Client Meeting 1

September 14th, 2018
Meeting Time: 2pm-2:45pm
Where: Biomechatronics Lab
Members Present: Abdulla, Ebrahim, Leah, Dominic

The team met with Dr. Lerner and Thomas Huck at the Biomechatronics Lab to discuss the project more in depth and learn what the client wants out of the design.

- Make it adjustable in the width direction
- Create an attachment for the knee for below the knee amputees to be tested on people who do not have amputations
- Tomas phD student working on the BiOM prosthesis
- Adjustable in length and width
- Connectable to the ankle prosthetic
- Maximize weight savings with factor of safety
- Make as light as possible
- Attach regularly to different prosthesis adaptors
- Lighter than 1 kg
- Interchangeable knee attachment
- Design relatively affordable, budget to come later
- Keep cost and weight down, use creativity
- Won't meet unless absolutely necessary
- Send updated meeting minutes to client to keep client in loop
- 3 or so designs
- Device meant for men ~ 180 lbs or 80 kg
- Heights for shank length
- Comfortable socket that is adjustable
- Design parameter: leg bent or fully extended for testing, just tethered to upper limb
- Pay attention to knee bones.
- Powered plantar flexion, not connected to a motor, torque for plantar flexion, torque generation is similar to able bodied person
- Only works for level walking, 2 degrees of freedom (ankles have 6), no hills, no stairs, hard to do with the ankle prosthetic.
- Testing biom through other circumstances, upstairs downstairs, slopes?

Tomas
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Client Meeting 2

October 1st, 2018
Meeting Time: 1pm-1:30pm
Where: Biology
Members Present: Abdulla, Ebrahim, Leah, Dominic

The team met with Thomas in the Biology building at 1pm to get a better understanding of the project. The notes are as follows:

- Purpose is to test out biom without having the subject there
- Not designing socket for someone with amputation
- Designing device to test without subject
- Currently only testing with subjects for data collection
- Specs for ankle prosthesis
- Should be very rigid design, no hydraulics, springs, no deflection at all. Should only be rigid rod
    - Otherwise it will mess with the force readings, because the ankle prosthetic already measures the force on the object
- Rigid support and able to connect to the testing subject
- Problem will most likely be keeping device lightweight and choosing materials that are light and durable.
- Create socket for adjustable knee widths and that's comfortable
- Maintain rigid device and still be able to change length
- Materials, comfort, adjustable socket, adjustable length while maintaining rigidity
- Biom T2 prosthesis -> look for user manual
    - Design dimensions, universal attachment device, look for industry standard
- Take in account outerwear on legs for designing sockets, pants or shorts?
    - Soft parts of body go with harder materials
    - Hard parts of body go with softer materials
- Total weight of current device is around 2kg
- How easy is that adjustment? (lots of screws to adjust?)
    - Be able to be adjusted within a maximum of 5 mins, minimum time as low as you can go
- Ask Zach Lerner about budget
- “Horizons in Prosthesis development for the restoration of limb function” 2006
    - Lays out broader goals in prosthesis development
    - Section on socket design which might be helpful

Client Meeting 3

November 1st, 2018
Meeting Time: 9:30am-11pm
Where: Bean and Beaker
Members Present: Abdulla, Ebrahim, Dominic

The objective of this meeting is to show the final designs that the team has created to show the client and get his opinion on the concepts. The team also wanted to talk with the client about the flexibility of the constraints and ask a permission to take it to the next level.

9:35am
The client has mentioned that he has received an email from the technical advisor "Professor Oman" explaining that the project has to be more complicated than it currently is. He started explaining the reasoning of why the project is not complicated and justifying the weight should be as low as possible or at least as heavy as the average human limb, moreover he explained that the "Fibula" is the bone that is supporting the human body which makes it the heaviest and strongest bone in the body.

10am
Thomas explained how important the project is to him and the stakeholders in general to help people and give them hope. In other words the design was meant to be simple and lightweight because it is going to be used in simple usage. We are designing the device to be used for walking on flat level. We are not designing it to facilitate it on running or hiking … etc.

10:30am
The team has shown the designs that have been sketched to our client and asked for feedback and improvements to be done in the design to satisfy his needs. He liked the idea of the adjustable bike pylon, and said that the memory foam is something extra and what he needs is something more simple like gel and only on the hard parts like the Patella and hard surface around the soft parts. Thomas have said that he doesn't like the rigid bar and attachment between the pylon and leg support should be fixed in 90 degrees and should not be adjustable. One last suggestion that he had was to create a quicker attachment than what the standard is, which is screws. He suggested if we could make it a strong magnet snap or something like that.

11am
Thomas mentioned that it would be better if we could send him emails in the afternoon or text him since we have his phone number now.

Client Meeting 4

November 16th, 2018
Meeting Time: 12:30 pm-12:45 pm
Where: EGR, Dr. Lerners office
Members Present: Abdulla, Ebrahim, Dominic, Leah, Dr. Lerner

The goal of this meeting was to show the client our updated design from last meeting. The meeting took place in Dr. Zach Lerner's office in the Engineering building Friday afternoon. Dr. Lerner liked the design but had a suggestion of having the knee be supported from under the knee with another support. This was so the upper leg support would stay in place on the leg and would not slide up the leg. Dr. Lerner liked the attachment on both sides of the knee so it would be able to hinge at the axis of rotation about the actual knee. The hinge would be connected to the pylon through bearings so it would be able to rotate freely around the axis of rotation. Dr. Lerner suggested that the team look into two springs instead of one. The two springs should be adjustable and one in compression and one in extension to accurately model a person walking.

Client Meeting 5

January 25th, 2019
Meeting Time: 10:30 am-10:45 am
Where: Dr. Lerner's Office
Members Present: Abdulla, Ebrahim, Leah, Dominic, Dr. Zach Lerner

10:30
The team thought it necessary to meet with the client and update the client on any design changes as well as ask for guidance in any technical aspects of the project. The team asked Dr. Lerner about the BiOM Prosthesis attachment in which he said we were to design the attachment despite hearing from Thomas last semester that it was a standard part and it would have to be bought off the market and implemented into our design. Dr. Lerner advised that we take measurements of the attachment and try to find someone similar to it online, but ultimately we would be designing a new attachment. The team also asked Dr. Lerner about possible technical analysis the team could perform on the system. He suggested someone do an analysis on the attachment system using a Finite Element model, a spring selection analysis, and structure analysis, a bearing design embedded in the carbon fiber, and he agreed that determining the layers required for the U bar made of carbon fiber would be a beneficial analysis to the team.

10:45
The team will continue the meeting in a team meeting format over in the Biomechatronics lab.