Software Requirement Specification Document for Health Care System

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December 23, 2024

Table 1: Document version history

Version	Date	Reason for Change
1.0	26-Oct-2024	SRS First version's specifications are defined.
2.0	23-Dec-2024	SRS second version specifications are defined.

GitHub: https://github.com/noorharidy19/HealthCareSystem

Contents

Abstract

The healthcare chatbot system aims to improve patient engagement and health management through an intuitive platform. It allows patients to schedule doctor appointments easily. Additionally, the system provides clear explanations of lab results and medications, enabling patients to better understand their health information. By combining these features, the healthcare chatbot supports patients in managing their health proactively while enhancing communication with healthcare providers. This comprehensive tool seeks to empower users to take charge of their health and well-being.

1 Introduction

1.1 Purpose of this document

This document focuses on the Software Requirements Specifications for the Healthcare chatbot system. It details the system's functionalities, requirements, performance expectations, design constraints and context to meet stakeholders needs and on top of that to serve as a guide during the development process. By outlining requirements for chatbot interactions, patient appointment scheduling , this document aims to provide a user-centered experience for patients, doctors and an administrator who manages users. This SRS document acts as a comprehensive reference throughout development and maintenance phases, ensuring that each feature and requirement is clearly defined and achievable.

1.2 Scope of this document

The SRS defines the functional and non-functional requirements for the healthcare chatbot system. It specifies the system functions, user interactions, objectives and constraints on implementation and design. The scope here includes descriptions of similar systems, detailed system functionality and user characteristics. Moreover, this document outlines standard compliance, hardware requirements, data design and operational scenarios. Complex diagnosis and emergency response functionalities aren't included in this scope, as the system is intended for general inquiries, appointment scheduling and medical reminders. The document focuses on requirements related to the website's interactive, scheduling and management features.

1.3 Business Context

The healthcare software system aims to create easier interactions between patients and doctors by offering an accessible and convenient website. Through the healthcare AI chatbot, patients have the option to ask common medical queries, freeing up time for healthcare providers while allowing patients quick and easy access to medical information. Moreover, by adding online appointment scheduling, the system improves user engagement and healthcare management for patients. Additionally, hospitals and clinics can benefit from this software as well, as it simplifies appointment bookings and patient inquiries, possibly increasing operational efficiency and patient satisfaction. The system is designed for patients and doctors each of whom will use the software through a user-friendly, secure platform customized to their needs. The software is on the right track as it satisfies the current healthcare's digital growth and technology driven patient care solutions.

2 Similar Systems

2.1 Academic

Potential of AI-Driven Chatbots in Urology: Revolutionizing Patient Care Through Artificial Intelligence Researchers Ali Talyshinskii, Nithesh Naik, and B. M. Zeeshan Hameed [2] proposed an AI-driven chatbot system specifically designed for the field of urology, aiming to enhance patient care through advanced artificial intelligence techniques. This system employs various natural language processing (NLP) methodologies, including recurrent neural networks (RNN) and transformer models, to optimize the accuracy and efficiency of responses to patient inquiries. The chatbot is adept at identifying a wide range of patient intents related to urological conditions, such as symptoms, treatment options, and appointment scheduling. In their study, the researchers conducted evaluations using both simulated and actual patient interactions, achieving an impressive intent recognition accuracy of over 90%. While RNN-based models demonstrated commendable performance, transformer models, such as BERT, outperformed with a 94% accuracy rate in comprehending complex patient queries. However, the research noted a limitation in not including a diverse patient demographic in testing, indicating a significant area for further investigation to ensure the chatbot's applicability across various populations and scenarios in urology.

Technical Metrics Used to Evaluate Health Care Chatbots: Scoping Review Researchers Alaa Abd-Alrazaq, Zeineb Safi, Mohannad Alajlani, Jim Warren, Mowafa Househ, and Kerstin Denecke [1] conducted a systematic scoping review to evaluate the technical metrics used in assessing healthcare chatbots. This study aimed to develop a comprehensive framework for analyzing the performance of these AI-driven systems across diverse healthcare environments. The review quantitatively assessed key metrics, including intent recognition accuracy, which was reported to range from 85% to 95% in various studies, user engagement rates averaging around 60%, and response times typically under three seconds. User satisfaction scores varied, with many chatbots achieving scores above 4 out of 5 on average. The authors highlighted significant discrepancies in performance, noting that while some chatbots excelled in specific applications, others showed weaknesses in diverse demographic contexts. They also identified a lack of standardized evaluation frameworks, which limits comparability across studies. This underscores the need for further research to establish uniform metrics and ensure that healthcare chatbots effectively serve a wide range of patient populations, thereby enhancing overall patient care outcomes.

User Intent Recognition Researchers Ying Huang and Sylvain Dufour [3] investigated user intent recognition in the context of healthcare chatbots, aiming to enhance user interaction and satisfaction. Their study, published in the *International Journal of Medical Informatics*, focused on the implementation of advanced natural language processing (NLP) techniques to accurately identify and respond to patient inquiries. The authors developed a chatbot that employs machine learning algorithms to discern various user intents, such as symptoms, medication inquiries, and appointment requests. Through rigorous testing on a dataset of simulated patient interactions, the chatbot achieved an intent recognition accuracy exceeding 90%, demonstrating its effectiveness in understanding complex queries. Huang and Dufour also evaluated user satisfaction through qualitative and quantitative feedback mechanisms, noting significant improvements in user engagement

and overall experience. However, they identified the need for further refinement in handling ambiguous queries and incorporating diverse linguistic patterns, suggesting areas for future research to enhance the chatbot's performance across varied patient demographics.

