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MICHIGAN STATE UNIVERSITY

Resource Center for
Persons with Disabilities

MICHIGAN STATE UNIVERSITY

College of Engineering

Proposal to construct a prosthetic “bionic” arm with tactile internal controls

Friday, August 12, 2016

Current Sponsors: Lee Cleaveland, MSU Dairy Store, IronCAD, Employees of Michigan Department of Treasury Office of Collections, Texas Instruments, MSU College of Engineering, MSU Resource Center for Persons with Disabilities (RCPD), MSU Adaptive Sports Club, Marathon Oil, MSU Tower Guard Honor Society, Dart Container, Mason Michigan

Current participants: Lee Cleaveland, Project designer; Frank Luchini chief engineer from Dart Container, Allison Burzynski prosthetic specialist, Matt Marshall 3D cad and computer scientist, Stephen Blosser Engineering technologist

MSU Electrical and Computer Engineering (ECE480) project contribution

ECE 480 students during the fall 2016 semester will work with Lee and his team to build the electronic control interface that will operate the 3-D printed hand via actuators that they will select.

This is a collaborative project. The following is a possible division of responsibilities. This is subject to change if needed.

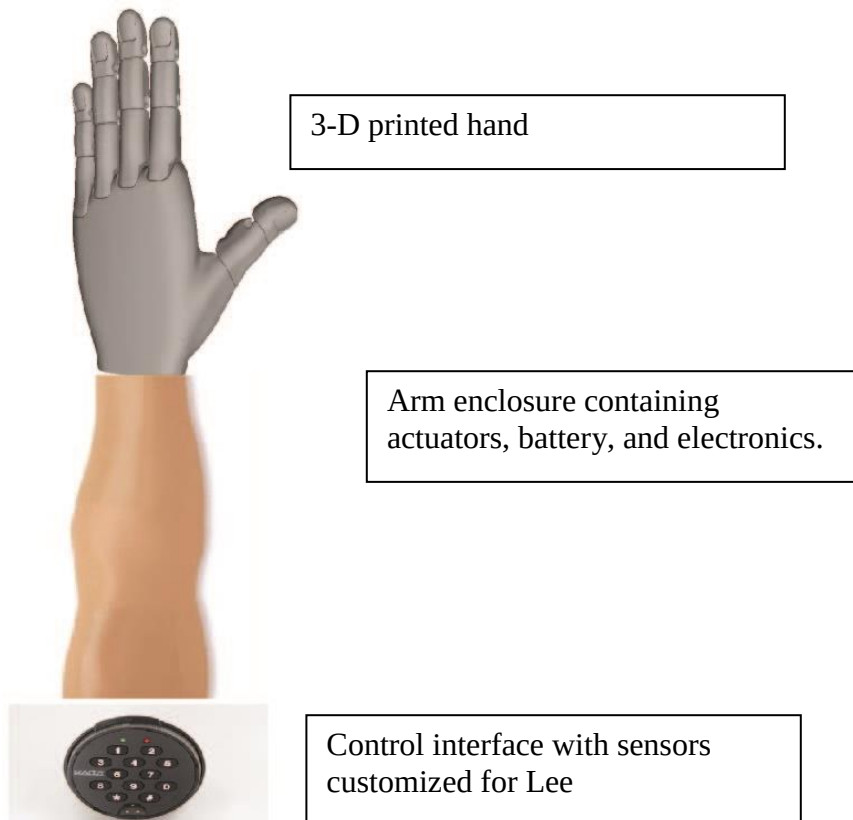
The 3-D printed hand and arm enclosure will be provided by the current project participants.

Frank Luchini and his team of engineers will construct the arm enclosure and mount the actuators, battery and other needed hardware. Allison Burzynski will design the cuff and attachment to Lee's upper arm.

Possible components to consider include: The Flexi hand <http://3dprint.nih.gov/discover/3dpx-000502> , Firgelli actuators <http://www.firgelli.com>, and FSR sensors <http://www.interlinkelectronics.com/standard-products.php>

Alternatives for these components may also be considered.

Minimum function would be to control only one actuator to provide gripping. If time permits other degrees of freedom could be provided, such as individual finger movement or wrist rotation.





Lee, a talented student at MSU is seeking assistance to build a custom prosthetic arm



Lee plays his guitar using very small fingers of his left arm.

Lee's request

“ I am a student at Michigan State registered with the RCPD and I would like to inquire about scholarship and grant opportunities you may know about.

I was born missing my left arm below my elbow, and have never really worn prosthetics. I never really had to adapt because doing things with one hand was all I knew and I found things to be easier not wearing my body-powered prosthetic. I haven't worn one since I was 14 and didn't think I'd ever really need one again. However, in 2015 I sustained a number of sports and work/lifting injuries that caused me to rethink that (most notably breaking my foot last January and being hospitalized for a herniated disc in September).

After speaking with my doctor, he says that the early twenties is about the age that congenital amputees begin to become fully aware of what they can and can't do and finally decide to get a prosthetic for various reasons, but mostly to have one just to wear around in order to straighten out the way they grew into their body. Just wearing a prosthetic around my house will help build muscle on my left side and to balance out the way I move. As an acting major, my professors have been encouraging me to invest in one in order to not only move better and more balanced onstage but to work out some of my tics.

I've been doing research on bionic arms for the past few months, but I've been having trouble contacting the manufacturers. There's only a handful in the world but there are a lot of people 3D printing their own. I used to go through Shriners Children's Hospital as a kid, but now that I'm older my mom and I don't really know how to go about this sort of thing any more. I've also

discovered that it's cheaper to build your own and I've begun gathering schematics and codes online, but building one requires skills that I don't have. Do you know of any researchers or student groups on campus that focus in neuroscience, biotechnology, or engineering that are working on similar projects that I may be able to get in contact with?

If you are available sometime, I would love to meet with you and discuss some possibilities. Thank you.”

Sincerely,

Lee Cleaveland
Philanthropy Chairman
Phi Kappa Sigma International Fraternity
Beta Delta Chapter, Michigan State University
(248)686-6630

Lee introduces himself and demonstrates some of his musical ability in this YouTube video <https://www.youtube.com/watch?v=jcrMKeFS0MA>

Proposal

Many individuals around the world are using 3-D printing to create prosthetic limbs. <https://3dprint.com/38355/teen-3d-prints-prosthetic-arm/> This approach enables users to experiment and customize the device to suit their specific needs.

Through the collaboration of Lee Cleaveland, MSU’s Resource Center for Persons with Disabilities, the College of Engineering and other potential contributors we are proposing to construct a 3-D printed prosthetic limb with at least one degree of powered, gripping motion.

This project will be conducted similar to other successful collaborative projects¹ such as “David’s Smart Walker” <https://www.egr.msu.edu/news/2015/09/14/smart-walker> and the accessible insulin pump project <https://www.rcpd.msu.edu/blog/post/insulin-pumps>

Project timeline

In December 2016 Lee will take possession of the first phase of his prosthetic limb. It is hoped this device will be easily attached to Lee’s left arm and will enable him to grip objects. It is very likely that future enhancements will be needed. A second phase of this project will be completed during the spring semester 2017.

¹ <https://www.rcpd.msu.edu/blog?c=33>

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