Software Requirements Specification

for

Patient Stroke Prediction

Version 1.1

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-02-

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Revision History

Name	Date	Reason For Changes	Version
<Artem, Vincenzo>	<02/18/22>	SRS preparement/Utilization	<1.1>
<Artem, Vincenzo>	<03/03/22>	Functional Requirement Revision	<1.2>
<Artem, Vincenzo>	<05/01/22>	Web-based Implementation	<2.1>

1. Introduction

The point of this project is to be able to provide patients with their own personal status using machine learning algorithms to be able to predict the possibility of a patient possibly getting a stroke within their lifetime.

1.1 Purpose

The purpose of this is to be able to provide accurate health information for patients in order to help them prevent future signs of strokes, prevent current status of getting a stroke, or even be able to help different communities gather health information in order to be able to predict stroke outcomes for their people. This project would be a very important breakthrough within the medical field. The ability for patients regardless of their professional status are able to access the system, simply answer a couple questions regarding their health such as age, living factors, bmi, etc and after inputting the information are able to come back with an outcome based on their own health factors. This will grant the ability for others to be able to predict their own outcome and based on this outcome are able to change for the positive to decrease their risk(s) factors. The project can even be utilized by hospitals to be able to help their patients that are already within their care.

1.2 Scope

The system will ask the user specific questions and will have a limited selection of input text fields to write in. We decided to keep the project simple due to our time constraints. Allowing the user to input a variety of written comments would create a more challenging environment for the machine learning algorithms to figure out if the user's comments could contribute to a stroke. The selection of questions we will ask the user will be straightforward for the algorithm and will be picked based on which conditions cause strokes the most.

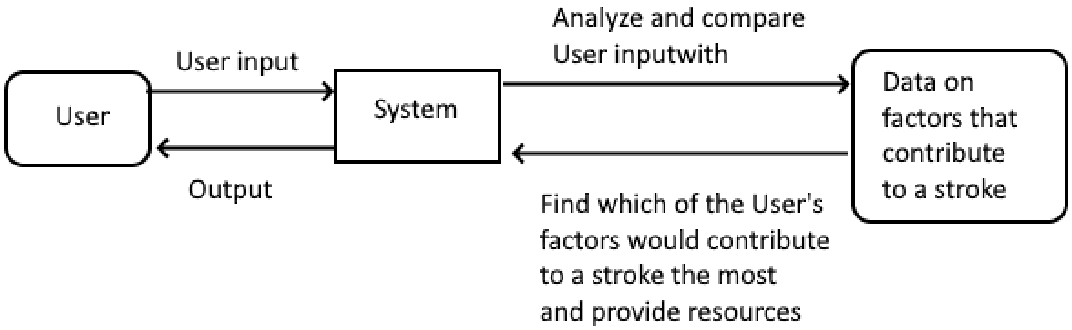
1.3 Overview

The Product at first was an executable program (.exe) allowing users to download it onto their operating systems of any type, input the correct information and achieve their results after utilizing the many different ML outcomes. We have updated the software to be web-based. In the development process, you can run the program in a virtual environment using a local host.

2. General/Overall Description

2.1 Product/System Perspective

This project will utilize machine learning algorithms to compare the user's input to data that demonstrates which factors cause strokes. The system will then inform the user which of the factors they input contribute to a stroke as well as provide the user resources on how they can alter their habits and receive help for preventive stroke measures.


User
User input
Output
System
Analyze and compare User inputwith
Find which of the User's factors would contribute to a stroke the most and provide resources
Data on factors that contribute to a stroke

2.2 Product Functions/Features

The system will ask the user questions such as their age, living conditions, weight, and Body Mass Index for instance. The system will also display to the user their likelihood of having a stroke as well as ways the user can prevent the stroke based on which of their factors would contribute the most to the stroke.

2.3 User Classes and Characteristics

The Users will be individuals who are either at risk of a stroke, study symptoms of a stroke, or have had a stroke in the past. They would want to use the system to either assist themselves in taking precautionary measures to prevent a stroke, if they are at risk, changing habits to prevent a stroke from occurring once more, as well as understanding different variables that cause strokes.

2.4 Operating Environment

The actual final product will be able to work on most major platforms that are able to execute .exe files. Such products consist of Windows 7, Windows 10, Windows 11, Mac Operating System, and Linux. Able to run the actual program on both 32 and 64 bit operating platforms. Access to the internet would be a great asset for best prediction but not required. The program will also function on the latest versions of current browsers such as Google Chrome, Mozilla Firefox, Internet Explorer, Microsoft Edge, etc.

