby waive any and all defenses you may have based on the electronic form of these Legal Terms and the lack of signing by the parties hereto to execute these Legal Terms.

## 23. CONTACT US

In order to resolve a complaint regarding the Services or to receive further information regarding use of the Services, please contact us at:

Responsive Health Care System

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Lebanon

responsive health care system@gmail.com