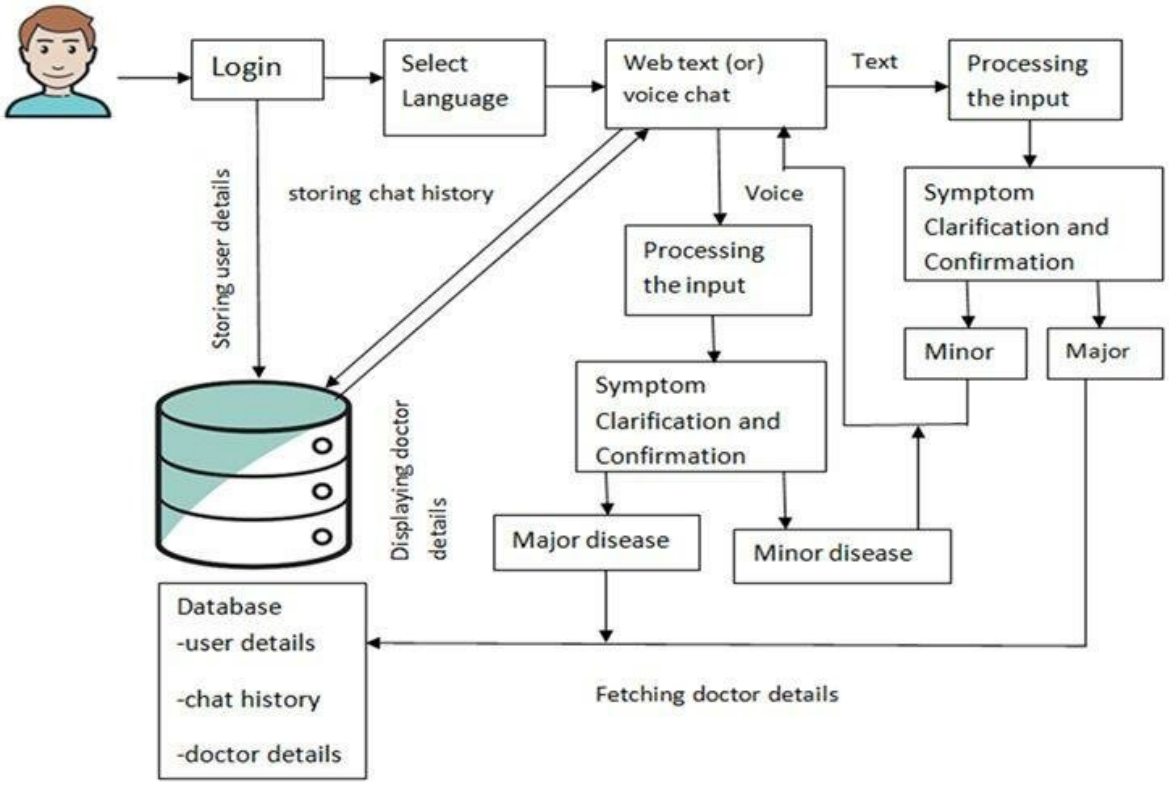

Figure 1: System Overview for similar systems

2.2 Business Applications

Babylon Health Babylon Health offers a healthcare chatbot as part of its telemedicine service, helping users book appointments, ask questions, and access general healthcare advice. Using a combination of NLP and machine learning, the chatbot can answer common healthcare questions and guide users through self-triage processes, suggesting when to see a doctor and when to seek emergency care. Users can book appointments directly through the chatbot, which integrates with the patient's medical history and a secure platform for booking consultations. This business-oriented chatbot is one of the most advanced in the healthcare industry, reaching over 10 million people and achieving high user satisfaction scores. However, some reviews note limitations in understanding complex or rare medical questions, highlighting potential areas for improvement in complex diagnosis and empathy-driven interactions.

Figure 2: Babylon Health App

MedChat AI MedChat AI represents a real-world healthcare application of chatbot technology, offering patients a virtual assistant for medical appointments, symptom tracking, and general health-related queries. Integrating with major healthcare providers, it enables patients to schedule appointments based on real-time availability, receive reminders, and gain immediate responses to health questions. The MedChat AI system has achieved widespread use for its reliability, accurate information, and user-friendly interface. This has demonstrated that AI-driven chatbots can effectively bridge communication gaps, reduce wait times, and enhance patient satisfaction across various healthcare settings.

