A logo with black text

Description automatically generated

NIT6150 Advanced Project

**Final System Delivery and Evaluation**

**Healthcare Chatbot System**

**Team Leader:** Jitendra Shrestha (s8104215)

**Team Member:** Pranish Acharya (s8100698)

**Client:** Holroyd Private Hospital

**Supervisor:** Fakhra Jabeen

VU Sydney

**Coordinator**: Dr. Alex Wenjie Ye

**GitHub Link code Source:**

1. Document: <https://github.com/pranish33/Advance-Project/tree/main/Reports>
2. Source Code: [https://github.com/pranish33/Advance-Project/tree/main/ Source Code](https://github.com/pranish33/Advance-Project/tree/main/%20Source%20Code)

A screenshot of a computer

Description automatically generated

**Version Control**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Documentation | | | | |
| Version Number | **Modified Date** | **Modified By** | **List of Modifications Made** | **Status** |
| 1.01 | Aug 9, 2024 | Pranish | Created Repository  Initial Proposal report file added  Added Deliverable, schedule and budget | Completed |
| 1.02 | Aug 10, 2024 | Jitendra | Added Project Allocation document and modified proposal part  Finalized the Project Proposal | Completed |
| 1.03 | Aug 19, 2024 | Pranish | Added System Analysis and Design report file added  Added Functional requirements  Created ER Diagram  Created Sequence Diagram  Created Class Diagram | Completed |
| 1.04 | Aug 20, 2024 | Jitendra | Created Meeting Minutes Report  Created System Version Control  Created Wireframes for chatbot UI  Created Login UI  Created overall Use case  Created Flow Chart Diagram | Completed |

Table of Contents

[Introduction 9](#_Toc175175420)

[Objective 9](#_Toc175175421)

[Technology Stack 9](#_Toc175175422)

[System Development Approach 11](#_Toc175175423)

[Functional Decomposition Diagram (FDD) 12](#_Toc175175424)

[System Requirement Specifications (SRS) 12](#_Toc175175425)

[Data Dictionary 13](#_Toc175175426)

[Patient Data Dictionary 13](#_Toc175175427)

[Doctor Data Dictionary 13](#_Toc175175428)

[Appointment Data Dictionary 14](#_Toc175175429)

[Functional Requirements 14](#_Toc175175430)

[Non-Functional Requirements 14](#_Toc175175431)

[1. Look and Feel Requirements 15](#_Toc175175432)

[2. Usability and Humanity Requirements 15](#_Toc175175433)

[3. Performance Requirements 15](#_Toc175175434)

[4. Operational Requirements 15](#_Toc175175435)

[5. Maintainability and Support Requirements 15](#_Toc175175436)

[6. Security Requirements 15](#_Toc175175437)

[7. Cultural and Political Requirements 15](#_Toc175175438)

[8. Legal Requirements 16](#_Toc175175439)

[Usability Requirements 16](#_Toc175175440)

[Overall use case Diagram 17](#_Toc175175441)

[SRS Table for User Management System (S1) 17](#_Toc175175442)

[Use Case Diagram for UMS 19](#_Toc175175443)

[ER Diagram of UMS 20](#_Toc175175444)

[WireFrame of UMS Register Page 21](#_Toc175175445)

[WireFrame of UMS Login page 22](#_Toc175175446)

[SRS Table of Personal Health Management System (S2) 23](#_Toc175175447)

[Use Case Diagram of PHMS 24](#_Toc175175448)

[ER Diagram of PHMS 25](#_Toc175175449)

[Wireframe of PHMS 26](#_Toc175175450)

[SRS Table of Chatbot System (S3) 26](#_Toc175175451)

[Chatbot Architecture 27](#_Toc175175452)

[Flow Chart Diagram for Chatbot 28](#_Toc175175453)

[Wireframe for Chatbot Interface 29](#_Toc175175454)

[Wireframe for Chatbot Homepage 30](#_Toc175175455)

[Wireframe for Chatbot About Us page 31](#_Toc175175456)

[**Project Management** 32](#_Toc175175457)

[Project Cost Estimate 32](#_Toc175175458)

[Project Detail Costs 32](#_Toc175175459)

[Project Schedule 34](#_Toc175175460)

[Issues in Project 37](#_Toc175175461)

[Project Risks 37](#_Toc175175462)

[Cutover Issues 37](#_Toc175175463)

[Quality Assurance and Testing Issues 37](#_Toc175175464)

[Project Documentation 38](#_Toc175175465)

[Project Meeting with Minutes 38](#_Toc175175466)

[Potential Involvements of human factors 45](#_Toc175175467)

[Team Dynamics: 45](#_Toc175175468)

[User Interactions: 45](#_Toc175175469)

[User Feedback and Adaptation: 45](#_Toc175175470)

[**Potential Privacy Issues** 46](#_Toc175175471)

[**Professional ethics Issues** 46](#_Toc175175472)

[Data Privacy and Confidentiality: 46](#_Toc175175473)

[References 47](#_Toc175175474)

**List of Figures**

[Figure 1: FDD of the System 12](#_Toc175174270)

[Figure 2: Overall Use case Diagram 17](#_Toc175174271)

[Figure 3: Use case Diagram of UMS 19](#_Toc175174272)

[Figure 5: Wireframe of User Registration Form 21](#_Toc175174274)

[Figure 6 : Wireframe of User Login System 22](#_Toc175174275)

[Figure 7: Use Case Diagram of PHMS 24](#_Toc175174276)

[Figure 8: Detailed ER Diagram of PHMS 25](#_Toc175174277)

[Figure 9: Wireframe of PHMS 26](#_Toc175174278)

[Figure 10: Chatbot Architecture 27](#_Toc175174279)

[Figure 11: Flow chart Diagram of Chatbot System 28](#_Toc175174280)

[Figure 12: Wireframe Diagram of Chatbot Interface 29](#_Toc175174281)

[Figure 13: Wireframe of chatbot Homepage 30](#_Toc175174282)

[Figure 14: Wireframe of chatbot About us page 31](#_Toc175174283)

[Figure 15: Work Break Down for Project Schedule 34](#_Toc175174284)

[Figure 16: Gantt chart for Work Break Down showing the date 36](#_Toc175174285)

[Figure 17: Timeline of project scheduleResources Used 36](#_Toc175174286)

[Figure 18: Resource Used for Project 37](#_Toc175174287)

**List of Tables**

[Table 1: SRS for S1 17](#_Toc175173926)

[Table 2: SRS for S2 23](#_Toc175173927)

[Table 3: SRS for S3 26](#_Toc175173928)

[Table 4: Miscellanous Cost Breakdown 33](#_Toc175173929)

# Introduction

The way people interact with one other has been completely transformed by internet-connected devices. As a result of technological advancements, "people are demanding more intelligent self-service options and experiences answers within seconds, not minutes." Machine learning (ML) and artificial intelligence (AI) (Santosh Gore, 2023) are being adopted by several sectors to improve customer service. Chatbots are employed in various fields these days, including e-commerce to answer product-related queries from customers and banking systems for customer support. A chatbot is a computer software that receives human input in natural language and responds to it with a perceptive and pertinent response before sending it back to the user. Hospitals are now permitting patients to engage with technology, such chatbots, to learn more about disease, doctor or hospital speciality. This technology will assist in offering the user support around-the-clock. (Ayanouz, S., Abdelhakim, B.A. and Benhmed, M.) also explains that Physicians, nurses, patients, and their families could benefit from a chatbot. Chatbots (Kurup, G. and Shetty, S.D., 2022) may assist medical personnel in several scenarios, such as better patient information organization, medication administration, emergency assistance, first aid, and providing a solution for minor medical problems.