2.5 Design and Implementation Constraints

Constraints include timing, memory and storage requirements enough to perform calculations quickly as well as have the software installed. An internet connection is also required for the user to download the software.

3. Functional Requirements

Translate product or system level requirements (e.g. documented elsewhere in product/system requirements documents) to the functions this software must perform, with a sub-paragraph for each function.

3.1 System Features

3.1.1 Gather information from the user

3.1.1.1 Description and Priority

This feature will use existing patient information on their health data in order to predict new patient data. Without this dataset there would be no way to actually predict our results for the patients.

3.1.1.2 Stimulus/Response Sequences

The user will have to input proper and up to date information into the system. The system should be able to predict results from 30 seconds to a minute if not more after utilizing all of the information. In exchange for this the system would store information on users to help further ML predictions for more patients.

3.1.2 Compare user's information with common symptoms of a stroke

Data Storage

3.1.2.1 Description and Priority

This feature will take patient information that was entered and compare it with existing information about which symptoms contribute to a stroke more frequently.

3.1.2.2 Stimulus/Response Sequences

The machine learning algorithm will compute the likelihood of the patient having a stroke based on every factor the patient input into the system. There will be a mathematical formula that will compute the percentage of likelihood

3.1.3 Display to the user their likelihood of having a stroke and preventions based on their provided information

Data Manipulation

3.1.3.1 Description and Priority

This feature will display the results from the machine learning computation and match which factors the user is at risk for a stroke with resources that can help prevent the stroke by stopping those risks.

