



Trine University
Biomedical Engineering

Helping Hands

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Introduction:

The Trine University team partnered with the J.C. Innovations Helping Hands program to develop upper-limb prosthetics for two girls in Warsaw, Indiana to improve their quality of life. The Helping Hands program focuses on open-source design allowing for collaboration amongst multiple groups and organizations working to achieve similar upper-limb prosthetic design goals.

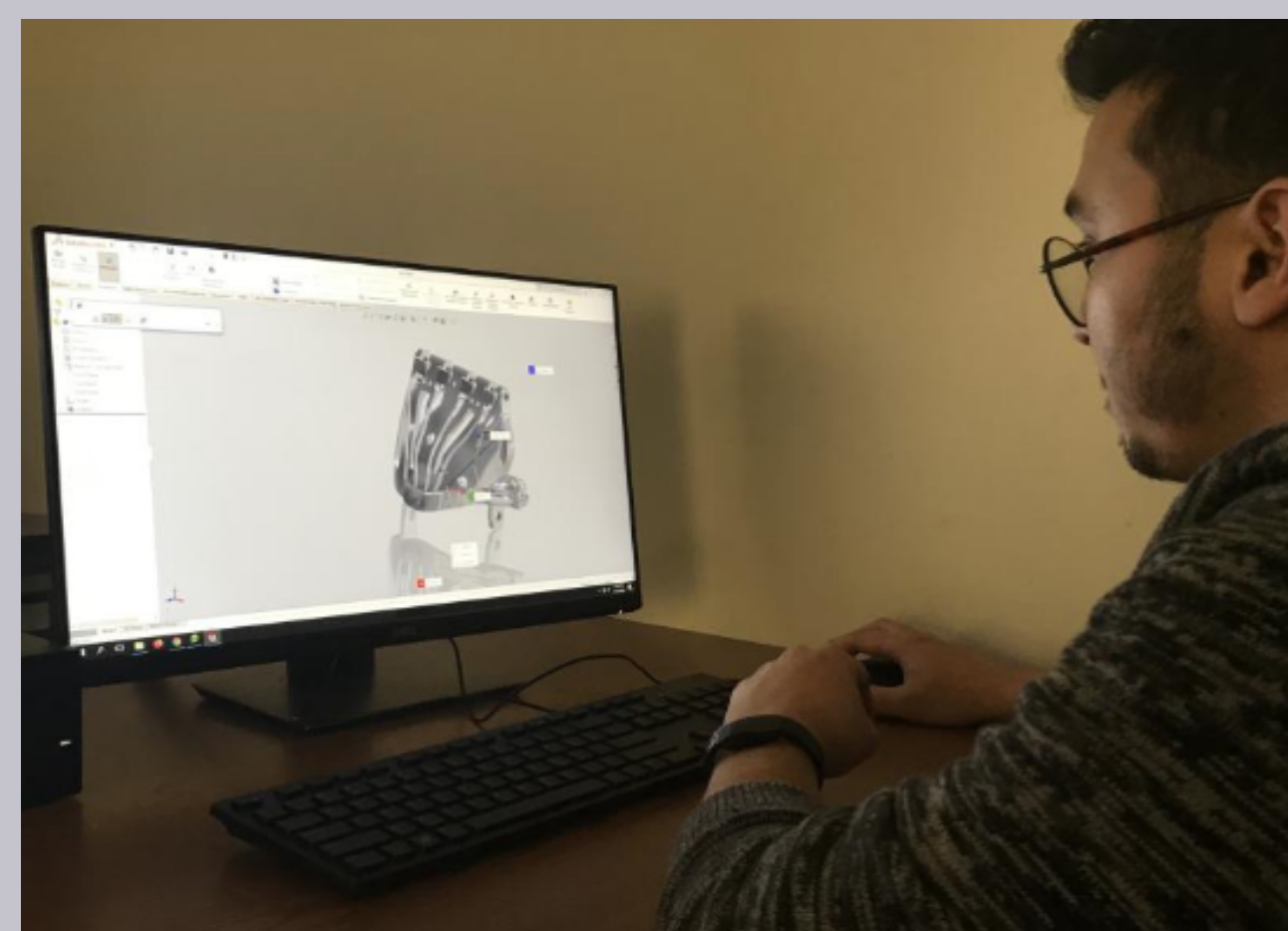
The two girls that the Trine team worked with had similar lists of activities they wished for the prosthetic to help them accomplish. Examples of these activities included doing their hair, doing the dishes, and riding a bike. The team took this information and maximized their open-source capabilities to select the most appropriate design.

Methods:

The Trine team met with both prosthetic recipients to identify daily activities that the device would allow them to perform as well as obtained initial measurements to initiate the design process. After thoroughly investigating two options using Table 1, the Cyborg Beast design was selected to best meet the project goals.

With measurements and photos obtained of the girls' hands, the team was able to scale CAD files for each of the 3-D printed components to fit the respective hand utilizing SolidWorks and Fusion360 technology.

For both design options, kits are available for purchase online that supply all the necessary components except for the 3-D printed parts. The 3-D printed components could be printed using a 3-D printer with an Acrylonitrile butadiene styrene (ABS) material or similar.