# Objective

The objectives of the system are as follows:

* To provide response on health queries
* To diagnose disease based on symptoms provided based on yes/no statement
* To provide way to maintain patient health record

# Technology Stack

Various tools and techniques were used for the development of web applications in different programming languages such as java, python etc. Some of the tools and techniques that I used for my project are described here.

**Python Programming Language**

A wide variety of programming languages are available for use in the creation of web applications. I have decided to use Python as my programming language for the project development. It is simple to read and write using simple programming syntax. Python programming was created in 1991 by Guido Van Rossum at the National Research Institute. Since its inception, this programming language has grown in popularity among developers on a daily basis. One of my other favorite things about Python for my project is how many web application development frameworks it offers, such Django, Flask, and others. Python programming is particularly well-known for its ability to support artificial intelligence and machine learning, making it suitable for projects involving AI like chatbots. Since I created the chatbot with the RASA framework, it has also used python in backend.

**Django Framework**

The open source web application development platform Django is used. For projects that are mid-range scalable, Django is excellent and helpful. The simplicity, flexibility, dependability, and scalability of Django helped my project get off to a good start. Django offers a wealth of built-in features, including flexible code rearranging. Thus, it was the ideal option for my project's online application. Django makes it simple for developers to handle databases by supporting a variety of database types. Additionally, Django extends passwords using the SHA256 hash of the NIST-recommended PBKDF2 technique. This password encryption technique is reliable and secure. A large amount of processing time will be needed to crack this encryption technique. We will only keep the necessary personal data, and it will be kept in a secure manner with restricted access. Different vulnerabilities attacks may be used to make an application more secure. (Django, 2020)

**Rasa Framework**

The open-source Rasa framework is used to create chatbots using artificial intelligence. Rasa is a natural language processing framework that can comprehend spoken language and provide users with answers to their queries. One advantage of utilizing the rasa framework is that it is built on Python programming. Rasa is an open-source NLP (Md Meem Hossain, 2021) toolkit based on Python that has a pre-built architecture that we may modify to our specifications. One suggestion is to start filling up this framework with words to establish a dataset for training your bot. Next, construct the NLU model, create dialogue patterns, and develop a skeleton for the dialogues. Rasa Stack is meant for brief messages and can do tasks. (Rasa Technologies, 2019)

**Visual Studio Code Editor**

Better Community support is compatible with all operating systems, and it has excellent code highlighting and a clear indentation level for Python programming, which is better for my project. Visual Studio Code combines sophisticated development tools like IntelliSense code completion and debugging with the user-friendliness of a source code editor. (Visual Studio Documentation , 2020)

**SQlite**

An excellent, free, and visual tool for building, developing, and modifying SQLite database files is called DB Browser for SQLite (DB4S). Data manipulation and maintenance are made simple by Django's inclusion of SQlite as an integrated database.

# **LITERATURE REVIEW**

## Potential End User

Internet communication is getting more and more popular among the people. Due to the advancement in technology such as Artificial Intelligent (AI), Machine Learning (ML) and data mining technique critical decision making capabilities such as chatbot has become more practical with many commercial fields. Medical field has also been affected with such kind of technology. Medical field has adopted chatbot system to facilitate the patient and doctor’s interaction. Chatbot system has been introduced as interface between doctors or any health related professional with user. Chatbot has become personal health assistant that uses patient-doctor communication model. So, the potential end users are those who are seeking for health information within their hand (Benilda Eleonor V. Comendador, 2015). Many people use Google search to get information of disease or hospital. But the internet is also full of fake news and information which mislead the viewers to sell something. Chatbot help users to interact with health organization via platform of their choice such as web application or mobile application. Large number of data is generated from medical field or medical research with the help of chatbot that information can be accessed safely which will deliver to the end users.

## Research Papers

### Chatbot using Left-Right Parsing Algorithm

A research paper published in the “Journal of automation and control Engineering” in 2015, in the paper researchers have introduced a “Pharmabot, A Pediatric Generic Consultant chatbot” which suggest and give queries regarding generic medicines for children. In this proposed system series of conversation from user will be analyzed using Left-Right Parsing (Bottom-Up and Left-Right approach) Algorithm after then chatbot will prescribe medicine or other information based on symptoms provided through chatbot interface. (Benilda Eleonor V. Comendador, 2015).

### Chatbot using AIML

Similarly, the research paper published on “International Journal of Advanced Computer Science and Applications (IJACSA)” by the researchers Sameera A. Abdul-Kader and Dr. John Woods have introduced techniques such as AIML, Parsing, pattern matching, SQL and relational database which are used in the development of chatbot system. Natural language understanding toolkit (NLTK) is used to train chatbot for the understanding of human language to the machine. In this paper researchers have introduced AIML technique to develop chatbot system which is the derivative of XML. The purpose of the AIML language is to change the work of conversational modelling, in reference to a “stimulus-response” process. (Woods, 2015)

### Chatbot using SVM

Journal published in International Journal of Computer Trends and Technology (IJCTT) has introduced “A Medical Chatbot” using Support Vector Machine Algorithm **(SVM).** **SVM** is the powerful algorithm which can distinguish two classes. This algorithm-built model can classify whether the input falls under that class or not. It is the learning algorithm for classification that decide to discover the best distinguishing hyper plane that minimize the error for unseen patterns. The main aim of the proposed system is to provide queries regarding the personal health without visiting to the hospital. (Deshpande, 2018)

### Chatbot using LSTM model

A research paper published on 3rd International Conference on Emerging Technologies in Computer Engineering: Machine Learning and Internet of Things (ICETCE) has introduced a conversation modeling agent using Recurrent Neural Network **(RNN)** and Long Short-Term Memory **(LSTM)**. Instances wherever the space between the specified info and the place wherever it's being used is little, **RNN** algorithm will learn with efficiency, however the cases wherever this gap is additional, it can't reproduce the knowledge with efficiency due to such an extended dependency. So, to full fill such gap **LSTM** model was introduced. **LSTM** is the advanced form of Recurrent Neural Network **(RNN)**. **LSTM model** has ability to forget data which are not necessary, this is done by forget gate using sigmoid function. Here sigmoid function decides which value need to be updated. (Vipasha Chandwani, 2020) [5]

A diagram of a gate

Description automatically generated

Figure 6:- **LSTM** Model (Vipasha Chandwani, 2020)

### Chatbot using Multinomial Naïve Bayes Algorithm

A paper published in “Proceeding of the Fifth International Conference on Communication and Electronics System” in 2020 has proposed a “Health Care Counselling via voice bot using Multinomial Naïve Bayes Algorithm”. In this proposed System the voice based chatbot system is used to address the problem facing individuals at the moment of illness. The proposed system is used for the treatment of general health. In this system, the input is provided in text format, which will be analyzed by **Multinomial Naïve Bayes Algorithm** from that, data will be fetched from database and generates response to the user through voice as well as textual format. In this whole process Listener trainer function will analyze the text provided by user and split the text by tokenization and stemming process and with reference to the root word, data will be fetched from database and will be provided to the user. (S.Revathy, 2020)

### Chatbot using AI

The proposed paper, “a novel approach for medical assistance using trained chatbot” by researcher from “Muthoot Institute of Technology and Science-Varikoli” aims to develop a trained chatbot using artificial intelligence that help people to identify treatment for the disease. In this planned model, artificial intelligence plays most part in providing a list of available treatments supported the sickness known through the symptoms provided. (Divya Madhu, 2017)