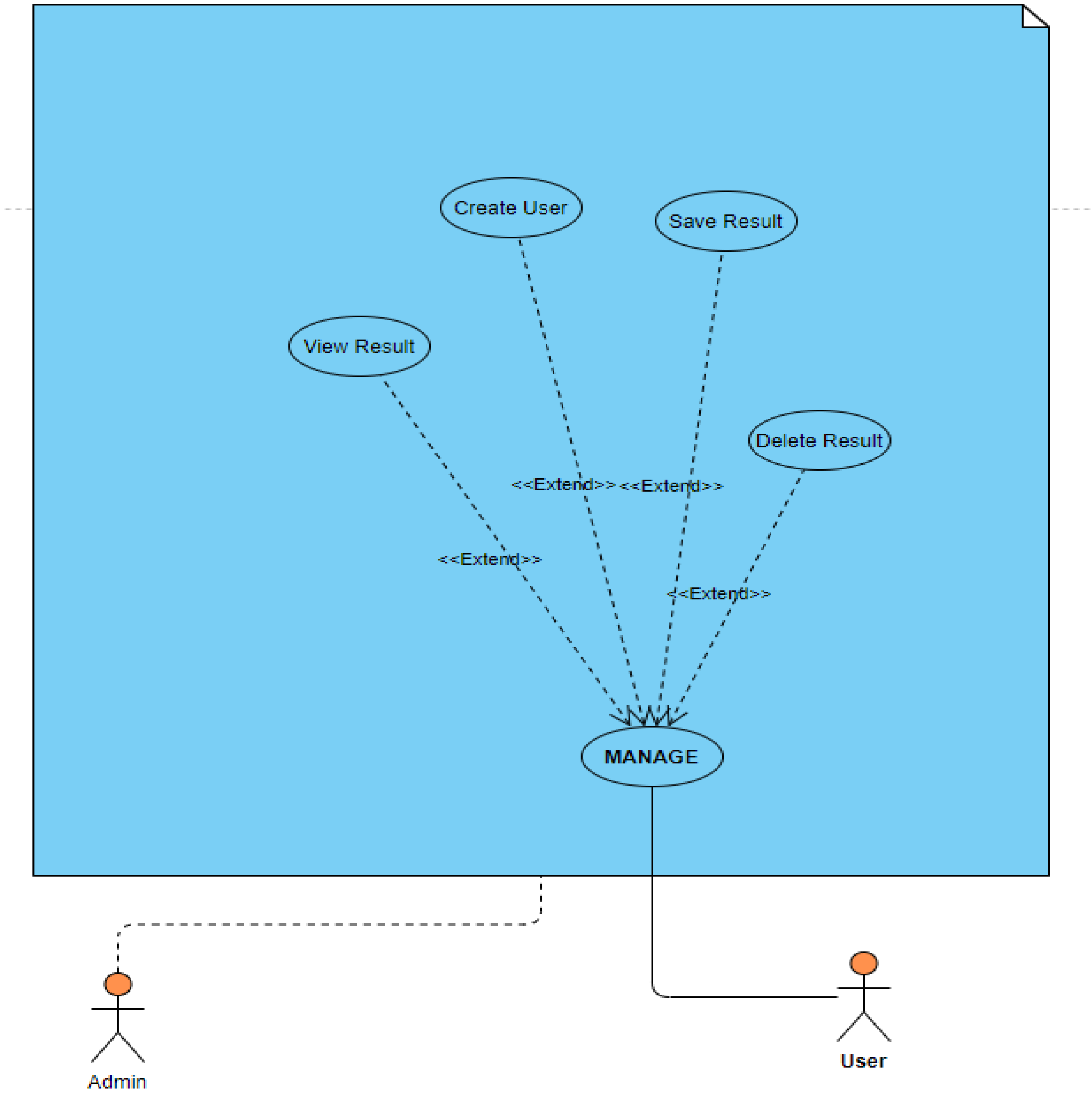
3.1.3.2 Stimulus/Response Sequences

This feature will display example resources if the user is not connected to the internet. Connecting to the internet will allow the system to dynamically find a specialist for the user based on their location and their need.

3.1.3.3 Functional Requirements

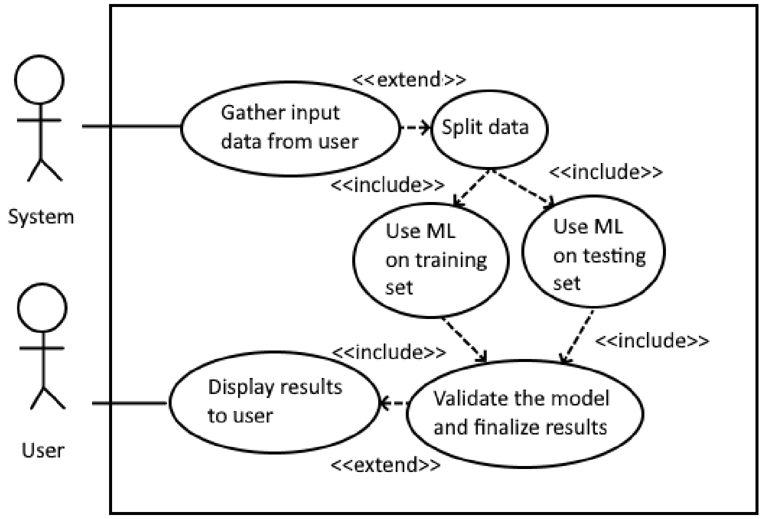
REQ 1): Ability for user to create an account

Users should create an account to be able to store their saved information from the prediction results and the ability to retake with new results at any time.



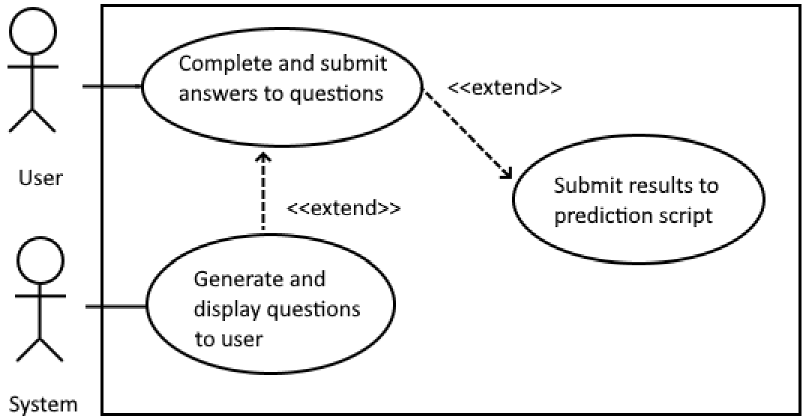
REQ 2): Supervised & Unsupervised Machine Learning (ML) for User Prediction

System must contain both Supervised and Unsupervised ML, and utilize **cross validation methods** in order to get the most accurate prediction possible.



