

Preventing Weightlifting Injuries by Barbell Modifications

October 14th - October 18th, 2024

Client: Mr. Robert Gold

Advisor: Prof. William Murphy

Team Members:

Jackson Jarrett jrjarrett2@wisc.edu (Leader and BWIG)

Kai McClellan kamcclellan@wisc.edu (Communicator)

Gavin Gruber gtgruber@wisc.edu (BPAG)

Luke Schmeling lascmeling@wisc.edu (BSAC)

Problem Statement

Thousands of weightlifting injuries occur every year. Injuries are often caused by an uneven distribution of load on the barbell, leading to the weight lifter favoring one arm over the other. The team has been tasked with designing a biomedical device that can prevent weight lifting injuries by targeting, identifying, and correcting improper form.

Brief Status Update

The team has finalized its design, ordered necessary parts, and will begin fabrication of the weightlifting clip and coding the MPU-6050 and Arduino.

Team Goals

We look forward to fabricating the weightlifting clip via 3D printing and beginning testing on this subject, as well as beginning the coding and pairing of the MPU-6050 and Arduino.

Individual Accomplishments and Goals

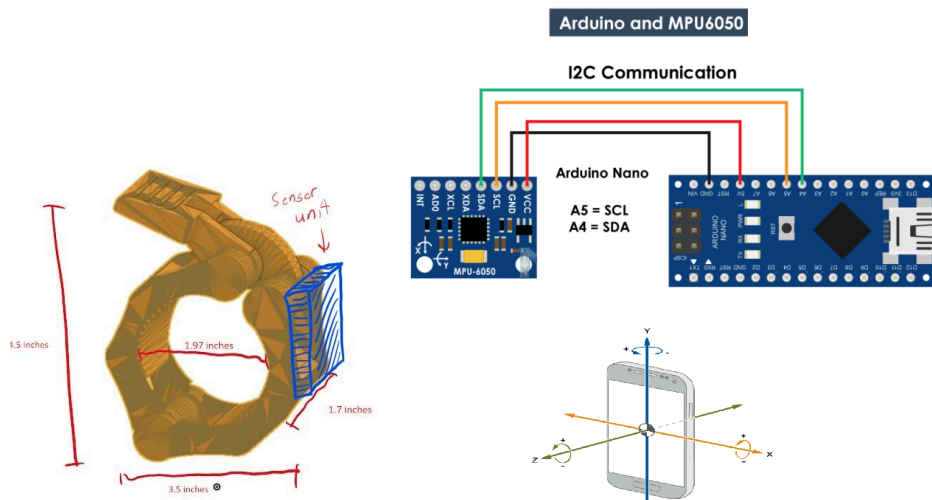
Jackson: This week, I coordinated the ordering of our parts, as well as worked with the team to decide on meeting times so that we could move forward with fabrication. As a team, we all agreed on the importance of this “off” time to really focus on the development of our final design. We met on Thursday night to begin the 3D printing process, and to talk with the Makerspace staff in order to hear their advice on our project. Kai and I worked with IMU’s in BME 315 lab on Wednesday, and this really helped us visualize what we will have to be doing in the coming weeks to create the barbell tracking portion of the project.

Kai: Throughout the week the team and I met a few times to discuss our plan for fabrication and ended up ordering parts for our first prototype. I also met with the team in the makerspace and began early stages of fabrication by uploading code onto the arduino nanos. Jackson and I’s 315 lab allowed us to play around with bluetooth IMU’s to get a sense for how they collect data and what noise filters may be necessary. Looking forward, i’m hoping the team will have a finished prototype and some elementary testing done in the next week or so.

Luke: This week I looked deep into how frequency, a gym's ambient noise, and sudden acceleration would affect the raw data output of the Arduino IMU. I looked into solutions to these problems, which caused me to find the topic of complementary filters for turning raw data from the IMU into a more optimized output that I believe may possibly be a necessity and an easy addition to our code for this project. I discussed this with Kai and we will look into it further and how it may apply to this project. This coming week I am going to look into the sketch processing software "6th Degree of Freedom" animation through MathWorks. I also am looking forward to learning more circuitry and 3D printing from the 300's in our group these upcoming weeks.

Gavin: This week I ordered and picked up the parts we needed. We will also be meeting on Thursday to work on our fabrication, especially 3-D printing the clips, and hardwiring our electrical devices. I also did some research on the strength of 3-D printed materials to see if 3-D printing the clamp will work well. In this coming week, we will focus heavily on fabrication, and we will be meeting a few times this next week to fabricate our product.

Design Accomplishments



The team will move forward with the 3D printing of a functional weight lifting clip with necessary housing for the following technology. We will utilize an Arduino Nano in each clip, paired with a MPU6050. The Arduino Nanos will collect data and pair with each other via Bluetooth, and the MPU6050 will collect data in terms of angular velocity and acceleration. We will derive this data to displacement, and establish a coordinate system and line of best fit of the barbell path from there.

Weekly/Ongoing Difficulties:

N/A

Project Timeline:

Week #	Task
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1	Choose project Assign roles
2	Finish first progress report BSAC meeting First client meeting
3	PDS, Brainstorm, Research
4	Brainstorm, Literature Search, Design matrix criteria and design ideas (at least three) due
5	Preliminary Oral Presentation
6	Preliminary Report, Electronic Notebook, Peer/Self Evaluation, Decide on final design
7	Final Design
8	Order materials, consider submitting invention disclosure
9	Fabrication, show and tell
10	Fabrication
11	Fabrication
12	Design Testing and Modification, Poster Draft Review
13	Design Testing and Modification, Final Report
14	Poster Presentation, Final Report, Final Electronic Notebook, Team Evaluation, Peer/Self Evaluation

Expenses  BPAG Expense Spreadsheet