

Practicum Product Design Specification (PDS) Outline

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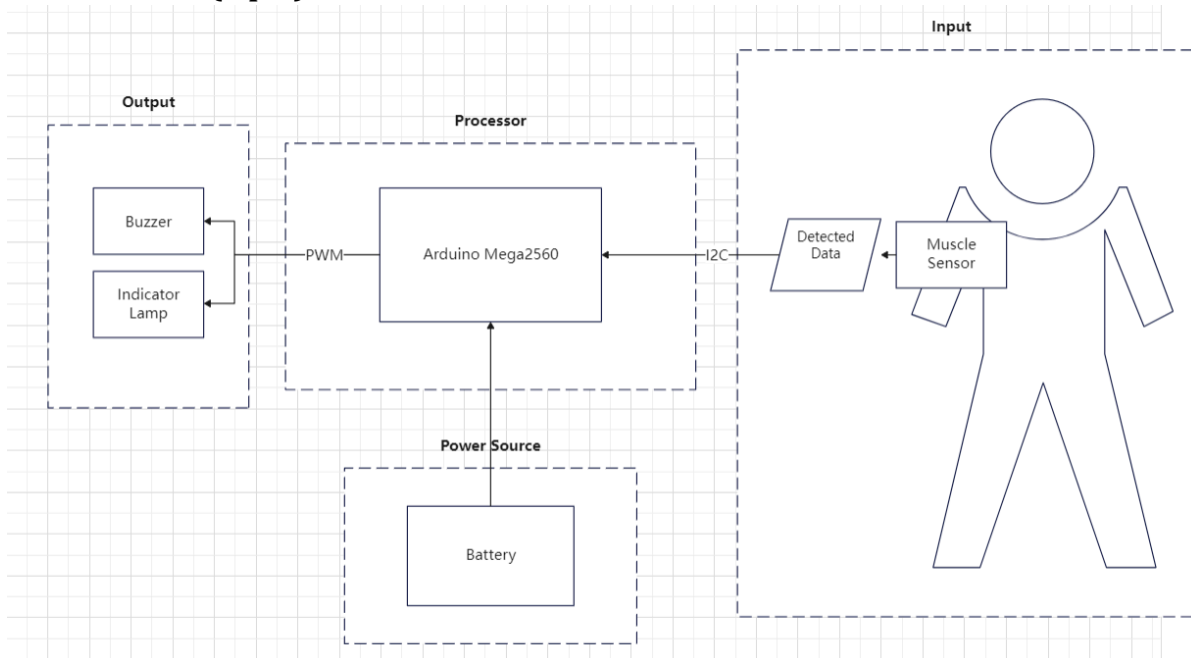
- **Short Descriptive Name**
 - M.I.A.O. System (Muscle Intelligent Analyzing and Optimization)
- **Executive Summary with Concept of Operations (2 pts)**
 - Our products can be used in monitoring the condition of people's muscles by collecting the electric signals from the muscle, then the device will act to give the users feedback.
 - When exercising, usually people don't know the condition of muscles, then, they'll exercise too much or less, which makes them feel sick after the exercise or feel nothing. In this condition, we come up with an idea that we can make a device to monitor the condition of muscle, this device can also encourage the user to exercise more or prevent the user from harm by over-exercising.
 - Sports lovers and Fitness enthusiasts will use it.
 - When the user use it, he can just stick it onto the user's arm, then turn it on, then the device will monitor the electrical signals from the user's arm, and the microprocessor will analyze the signal and give the user a suggestion for the user's exercising.
 - Users can just stick the sensor onto their skin, then do their exercise. When they finish a group of training, the device will tell them if they have met the scientific fitness requirements.
- **Brief "Market" Analysis (2 pts)**
 - The device targets fitness enthusiasts and athletes who want real-time feedback to improve workouts. Personal trainers and physical therapists could use it to track clients' progress.
 - Our products are more portable than many professional equipment used to analyze muscle strength. This device can also come with a music playback function, providing a relaxing atmosphere for fitness. It can be equipped with a dedicated user-friendly design app if there are any follow-up requirements. Most importantly, due to its relatively simple structure, the product cost is much lower than that of similar professional equipment.
 - This product can be sold for approximately \$80, as it is mainly aimed at most ordinary fitness enthusiasts and has low research and development costs. If successfully developed, it will be a widely popular affordable product.
- **Requirements (4 pts)**
 - The system should implement high-quality signal filtering techniques.
 - The installation time should be less than 3 minutes.
 - The material should be elastic and the equipment should not influence people's sports performance when wearing it.
 - When the user completes the exercise requirement, the system will automatically trigger an alert, and at this point, the signal variance should reach its maximum value.
 - A low-dropout regulator (LDO), like a switch, may be used to maintain a steady supply voltage to the EMG sensors, controller, and alerting systems.
 - The M.I.A.O system should have enclosures around sensitive components to minimize the impact of ambient electromagnetic fields, like mobile phones and other electronic devices.
 - The muscle fatigue alert should be made when the user is in a resting state.
 - The weight should be less than 200 grams to minimize user's discomfort.
 - The accuracy of the system should be more than 90%.

- It should be capable of functioning for at least 12 hours of continuous monitoring on a single charge. The charge can be rechargeable.
- The system may be equipped with a wifi module and connected to apps.

Safety:

- The voltage should not exceed 3.3V to 5V for the signal acquisition and processing circuits.
- The recommended current should be below 10 microamperes (μA) for continuous contact, and it should not exceed 1 milliampere (mA) even during transient conditions.
- The system must have a protective circuit to ensure safety.

● **System Architecture (4 pts)**



● **Design Specification (4 pts)**

- Sensor: EMG sensor
- Processor: Arduino Mega 2560
- Actuator: motor, buzzer
- Power: lithium battery (Adafruit PowerBoost 500/1000)
- Mechanical: Use blender to simulate, a tie to tie the device on shoulders
- Firmware: MATLAB, Arduino IDE, LTspice
- Arduino or not: Yes.
- Development environment: VScode, Proteus

Important Notes:

- Format nicely, include all the standard things: Title, team #, names, page #s, sections, etc. (2 pts)
- Spell check it, and *write it in a direct, simple, active voice.* (2 pts)
- Pictures are good, when useful. Gratuitous pictures are not good.
- This should only be 2-3 pages.

Do you have questions or comments on this homework assignment? [Please comment on them!!](#)