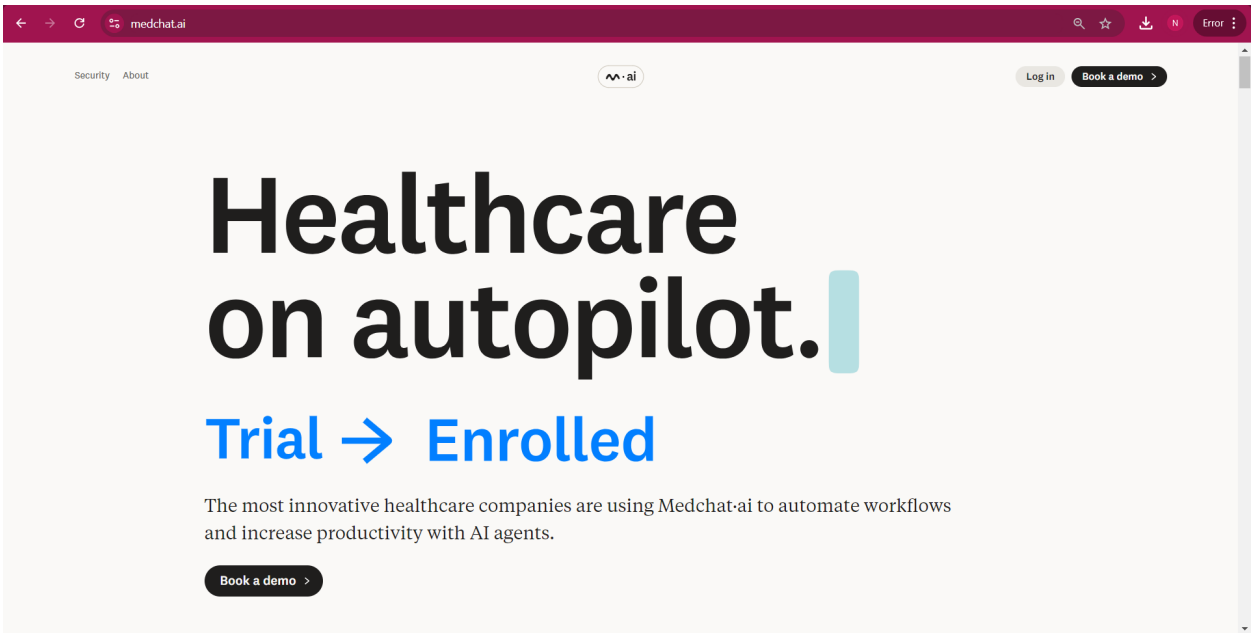

Figure 3: MedChat AI

3 System Description

3.1 Problem Statement

Many people face challenges in managing their health, including difficulties in remembering to take medications on time, keeping up with doctor appointments, and understanding medical information like lab results and prescriptions. Traditional healthcare systems often lack easy, on-demand support for these daily needs, which can lead to missed appointments, skipped medications, and confusion about health.

Our project, a healthcare chat bot system, addresses these challenges by providing everyone an easy way to schedule doctor appointments, set up medication reminders, and track important health metrics like blood sugar and blood pressure. It also helps detect chronic diseases and aids users in understanding their lab results and medications, empowering them to manage their health confidently and conveniently.

3.2 System Overview

Our healthcare chatbot system provides a comprehensive solution for managing patient health by offering appointment scheduling, tracking vital signs, explaining medical data, and setting medication reminders.

1. The process begins when the user interacts with the chatbot through a web interface. The user can input their health data, ask for an appointment, request medication reminders, or seek explanations about their lab results or prescriptions.

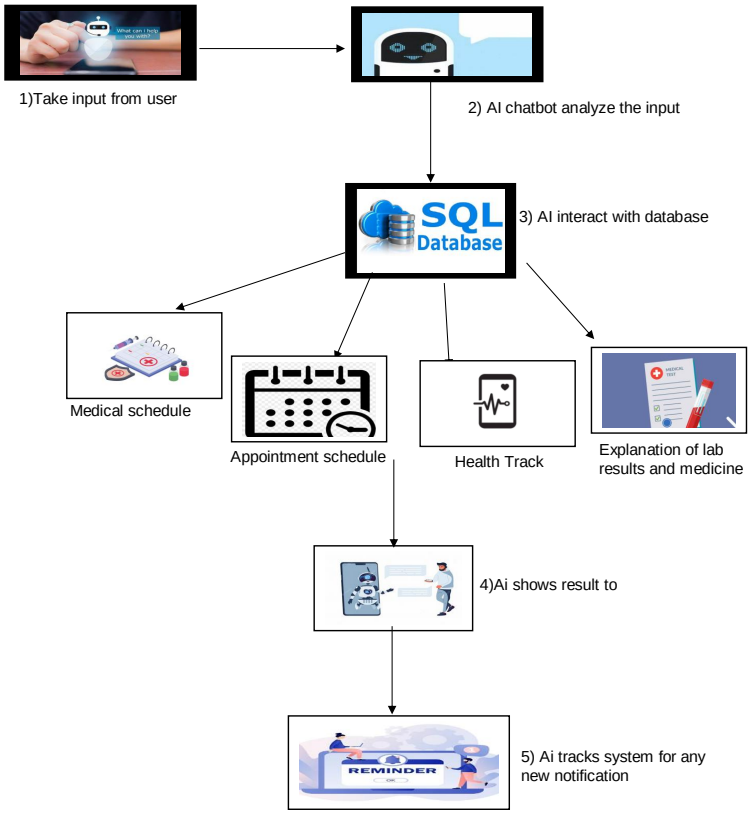

Figure 4: System Overview for our project

2. The chatbot, powered by an AI, analyzes the user input to determine the request. The AI understands what the user wants to do, whether it's booking a doctor's appointment, tracking health metrics, getting medical information, or setting reminders.

3. Once the chatbot understands the user's request, it communicates with a secure database to retrieve relevant information. For instance:

    - **Appointment Scheduling**: The system accesses available appointment slots and presents them to the user.
    - **Health Tracking**: The database stores the user's past health records.
    - **Explanation of Lab Results & Medications**: If the user needs an explanation of lab

results or prescribed medications, the system pulls relevant information to provide a clear summary.

4. After retrieving and analyzing the necessary data, the chatbot responds to the user with the requested information.

5. The system continuously tracks vital signs and medication schedules, generating alerts when any abnormalities or missed medication doses occur.

3.3 System Scope

The chatbot component of the healthcare system will include the following features:

1. **Appointment Booking**: Allows patients to easily schedule, reschedule, or cancel doctor appointments through a chat interface and sends reminders for each appointment.
2. **Medical Information Assistance**: Provides easy-to-understand explanations of lab results and medications, answering patient questions in real-time through the chatbot.
3. **User-Friendly Interaction**: Creates a simple and intuitive chat experience that allows users to easily navigate and access the information they need.
4. **Doctor Access**: Allows doctors to access their appointments, cancel appointments, and view patient data through the chatbot interface.
5. **Admin Dashboard**: Includes an admin dashboard to manage users, overseeing patient and doctor accounts to ensure smooth operation of the system.

3.4 System Context

The Healthcare Chatbot System interacts with various external entities to provide patients with real-time healthcare assistance. This system context diagram outlines the primary external actors—patients, doctors, the chatbot AI, and the database—and demonstrates how they interact with the system. The system also works with a database to save patient records and retrieve information when needed. This allows the chatbot to give accurate answers. Doctors can access the system to view patient data and manage appointments. This setup ensures that healthcare data is handled efficiently and delivered quickly to the users. Patients can input requests for services such as scheduling medication reminders, receiving explanations of lab results, tracking health metrics, and booking appointments. The system forwards these requests to the chatbot AI, which analyzes the input to determine the user's intent. The chatbot then returns relevant results to the system.

