Software Requirements Specification

for

Health Prognosis

Version 1.0 approved

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Revision History

Name	Date	Reason For Changes	Version

1. Introduction

1.1 Purpose

This section elaborates on the significance of the Health Prognosis in the context of modern healthcare. It discusses the increasing importance of predictive analytics in improving patient outcomes and reducing healthcare costs. Additionally, it highlights the need for a standardized software solution to assist healthcare professionals in diagnosing and predicting medical conditions accurately.
The purpose of health prognosis is to predict the likely future health status or course of a patient's disease or condition. Health prognosis aims to forecast the potential outcomes, progression, and development of a patient's health based on current medical evidence, patient data, and clinical expertise.

1.2 Document Conventions

The document follows standard SRS conventions, including prioritization of requirements as High, Medium, or Low based on their significance and impact on system functionality.
Prioritizing requirements as High, Medium, or Low based on their importance and impact is a common practice in Software Requirements Specifications (SRS) documents.
Document conventions for a health prognosis system involve the use of standard formatting, style, and organization to ensure consistency and clarity in the software requirements specification (SRS) document.
Document conventions assist in making the document easy to read, understand, and follow, reducing confusion and potential errors during the development process.

1.3 Intended Audience and Reading Suggestions

This document is intended for a diverse audience including developers, project managers, data scientists, healthcare professionals, and stakeholders involved in the development and deployment of the Multi-Medical Prediction System. It is organized in a manner that facilitates understanding for different reader types, starting with an overview and gradually delving into more detailed functional and non-functional requirements.

The intended audience for a health prognosis system software requirements specification (SRS) document includes various stakeholders who will be involved in the development, implementation, and maintenance of the system.

Various stakeholders include Healthcare professionals, Software developers, designers, and engineers, Project managers, Quality assurance professionals.

reading suggestions for the health prognosis system are all stakeholders should focus on overall description, specific requirements,system features, and external interface requirements sections of the SRS document, which will provide insight into how the system will be used in a clinical setting.

1.4 Product Scope

The Health Prognosis is designed to be a comprehensive decision support tool for healthcare professionals. It will analyze various medical data inputs,laboratory test results, to generate predictions for the likelihood of diabetes, breast cancer, and heart disease. The system aims to integrate seamlessly with existing healthcare IT infrastructure and provide actionable insights to improve patient care and outcomes.

1.5 References

List any relevant documents, standards, or research papers that inform the development of the Multi-Medical Prediction System, such as medical research articles, machine learning frameworks, or healthcare regulations.

1.Machine Learning For Absolute Beginners by Oliver Theobald
2.Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Geron Aurelien
3.Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville
4.An Introduction to Statistical Learning by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani

2. Overall Description

2.1 Product Perspective

The Health prognosis is positioned as a standalone software application within the broader healthcare ecosystem.While it interfaces with existing electronic health record (EHR) systems and databases to access patient data.

Describe how the Health prognosis fits into the broader context of healthcare systems and emphasizing its role as a predictive tool for early disease detection.

The health prognosis perspective refers to the overall goal and approach of the health prognosis system. It includes the system's purpose, its intended users.

Purpose: The health prognosis system should have a clear and well-defined purpose, such as predicting the likelihood of a Diabetes,Breast

cancer,Heart disease, identifying high-risk patients, or guiding treatment decisions.

Intended Users: The health prognosis system should be designed for specific user groups, such as healthcare professionals, patients, and their families.

The health prognosis perspective can be defined in a way that is aligned with the system's purpose, user needs.

2.2 Product Functions

The primary functions of the Health prognosis include:

Summarize the key functions of the system, such as data preprocessing, model training, prediction generation, and result visualization.

Analyzing patient data to predict the likelihood of diabetes, breast cancer, and heart disease.

The functions of a health prognosis system are the specific tasks or actions that the system performs to provide prognostic information. Here are some common functions of a health prognosis system:

Data Collection: The health prognosis system collects and processes data from various sources, such as electronic health records, medical devices, and patient-reported outcomes.

Data Preprocessing: The health prognosis system preprocesses the collected data to ensure that it is clean, complete, and ready for analysis. This includes tasks such as data cleaning, normalization, and transformation.

Model Development: The health prognosis system develops predictive models based on the preprocessed data. The system should be able to handle various types of models, such as regression, decision trees, and neural networks, and select the most appropriate model based on the data and the prognostic question.