### Chatbot using Naïve Bayes Algorithm

An article published in the Journal of Physics: Conference Series" suggested the concept of developing a CHATBOT application as a tool to retrieve hearing loss information. Using the Natural language processing method and the **Naïve Bayes Algorithm** to identify I-Chat Bot input classes and using the generated Technology Acceptance Model to test hypotheses (extended). The result is an artificial intelligence from I-Chat Bot that understands user feedback and provides adequate response and produces a preferred and simple device model to be used in the search for hearing impairment information. With reliability 98.6 percent, recall 88.75 percent and Accuracy 88.75 percent, this research paper also gets the benefits from the accuracy of the test. (Merry Anggraeni, 2019)

### Chatbot using CNN, RNN and HAN

In the paper published at the IEEE 16th India Council International Conference (INDICON) in 2019, they suggested an intelligent social therapeutic chatbot that distributes the text, namely, Happy, Joy, Shame, Disgust, Sorrow, Anger, Guilt and Fear into emotion labels. In addition, it defines the emotional state of the users, such as stressed or depressed, based on the emotion symbol, using chat data from users. Three common deep learning classifiers have been deployed for emotion detection, namely Hierarchical Attention Network (HAN), Recurrent Neural Network (RNN), and Convolutional neural network (CNN). In particular, the chatbot's proposed approach is domain-specific, where the chatbot can aim to prevent pessimistic actions and by user interaction, recreate more positive thoughts. (Falguni Patel, 2019)

### Chatbot using TFID and N-gram

The main motive of the system proposed on the paper published on “8th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO)” is to help the people regarding the health information. In the proposed system researchers have used **Artificial Intelligence, Natural Language Processing and TFID and N-gram** technologies. In this system chatbot stores data in the database to find sentence similarity and answer the queries accordingly. Using n-gram, TFIDF and cosine similarity, ranking and sentence similarity is calculated. For each, the score will be obtained for query from user, and more similar for the query given, sentences will be obtained and provided to the user. (Lekha Athota, 2020)

### Chatbot using Random Forest Algorithm

In the paper by Monalisa Dey, Anupam Mondal, Dipankar Das, Kevin Garda and Sachit Nagpal has proposed a “Chatbot: An automated conversation system for the educational domain” using **Random Forest algorithm** which answer the question using pre provided datasets. In addition, an average is given by the validation method F-measure 0.870 on multiple K-values under random forest values for the chatbot that was proposed. (Anupam Mondal, 2018)

### Chatbot using K-nearest neighbor algorithm

In the paper published on “Proceedings of the Third International Conference on Trends in Electronics and Informatics (ICOEI 2019)” has proposed a system which Diagnosis disease and recommend treatment based on user-provided symptoms, for this to be happen the chatbot is trained with the some predefine datasets which can be asked by user. In the proposed system a chatbot is developed using the machine learning algorithm which is **K-nearest neighbor algorithm (KNN)**. (Rohit Binu Mathew, 2019)

Diagram

Description automatically generated  
 Figure 7: Working Principle of Proposed System

### Chatbot using LSTM-based Multi-Layer Embedding

Another Research paper has put forward a development of a chatbot using **LSTM** model on topic “A Chatbot Using **LSTM**-based Multi-Layer Embedding for Elderly Care”. In this proposed paper, Multi-layer embedding based on **LSTM** the model is used to extract the semantic data between the Words and sentences with several sentences in a single turn Chatting with elderly people. The distance between Euclid’s the selection of a proper question pattern is used, which is further used to pick the corresponding response to respond to the user. The five-fold cross validation system for preparation and assessment was used for performance evaluation. The proposed method for top-1 response achieved an accuracy of 79.96 percent which outperformed older traditional methods. (Ming-Hsiang Su, 2017)

### Chatbot using different algorithms

In the paper published in “22nd International Conference of Computer and Information Technology (ICCIT)” in 2019 has proposed a health care chatbot system which uses different algorithms to classify disease. They have used Decision Tree **(DT)**, Random Forest **(RF)**, Multinomial Naive Bayes **(MNB)**, Support Vector Machine **(SVM)**, AdaBoost, and K Nearest Neighbor **(KNN)**. Every one of these algorithms is Supervised algorithms for machine learning and can be used in Classification as well as regression. TF-IDF was used for the Bangla text and Cosine Similarity vectorization. All the algorithms performed well with good accuracy while SVM with 98.39 percent, it produces the highest accuracy. They have therefore used SVM as a classifier of core devices. (Md. Moshiur Rahman, 2019)

### Chatbot using CNN

In the Proceedings of the 2nd International conference on Electronics, Communication and Aerospace Technology, some researchers from “Sardar Patel Institute of Technology” has put forward a design to develop a chatbot system using Convolutional Neural Network **(CNN)**. In this one, they have proposed a healthcare assistant in the paper that will make it possible for users to search for common disease signs, a recommendation to visit a Doctor, if applicable, advice for exercise, monitoring exercise/workout schedule, complete with an extensive guide to exercise. The primary aim of the proposed system was to build a system that uses AI and deep Learning to help better the lives of busy individuals. In the proposed system **CNN** was deployed for Intent Classifier. A trained model of the highest accuracy achieved was 97.37 percent. Using it the whole dataset was tested and 98.39% accuracy was checked. (Siddhant Rai, 2018)

## Similar Systems

### Your.Md web application and Android Application

Your.MD is a mobile application as well as web application which is a digital health platform committed for everyone who are seeking for self-care. This application was developed by doctors, data scientist and digital experts. This application is helping people to get information of health related query without any cost. This application provides Health A-Z service which means that we can get the information of health related from the trusted source written by qualified doctors. (Your.MD, 2017)

A phone with a chat window

Description automatically generated with medium confidence

Figure 8:- Your.Md Application

### Youper mobile and android application

Youper is also a mobile application as well as web application which is developed to remove anxiety and remove depression. They claim that this application is emotional health assistant. They uses Artificial Intelligence (AI) to provide various therapy to fit the needs of user. The other function of this application is same as the function of Your.MD application. This application has helped millions of people to fight against depression. (Youper, Inc., 2020)

A screenshot of a computer

Description automatically generated

Figure 9:- Youper Web Application

## Analysis to the Reviewed Literature

From all the research papers, I found that all the chatbots will going to be more personal and human no matter which kind of approach we use to develop them. Various Researchers from the world are using different techniques to develop different kinds of chatbot system. Artificial Neural Network **(ANN)**, Natural Language Understanding **(NLU)**, Natural Language Processing **(NLP**) are being used to develop more reliable chatbot system. One of the methods that has not been discussed above i.e., Artificial Neural Network **(ANN)** which is used to calculate the output from input provided by user using weighted connections which are calculated from repeated iterations while training the data is also the one of the methods to develop artificial intelligence chatbot system. Some of the common functionalities and method that have been used in these research papers are the natural language processing, natural language understanding, pattern matching algorithm, Support Vector Machine Algorithm **(SVM),** Naïve Bayes Algorithm,Random Forest, K-nearest Algorithm. Tokenization, vectorization and Cleansing are the method used for the datasets collection. Using **LSTM** model, more advanced Artificial Intelligence chatbot system which can store old conversation and analyze them to give more relevant answer to the query, can be developed where other methods are used to develop simple conversational chatbot system that can answer the query according to the trained data sets. Similarly, three common deep learning classifiers, namely Hierarchical Attention Network **(HAN),** Recurrent Neural Network **(RNN),** andConvolutional Neural Network **(CNN)**, are used for emotion detection. From the research I found that the accuracy of the chatbot system developed using **SVM** algorithm was 98.39 % which is the highest while the experimental accuracy of LSTM model was 79.96 %. In this type of model, pre-defined data sets are low as compared to other proposed models. Similarly, the accuracy rate of **CNN** as compared to other model was quite high which produces 98.39 % accuracy which is equal to **SVM** model, but it was tested with large number of data sets. So, from all the research paper I found that LSTM model is the emerging technology for the development of chatbot system where old conversion are used to get reference to answer queries of user. In this model, system learns from past conversation which will produce more accuracy in future.