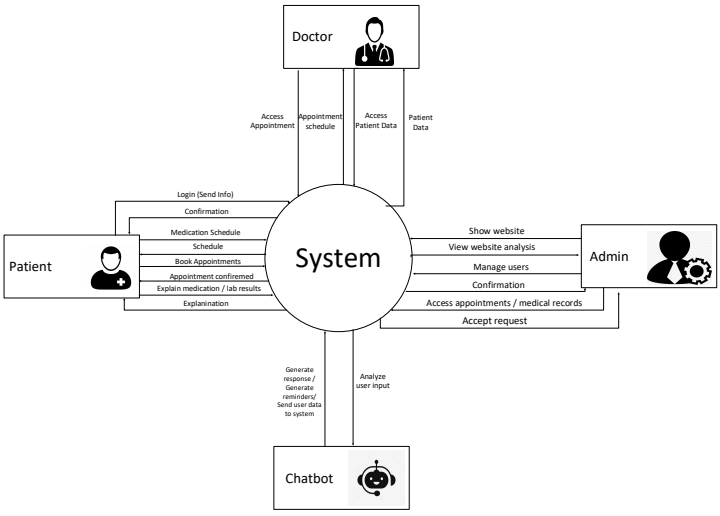

Figure 5: System Context

3.5 Objectives

In our project, we aim to:

1. **Increase Patient Engagement:**
    - Make it easy for patients to get involved in managing their health with regular reminders and support.
2. **Simplify Appointment Management:**
    - Help patients easily book and keep track of doctor appointments, reducing missed visits through the chatbot system.
3. **Educate Patients:**
    - Explain lab results and medications in simple language to help patients understand their health better through the chatbot system.
4. **Enhance Communication:**
    - Provide an easy way for patients to ask questions and communicate with healthcare providers through the chatbot system.
5. **Gather User Feedback:**
    - Collect feedback from users to improve the chatbot's features and make it more helpful.

3.6 User Characteristics

The healthcare chat bot system serves a wide range of users, including patients, healthcare providers , and administrators.

- **Patients:** Typically non-technical users seeking quick and easy access to health information, appointment scheduling, and health assessments. They value easy direct guidance and simplicity on health-related queries.
- **Healthcare Providers:** Users who primarily use the system to view their upcoming appointments with patients. These users who are mainly professional doctors have basic technical skills and require a straightforward interface that displays scheduled appointments in an organized manner.
- **Administrators:** Advanced users responsible for managing other users, and monitoring system performance. Administrators to add or remove other administrators or healthcare providers (doctors) as needed to ensure the system functions smoothly and securely.

Each user group is provided a tailored interface and functionality that matches their needs and technical skills.

4 Functional Requirements

4.1 System Functions

Use-Case diagram demonstrates the system's functional requirements. The system comprises 3 user types Admin,Patients,Doctors and a Chat bot.

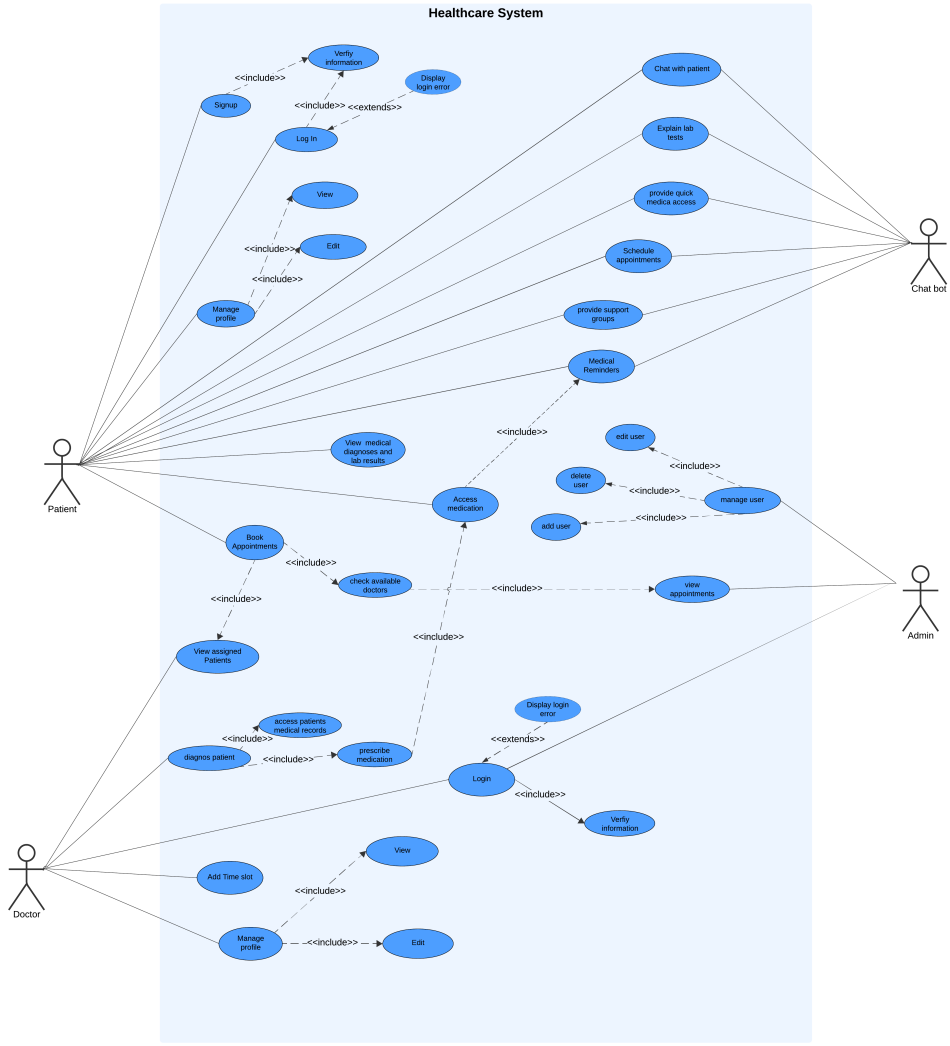

Figure 6: Use case

Admin Requirements

1. Admin should be able to manage the doctors . **(AD01)**
2. Admin should be able to manage the patients in the system. **(AD02)**
3. Admin should be able to view each patient appointments. **(AD03)**
4. Admin should be able to access patients medical records and lab results.**(AD04)**

