Preventing Weightlifting Injuries by Barbell Modifications

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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

Over one million weightlifters experience serious injuries 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 diagnose this strain on the body in coordination with specific muscles in use.

Brief Status Update

The design team met on Monday to discuss the design matrix. The team had an in depth, very successful brainstorming session in which we talked over dozens of ideas and possible directions with which we could follow. We worked to complete the design matrix, which highlights these categories and designs and our related thoughts.

Team Goals

Now that the team has honed in on a design, we look forward to expanding on this idea. We will explore bioinstrumentation concepts with the accelerometer and data collection, as well as connecting sensors via Arduino. We will look to begin a 3D printing process, and begin brainstorming ideas to house the necessary technology.

Individual Accomplishments and Goals

Jackson: This week, Kai and I were lucky enough to have the opportunity to meet with our Biomechanics professor, Dr. Christa Wille. We discussed a large range of topics within the biomechanics sphere, including the ratios of height and wingspan with arm lengths. These anthropometric ratios will be crucial to have in literature and research moving forward with our project, and we continue to use Dr. Willie as a resource. For the upcoming week, I look forward to diving into researching the accelerometer and the future derivation from acceleration to position that we will have to do, as well as looking to begin the 3D printing process of a technology housing system that resembles and retains the functionality of a weight lifting clip.

Kai: Jackson and I were able to meet with our biomechanics professor and discussed methods of analyzing and calculating the range of motion of a person during a bench press using IMUs to track the elbow flexion. We also discussed anthropometry relationships to accommodate for users of varying heights and weights/wingspans. Some research was done regarding optimal form and the ideal angles for each joint. I also helped with the design matrix and made solidworks drawings of the designs. In the coming days I hope to find how to display the flexion angles on our device from the IMUs and do some early testing.

Luke: Brought forth the idea to pursue a coordinate system with a calibrated origin from which we can document the data that would be needed to then recommend critiques to the user of the device. I played with different bar orientations and hand grasps to determine the best distance of the hands that they can be from each other so that we are informed when we begin barbell calibration. This upcoming week I plan to do a large amount of research on form and possible coding we can pursue for the clips if we decide to take that route. Also planning to continue to discuss with the group what project would be the best to move forth with and discuss the merits of each.

Gavin: Worked on the design matrix and brainstormed some ideas for the project before we met on monday. I also looked at similar designs and mobile apps that do similar things to what we are trying to accomplish. I did some more research on how bench form correlates to muscle activation, and the strain on your muscles, especially the shoulder muscles. In the following week, I hope to find out more about how we can code our devices and what specific microcontrollers we will need for our designs.

Design Accomplishments
Design Matrix:

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**