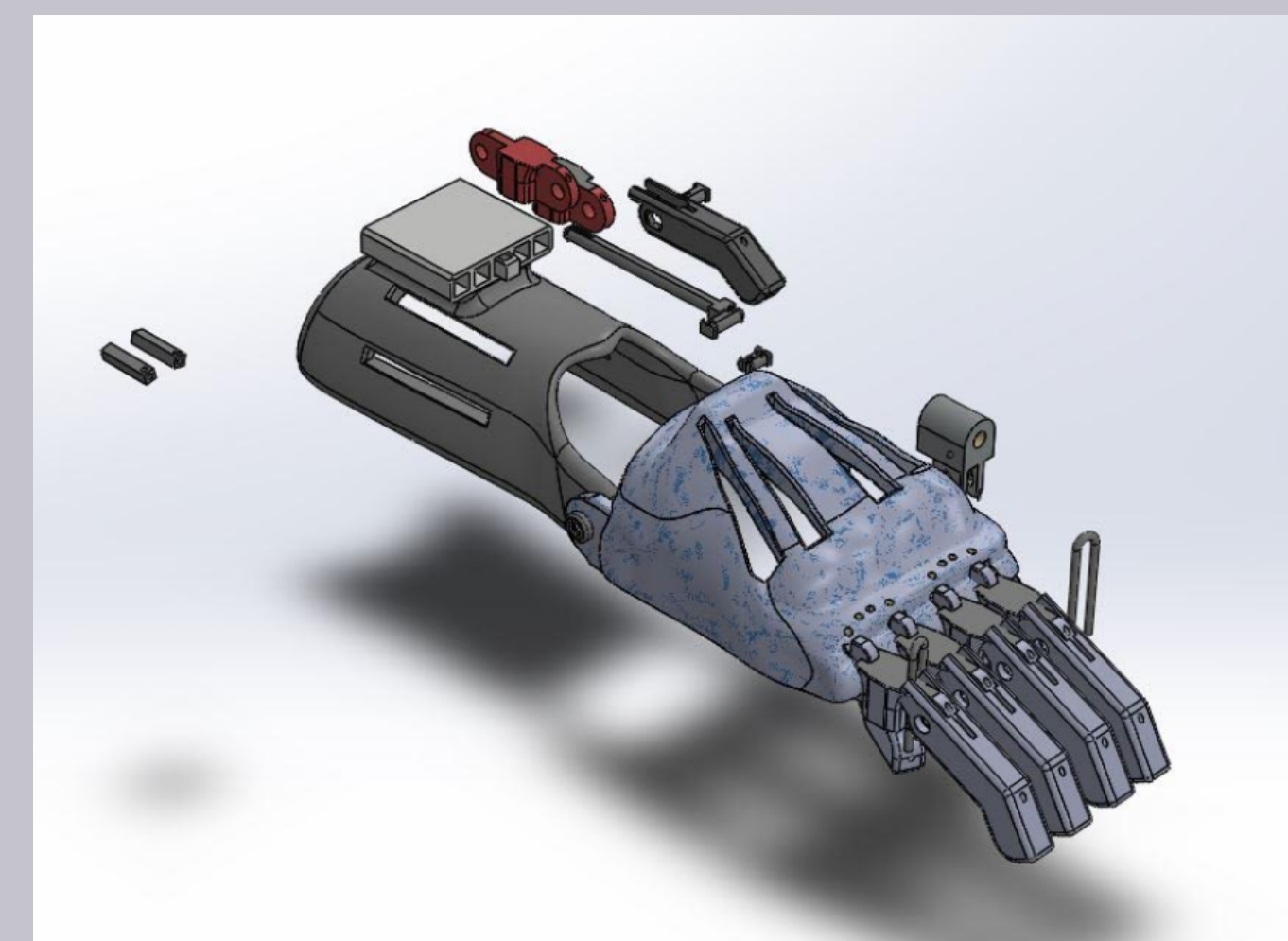
Cyborg Beast:

Pros

- Improved thumb design (stronger and more visually realistic)
- Less components required for 3-D printing and assembly
- Assembly kit available for purchase

Cons

- Less adaptability based on available CAD models
- Less documentation/testing experience available



Raptor Reloaded:

Pros

- Strong DHF background provided to us by Grace College team
- Assembly kit available for purchase

Cons

- Weaker thumb design
- Higher cost for production



Results:

Table 1 below illustrates the design selection process between the Cyborg Beast and Raptor Reloaded prosthetic hand design options.

Table 1: Design Selection Matrix

Criteria	Meets Customer Needs	Cost	Assembly	Aesthetics	Custom Fit	Total Score
Cyborg Beast	4	3	4	5	4	20
Raptor Reloaded	3	2	3	3	4	15



Discussion:

This semester's team was unfortunately unable to complete the 3-D printing of the devices due to the temporary closure of Trine University for health precautions in response to COVID-19; however, all components are scaled to be 3-D printed and assembled to make functional prosthetics for the two girls.

Future Work:

The team encourages future work to be dedicated towards optimizing the Cyborg Beast design. Possible future work could include:

- Printing and assembling the prosthetics for the original two girls
- Improve scaling techniques to provide better custom fit
- Add attachments designed to accomplish specific tasks
- Provide devices for more recipients
- Reduce the quantity of assembly components

Acknowledgements:

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