# System Development Approach

It can therefore be argued that a project succeeds when it is well managed. Development team or the manager of the development must well choose a software development methodology which is best suited to the project. Every methodology has its own method, advantage and disadvantage and exist for a purpose.

**Scrum** is one of the examples of agile software development methodology. Agile is the way that most software is developed in the 21st century. Repetition of development and testing at some organized intervals within the complete life cycle of the particular project is the key consideration of the agile software development method. The above method of the development is a parallel process with testing different from the waterfall method where development and testing are sequential. (Guru99, 2020)

Thus, there are several things to take into account while choosing a software development process, the most crucial of which is how to handle changes in end-user requirements. The primary advantage of Agile approaches is that modifications and communication techniques are followed in a clear-cut and efficient way. Frequent meetings with the supervisor are feasible now that the Agile system is in place.

For our project, the Agile Scrum framework would be the most suitable methodology. During the project's operating phase, requirements that were not found during the beginning phase can be resolved. Scrum is particularly adaptable to requirements changes. It can be used for projects involving small teams, like ours.

# Functional Decomposition Diagram (FDD)

**A diagram of health care system

Description automatically generated**   
 Figure 1: FDD of the System

# System Requirement Specifications (SRS)

This system requirement describes the software system that is being developed for the Health Care Chatbot System. Drawing on the department's and customers' transactions, it delineates the main functional, non-functional, and usability requirements.

## Data Dictionary

### Patient Data Dictionary

|  |  |  |  |
| --- | --- | --- | --- |
| Attributes | Meaning | Data Type | Other |
| Patient ID | A unique identifier for patient user | Integer (8) | Index Yes (No Duplicates) |
| Patient Name | Name of Patient | Varchar (20) | Example “Pranish Acharya” |
| Patient Email | Patient email address can be used as username | Varchar (30) | Example “pranish@gmail.com” |
| Patient Address | Address of patient | Varchar (50) | Example “Hillers Road Auburn Australia” |
| Patient Phone Number | Phone number of Patient | Varchar (12) | Not null |

### Doctor Data Dictionary

|  |  |  |  |
| --- | --- | --- | --- |
| Attributes | Meaning | Data Type | Other |
| Doctor ID | A unique identifier for Doctor | Integer (8) | Index Yes (No Duplicates) |
| Doctor Name | Name of Doctor | Varchar (20) | Example “Jitendra Shrestha” |
| Doctor Email | Doctor email address can be used as username | Varchar (30) | Example “pranish@gmail.com” |
| Doctor Address | Address of Doctor | Varchar (50) | Example “Hillers Road Auburn Australia” |
| Doctor Phone Number | Phone number of Patient | Varchar (12) | Not null |
| Doctor License Number | Doctor’s unique registration number | Varchar (12) | Not Null |

### Appointment Data Dictionary

|  |  |  |  |
| --- | --- | --- | --- |
| **Attributes** | **Meaning** | **Data Type** | **Other** |
| Appointment ID | A unique identifier for Appointment | Integer (8) | Index Yes (No Duplicates) |
| Appointment Date | Appointment date with doctor | Date Time | Example “11 Nov 2024” |
| Follow Up Date | Next visit with the Doctor | Date Time | Example “15 Nov 2024” |
| Patient Email | Patient email address can be used as username | Varchar (30) | Example “pranish@gmail.com” |
| Patient Name | Name of Patient | Varchar (20) | Example “Pranish Acharya” |
| Doctor Name | Name of Doctor | Varchar (20) | Example “Jitendra Shrestha” |
| Doctor Email | Doctor email address can be used as username | Varchar (30) | Example “jiten@gmail.com” |
| Patient Phone Number | Phone number of Patient | Varchar (12) | Not null |

## Functional Requirements

These specifications define the functions the system must perform, such as how it must process outputs, react to inputs, and act in a specific manner under certain conditions.

## Non-Functional Requirements

These prerequisites are the non-functional services that the system makes use of to support enhanced system functionality.

Here’s a brief explanation of each of the non-functional requirement’s categories:

### 1. Look and Feel Requirements

The system should have a unified, eye-catching interface that complements the company's logo. This guarantees a positive user experience and encourages system familiarity throughout.

### 2. Usability and Humanity Requirements

The navigation should be simple, and the directions should be straightforward for users to understand. It should be able to support several languages as necessary and be usable by a wide range of users, including those with impairments.

### 3. Performance Requirements

The system needs to react rapidly, have short load times, and function flawlessly. It must manage large numbers of concurrent users without experiencing performance deterioration.

### 4. Operational Requirements

With little downtime, the system should be dependable and accessible around-the-clock. It should be compatible with a range of platforms and devices, allowing consumers to access it easily.

### 5. Maintainability and Support Requirements

The system should have modular code, comprehensive documentation, and be simple to maintain. Ensuring that regular updates and bug fixes are simple will help minimize user interruption.

### 6. Security Requirements

User data must be safeguarded by the system using robust authentication, encryption, and frequent security audits. It should be safe from online attacks and adhere to all applicable data protection regulations.

### 7. **Cultural and Political Requirements**

Avoiding potentially harmful or politically charged information, the system should be impartial and sensitive to cultural differences. It needs to be flexible enough to accommodate varying regional laws and cultural norms.

### 8. Legal Requirements

The system needs to abide by all applicable laws and rules, including those pertaining to accessibility and data security. This entails getting the required permits and abiding by the laws that are particular to your sector.

## Usability Requirements

These requirements guarantee that users will find the produced system easy to use and that it will fulfil all necessary objectives while operating flawlessly.