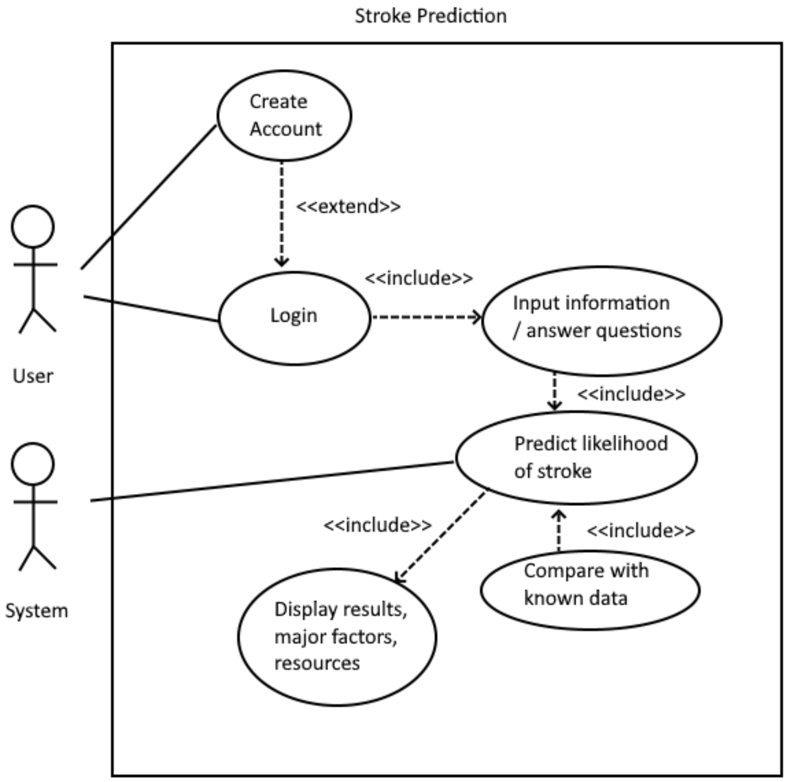
REQ 3): Questions as User Input

The system must ask questions to the user based on factors that cause strokes such as their height, weight, living conditions, Body Mass Index, and age to be able to determine the likelihood of a stroke. This is a functional requirement due to the questions being the basis of how the system operates, predicting if the user will have a stroke.


User
Complete and submit answers to questions
<<extend>>
Submit results to prediction script
<<extend>>
System
Generate and display questions to user

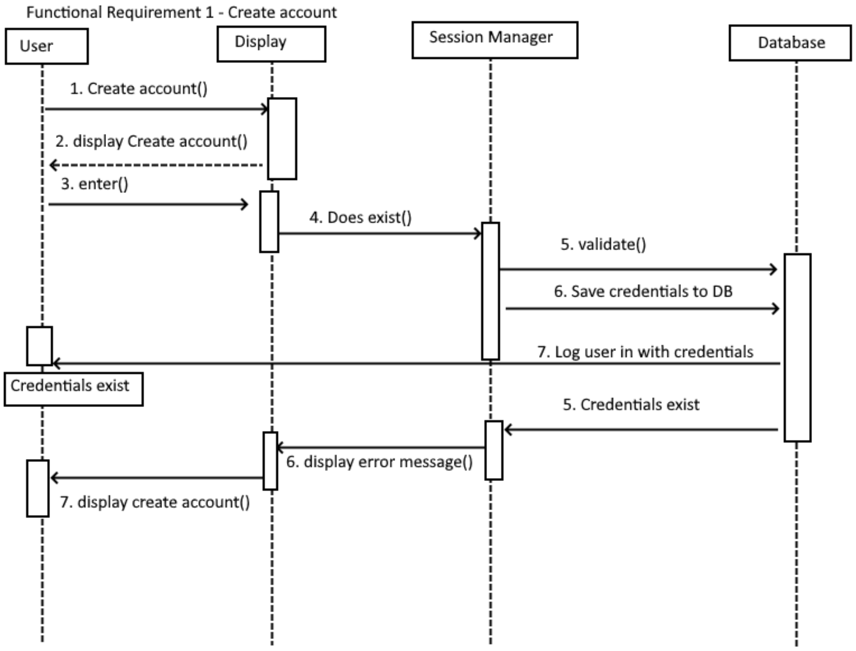
3.2 Preliminary Use Case Models and Sequence Diagrams