Model Validation: The health prognosis system validates the developed models to ensure that they are accurate, reliable, and robust. The system should use various techniques, such as cross-validation, bootstrapping
Model Deployment: The system should be able to integrate with other healthcare systems, such as electronic health records and clinical decision support systems, to provide seamless and efficient workflows.
Model Monitoring: The health prognosis system monitors the deployed models to ensure that they continue to perform accurately and reliably. The system should be able to detect and correct any issues or errors
Model Updating: The health prognosis system updates the deployed models as new data becomes available, incorporating the latest evidence and clinical guidelines. The system should be able to retrain and revalidate the models to ensure that they remain accurate and up-to-date.

By providing these functions, the health prognosis system can support clinical decision making, identify high-risk patients, and guide treatment decisions. The system should be designed to be user-friendly, secure, and reliable, ensuring that it provides actionable insights and recommendations that improve healthcare outcomes and reduce costs.

2.3 User Classes and Characteristics

Key user classes of the system include healthcare professionals (such as physicians, nurses, and specialists) who utilize the system for patient diagnosis and treatment planning, data scientists who develop and maintain machine learning models, and patients who indirectly benefit from improved diagnostic accuracy and personalized treatment options. User classes and characteristics of a health prognosis system are the different types of users who will interact with the system and their specific needs, requirements, and preferences. Here are some common user classes and characteristics of a health prognosis system:

Patients: Patients and their families are important user class of a health prognosis system. They require clear, understandable, and personalized prognostic information to make informed decisions about their healthcare and manage their condition. Patients value user-friendly interfaces, accessible language, and the ability to share information with their healthcare team.

Researchers: Researchers and clinical investigators are also users of a health prognosis system. They require access to raw data, models, and algorithms to conduct research and evaluate the performance of the system. Researchers value transparency, reproducibility, and the ability to customize and extend the system.

IT Professionals: IT professionals, such as system administrators and software developers, are responsible for installing, maintaining, and updating the health prognosis system. IT professionals value ease of deployment, configuration, and management, as well as robust security and privacy features.

By understanding the user classes and characteristics of a health prognosis system, developers can design and build a system that meets the needs and requirements of its users.

2.4 Operating Environment

The system operates on standard hardware platforms and is compatible with major operating systems. It requires access to patient data stored in electronic health records or compatible databases.

The operating environment for health prognosis refers to the physical and technical environment in which health prognosis systems and applications operate.

This can include:

Hardware: The physical machines and devices that the health prognosis system runs on, including servers, desktop computers, laptops, tablets, and mobile devices.
Software: The operating systems, databases, and other software applications that the health prognosis system interacts with, including electronic health records (EHRs), laboratory information systems (LISs), and picture archiving and communication systems (PACSs).
Network: The communication infrastructure that the health prognosis system uses to transmit and receive data, including local area networks (LANs), wide area networks (WANs), and the internet.
Data: The information that the health prognosis system processes, including patient demographics, medical history, laboratory results, and other relevant health data.
Security: The measures taken to protect the health prognosis system and its data, including encryption, access controls, and user authentication.
User interface: The design and features of the health prognosis system's user interface, including the layout, navigation, and presentation of information.

2.5 Design and Implementation Constraints

Use of scalable machine learning algorithms to handle large volumes of medical data.
Highlight any constraints that may impact the design and implementation of the system, such as regulatory requirements and technological limitations.
Design and implementation constraints of a health prognosis system refer to the limitations and restrictions that affect the development and deployment of the system.

Data privacy and security: Health prognosis systems must comply with relevant laws and regulations governing the privacy and security of patient data.
Scalability: Health prognosis systems must be able to handle large volumes of data and support growing numbers of users and applications.
Accuracy: Health prognosis systems must be able to provide accurate and reliable predictions and recommendations, based on validated models and algorithms.

2.6 User Documentation

The user documentation requirements for the Multi-Medical Prediction System are outlined here. This includes details about the types of documentation to be provided, such as user manuals, online help, and tutorials.
User documentation for a health prognosis system should provide clear and concise instructions on how to use the system, including its features, functions, and user interface. Here are some guidelines for creating user documentation for a health prognosis system:

Audience:The user documentation should be tailored to the needs and requirements of the intended audience.
Overview: The user documentation should provide an overview of the health prognosis system, including its purpose, benefits, and limitations. The documentation should also include information about the system's architecture, data sources, and security measures.
User Interface: The user documentation should provide detailed instructions on how to navigate the system's user interface, including how to log in, access patient data, and view prognostic information. The documentation should also include information about the system's features

and functions, such as how to customize settings, generate reports, and export data.