Patient Requirements

1. The Patient should be able to create an account and log in. **(P01)**
2. The Patient Should be able to book an appointment. **(P02)**
3. The Patient should be able to view/update his information into the system. **(P03)**
4. The Patient should have access to his medical reports**(P04)**
5. The Patient should have access to a system chat bot. **(P05)**
6. The Patient should have daily access to support groups **(P06)**

Doctor Requirements

1. The Doctor should be able to access his account by logging in. **(DR01)**
2. The Doctor should be able to view/update his information into the system. **(DR02)**
3. The Doctor should have access to his appointments.**(DR03)**
4. The Doctor should be able to view patients that are assigned to him/her and access their medical records. **(DR04)**
5. The Doctor should be able to prescribe medications according to the patient diagnoses. **(DR05)**

System Chat-bot Requirements

1. The System Chat-bot should be able to chat with patients.**(SCB01)**
2. The System Chat-bot should provide support groups for patient.**(SCB02)**
3. The System Chat-bot should provide a quick medical access.**(SCB03)**
4. The System Chat-bot should access patients lab test and explain its results.**(SCB05)**
5. The System Chat-bot should be able to schedule appointments.**(SCB06)**
6. The System Chat-bot should be able to connect patients with doctors for a follow-up. **(SCB07)**

4.2 Detailed Functional Specification

Name	Manage Doctors and View Assigned Patients
Code	AD01
Priority	High
Critical	Yes
Description	The admin should be able to view, add, update, or remove doctor profiles. Additionally, the admin should be able to view each doctor's assigned patients to ensure appropriate workload distribution and care management.
Input	Doctor information
Output	The system displays a list of patients associated with the selected doctor.
Pre-condition	The doctor and patient accounts are active in the system.
Post-condition	The system confirms the update/removal of a doctor's information and displays the patient list.
Dependency	Active doctor and patient profiles in the system.

Table 2: Manage Doctors and Assigned Patients

Name	Access Patient Medical Records
Code	DR04
Priority	High
Critical	Yes
Description	Doctors should be able to view the medical history, diagnoses, lab results, and treatment plans of patients assigned to them to ensure continuity of care.
Input	Doctor selects a patient's profile.
Output	The system displays the selected patient's medical records.
Pre-condition	Patient data, including medical records, is available in the system, and the doctor is logged in and authorized.
Post-condition	Medical records are displayed, enabling the doctor to view and assess patient progress.
Dependency	Patient records database and access control mechanisms.

Table 3: Access Patient Medical Records

Name	Patient Account Management
Code	P02
Priority	High
Critical	Yes
Description	Enables the patient to schedule a consultation by entering his medical records and be assigned to a doctor according to an available time slot. Upon successful booking, the patient receives confirmation of the appointment details, including a reference number for easy tracking.
Input	Patient login authentication, desired appointment date and time.
Output	Confirmation of the appointment, displaying key details such as doctor's name, date, time, and a unique reference number
Pre-condition	Patient must be logged in and authenticated within the system.
Post-condition	The scheduled appointment is successfully added to both the patient's and the doctor's calendars.
Dependency	Relies on P01 (Patient Account Access) and DR03 (Doctor's ability to view their Appointments).

Table 4: Appointment Booking by Patient

5 Design Constraints

5.1 Standards Compliance

- The chatbot system must comply with healthcare data privacy standards, such as HIPAA and GDPR, to ensure patient data confidentiality and security.
- Users must have a stable internet connection to access the chatbot's functionalities effectively.

5.2 Hardware Limitations

- The chatbot's response time and NLP processing capabilities may be slower on devices with low processing power or limited memory, potentially impacting user experience on older smartphones or computers.
- The chatbot requires a network connection to access cloud-based NLP models and databases; offline functionality is limited or unavailable.

5.3 Other Constraints as appropriate

- The chatbot currently supports only English

- System performance may vary based on server load and user traffic, potentially leading to delayed responses during peak hours.
- he chatbot may struggle with highly specialized or complex medical inquiries, which could require escalation to a healthcare professional.

6 Non-functional Requirements

- **Performance:** System response time should be acceptable especially for the chatbot responses, and viewing appointment and reminder information to ensure better user experience.
- **Reliability:** The software should operate continuously without issues, particularly for important functions like appointment scheduling and medication reminders.
- **Usability:** The system must provide for patients, doctors and the administrator a clear and an easy to understand navigation to ensure ease of use for each role.
- **Security:** All sensitive information such as passwords must be hashed.
- **Scalability:** The system must be able to handle an increasing number of users and concurrent sessions as demand grows.

7 Data Design

7.1 Dataset

Our dataset [4] contains key information on patient demographics, admissions, and healthcare services, making it valuable for data analysis and healthcare modeling. It includes 15 columns:

- **Name**
- **Age**
- **Gender**
- **Blood Type**
- **Medical Condition**
- **Date of Admission**
- **Doctor**
- **Hospital**
- **Insurance Provider**
- **Billing Amount**

- **Room Number**
- **Admission Type**
- **Discharge Date**
- **Medication**
- **Test Results**

This dataset consists of 10,000 records, each representing a synthetic patient healthcare record.

