

---

# **Software Requirements Specification**

**For**  
**ECG Analysis Dashboard**

**Version 1.0 approved**

**Prepared By Group 23**

**Sajeenthiran P – 210553J**

**Ranaweera HK - 210523T**

**Rathnayaka W.T - 210536K**

**7<sup>th</sup> July 2024**

# Table of Contents

<b>Table of Contents .....</b>	<b>ii</b>
<b>Revision History .....</b>	<b>ii</b>
<b>1. Introduction.....</b>	<b>1</b>
1.1 Purpose .....	1
1.2 Document Conventions .....	1
1.3 Intended Audience and Reading Suggestions.....	1
1.4 Product Scope.....	2
1.5 References .....	2
<b>2. Overall Description .....</b>	<b>2</b>
2.1 Product Perspective .....	2
2.2 Product Functions.....	2
2.3 User Classes and Characteristics .....	3
2.4 Operating Environment .....	3
2.5 Design and Implementation Constraints.....	3
2.6 User Documentation .....	4
2.7 Assumptions and Dependencies .....	4
<b>3. External Interface Requirements .....</b>	<b>4</b>
3.1 User Interfaces .....	4
3.2 Hardware Interfaces.....	6
3.3 Software Interfaces .....	6
3.4 Communications Interfaces .....	6
<b>4. System Features .....</b>	<b>7</b>
4.1 Preprocessing .....	7
4.2 Descriptive Analysis .....	7
4.3 Person Identification .....	8
4.4 Arrhythmia Detection .....	8
4.5 Myocardial Disease Detection .....	8
<b>5. Other Nonfunctional Requirements.....</b>	<b>9</b>
5.1 Performance Requirements.....	9
5.2 Safety Requirements.....	9
5.3 Security Requirements.....	9
5.4 Software Quality Attributes.....	9
5.5 Business Rules.....	9
<b>Appendix A: Glossary.....</b>	<b>9</b>

## Revision History

Name	Date	Reason For Changes	Version

# 1. Introduction

## 1.1 Purpose

This document specifies the software requirements for the ECG Analysis Dashboard, a critical tool for healthcare professionals involved in ECG signal analysis. The dashboard aims to provide a comprehensive suite of functionalities including preprocessing of ECG signals, detailed descriptive analysis, person identification through ECG patterns, arrhythmia detection, and myocardial disease diagnosis. By defining these requirements clearly, this document aims to guide the development team in implementing a robust and effective solution that meets the needs of medical professionals and patients alike.

## 1.2 Document Conventions

This document follows the IEEE Software Requirements Specifications (SRS) template to ensure clarity and consistency in presenting the requirements. It utilizes a uniform font style and size throughout for readability. All headings and subheadings are numbered and styled in bold to facilitate easy navigation and reference. Requirements are categorized and prioritized according to their importance and relevance, ensuring that each requirement statement is clear, unambiguous, and traceable throughout the development process.

## 1.3 Intended Audience and Reading Suggestions

This document is intended for:

- **Developers:** They will gain insights into both functional and non-functional requirements necessary for implementing the dashboard.
- **Project Managers:** This document assists in defining project scope, monitoring progress against milestones, and managing resource allocation effectively.
- **Testers:** Testers can derive test cases directly from specified system features and non-functional requirements, ensuring comprehensive coverage of functionality and performance.
- **Users:** Healthcare professionals and end-users can understand the capabilities, limitations, and intended use of the dashboard to make informed decisions regarding its adoption and utilization.

*Developers can refer to product scope (1.4) and system features (4). Testers can refer to system features (4) and Other non-functional requirements (5).*

## 1.4 Product Scope

The ECG Analysis Dashboard is designed to serve as an indispensable tool for healthcare professionals engaged in ECG signal analysis. Key functionalities include:

- **Preprocessing of Signals**  
Ensuring accurate and reliable ECG data by removing noise, baseline wandering, and other artifacts.
- **Descriptive Analysis**  
Providing detailed insights into ECG waveform characteristics, such as P, Q, R, S, T waves, intervals, and segments.
- **Person Identification via ECG**  
Utilizing unique ECG patterns to identify individuals, facilitating patient monitoring and medical record management.
- **Arrhythmia Detection**  
Automatically detecting abnormal heart rhythms, enabling timely intervention and treatment.
- **Myocardial Disease Diagnosis**  
Assisting in the diagnosis of various myocardial conditions based on ECG findings, supporting clinical decision-making.

## 1.5 References

[1] IEEE. IEEE Std 830-1998 IEEE Recommended Practice for Software Requirements Specifications. IEEE Computer Society, 1998.

