Cardiac Diagnosis System (CDS) Description

The Cardiac Diagnosis System (CDS) is designed to streamline Cardiac Diagnosis process, with key users including Healthcare Professionals (HP), Patients, and System Admins (SA). HP are the primary users of the CDS. They play a pivotal role in patient management, data collection, analysis, and reporting. The SA oversees user management, system configuration, security, and maintenance, ensuring the system's smooth operation. Patients are central to the system as their personal information and ECG data are essential components.

Here is a set of functional requirements,

- The system must allow Healthcare Professionals and System Admins to register as users with their credentials (e.g., name, email, password, role).
- Healthcare Professionals should be able to register patients by providing their personal information (e.g., name, date of birth, contact information).
- Each patient can have one profile, and one profile can be associated with one patient. Patient profile stores historical cardiac diagnosis information. Healthcare Professionals can view multiple patient profiles. Each patient profile can only be associated with one Healthcare Professional.
- System Admins should have the ability to manage user accounts, including Healthcare Professional accounts.
- ECG data is recorded as a series of waveforms on a graph. Each waveform represents a specific phase of the heart's electrical cycle. The ECG signal is converted into a digital format in real-time by the ECG machine itself. The raw data is stored in bytes. Figure 1 shows an example of ECG record.
- Healthcare Professionals must be able to collect ECG data from various monitoring devices and associate it with specific patients. Each Patient Profile can be associated with multiple ECG Data records.
- The system should provide ECG data analysis tools for Healthcare Professionals to identify cardiac abnormalities and anomalies.
- Healthcare Professionals must be able to request reports for specific patients. A patient can have multiple reports, but each is associated with one patient. The report contains patient information, report metadata, and details about the ECG analysis, such as heart rate, rhythm, intervals, and any abnormal findings. Figure 2 shows an example of diagnosis report.
- System Admins should have access to report generation and management features
- Healthcare Professionals and System Admins should be able to view the historical data of patients, including past ECG records and diagnoses.
- System Admins must have the ability to add, modify, and remove user accounts, including Healthcare Professionals and other System Admins.

Here is a set of non-functional requirements,

- The system must process ECG data analysis within a reasonable time frame, even for large datasets. Response times for user interactions should be under 2 seconds
- The system shall have a 99.9% uptime, ensuring continuous access for users. It must have a backup and disaster recovery plan to protect patient data.
- The system needs to be developed using Java programming language.

Among all system functionalities, ECG Data Analysis stands out as the most critical. The Healthcare Professional (HP) firstly select specific ECG data for processing. The HP sends a request to the Analysis Engine, requesting it to perform a detailed analysis. The Analysis Engine receives this request and proceeds to retrieve the chosen ECG data for analysis from the ECG data. Once the ECG data is obtained, the Analysis Engine processes and analyses the data to identify any cardiac abnormalities or anomalies. Upon completion, the Analysis Engine generates analysis results, which includes the diagnostic results. The Analysis Engine then sends the results back to the HP. The HP can decide to initiate another analysis round if more ECG data requires to be processed. The analysis process completes when the HP is satisfied with the results. The HP then requests the analysis report from the Analysis Engine.

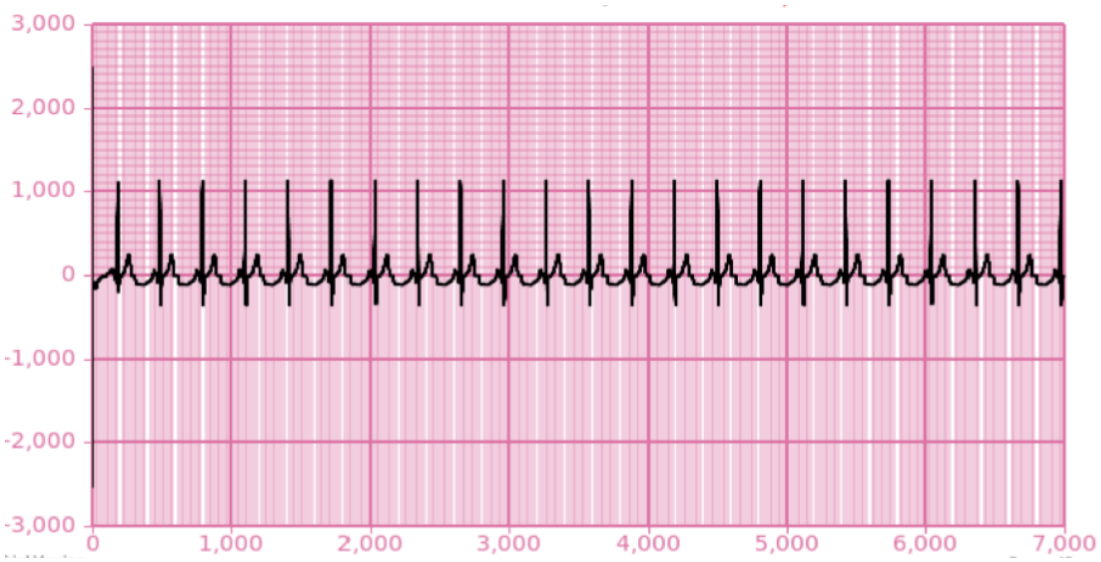

Figure 1: An example ECG record

Details

Patient Name:	xxxxxxx xxxxxxx	Test Date:	29/xx/xxxx xx:xx:xx
Patient Number:	xxxx	Job Number:	xxxxxxxxxx
Patient D.O.B.:	xx/xx/xxxx	Referring Site:	Demo Practice

Reason For Test Request

Syncope/Presyncope/Dizziness

Cardiology Advice

On basis of available information and ECG, immediate action is required. This means urgent discussion with cardiologist and/or referral to hospital.

Profound bradycardia plus suspected hemodynamic instability given reported history of Collapse/Presyncope/Dizziness.

ECG shows Type 2 second degree heart block (other than Mobitz I). This diagnosis is associated with progression to third degree heart block with no escape rhythm. Suggest urgent referral to cardiologist for permanent pacemaker implantation consideration.

Risk

Red

ECG Quality

Good

Physiologist's Report

	ECG Quality	Good
⚠	Ventricular Rate	Profound Bradycardia
⚠	PR Interval	Profoundly prolonged
✓	QRS Duration	Normal
✓	QTc Interval	Normal
✓	Cardiac Axis	Normal
✓	Sinus Rhythm Present	Yes
✓	Other Rhythm	None
✓	Atrial pause of more than 2 secon	No
⚠	AV Conduction	2nd degree AV block; (Other than Mobitz 1)
✓	Ventricular Ectopics	Not observed
✓	Atrial Ectopics	Not observed
✓	P-Wave Morphology	Normal
✓	QRS Morphology	Within normal limits
✓	Q-Wave	Within normal limits
✓	T-Wave Morphology	Within normal limits
✓	ST Segment	Within normal limits

Measurement History (ms)

Recorded	PR	QRS	QTc
29/xx/xxxx xx:xx:xx	308	104	429
22/xx/xxxx xx:xx:xx	306	102	432
15/xx/xxxx xx:xx:xx	302	98	436
08/xx/xxxx xx:xx:xx	304	100	432

Reporting Physiologist

Figure 2: An example diagnosis report