

# Owen Duggan, Ben Shinoski, Randy Reed

## **Idea: Threshold, the failure muscle tracker**

**Description:** With a rapidly growing community of fitness enthusiasts, more and more people are interested in how they can optimize their workouts. A commonly spoken topic within the fitness community is training until failure. Failure occurs when a person exhausts a muscle to its absolute max leading to the greatest amount of muscle growth. Not only can it be difficult for beginning lifters to know when they have achieved failure, but having a device to remind you that perhaps you have a few more repetitions left in the tank could be useful. I propose to create a small wearable device that accurately measures when a muscle achieves failure. I envision this device to be attached to a band and contain two leds, one red and one green, to indicate whether or not failure was achieved. Additionally, we will include a timer on our device that includes a start button. This timer will help lifters to measure rest. We hope to design this clock as adjustable so that lifters can set variable amounts of rest time. I also hope to implement a bluetooth connection that can automatically upload information to your phone to keep track of efforts on workouts.

**Justification:** This idea definitely poses some challenging aspects, but it is something I could see myself using in my everyday life. I think that as the world trends towards a healthier society, wearable devices to track health indicators will become only more popular and I think designing this device will provide myself with a great opportunity to learn more about the field. For weightlifting, beginner lifters, in our experience, often underestimate their effort and limits when it comes to muscle exertion. Exercise science is an often under researched field, but data has shown that, at the very least, getting close to failure in weight lifting movements improves hypertrophy gains (muscle building) and strength. Thus, this tool could be useful for novice and intermediate weightlifters to improve the efficacy of their weight lifting.

**Challenges:** Measuring failure is going to be challenging. My plan is to utilize an EMG sensor to measure electrical activity within the muscles. It is important to distinguish between objective failure and subjective failure. The device needs to decipher when a person has actually achieved muscular failure versus a person voluntarily stopping. To differentiate I will measure that intensity of the drop off in electrical activity in actual muscular there will be a strong drop off. Additionally, it is important to ensure that the electrodes stay properly connected with the muscles. Additionally EMG readings differ based on individual physiology and exercise type. As a group we will most likely have to perform some extensive data collection and testing in order to accurately determine the effectiveness of our device.

**Stretch Goal #1, Percentage Failure Indicator:** An interesting datapoint that we believe could be helpful to our users is a screen that displays the percentage of exertion achieved on a given set. This will be particularly challenging as without a baseline it is difficult to determine the percentage of exertion achieved.

**Stretch Goal #2, Oxygen Tracking:** Another indicator of muscle failure is oxygen saturation level in muscles. If I could utilize a NIRS sensor to measure SmO<sub>2</sub> levels I could provide the user with an additional indicator to track muscle failure. This would ensure a more accurate record of the user's workouts.

**Stretch Goal #3 LLM model :**

Designing a machine learning model that could help to better understand users as they attempt to achieve failure could be really interesting. If we developed an app to record additional data points to better understand the users conditions before, during, and after a workout we could couple this data with our failure monitor to provide potential suggestions on how they could better improve their workouts.

**Device:** We will be using the MyoWare 2.0 Muscle Sensor Basic Kit as our EMG device as it is compatible with the MSP430. We will test various adhesive products to determine how to best attach the electrodes to the muscle. We will use standard 3mm LEDs, the HM-10 for bluetooth connection and piezoelectric buzzer for the sound.

**Collaboration:** Our group will communicate via text. We will attempt to work together in the library and allot time as needed for the project. We will work together simultaneously on the project to ensure we both gain experience and knowledge from all parts.

<https://www.sparkfun.com/myoware-2-0-muscle-sensor-basic-kit.html>