## 2. Overall Description

### 2.1 Product Perspective

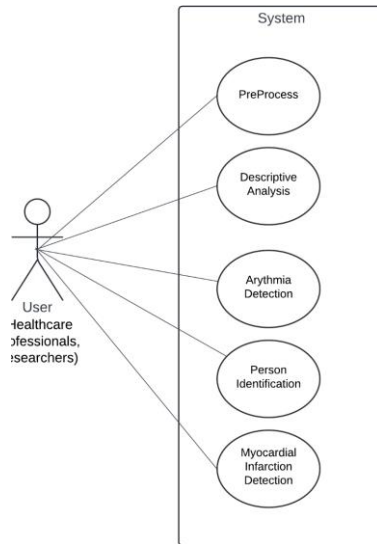
The ECG Analysis Dashboard is a standalone application designed for hospitals and research facilities. It is a new product leveraging advanced machine learning algorithms for ECG signal analysis

### 2.2 Product Functions

- **Preprocessing:** Cleaning and preparing ECG data.
- **Descriptive Analysis:** Providing statistical and graphical analysis of ECG signals.
- **Person Identification:** Determining if two ECG signals are from the same person.
- **Arrhythmia Detection:** Identifying irregular heartbeats.
- **Myocardial Disease Detection:** Diagnosing potential myocardial diseases.

## 2.3 User Classes and Characteristics

- **Healthcare Professionals:** High technical expertise, frequent use.
- **Researchers:** High technical expertise, frequent use.



## 2.4 Operating Environment

- **Hardware:** Standard PCs or servers.
- **Operating System:** Windows 10, macOS, or Linux.
- **Other Software:** Python 3.x, TensorFlow, Pytorch

## 2.5 Design and Implementation Constraints

- Compliance with healthcare data privacy regulations (e.g., HIPAA).
- Integration with existing hospital information systems.
- Use of specific machine learning libraries (e.g., TensorFlow).

## 2.6 User Documentation

- User manual
- Online help
- Tutorials

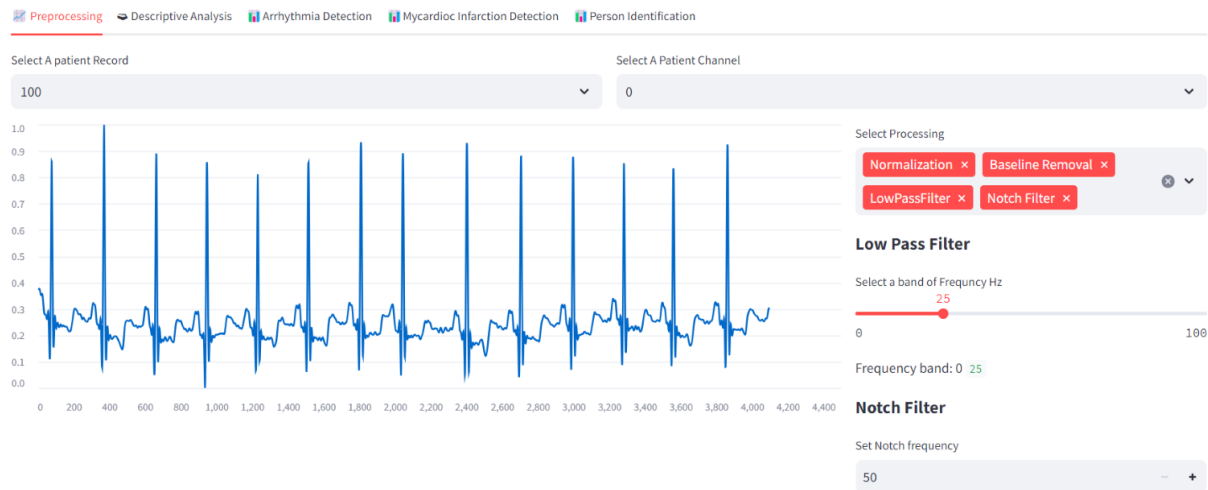
## 2.7 Assumptions and Dependencies

- Availability of labeled ECG datasets for training and testing.
- Reliable internet connection for cloud-based features.