**Legend**

UMS: User Management System

PHMS: Personal Health Management System

CS: Chatbot System

F: Functional Requirement

NF: Non-functional Requirement

UR: Usability Requirement

## Overall use case Diagram

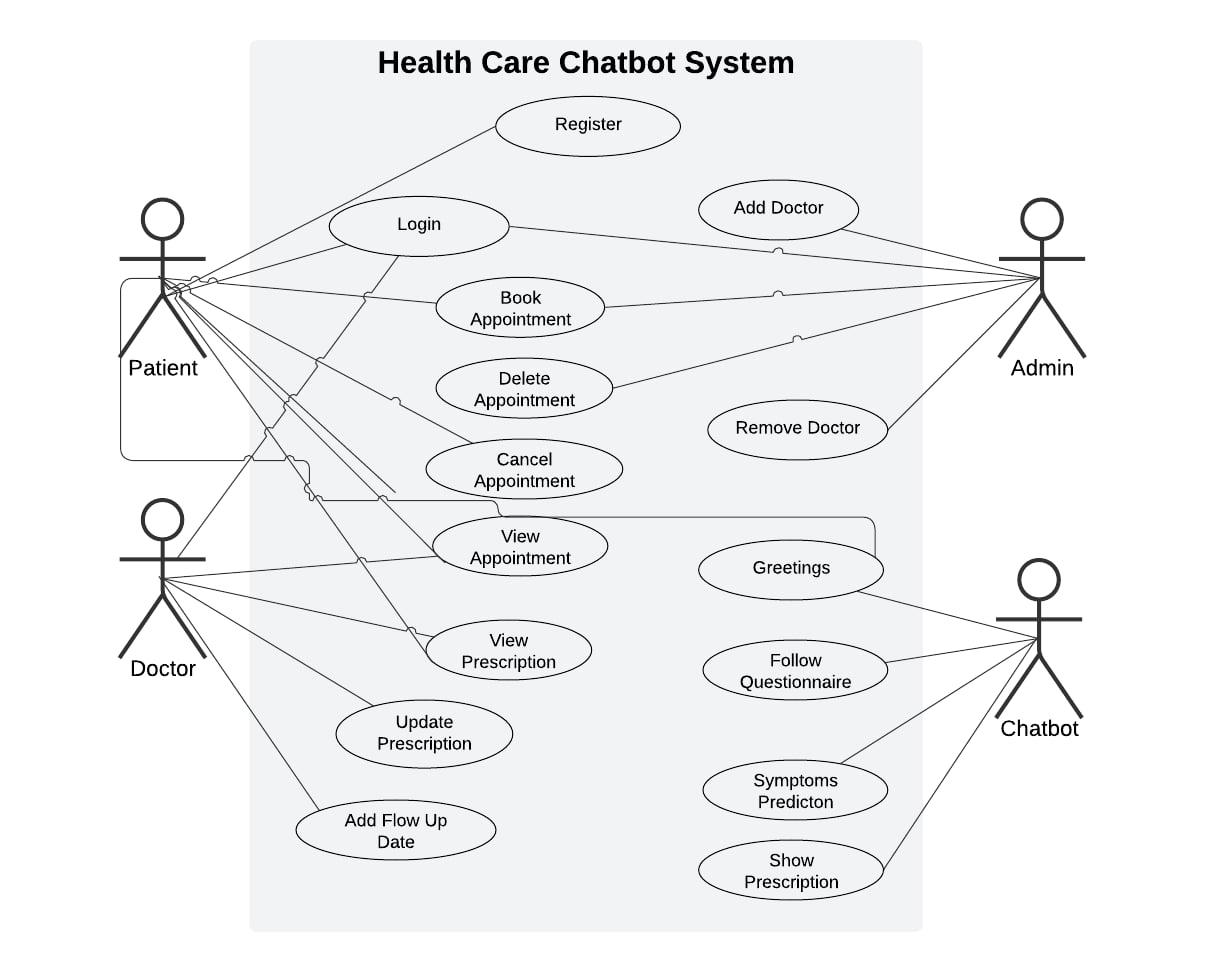


Figure 2: Overall Use case Diagram

## SRS Table for User Management System (S1)

Table 1: SRS for S1

|  |  |  |
| --- | --- | --- |
| **Requirement Code** | **Requirement Description** | **MoSCoW** |
| UMS-F-01 | The system should allow normal user to sign up and login to the system. | Must have |
| UMS-F-02 | The system should allow user to reset the password. | Must have |
| UMS-UR-03 | System should suggest adding numeric  and special characters in password. | Must have |
| UMS-UR-04 | System should give the option of making the credentials visible while login. | Should have |
| UMS-NF-05 | System should hide the login credentials of the user. | Must Have |
| UMS-F-06 | The system should allow user to chat with CHATBOT system without logged in. | Must have |
| UMS-F-07 | System should allow doctor to login to the system. | Must Have |
| UMS-F-08 | System should allow admin to Add Doctor. | Must Have |
| UMS-F-09 | System should allow admin to delete doctor. | Must have |

### Use Case Diagram for UMS

A diagram of a network

Description automatically generated

Figure 3: Use case Diagram of UMS

### ER Diagram of UMS

A diagram of a user

Description automatically generated  
 Figure 4: Detailed ER Diagram of UMS

### WireFrame of UMS Register Page

A screenshot of a computer

Description automatically generated

Figure 5: Wireframe of User Registration Form

### WireFrame of UMS Login page

Graphical user interface

Description automatically generated

Figure 6 : Wireframe of User Login System

## SRS Table of Personal Health Management System (S2)

Table 2: SRS for S2

|  |  |  |
| --- | --- | --- |
| **Requirement Code** | **Requirement Description** | **MoSCoW** |
| PHMS-F-01 | Allow user (patient) to book appointment. | Must have |
| PHMS-F-02 | Allow user to delete appointment. | Must have |
| PHMS-F-03 | Allow Doctor to view appointment of users. | Must have |
| PHMS-F-04 | Allow Doctor to add prescription in the booked appointment. | Must have |
| PHMS-F-05 | Allow user to see doctor’s prescription report. | Must have |
| PHMS-F-06 | Allow user to know about follow up date. | Should have |
| PHMS-NF-07 | Allow user to download the prescription report. | Could have |
| PHMS-UR-08 | Allow user to Know about doctors Speciality. | Could have |
| PHMS-UR-09 | Allow user to delete health records from the system. | Could have |

### Use Case Diagram of PHMS

A diagram of a diagram

Description automatically generated

Figure 7: Use Case Diagram of PHMS

### ER Diagram of PHMS

A diagram of a doctor

Description automatically generated

Figure 8: Detailed ER Diagram of PHMS

### Wireframe of PHMS

Table

Description automatically generated  
Figure 9: Wireframe of PHMS

## SRS Table of Chatbot System (S3)

Table 3: SRS for S3

|  |  |  |
| --- | --- | --- |
| **Requirement Code** | **Requirement Description** | **MoSCoW** |
| CS-F-01 | Should allow user to interact with chatbot interface without registration. | Must have |
| CS-F-02 | Should greet user. | Must have |
| CS-F-03 | Allow user to Ask question regarding health. | Must have |
| CS-UR-04 | User could use voice chat to ask questions. | Could have |

### Chatbot Architecture

A diagram of a machine learning process

Description automatically generated

Figure 10: Chatbot Architecture

### Flow Chart Diagram for Chatbot

A diagram of a flowchart

Description automatically generated

Figure 11: Flow chart Diagram of Chatbot System

### Wireframe for Chatbot Interface

Graphical user interface, text, application

Description automatically generated

Figure 12: Wireframe Diagram of Chatbot Interface

### Wireframe for Chatbot Homepage

Diagram

Description automatically generatedFigure 13: Wireframe of chatbot Homepage

### Wireframe for Chatbot About Us page

Graphical user interface, text

Description automatically generatedFigure 14: Wireframe of chatbot About us page

# **Project Management**

## Project Cost Estimate

A project cost estimate accounts for personnel, software, and contingencies for unforeseen charges in addition to any other costs necessary to finish the project. It supports efficient budgeting and planning to guarantee the project stays within allocated funds.

## Project Detail Costs

The project's below-average cost is intended to provide a realistic assessment of the undertaking, treating it as though it were an endeavour in professional growth. The breakdown shows the time, effort, and resources that would normally be needed if this project were sponsored or managed by university.

1. **Project Planning and Management Tools**:

* Project Management: Jira, Trello
* Communication: Microsoft Teams
* Version Control: Bitbucket
* Resources: Scrum Master @ $90/hr
* **Budget**: $20,600

1. **Development Costs**

**Budget:** $8,960

**Frontend Development**

* + Technologies: HTML, CSS, JavaScript
  + Tools: Webpack, Babel, npm
  + Resources: Frontend Developer @ $60/hr

**Backend Development**

* + Technologies: Django will handle backend, API Creation
  + Tools: Django REST Framework
  + Resources: Django Developer @ $60/hr

**Chatbot Development**

* + Technologies: Rasa Framework, NLP
  + Tools: RASA SDK, RASA CLI
  + NLP: SpacCY, TensorFlow
  + Resources: Python Developer @ $80/hr

**Database**

* + Technologies: Django ORM

1. **Design and User Experience (UX)**

**UI/UX Design**

* Wireframes: Balsamiq
* Resource: UI/UX Developer @ $50/h
* **Budget**: $10,000

1. **Testing and Quality Assurance**

**Functional, Performance, and Security Testing**

* CI/CD: Jenkins
* Functional Testing: Selenium
* Performance Testing: Apache
* Resource: Quality Control Team @ $40/hr, DevOps Engineer @ $60/hr
* **Budget**: $6,000

1. **Deployment and Hosting**:

**Tools and Technologies**

* Hosting: AWS
* Deployment: Docker
* Budget: $15,000

1. **Maintenance and Support**: ($30,000)
2. **Contingency** - ($20,000)

As the cost for other purposes which will be used while developing the project from beginning to end phase are given below.

