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**Project Initialization and Planning Phase**

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| Date | 21 JUNE 2025 |
| Project Title | **Arrhythmia Classification with Deep Learning and 2-D ECG Images** |
| Maximum Marks | 3 Marks |

**Project Proposal report**

| **Project Proposal (Proposed Solution) report** |  |
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| **The proposal report aims to** | Transform arrhythmia diagnosis using deep learning, boosting efficiency and accuracy. It tackles manual ECG review challenges, promising faster, more accurate, and scalable arrhythmia detection for healthcare providers and patients. Key features include a deep learning-based arrhythmia classification model, real-time prediction, and a user-friendly web application. |
| **Project Overview** |  |
| **Objective** | The primary objective is to revolutionize arrhythmia diagnosis by implementing advanced deep learning techniques, ensuring faster and more accurate ECG-based arrhythmia classification. |
| **Scope** | The project comprehensively addresses the detection and classification of arrhythmias from ECG data by developing and deploying a deep learning model. The model will be integrated into a web application for real-time, scalable, and user-friendly arrhythmia prediction. |

| **Problem Statement** |  |
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| **Description** | Manual review of ECG signals for arrhythmia detection is time-consuming, error-prone, and often leads to delayed or missed diagnoses, impacting operational efficiency and patient outcomes. |
| **Impact** | Solving these issues will result in improved diagnostic speed and accuracy, reduced clinician workload, and better patient outcomes through timely intervention and monitoring. |
| **Proposed Solution** |  |
| **Approach** | Employ deep learning techniques (multi-layer CNN) to analyze 2D spectral images derived from ECG signals. The model will be trained from scratch (not using transfer learning) to learn hierarchical features for robust arrhythmia classification. The solution will include a web interface for real-time predictions. |
| **Key Features** | - Implementation of a deep learning-based arrhythmia classification model (CNN from scratch). - Advanced data augmentation and regularization for improved generalization. - Real-time prediction via a Flask-based web application. - Comprehensive model evaluation using accuracy, precision, recall, and F1-score. - User interface for uploading ECG images and receiving instant results |

**Resource Requirement**

| **Resource Type** | **Description** | **Specification/Allocation** |
| --- | --- | --- |
| Hardware | Computing Resources | T4 GPU |
|  | Memory | 8 GB |
|  | Storage | 1 TB SSD |
| Software | Frameworks | Python frameworks, Flask |
|  | Libraries | scikit-learn, pandas, numpy, matplotlib, seaborn |
|  | Development Environment | Jupyter Notebook, PyCharm |
| Data | Data | Kaggle dataset, 614 samples, CSV format |