Procedures: The user documentation should provide step-by-step instructions on how to perform common tasks in the health prognosis system, such as adding or editing patient records, generating prognostic reports, and interpreting the results.

Examples: The user documentation should include examples and case studies to illustrate how the health prognosis system can be used in practice. The examples should be based on real-world scenarios and should demonstrate the system's capabilities and limitations. Maintenance: The user documentation should include information about how to maintain and update the health prognosis system, including how to install updates, perform backups, and troubleshoot issues.

2.7 Assumptions and Dependencies

Availability of sufficient and high-quality medical data for training machine learning models.

Access to electronic health records for data input.

Dependence on external libraries and frameworks for machine learning and deep learning. Assumptions and dependencies are essential to consider in health prognosis project management as they can significantly impact the success of the project.

Assumptions in project management refer to factors that are believed to be true or certain, though their certainty cannot be fully confirmed. They serve as a foundation for progress in the face of uncertainty. In the context of health prognosis, some assumptions could be:

The data used for health prognosis is accurate and complete.

The health prognosis algorithms are based on the latest medical research.
The health prognosis results will be interpreted correctly by healthcare professionals.
Dependencies in project management refer to the connections between tasks or deliverables in a project. In health prognosis, some dependencies could be:
Data Dependencies, Technological Dependencies, Human Dependencies, Stakeholder Dependencies, Infrastructure Dependencies.

3. External Interface Requirements

3.1 User Interfaces

The system provides intuitive and user-friendly interfaces for interacting with healthcare professionals. These interfaces enable seamless input of patient data, visualization of prediction results,, and access to explanatory insights to support clinical decision-making.
Details about the user interfaces of the Multi-Medical Prediction System are provided here.
User interface (UI) in health prognosis plays a crucial role in ensuring that the system is user-friendly, accessible, and effective in delivering prognostic information to healthcare providers and patients. Here are some key considerations for UI design in health prognosis
Simplicity: The UI should be simple and intuitive, with clear and concise instructions for using the system.
Customization: The UI should allow users to customize the display and layout of information based on their preferences and needs. This includes options for font size, color scheme, and data visualization.

Navigation: The UI should provide clear and easy-to-use navigation, allowing users to quickly and easily access the information they need.
Feedback: The UI should provide clear and timely feedback to users, indicating the status of the system, any errors or exceptions, and the results of their actions.
Security: The UI should provide robust security measures, such as user authentication and data encryption, to protect the privacy and confidentiality of patient information.
Data Visualization: The UI should provide clear and effective data visualization, allowing users to quickly and easily interpret complex medical data
Compatibility: The UI should be compatible with various devices and platforms, including desktop computers, laptops, tablets, and smartphones.
Help and Support: The UI should provide easy access to help and support resources, such as user guides, tutorials, and technical support.

3.2 Software Interfaces

Integration with existing software systems is a critical aspect of the Health prognosis. It interfaces with electronic health record systems, databases, and other healthcare IT infrastructure components to exchange data and ensure interoperability across different systems.

3.3 Communications Interfaces

Details about the requirements associated with any communications functions required by the Multi-Medical Prediction System are outlined in this section. This includes information about communication protocols, message formatting, communication standards, security considerations, and data transfer rates.

4. System Features

Explore the system features section to understand the specific functionalities and requirements associated with predicting diabetes, breast cancer, and heart disease.

4.1 System Feature 1

4.1.1 Diabetes Prediction:

The system predicts the likelihood of diabetes based on laboratory test results(data points).It employs advanced machine learning algorithms to analyze data inputs and generate accurate predictions

4.1.2 Breast Cancer Prediction:

Similar to diabetes prediction, the system analyzes patient data to predict the likelihood of breast cancer. It leverages machine learning techniques to identify relevant risk factors and generate predictive models that assist healthcare professionals in early detection and treatment planning

4.1.3 Heart Disease Prediction:

In addition to diabetes and breast cancer prediction, the system also provides predictive capabilities for heart disease. By analyzing patient data, including cardiovascular risk factors and medical history, it generates predictions that support proactive interventions and personalized care for patients at risk of heart disease.

4.2 System Feature 2 (and so on)

Automatic diet plan according to the conditions.

5. Other Nonfunctional Requirements

5.1 Performance Requirements

The Health Prognosis must meet stringent performance requirements to ensure timely delivery of prediction results. Response times for generating predictions should be within seconds, enabling healthcare professionals to make informed decisions quickly during patient consultations.
Performance requirements for health prognosis can vary depending on the specific use case and application. However, some common performance requirements may include:

Accuracy:

The health prognosis model should be able to accurately predict the likely course of a disease based on the available data.