3.2.1 Use Case Model

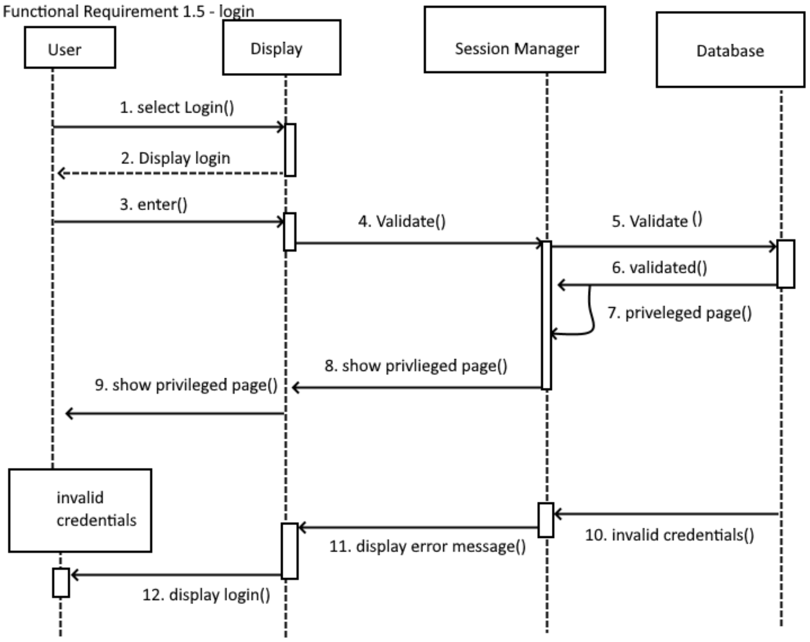


3.2.2 Sequence Diagrams

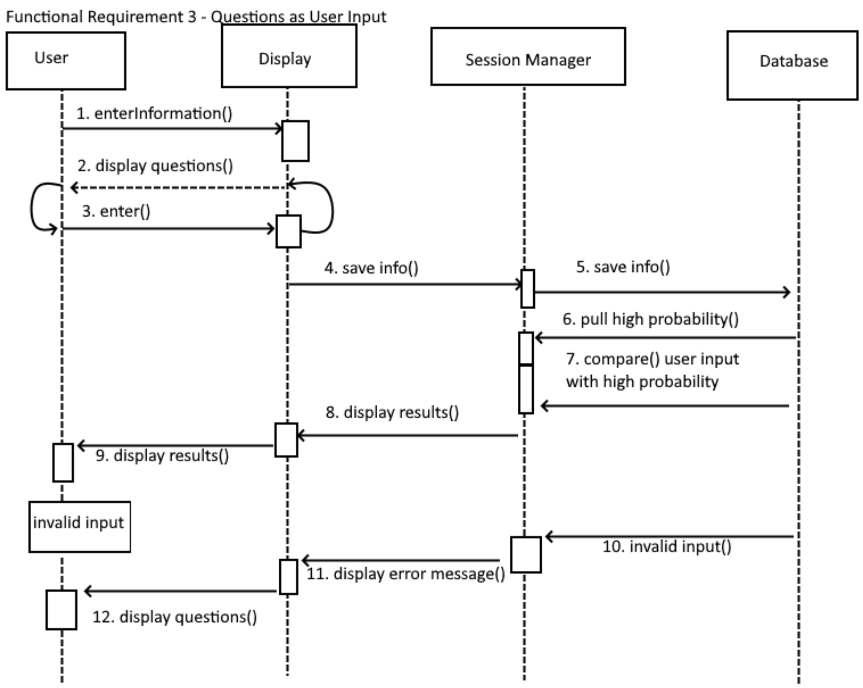
1. Create account


Functional Requirement 1 - Create account
User
Display
Session Manager
Database
1. Create account()
2. display Create account()
3. enter()
4. Does exist()
5. validate()
6. Save credentials to DB
7. Log user in with credentials
Credentials exist
5. Credentials exist
6. display error message()
7. display create account()