7.2 Database

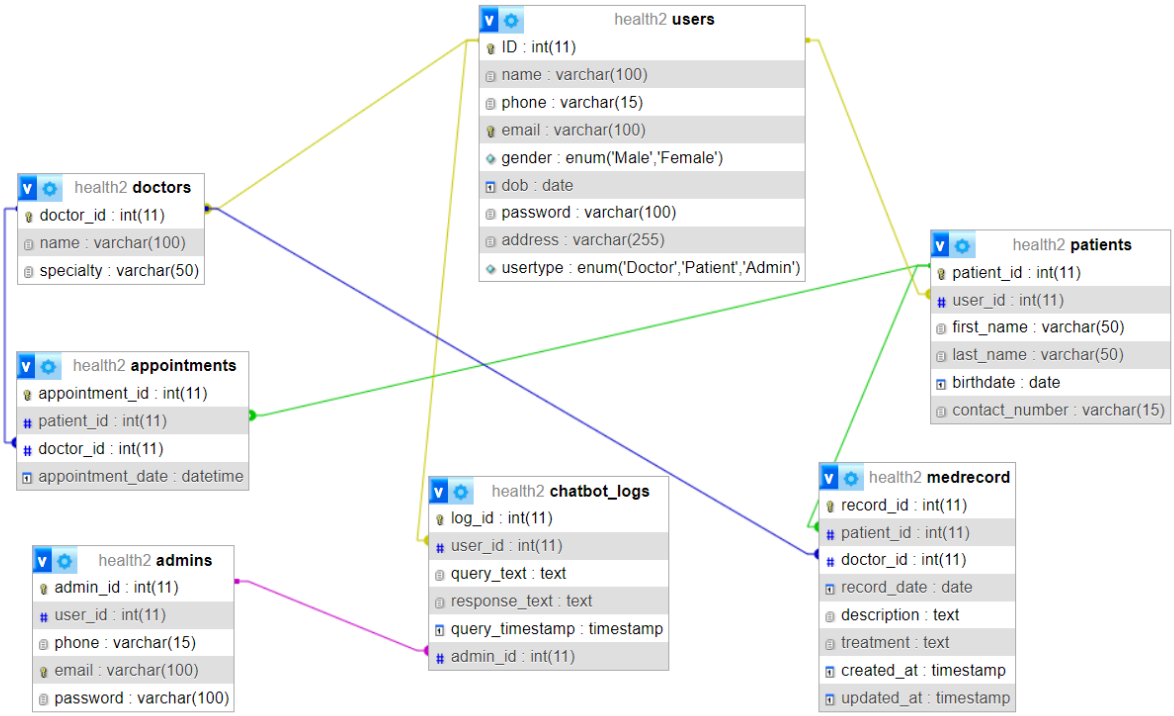

Figure 7: Database schema

8 Prototype

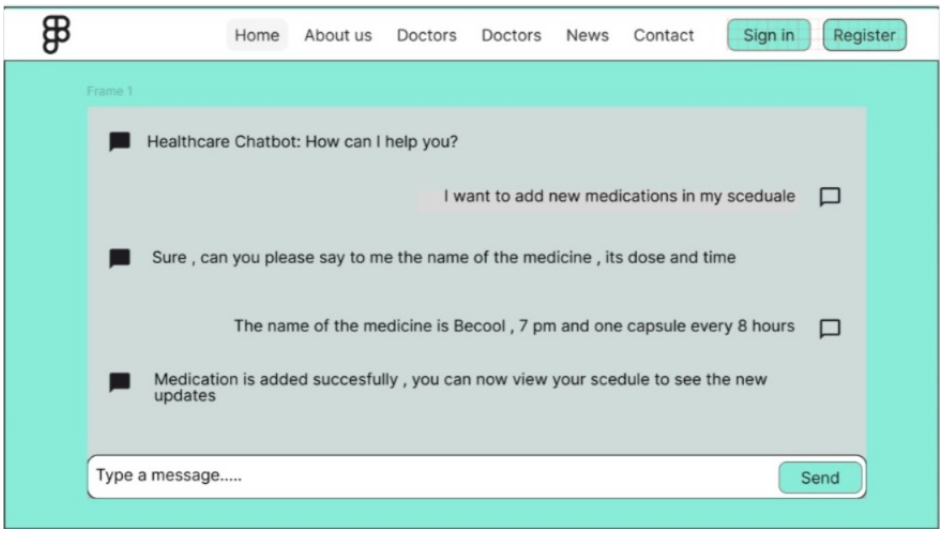

Figure 8: Medication schedule

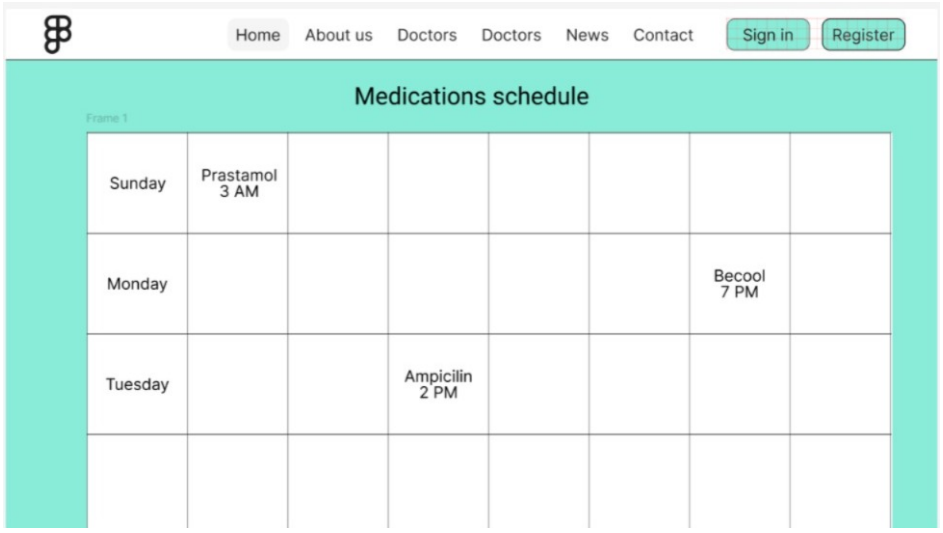

Figure 9: Medication schedule

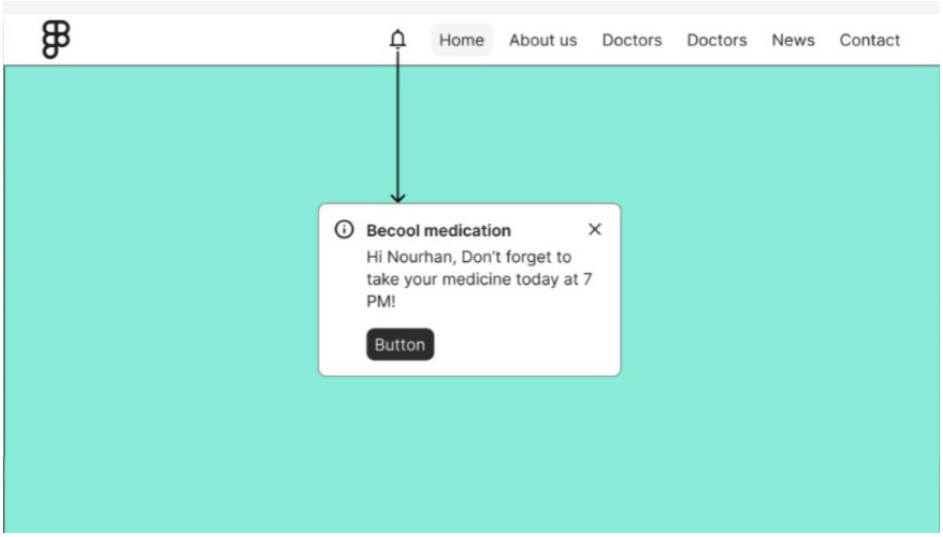

Figure 10: Medical Reminders

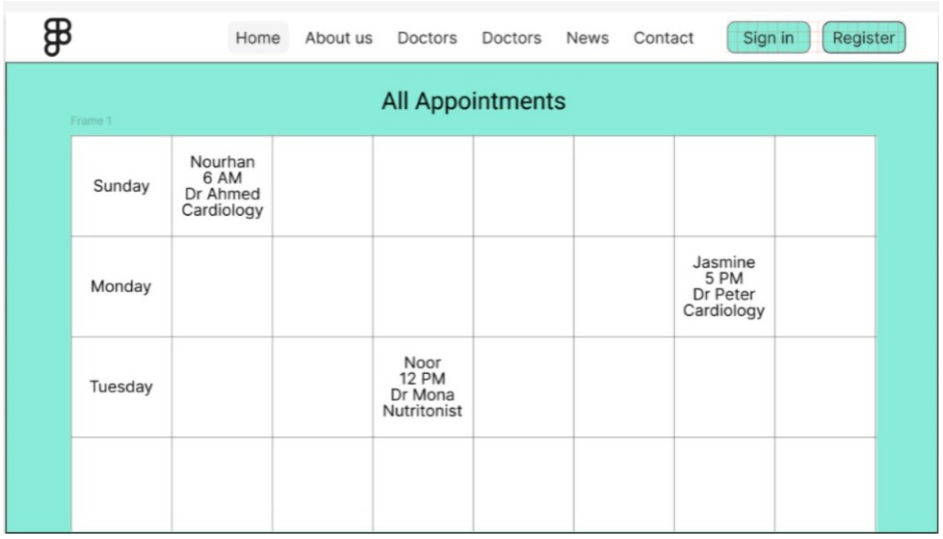

Figure 11: View all Appointments

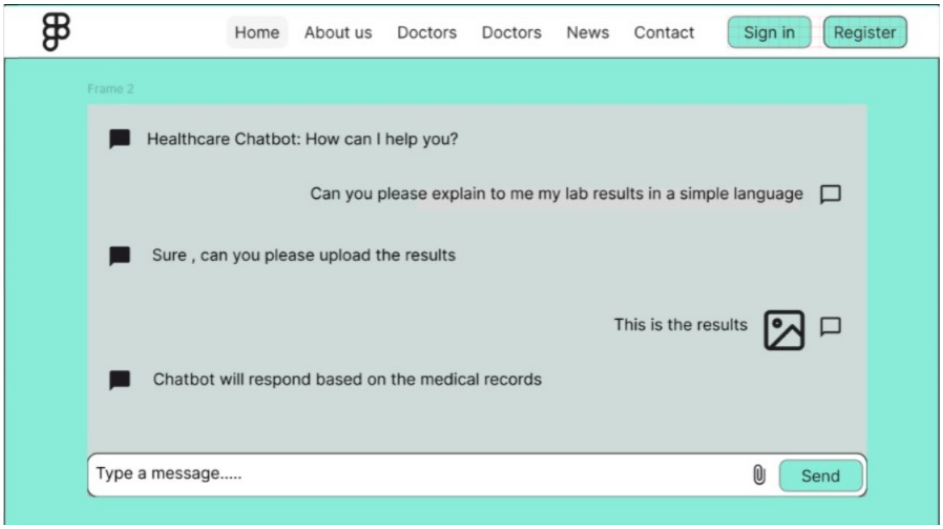

Figure 12: Lab Results

9 Operational Scenarios

Scenario 1: Patient Account Creation

1. **Initial assumption:** The patient has access to a stable internet connection, and a device capable of running the system.
2. **Normal:** The patient initiates their journey by creating an account. The user interface guides them through entering personal information, setting up login credentials, and verifying their email. This process establishes a basic profile for personalized healthcare interaction.
3. **What can go wrong:** In case of connectivity issues or validation errors, the account creation process may experience delays or interruptions.

Scenario 2: Patient Scheduling an Appointment

1. **Initial assumption:** The patient has an active account and is logged into the system.
2. **Normal:** The patient uses the chatbot to book an appointment with a healthcare provider (doctor) . The chatbot provides available time slots, and the patient selects a convenient time. A confirmation is generated, and a notification is sent to the patient's account and email.
3. **What can go wrong:** If there are scheduling conflicts or network delays, the appointment request may fail, requiring the patient to try again or choose a different time.