Speed:

The health prognosis model should be able to generate predictions quickly and efficiently to make decisions in a timely manner.

Scalability:

The health prognosis model should be able to handle large volumes of data and scale to accommodate the needs of a large and diverse patient population. This may involve implementing distributed computing architectures and optimizing the model for parallel processing.

Robustness:

The health prognosis model should be able to handle missing or incomplete data, as well as data that may be inconsistent or of poor quality.

This may involve implementing data cleaning and preprocessing techniques, as well as developing methods for handling missing or incomplete data.

Security: The health prognosis model should be secure and protect patient data according to relevant regulations and standards. This may involve implementing encryption, access controls, and other security measures to ensure that patient data is protected and confidential.

Usability:

The health prognosis model should be user-friendly and easy to use.

5.2 Safety Requirements

Ensuring the safety and privacy of patient data is paramount for the Health prognosis. It must adhere to medical safety standards and regulations to protect patient confidentiality and prevent unauthorized access or disclosure of sensitive information.

5.3 Security Requirements

Robust security measures are implemented to safeguard against cybersecurity threats and breaches.

The system employs data encryption, user authentication mechanisms, and access controls to mitigate risks and ensure the integrity and confidentiality of patient data.

Health prognosis systems often handle sensitive personal and medical data, making security a critical concern. The specific security requirements for a health prognosis system will depend on various factors, such as the type and amount of data being handled.

Authentication and access controls: The system should have robust authentication mechanisms to ensure that only authorized users can access

the system and its data. Access controls should be in place to limit the actions that users can perform based on their role and permissions.
Regular updates and patches: The system should be regularly updated and patched to address known security vulnerabilities and maintain the latest security protections.

5.4 Software Quality Attributes

The Multi-Medical Prediction System prioritizes software quality attributes such as reliability, accuracy, and scalability. It undergoes rigorous testing and validation to ensure that predictions are consistent, trustworthy, and scalable to accommodate varying volumes of medical data.

Usability: The software should be user-friendly and easy to use for both patients and healthcare providers, allowing for efficient data entry and retrieval.
Reliability: The software should consistently perform its intended functions without failure, which is critical for accurate health prognosis.
Maintainability: The software should be easy to modify and maintain, allowing for the addition of new features and the ability to fix bugs quickly.
Security: The software should protect patient data and ensure privacy, which is essential in healthcare applications.
Security: The software should protect patient data and ensure privacy, which is essential in healthcare applications.

5.5 Business Rules

Access to system functionalities and patient data is governed by predefined business rules and role-based access controls. These rules ensure compliance with organizational policies and regulatory requirements, as well as promote accountability and transparency in system usage.

6. Other Requriements:

Appendix A: Glossary

Diabetes Mellitus: A chronic metabolic disorder characterized by elevated blood glucose levels due to insufficient insulin production or impaired insulin action.

Breast Cancer: A malignancy arising from breast tissue, characterized by abnormal cell growth and the potential to spread to other parts of the body.