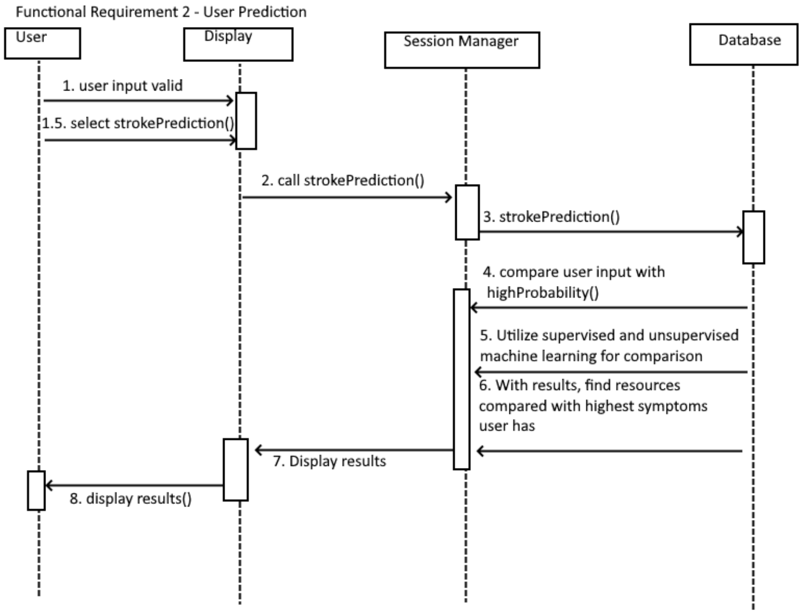
2. Login



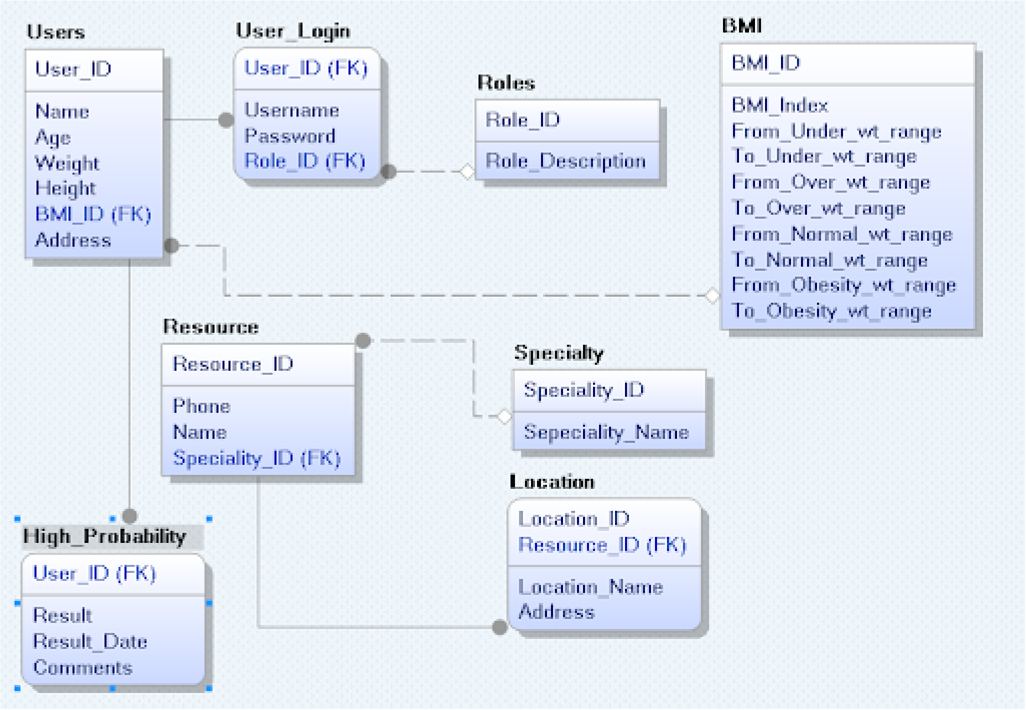
3. Questions as User Input



4. User Prediction


Functional Requirement 2 - User Prediction
User
Display
Session Manager
Database
1. user input valid
1.5. select strokePrediction()
2. call strokePrediction()
3. strokePrediction()
4. compare user input with
highProbability()
5. Utilize supervised and unsupervised
machine learning for comparison
6. With results, find resources
compared with highest symptoms
user has
7. Display results
8. display results()

3.2.3 Entity Relationship Diagram



4. Nonfunctional Requirements

4.1 Performance Requirements

Windows 7 or later operating systems.
3500 MHz processor or higher
8GB RAM or higher
25 GB Available Hard Drive Space

4.2 Security Requirements

There must be a password protection in place before any other action can be done on the software. Data can still be collected before authentication, but order execution cannot. They must also be signed into their broker to allow order to go through

Prior to using the system, the user must create or sign into their account. Creating an account will allow the user to save their data onto the system for future reference.