Table 4: Miscellanous Cost Breakdown

|  |  |  |  |
| --- | --- | --- | --- |
| **S.N.** | **Name** | **Used For** | **Cost** |
| 1 | Microsoft Teams | Communication | $20,000 |
| 2 | Bitbucket | For Source | $20,000 |
| 3 | Jenkins | For Pipeline, DevOps | $15, 000 |
| 4 | Laptops | For development and testing purpose | $20,000($2,000 pp) |
| 5 | Miscellaneous |  | $20,000 |
|  |  | **Total** | **$95,000** |

**Total Budget**: $200,000(Approx.)

## Project Schedule

A project schedule is a comprehensive timetable that outlines the activities, deadlines, and dependencies needed to finish a project on time. It facilitates resource management, progress monitoring, and on-time project delivery.

The following figure shows the project schedule with the duration, completion of the project and cost related to only development phase.

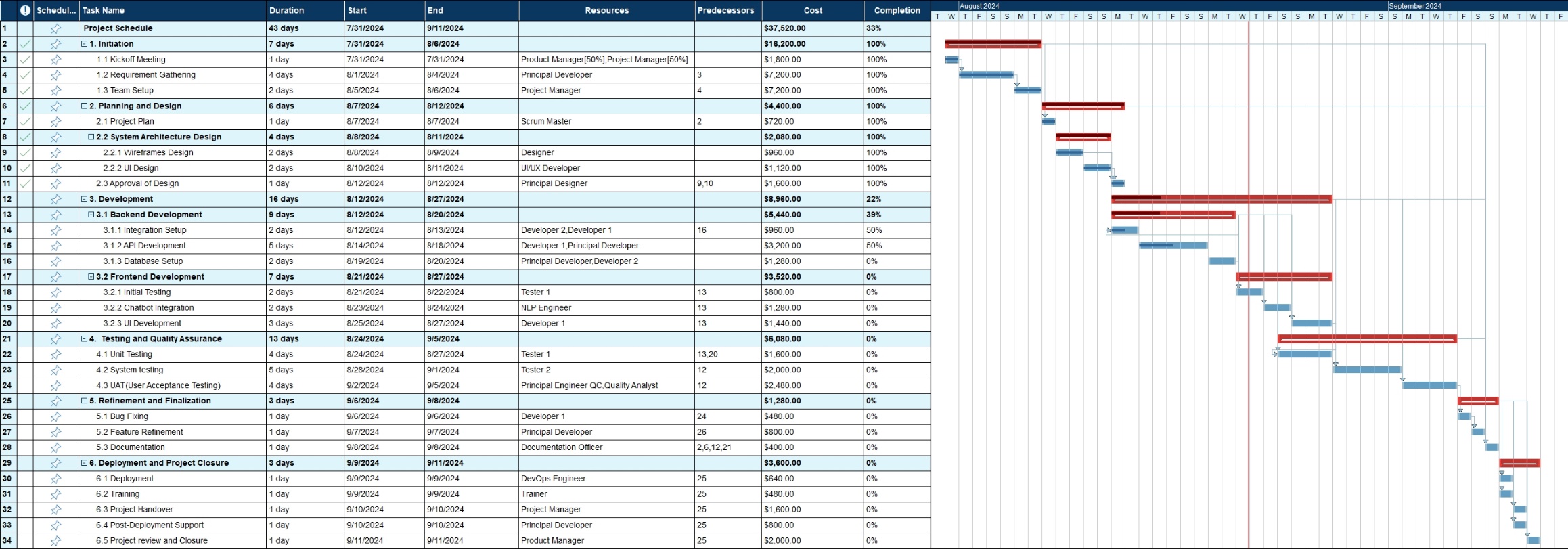


Figure 15: Work Break Down for Project Schedule

1. **Initiation**: Specify the goals, parameters, and deliverables of the project. Determine the important parties and compile the healthcare chatbot's first specifications. To describe the project's objectives and vision, draft a project charter.
2. **Planning and Design**: Create a thorough project plan with deadlines, goals, and resource allocation. Wireframes and prototypes should be made to design the chatbot's user interface and experience.
3. **Development**: Construct the chatbot's front end, back end, and components. Django is used to construct the backend while HTML, CSS, and JavaScript are used to implement the user interface. Set up the database using Django ORM and integrate the Rasa Framework for the chatbot.
4. **Testing and Quality Assurance**: To make sure the chatbot functions properly and satisfies quality requirements, do functional, performance, and security testing. Find and address any defects or problems found during testing.
5. **Refinement and Finalization**: Examine and improve the chatbot in light of user input and testing results. Complete the functionality and design to make sure the application satisfies all project criteria and is prepared for deployment.
6. **Deployment and Project Closure**: Install and run the chatbot program in a live setting. Make sure users can access and the application is hosted correctly. Finalize project documentation, carry out a project review, and get input from relevant parties. Ascertain that all deliverables are fulfilled and offer any training or resources that may be required. Archive the project's documentation, then declare it closed.

