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.
- 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.

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.
  - 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.