4.3 Usability Requirements

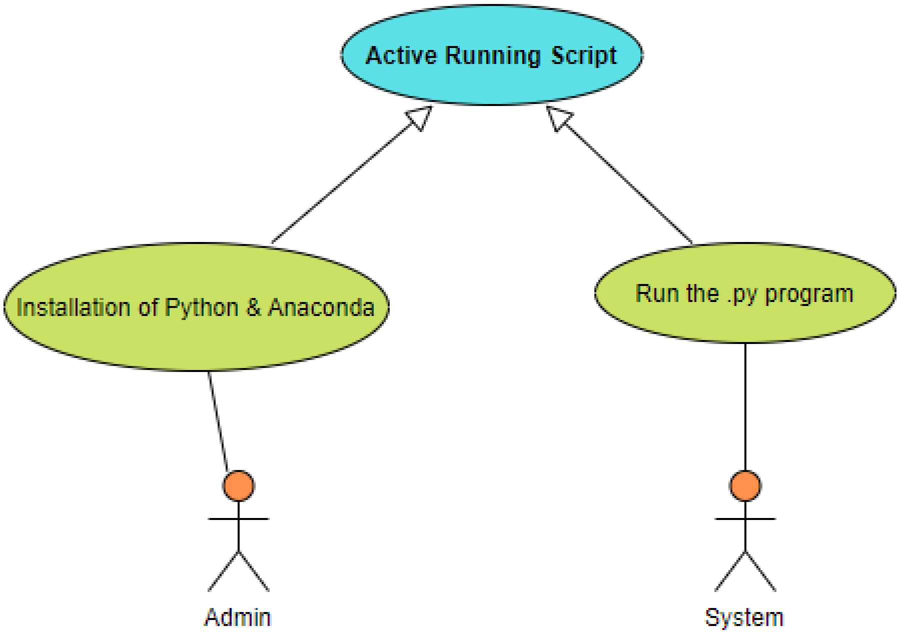
Users should understand how to download a program and connect to the internet. The system will be understandable enough for the user to figure out how to operate it. There will also be a user manual for their reference. Users should also know how to access a website on any internet browser application.

4.4 Software Quality Attributes

The system requires the user to fill in every field within the questionnaire to be able to determine the likelihood of a stroke. If a user does not fill in certain fields such as their weight, the system will not be able to accurately determine their likelihood of a stroke. The system must include an auto save feature after the user fills in a field within the form. This will make it convenient for the user in case they lose connection their data will be saved.

4.5 System Requirements

Installation of active working Python 3.7 or 3.9 and Anaconda library & Utilization of Python libraries such as; Matplotlib, Pandas, Numpy. Must possess an active and working installation of Python, also must have Anaconda library installed in order to further simplify the process. Proper utilization of matplotlib, pandas, numpy, and more data science pip installers must be processed in order to accurately go through the dataset to properly process the dataset and prepare for executable.



4.6 Reliability Requirements

Mean Time Between Failures (MTBF) — 1 year

Mean Time To Repair (MTTR)—5 hours

Accuracy—99.9%

Maximum Bugs or Defect Rate—1/KLOC

4.7 Supportability Requirements

The system will be built upon a downloadable program file in a python base which will allow it to function on most computers as well as function with offline usage.

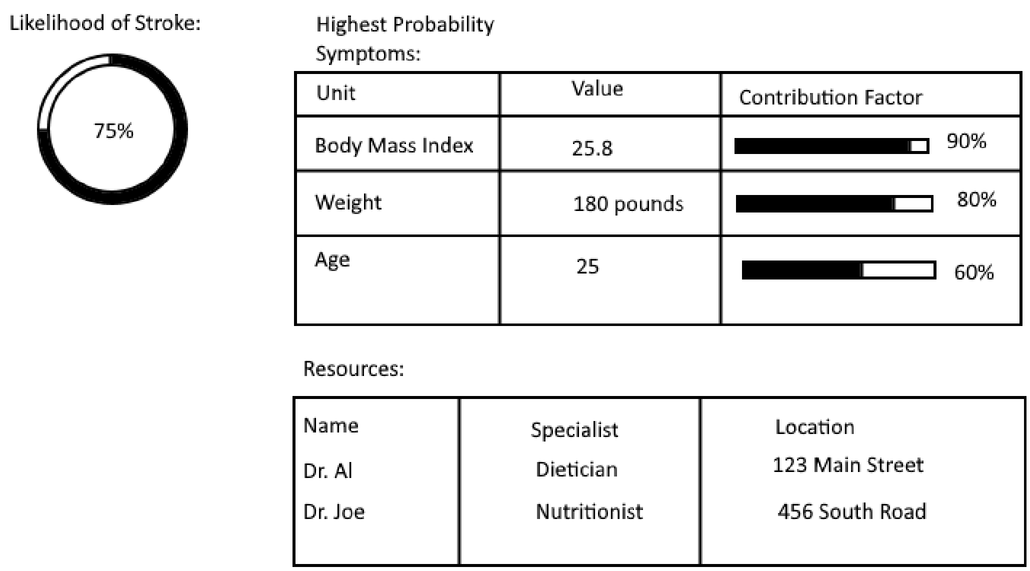
4.8 Legal, Copyright, and Other Notices

This software will be completely open source and anyone can use it.

