Preventing Weightlifting Injuries by Barbell Modifications
September 30 - October 3, 2024

Client: Mr. Robert Gold
Advisor: Prof. William Murphy

Team Members:
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Problem Statement
Thousands of weightlifting injuries occur every year. These 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 met on Monday and Thursday this week to discuss the final design and the upcoming preliminary presentation, where we will present our progress to our peers and advisor.

Team Goals
We look forward to moving forward with the fabrication of our design, beginning with the ordering of necessary materials, beginning the 3D printing process of the weightlifting clip, and creating the code that connects the Arduino Nanos with the MPU6050 to establish the coordinate system.

Individual Accomplishments and Goals
Jackson: This week I really dove into the technology aspect of our design. After talking with my biomechanics professor Dr. Willie, she highly recommended moving forward with an IMU to do the necessary tracking of data that our design requires. I researched the pairing Arduino Nanos that we will also utilize, and began my search to find code that will connect the Arduino Nanos to the MPU6050 in order to establish the coordinate system that we need to track the barbell path. I completed my slides on the preliminary presentation, and look forward to sharing our ideas with our peers, advisor, and client. I look forward to beginning the 3D printing process of the weightlifting clip, and adding the necessary element that will house our technology.

Kai: This week I focused heavily on the circuitry elements that our team wants to use for our design. Jackson and I met with our biomechanics professor Dr. Wille and mentioned IMU sensors as opposed to accelerometers because they incorporate both accelerometers and gyroscopes to calculate angular velocity. Dr. Wille said that this would be much more efficient in tracking elbow movement which is the

most significant factor in bench form. I also worked with the team to complete our presentation slides that we are presenting this friday and discussed our plans for purchasing materials to begin fabrication soon.

Luke: This week I researched exactly how shoulder impingements and tears in the shoulder occur during bench press and learned the technical ways on the scientific level as to what variables and variations of technique for bench press minimize the risk of injury. I also continued research on the biology and physiology of the shoulder which worked hand in hand with my research about shoulder impingements. This upcoming week I want to bring myself up to speed on the technologies being used for this device and learn how the IMU chip's work and how we are going to create relevant computer code for them.

Gavin: Worked on completing our preliminary presentation and figuring out what we would be saying in our presentation. I also did a little deeper research on some of the competing designs. I did a bit more research on how to correct an uneven barbell when you are benching both in the vertical direction and staying parallel to your shoulders. In the coming days, I hope to further finalize our design and figure out all of the exact components and sizes. I also plan to look more at how we are going to code our device to track all of the data and display it.

Design Accomplishments
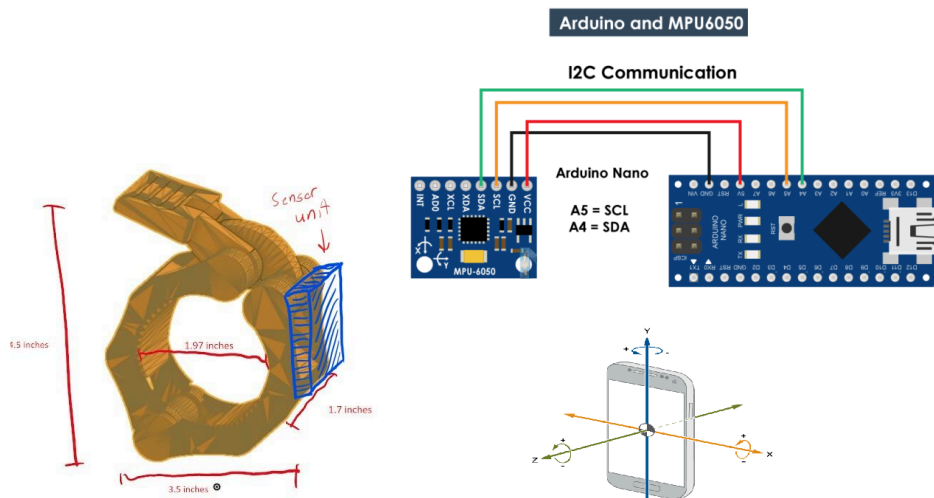
The team will move forward with the 3D printing of a functional weight lifting clip with necessary housing for the following technology. We will utilize an Arduino Nano in each clip, paired with a MPU6050. The arduino nanos will collect data and pair with each other via bluetooth, and the MPU6050 will 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
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**