

1. Desired Needs for Project Design

- Low cost (<\$100) and fully portable ECG with interactive demonstration
- Clear, low-noise signal with multiple lead display and adjustable amplification

2. Major Constraints on Design

- **Safety:** Must rely on <9V power and must not receive current from wall outlets. Electronics must be isolated to eliminate shock risk.
- **Risks:** Noise from the environment could distort ECG signals, as well as any sudden movements that may occur in a classroom environment. If a device draws current from wall outlets or bare wires are exposed there is also a potential shock risk.
- **Global Impact:** Must be low-cost and easy to use so that the device is accessible to a variety of classrooms and learning environments.
- **Manufacturability:** Final circuit must be compressed into a PCB design which allows for mass reproduction of the device.
- **Marketability:** Must appeal to STEM teachers at the high school level and certain engineering professors, so there must be an interactive aspect and clear real world applications to the device and demonstration.

3. Major Engineering Standards

- IEC 60601-1 provides general requirements for basic safety and essential performance in medical electrical equipment
- IEC 60601-2-47 provides particular requirements for the safety of ambulatory electrocardiographic systems, which lays groundwork for signal processing requirements.

4. Ethical, Environmental, and Societal Concerns

- **Ethical:** Consent must be given by students to have their medical data recorded, and this data can't be shared to internet
- **Environmental:** Device can't rely on too much energy and should have no waste products
- **Societal:** Educational demonstration must accurately communicate science

5. Active Teamwork and Leadership

- We had regular team meetings to collaborate and share opinions amongst the whole group
- We split the project into three core subprojects, each had one main leader and the other three group members would help out amongst the three subprojects
- We had a gantt chart to establish a timeline, and then we had mandatory meetings each week to re-evaluate goals and deadlines
- All criticism and feedback was shared freely and discussed amongst the team

6. Motivating Factors

- Learning new circuitry techniques for measuring biosignals while working under industry-level design constraints
- Getting to lead my own portion of the circuitry design and learning how to incorporate new hardware
- Seeing the potential real world applications of this device and getting to test the prototype with students

7. Innovative Ideas

- Utilizing pre-existing hardware modules to make device more efficient and cheaper
- Using low-cost analog circuitry to work around the constraints of pre-made electronics