



Department of Computer Science & Engineering and Information Technology

Major Project Proposal (2024-25)

Group No.

31

1. Project Title

HeartGuard: ECG Image Analysis for Cardiovascular Anomaly Detection

2. Team Members

S. No.	Roll No.	Name	Mobile No.	Proficiency
1.	211169	Shivansh	7876590059	Cloud Computing
2.	211343	Shambhavi Singh	7006095129	Machine Learning
3.	211450	Antriksh Dubey	9797670047	Cloud Computing

3. Name of Supervisor

Dr. Hari Singh Rawat, Assistant Professor (SG)

4. Work Distribution

S. No.	Roll No.	Work Distribution
1.	211169	<ul style="list-style-type: none">Develop the system to digitize paper-based ECG records into digital formats.Implement image processing techniques to convert ECG images into 1-D signals.Ensure the digitized data is stored securely in the cloud and is easily accessible for further analysis.Set up a scalable cloud infrastructure to handle large volumes of ECG data.
2.	211343	<ul style="list-style-type: none">Develop and train deep learning models to extract critical ECG features such as the P wave, QRS complex, and T wave from the digitized signals.Enhance signal processing techniques to improve feature extraction accuracy and highlight subtle anomalies.



		<ul style="list-style-type: none">● Implement machine learning models to automatically detect and classify cardiovascular anomalies based on extracted features.● Continuously improve model performance and adapt the system to recognize various ECG patterns, enhancing diagnostic accuracy over time.
3.	211450	<ul style="list-style-type: none">● Design and manage the cloud infrastructure for the project, ensuring it is robust, scalable, and secure.● Integrate the digitized ECG records with the machine learning models for real-time processing.● Optimize data flow and storage solutions in the cloud to support efficient processing and retrieval.● Ensure compliance with healthcare data regulations (e.g., HIPAA) and implement necessary security measures.

5. Problem Statement

CVD is a group of diseases that leads to the malfunctioning of our heart and causes damage to the blood vessels. CVDs account for a significant number of deaths around the world and tend to influence global mortality rates, accentuating the critical need for early detection and precise diagnosis. The ECG is a crucial tool for early diagnosis of heart conditions. It records the heart's electrical activity, helping doctors detect abnormal rhythms and timing issues that can indicate underlying heart problems.

Traditionally, ECG data has been recorded on paper and manually analyzed by healthcare professionals. This process is slow, prone to human error, and can lead to missed heart problems and delayed diagnoses. Given the critical need for accuracy and speed in modern healthcare, this outdated method is no longer sufficient.

To overcome these issues, our HeartGuard project will use deep learning to convert ECG images into 1-D signals, extracting key cardiac indicators and analyzing them with an algorithm to assess heart function. This strategy would not only remove the time constraint but also enable the system to learn and adapt to various ECG patterns, enhancing the efficiency of diagnostic competencies over time. Our automated system offers a reliable and faster alternative to manual ECG analysis, thus providing healthcare professionals with the tools they need to make accurate and timely diagnosis, ultimately reducing mortality rates by avoiding delays in the detection of cardiovascular anomalies.



6. Main Objectives

- 1) **Digitize and Process ECG Records:** Develop a system to convert traditional paper-based ECG records into digital formats. This involves using image processing techniques to transform paper ECG images into 1-D signals, which will serve as the foundation for further analysis. The goal is to streamline the data acquisition process and make it suitable for automated analysis.
- 2) **Advanced Feature Extraction and Signal Enhancement:** Utilize state-of-the-art deep learning models and other advanced neural architectures, to extract and enhance critical ECG features such as the P wave, QRS complex, and T wave. This objective focuses on improving the accuracy and reliability of feature extraction and highlighting subtle anomalies that may be missed with traditional methods.
- 3) **Automated Cardiovascular Anomaly Detection:** Develop and integrate machine learning models to automatically detect and classify cardiovascular anomalies based on the extracted features. The objective is to enhance diagnostic capabilities, enabling early and reliable detection of lethal heart conditions.

7. Resources Required

Category	Description	
Software Resources	<ul style="list-style-type: none">• Python• OpenCV• TensorFlow• Keras• PyTorch• Docker	<p>Version: 3.12.3</p> <p>Version: 4.5.4</p> <p>Version: 2.x</p> <p>Version: 3.5.0</p> <p>Version: 2.3.1</p> <p>Version: 24.0.9</p>
Hardware Resources	<ul style="list-style-type: none">• Intel i7 Processor• NVIDIA GeForce RTX 3050• 16 GB RAM	
Others	<ul style="list-style-type: none">• Jupyter Notebook, VS Code• Storage solutions ---cloud etc. GitHub etc.• Roboflow	



8. Project Plan

Activity	Year 2024										Year 2025									
	Aug.		Sept.		Oct.		Nov.		Dec.		Jan.		Feb.		Mar.		Apr.		May	
Literature Review																				
Analysis and Requirements																				
Project Design and Architecture																				
Implementation																				
Testing and Validation																				
Documentation and Write-up																				

Signatures

Shivansh
31/08/24

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Antriksh Dubey

Dr. Hari Singh Rawat

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