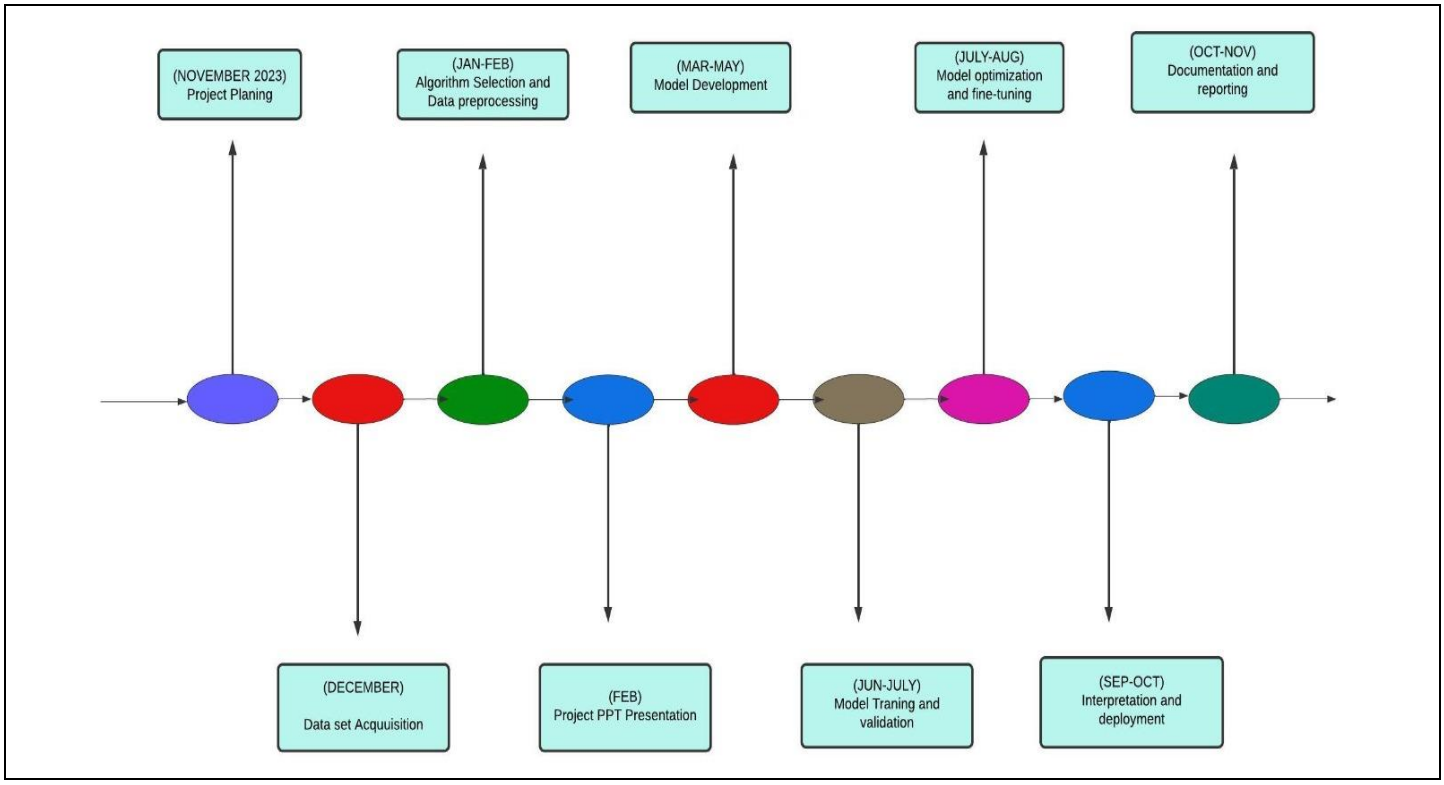
Heart Disease: A range of conditions that affect the heart's structure and function, including coronary artery disease, heart failure, and arrhythmias.

Machine Learning (ML): A subset of artificial intelligence (AI) that enables systems to automatically learn and improve from experience without being explicitly programmed.

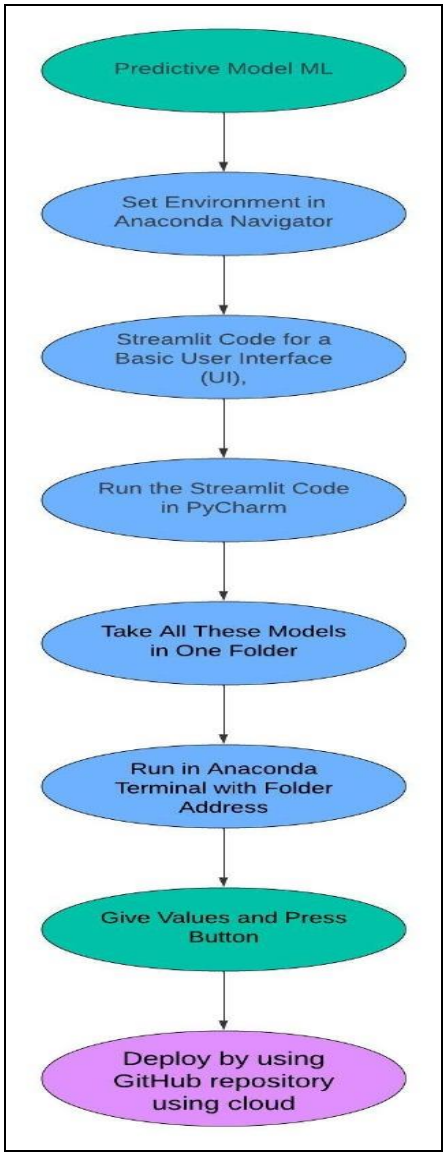
Deep Learning: A subfield of ML that utilizes artificial neural networks with multiple layers to learn hierarchical representations of data.