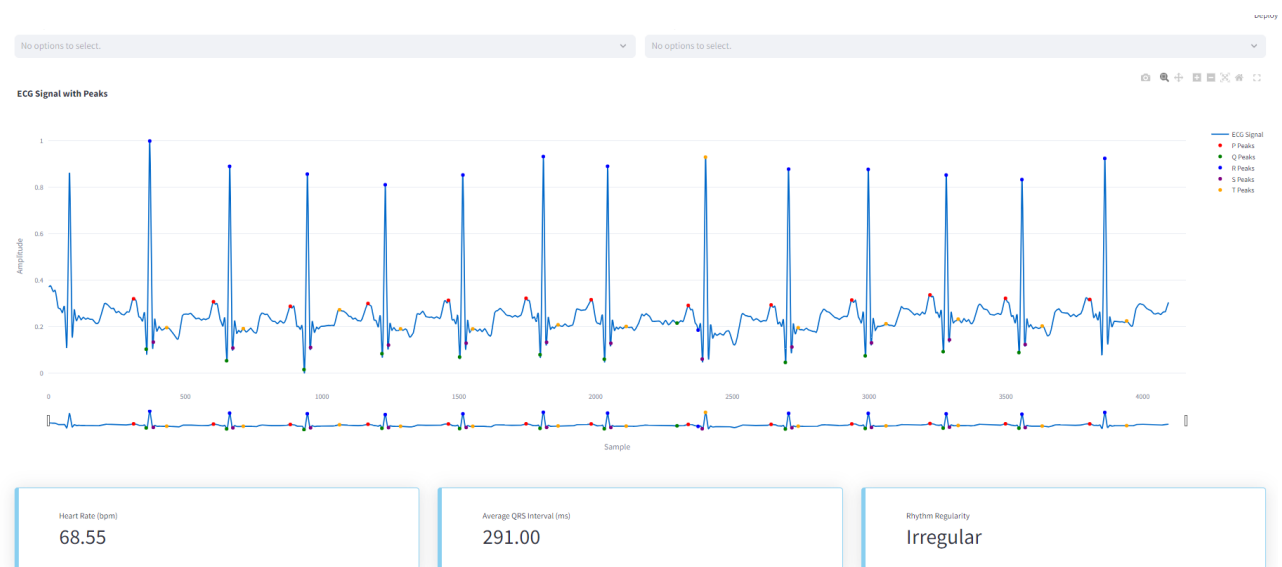
# 3. External Interface Requirements

## 3.1 User Interfaces

### 3.1.1 .Preprocessing



### 3.1.2 Descriptive Analysis



### 3.1.3 Myocardial Infarction Detection

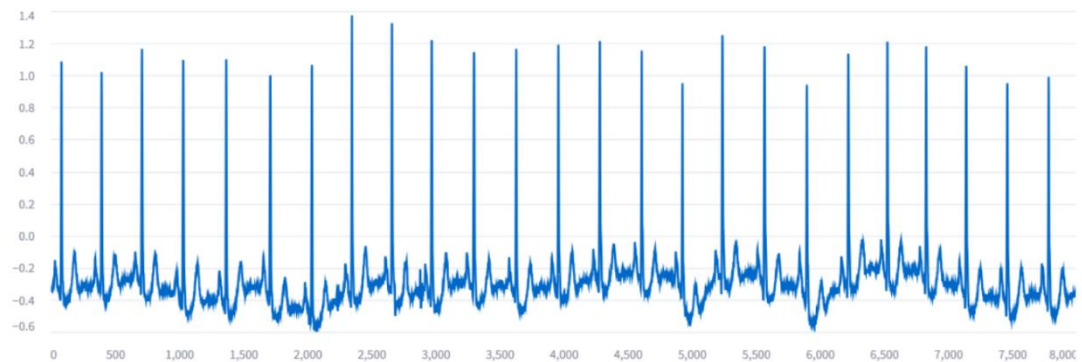
Preprocessing Descriptive Analysis Arrhythmia Detection **Myocardial Infarction Detection** Person Identification

## Myocardial Infarction Detection

Myocardial Infarction (MI), commonly known as a heart attack, occurs when blood flow to a part of the heart muscle is blocked. This blockage usually results from a buildup of cholesterol, fat, and other substances, forming a plaque in the coronary arteries.

Select A patient Record

101



Result

MI is detected.

### 3.1.4 Person Identification

Preprocessing Descriptive Analysis Arrhythmia Detection Myocardial Infarction Detection **Person Identification**