4.9 External Interface Requirements

4.9.1 User Interfaces

MOCKUP UI



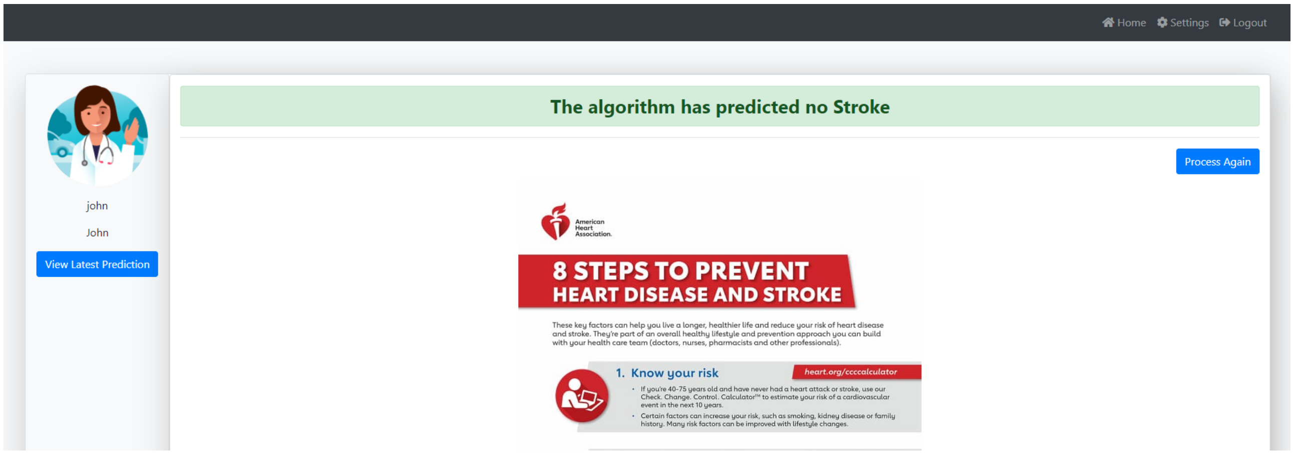
Highest Probability Symptoms:

Unit	Value	Contribution Factor
Body Mass Index	25.8	90%
Weight	180 pounds	80%
Age	25	60%

Resources:

Name	Specialist	Location
Dr. Al	Dietician	123 Main Street
Dr. Joe	Nutritionist	456 South Road

Web Based UI



The algorithm has predicted no Stroke

8 STEPS TO PREVENT HEART DISEASE AND STROKE

These key factors can help you live a longer, healthier life and reduce your risk of heart disease and stroke. They're part of an overall healthy lifestyle and prevention approach you can build with your health care team (doctors, nurses, pharmacists and other professionals).

1. Know your risk heart.org/ccccalculator

- If you're 40-75 years old and have never had a heart attack or stroke, use our Check. Change. Control. Calculator™ to estimate your risk of a cardiovascular event in the next 10 years.
- Certain factors can increase your risk, such as smoking, kidney disease or family history. Many risk factors can be improved with lifestyle changes.

4.9.2 Hardware Interfaces

This software may connect to the internet either through wired or wireless methods. It can also run without an active internet source connection. However one is strongly recommended for best up to date results from the program.

4.9.3 Software Interfaces

This project will be utilizing python to demonstrate the user interface and display information. Pycharm and or Spyder as an IDE for Python and the use of Auto-to-Py for conversation into the executable file.

4.9.4 Communications Interfaces

This software will use python and SQL to communicate between the stored data, machine learning algorithm, and user input. The program specifically utilizes SQLAlchemy

4.10 On-Line User Documentation and Help System Requirements

Any User who needs Documentation will be referred to a website which will explain how to operate the system as well as the user manual.

Appendix A: Glossary

Term	Definition

Appendix B: Analysis Models

Appendix C: To Be Determined List

TBD eternal application for which the database will be managed.