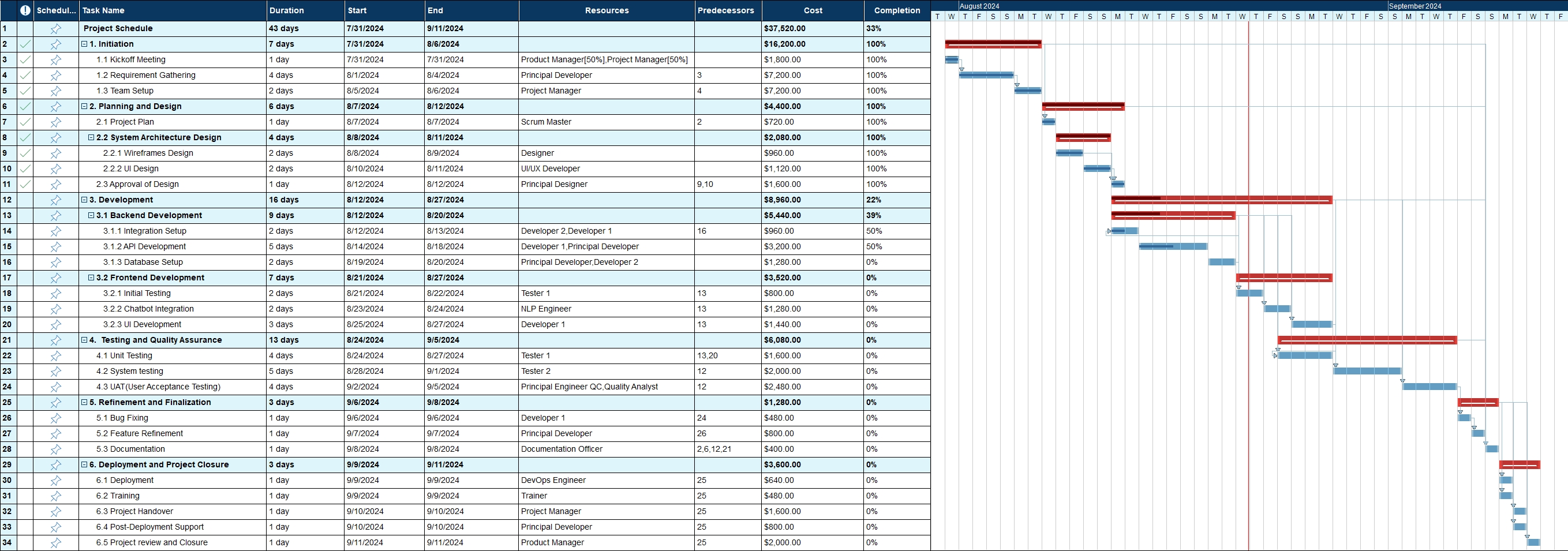


Figure 16: Gantt chart for Work Break Down showing the date

The below figure shows the overall timeline of the project schedule

A computer screen shot of a diagram

Description automatically generated

Figure 17: Timeline of project scheduleResources Used

A screenshot of a computer

Description automatically generated

Figure 18: Resource Used for Project

## Issues in Project

Project Risks**:** Overcoming unanticipated technological obstacles and integration problems is essential to the healthcare chatbot project's success. Risks might include unforeseen restrictions in the tools and frameworks employed, or incompatibilities with emerging technology. It is crucial to carry out in-depth risk assessments early in the project and to put strong testing procedures in place as it develops to mitigate these risks. This entails establishing trial periods to spot any problems and making sure technological fixes are thoroughly tested and documented.

Cutover Issues: Cutting edge problems like data transfer mistakes or service outages are common during the development to production phase. These problems may interfere with the chatbot's availability and operation. Create a thorough cutover strategy that outlines data transfer procedures, backup plans, and a failsafe rollback plan to reduce cutover risks. To further ensure a seamless transition and reduce interruptions, thorough pre-deployment testing as well as user training and support are recommended.

Quality Assurance and Testing Issues**:** Undiscovered defects or incomplete testing might have an impact on the chatbot's dependability and functionality. A less-than-ideal user experience may be caused by problems like insufficient test coverage or overlooked bugs. Create a thorough testing plan that incorporates security, performance, and functional testing to allay these worries. Use continuous integration techniques to make sure problems are found and fixed as soon as possible throughout the development process.

# Project Documentation

## Project Meeting with Minutes

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Date**: | | 31st July, 2024 | | **Time**: | 15:00 | | | **Location**: | | Inside Classroom |
| **1. Kickoff Meeting** | | | | | | | | | | |
| **Agenda**:  - Introduction  - Project Overview  - Project Scope and deliverables  - Work division of project proposal | | | | | | | | | | |
| **Attendance** | | | | | | | | | | |
| **Present** | | | | | **Absent** | | | | | |
| Both | | | | | Nil | | | | | |
| **Meeting Brief Summary** | | | | | | | | | | |
| **Introduction:**  - Self Introduction  - Bring topics and get confirmed by supervisor  - Find out each members strength on the chosen topic  - Search the project on scholar and discussed on those  - Discussed on SDLC | | | | | | | | | | |
| **Project Overview:**  - Discussed the selected chatbot system topic  - Discussed types of chatbot system  - Finalized the objectives and purpose | | | | | | | | | | |
| **Project Scope and Deliverables:**  - Defined the scope which we will be working on it  - Searched for the deliverables required for project | | | | | | | | | | |
| **Work division of project proposal:**  - Introduction, Background and client profile is completed on surface level  - Purposes and Objectives, Scope and Exclusion, Assumptions and constraints will be done by Jitendra  - Deliverables, Schedule, budget will be done by Pranish  - Will merge our contribution and review once before submission by both | | | | | | | | | | |
| **AOB:**  - Nil. | | | | | | | | | | |
| **Next Meeting** | | | | | | | | | | |
| **Date**: | 7th August, 2024 | | **Time**: | | | 14:00 | **Location**: | | Inside Classroom | |
| This meeting minute was prepared by Jitendra. | | | | | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Date**: | | 7th August, 2024 | | **Time**: | 14:00 | | | **Location**: | | Inside Classroom |
| **2. Requirement Gathering** | | | | | | | | | | |
| **Agenda**:  - Progress of Project Proposal  - Any challenges in proposal  - Feasibility Study | | | | | | | | | | |
| **Attendance** | | | | | | | | | | |
| **Present** | | | | | **Absent** | | | | | |
| Both | | | | | Nil | | | | | |
| **Meeting Brief Summary** | | | | | | | | | | |
| **Progress of Project Proposal:**  - Introduction, Purposes and Objectives, Scope and Exclusion are completed  - Deliverables and schedule are completed | | | | | | | | | | |
| **Any challenges in proposal:**  - Discussed the challenges might be on real data feeding for chatbot  - Also, for the budget, estimated the real project cost | | | | | | | | | | |
| **Feasibility Study**:  - Can be developed using python and NLP  - Will be working on limited data so every area will not be covered | | | | | | | | | | |
| **AOB:**  - Nil. | | | | | | | | | | |
| **Next Meeting** | | | | | | | | | | |
| **Date**: | 14th August, 2024 | | **Time**: | | | 18:00 | **Location**: | | Outside Classroom | |
| This meeting minute was prepared by Pranish. | | | | | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Date**: | | 14th August, 2024 | | **Time**: | 18:00 | | | **Location**: | | Outside Classroom |
| **3. Design Phase 1 Meeting** | | | | | | | | | | |
| **Agenda**:  - Development Methodology  - Functional and Non-Functional Requirements  - Use Case Diagrams  - User Interfaces  - Tools discussion for creating diagrams  - Task Allocation | | | | | | | | | | |
| **Attendance** | | | | | | | | | | |
| **Present** | | | | | **Absent** | | | | | |
| Both | | | | | Nil | | | | | |
| **Meeting Brief Summary** | | | | | | | | | | |
| **Development Methodology:**  - Using Agile Approach  - Testing at same time while development  - Breaking down the features and combine  - Issue can be resolved and modify the features | | | | | | | | | | |
| **Functional and Non-Functional Requirements:**  - Functional Requirements   * Create ER diagram * Create Functional Decomposition Diagram * Define the data (User, Appointment, Doctor)   - Non-Functional Requirements   * Look and Feel Requirements * Performance Requirements * Maintainability and support Requirements * Security Requirements * Cultural and Political Requirements * Legal Requirements | | | | | | | | | | |
| **Use Case Diagrams**:  - Overall use case Diagram  - Deep dive into the functionality on each function from overall use case | | | | | | | | | | |
| **User Interfaces**:  - Discussion on the wireframes for the chatbot  - Discussion on the wireframes for booking an appointment  - Discussion on Login Page wireframe | | | | | | | | | | |
| **Tools discussion for creating diagrams:**  - Draw.io will be used for diagrams (https://app.diagrams.net/)  - WBS tool for Gantt chart (https://www.workbreakdownstructure.com/) | | | | | | | | | | |
| **Task Allocation:**   |  |  | | --- | --- | | **Jitendra** | **Pranish** | | * Creating wireframes for chatbot UI, login in UI * Non-Functional requirements * Creating Overall Use case and multiple level Use case * Flow chart diagram | * Functional Requirements * Create ER Diagrams * Sequence Diagram * Activity Diagram * Class Diagram | | | | | | | | | | | |
| **AOB:**  - Nil. | | | | | | | | | | |
| **Next Meeting** | | | | | | | | | | |
| **Date**: | 16th August, 2024 | | **Time**: | | | 13:00 | **Location**: | | Inside Classroom | |
| This meeting minute was prepared by Jitendra. | | | | | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Date**: | | 16th August, 2024 | | **Time**: | 13:00 | | | **Location**: | | Inside Classroom |
| **4. Design Phase 2 Meeting** | | | | | | | | | | |
| **Agenda**:  - Progress on the assigned tasks  - Issues on design  - System Navigation | | | | | | | | | | |
| **Attendance** | | | | | | | | | | |
| **Present** | | | | | **Absent** | | | | | |
| Both | | | | | Nil | | | | | |
| **Meeting Brief Summary** | | | | | | | | | | |
| **Progress on the assigned tasks:**  - Completed the overall use case diagram  - Completed wireframes for login page UI  - Completed the Flow chart diagram, sequence diagram | | | | | | | | | | |
| **Issues on design**:  - Discussion on wireframes for chatbot  - Go through the chatbot from different websites and checked the UI  - Planned to implement the chatbot for quicker and correct response | | | | | | | | | | |
| **System Navigation**:  - After creating wireframes, decided the system navigation  - Users doesn’t need to login for accessing chatbot  - Users need login to save their data and book appointment  - Doctors can add prescription after looking the patients  - Admin can manage the patients and doctors | | | | | | | | | | |
| **AOB:**  - Nil. | | | | | | | | | | |
| **Next Meeting** | | | | | | | | | | |
| **Date**: | 21st August, 2024 | | **Time**: | | | 13:00 | **Location**: | | Inside Classroom | |
| This meeting minute was prepared by Jitendra. | | | | | | | | | | |