Appendix B: Analysis Models

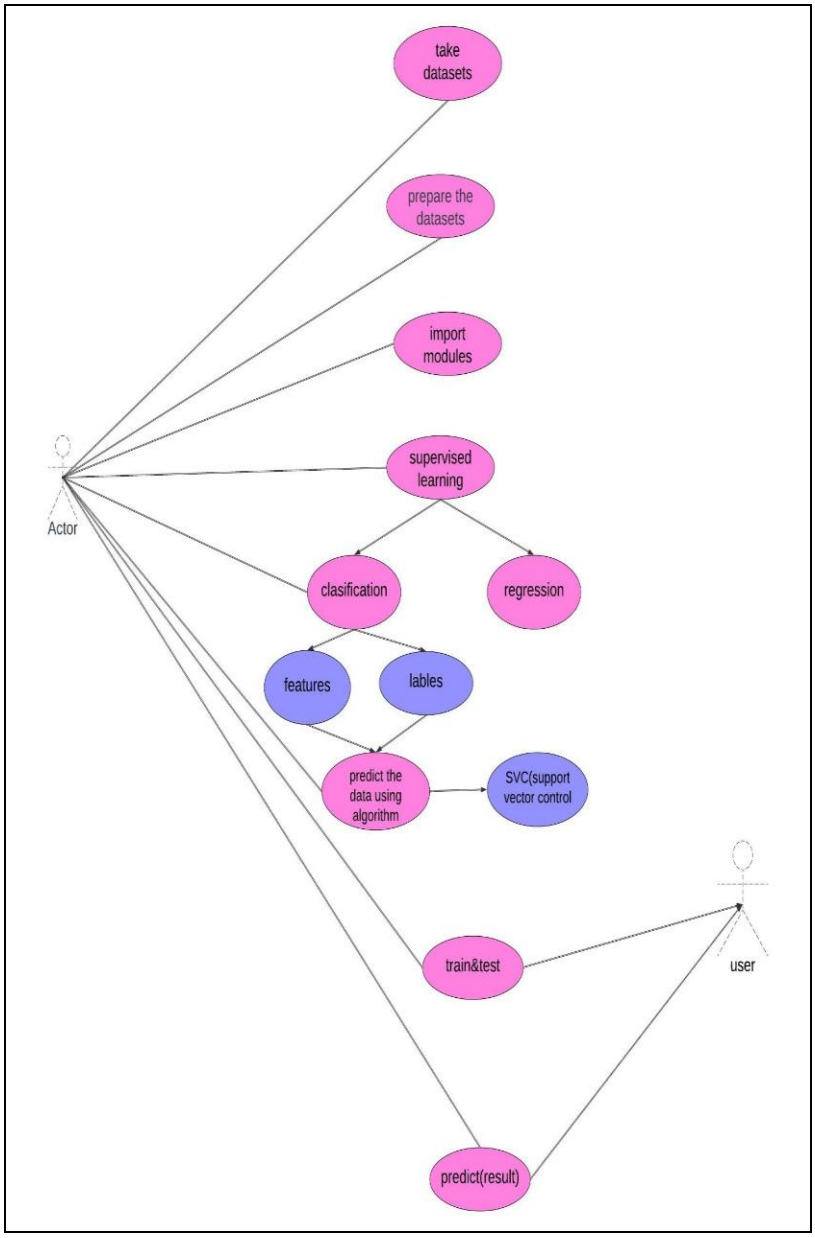
Time Line Chart :



Flow Chart:


Predictive Model ML
Set Environment in Anaconda Navigator
Streamlit Code for a Basic User Interface (UI),
Run the Streamlit Code in PyCharm
Take All These Models in One Folder
Run in Anaconda Terminal with Folder Address
Give Values and Press Button
Deploy by using GitHub repository using cloud

UML Diagram:


take datasets
prepare the datasets
import modules
supervised learning
Actor
clasification
regression
features
lables
predict the data using algorithm
SVC(support vector control
train&test
user
predict(result)

Appendix C: To Be Determined List

TBD-1: Specify the exact hardware specifications required for the system.

TBD-2: Determine the communication protocols to be used for data exchange between system components.

TBD-3: Identify the specific machine learning algorithms to be implemented for diabetes, breast cancer, and heart disease prediction.

TBD-4: Clarify the data sources and acquisition methods for training and testing the prediction models.

TBD-5: Finalize the user interface design and functionality based on stakeholder feedback and usability testing results

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