**ECG Stress Monitoring Project – Procedure Steps**

# 1. Define Objectives

* Monitor ECG signals in real-time.
* Detect and classify stress levels.
* Visualize ECG data and possibly send alerts.

# 2. Required Components

**Hardware:**

* Arduino UNO – Microcontroller to process data.
* Potentiometer – Simulates heart rate input (demo purpose).
* LED – Lights up when heart rate is abnormal.
* Buzzer – Emits sound alert on high or low heart rate.
* Wires & Breadboard – For circuit connections.
* Power Source – USB or battery pack.
* Resistor

**Software:**

* Arduino IDE / Python
* Python (for signal processing)
* Mobile/web app (optional) for live monitoring

# 3. Hardware Setup

* Connect potentiometer electrodes to the subject (RA, LA, RL or chest placements).
* Interface potentiometer with the microcontroller.
* Power the system and test signal transmission to the PC or cloud.

# 4. Data Acquisition

* Use Arduino/Python to read ECG values.
* Store data in .csv or database for later analysis.
* Optionally transmit live data over Bluetooth/Wi-Fi.

# 5. Signal Processing

* Filter noise using digital filters (e.g., Butterworth filter).
* Remove baseline wander and power-line interference.
* Detect R-peaks to calculate HR (Heart Rate) and HRV (Heart Rate Variability).

# 6. Feature Extraction

Extract features useful for stress detection:

* Heart rate (HR)
* Heart rate variability (HRV)
* RMSSD, SDNN, LF/HF ratio (from HRV)
* ECG waveform changes

# 7. Stress Detection (Optional ML/Rule-based)

* **Rule-based method:** Use thresholds for HRV/HR to classify stress.
* **Machine Learning:**
  + Collect labeled data (stressed vs. relaxed).
  + Extract features from ECG.
  + Train classifiers: SVM, Random Forest, KNN, etc.
  + Evaluate model accuracy (cross-validation, confusion matrix).

# 8. Visualization

* Use Python (Matplotlib, Dash, Streamlit) to plot ECG in real-time.
* Mobile app/web dashboard (if needed) for remote visualization.

# 9. Alert System (Optional)

* If stress is detected beyond a threshold:
  + Send SMS/email
  + Trigger buzzer or notification

# 10. Documentation & Report

* Project objective, methodology
* Circuit diagrams and code
* Sample ECG plots
* Result analysis (e.g., stress detection accuracy)
* Challenges and future improvements

# 11. Deployment (Optional)

* 3D-print a case for the ECG unit.