## Potential Involvements of human factors

Project success, including the development of healthcare chatbots, is greatly influenced by human factors. Here are the some of the human factors explained:

Team Dynamics: Controlling team dynamics is essential to the healthcare chatbot project's success. Variations in communication styles, working methods, and experience levels can impact team cohesiveness and productivity. Promoting a collaborative atmosphere through frequent team meetings and the use of efficient communication technologies like Microsoft Teams are crucial to overcome these problems. To keep team morale up and conflicts resolved in a constructive manner, it may also be helpful to promote open communication and offer conflict resolution training. This will assist to keep the team united and motivated.

User Interactions: The degree to which the chatbot satisfies user requirements and expectations determines its efficacy. User discontent and low adoption might result from misunderstandings or unfulfilled demands. It's critical to build the chatbot with a user-centric perspective to handle these interactions, which entails performing user research and collecting feedback across the development process. A smoother deployment and improved user experience may be achieved by offering thorough training and support materials to users, who will need them to handle any problems they may have adjusting to the new system.

User Feedback and Adaptation: The efficacy and relevancy of the chatbot depend heavily on ongoing user input and change. User input might call for system updates or modifications, which would affect project budgets and schedules. It is possible to incorporate user feedback and make essential adjustments with flexibility when using agile techniques and an iterative development strategy. This guarantees that the chatbot adapts to user demands and maintains its effectiveness over time.

# **Potential Privacy Issues**

Since personal health information is sensitive, controlling privacy issues is essential in healthcare chatbot projects. Unauthorized access to data, data breaches, regulatory noncompliance, incorrect data retention, insufficient user permission, and insufficient data anonymization are some major hazards. To solve them, put strong access restrictions and encryption in place to stop unwanted access, carry out frequent security assessments to find weaknesses, and make sure that laws like HIPAA and GDPR are being followed by conducting regular audits and training. To safely handle information, establish explicit regulations for the preservation and deletion of data, offer clear permission procedures that educate users about the use of their data, and employ data anonymization techniques for any study or analysis to safeguard user privacy. This may protect sensitive data, uphold regulatory compliance, and foster user confidence by proactively addressing these threats.

# **Professional ethics Issues**

A healthcare chatbot must consider several ethical considerations, including protecting user privacy by disclosing the chatbot's limitations, maintaining accuracy and dependability through evidence-based information, preventing bias through the use of diverse data, and handling data ownership and usage transparently.

Among all, the data privacy and confidentiality seem to be the major one so described below clearly.

Data Privacy and Confidentiality: For a healthcare chatbot, maintaining data privacy and confidentiality is essential. To comply with laws like HIPAA and GDPR, this entails protecting data with robust encryption, enforcing stringent access restrictions, getting explicit user consent, and performing frequent security assessments. By taking these precautions, users' confidence is preserved, and sensitive data is protected. (Kosinski, 2018)

# References

1. Ayanouz, S., Abdelhakim, B.A. and Benhmed, M., 2020 March. A smart chatbot architecture based NLP and machine learning for health care assistance. *In Proceedings of the 3rd international conference on networking, information systems & security,* pp. 1-6.
2. Divya Madhu, N. J. C. J. E. S. S. S. A. A., 2017. *A Novel Approach for Medical Assistance Using trained chatbot.* s.l., s.n.
3. Django, 2020. *Django Project.* [Online]   
   Available at: https://www.djangoproject.com/start/overview/  
   [Accessed 18 09 2020].
4. GeeksforGeeks, 2020. *geeksforgeek.* [Online]   
   Available at: https://www.geeksforgeeks.org/software-engineering-spiral-model/  
   [Accessed 29 04 2020].
5. Guru99, 2020. *Guru99.* [Online]   
   Available at: https://www.guru99.com/agile-scrum-extreme-testing.html  
   [Accessed 30 04 2020].
6. Kosinski, Y. W. a. M., 2018. Deep Neural Networks Are More Accurate Than Humans at DetectingSexual Orientation From Facial Images. *Journal of Personality and Social Psychology,* Volume 114, pp. 246-257.
7. Kurup, G. and Shetty, S.D., 2022. AI conversational chatbot for primary healthcare diagnosis using natural language processing and deep learning. *In Computational Intelligence in Pattern Recognition: Proceedings of CIPR 2021,* pp. 259-272.
8. Md Meem Hossain, S. K. P. S. E. D. A. A. B. I. Y. P., 2021. Mr. Dr. Health-Assistant Chatbot. *International Journal of Artificial Intelligence,* Volume 8, pp. 58-73.
9. Mendapara, H., Digole, S., Thakur, M. and Dange, A., 2021. Ai based healthcare chatbot system by using natural language processing. *International Journal of Scientific Research and Engineering Development,* 4(2).
10. Rasa Technologies, 2019. *Rasa.* [Online]   
    Available at: https://rasa.com/docs/rasa/  
    [Accessed 12 09 2020].
11. Rashid Khan, A. D., 2018. *Build Better Chatbots.* I ed. Bangalore: Apress.
12. Sagar, R.H., Ashraf, T., Sharma, A., Goud, K.S.R., Sahana, S. and Sagar, A.K., 2021. Revolution of AI-enabled health care chat-bot system for patient assistance. *In Applications of Artificial Intelligence and Machine Learning: Select Proceedings of ICAAAIML 2020,* pp. 229-249.
13. Santosh Gore, D. D. J. M. E. I. S. G. U. N., 2023. *Leveraging BERT for Next-Generation Spoken Language Understanding with Joint Intent Classification and Slot Filling.* Mumbai, India, IEEE.
14. Scrum Study, 2017. *SCRUMstudy.com.* [Online]   
    Available at: https://www.scrumstudy.com/whyscrum/scrum-phases-and-processes  
    [Accessed 02 05 2020].
15. Sven Laumer, C. M. F. T. G., 2019. *CHATBOT ACCEPTANCE IN.* Stockholm & Uppsala, European Conference on Information Systems (ECIS).
16. Visual Studio Documentation , 2020. *Visual Studio Code.* [Online]   
    Available at: https://code.visualstudio.com/docs  
    [Accessed 19 09 2020].