Scenario 3: Doctor Viewing Appointments

1. **Initial assumption:** The doctor has an active account and is logged in.

2. **Normal:** The doctor navigates to their appointments section, where they can view scheduled patient appointments, organized by date and time. The doctor can click on each appointment for more details, such as patient history or special notes. The doctor also has the authentication to cancel or postpone a patient's appointment.

3. **What can go wrong:** If the system has connectivity issues or if there's a database error, appointments may not load correctly, potentially causing scheduling issues for the doctor.

Scenario 4: Doctor Viewing Patient Medical Record

1. **Initial assumption:** The doctor is logged in and has the necessary permissions to access patient's medical records.

2. **Normal:** After logging into the system, the doctor navigates to the patient's medical records section. The system shows the patient's detailed medical history,including past diagnosis, and ongoing prescriptions. The doctor can edit fields directly within the record if necessary. Once the modifications are complete, the doctor submits the changes, and the system saves them.

3. **what can go wrong:** If there's an interruption in connectivity, the updates may delay, prompting the doctor to try again when the connection is stable.

Scenario 5: Administrator Managing Users

1. **Initial assumption:** The administrator has an active account with appropriate access permission.

2. **Normal:** The administrator accesses the user management section, where they can add, remove, or edit user roles, including creating new accounts for doctors and other administrators. They fill in relevant details, set permissions, and confirm changes.

3. **What can go wrong:** If the system's security checks fail or if there are connectivity issues, the process of adding or modifying users may not complete successfully. In case of a data entry error, incorrect user roles may be assigned.

Scenario 6: Patient Accessing Basic Health Assessment

1. **Initial assumption:** The patient is logged in and has access to the chatbot system.

2. **Normal:** The patient initiates a basic health assessment by responding to chatbot questions about their symptoms. The chatbot provides preliminary health advice based on the responses and may recommend scheduling an appointment with a doctor if necessary.

3. **What can go wrong:** Miscommunication or vague responses from the patient could result in inaccurate health assessment results. Additionally, if the chatbot's response model is outdated, it may not provide the most relevant advice.

Scenario 7: Feedback Submission by Patient

1. **Initial assumption:** The patient has completed an interaction with the chatbot system and wishes to provide feedback.

2. **Normal:** After the interaction, the patient is prompted to rate their experience and provide comments. This feedback is saved in the system for the administrators to review and use in system enhancement.

3. **What can go wrong:** If the feedback form fails to load properly or if there are connectivity issues, the patient may be unable to submit their feedback.

Scenario 8: Admin Reviewing System Analytics

1. **Initial assumption:** The admin has an active account and access to the analytics section.

2. **Normal:** The admin accesses system analytics to view data on user engagement, common queries, and chatbot performance. Based on these insights, the admin can make informed calculated decisions to optimize the chatbot functionality.

3. **What can go wrong:** If there are data retrieval issues or if the analytics system has a bug, the admin may see incomplete or incorrect data, potentially impacting decision making.

10 Project Plan

We are using Ajile methodology because the industry is always changing . Also , we lack medical background so every now and then we release a version of our system to make sure that everything is correct.

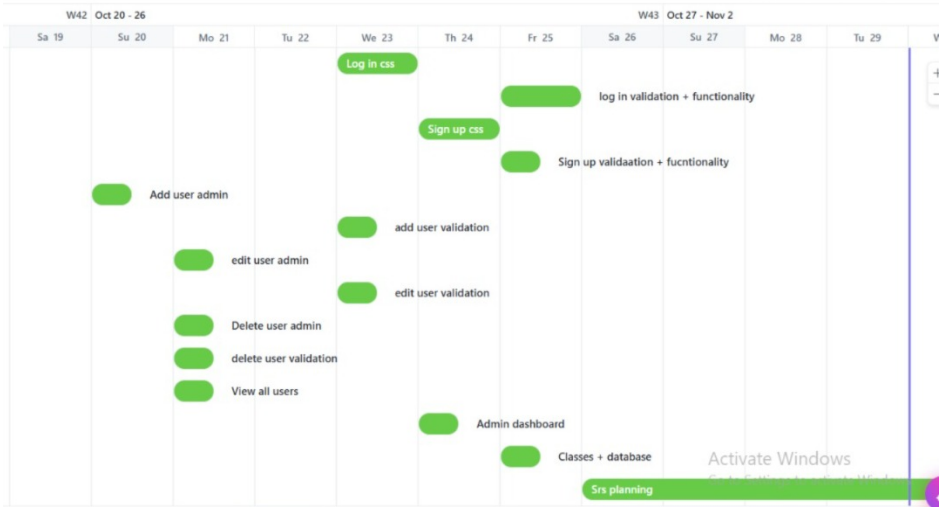

Figure 13: project$_plan$

11 Appendices

11.1 Definitions, Acronyms, Abbreviations

11.2 Supportive Documents

References

[1] Alaa Abd-Alrazaq et al. "Technical Metrics Used to Evaluate Health Care Chatbots: Scoping Review". In: *International Journal of Medical Internet Research* 22 (2020), p. 15. URL: https://www.jmir.org/2020/6/e18301.

[2] Nithesh Naik Ali Talyshinskii and B. M. Zeeshan Hameed. "Potential of AI-Driven Chatbots in Urology: Revolutionizing Patient Care Through Artificial Intelligence". In: *Current Urology Reports* 24 (2023), p. 18. URL: https://link.springer.com/article/10.1007/s11934-023-01184-3.

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[4] Prasad Patil. *Healthcare Dataset*. Accessed: 2024-10-29. 2024. URL: https://www.https://www.kaggle.com/datasets/prasad22/healthcare-dataset.

Note that you should use a minimum of ten references (80% Academic)