## ECG Signal Comparison

Choose the first ECG signal

Select A patient Record For ECG A

100

Select A patient Channel For ECG A

0

Choose the first ECG signal

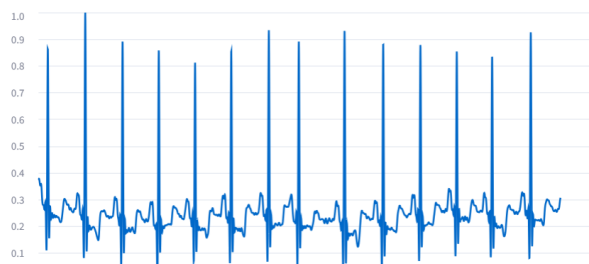
Select A patient Record for ECG B

100

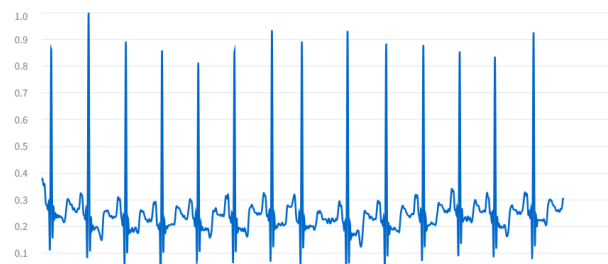
Select A patient Channel For ECG B

0

### ECG Signal 1



### ECG Signal 2



### **3.2 Hardware Interfaces**

- Integration with ECG machines via USB or Bluetooth.

### **3.3 Software Interfaces**

No External software interface

### **3.4 Communications Interfaces**

- **HTTP/HTTPS:** For secure web-based features.
- **FTP/SFTP:** For file transfers.

## **4. System Features**

### **4.1 Preprocessing**

#### **4.1.1 Description and Priority**

Preprocessing involves cleaning and preparing ECG data for analysis. This is a high-priority feature as it ensures data quality

#### **4.1.2 Stimulus/Response Sequences**

- User uploads raw ECG data.
- System processes the data (filtering noise, normalizing , Baseline wander removal, notch filter ).

#### **4.1.3 Functional Requirements**

- REQ-1: System shall filter out noise from ECG signals.
- REQ-2: System shall normalize ECG signal amplitudes.
- REQ-3: System shall remove Baseline wander from ECG signals.
- REQ-4: System shall provide a notch filter to remove noises such as powerline inference noises.



## **4.2 Descriptive Analysis**

### **4.2.1 Description and Priority**

Provides statistical and graphical analysis of ECG data. Medium priority.

### **4.2.2 Stimulus/Response Sequences**

- User selects an ECG dataset.
- System generates statistical metrics and plots.

### **4.2.3 Functional Requirements**

- REQ-1: System shall compute mean, median, and standard deviation of ECG signals.
- REQ-2: System shall generate time-series plots of ECG signals.

## **4.3 Person Identification**

### **4.3.1 Description and Priority**

Identifies if two ECG signals are from the same person. High priority.

### **4.3.2 Stimulus/Response Sequences**

- User uploads two ECG signals.
- System compares the signals and returns a similarity Probability.

### **4.3.3 Functional Requirements**

- REQ-1: System shall compare ECG signals using a state of the art Deep learning Model.
- REQ-2: System shall return a similarity score with a confidence level.

## **4.4 Arrhythmia Detection**

### **4.4.1 Description and Priority**

Detects irregular heartbeats in ECG signals. High priority.

### **4.4.2 Stimulus/Response Sequences**

- User uploads an ECG signal.
- System analyzes the signal and identifies arrhythmias.

#### **4.4.3 Functional Requirements**

- REQ-1: System shall detect common types of arrhythmias.
- REQ-2: System shall highlight segments of the ECG signal with detected arrhythmias.

### **4.5 Myocardial Disease Detection**

#### **4.5.1 Description and Priority**

Diagnoses potential myocardial diseases from ECG signals. High priority.

#### **4.5.2 Stimulus/Response Sequences**

- User uploads an ECG signal.
- System analyzes the signal and provides a diagnosis.

#### **4.5.3 Functional Requirements**

- REQ-1: System shall identify markers for myocardial diseases.
- REQ-2: System shall provide a diagnostic report with probabilities.

## **5. Other Nonfunctional Requirements**

### **5.1 Performance Requirements**

- System shall process an ECG signal within 2 seconds.
- System shall handle up to 100 concurrent users.

### **5.2 Safety Requirements**

- System shall ensure data integrity and prevent data loss.
- System shall comply with medical device safety standards.

### **5.3 Security Requirements**

- System shall require user authentication for access.
- System shall encrypt ECG data in transit and at rest.

### **5.4 Software Quality Attributes**

- **Usability:** Intuitive and user-friendly interface.
- **Reliability:** 99.9% uptime.
- **Maintainability:** Modular codebase for easy update

### **5.5 Business Rules**

- Only authorized healthcare professionals can access patient data.
- Data must be anonymized for research purposes.

## **Appendix A: Glossary**

- **ECG:** Electrocardiogram
- **HIPAA:** Health Insurance Portability and Accountability Act
- **GDPR:** General Data Protection Regulation