

M | ROBOTICS



Award Numbers:
1734586, 1949346, and 1734559

NRI: FND: COLLAB: AN OPEN-SOURCE ROBOTIC LEG PLATFORM THAT LOWERS THE BARRIER FOR ADVANCED PROSTHETICS RESEARCH



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Levi Hargrove
(AbilityLab Co-I)

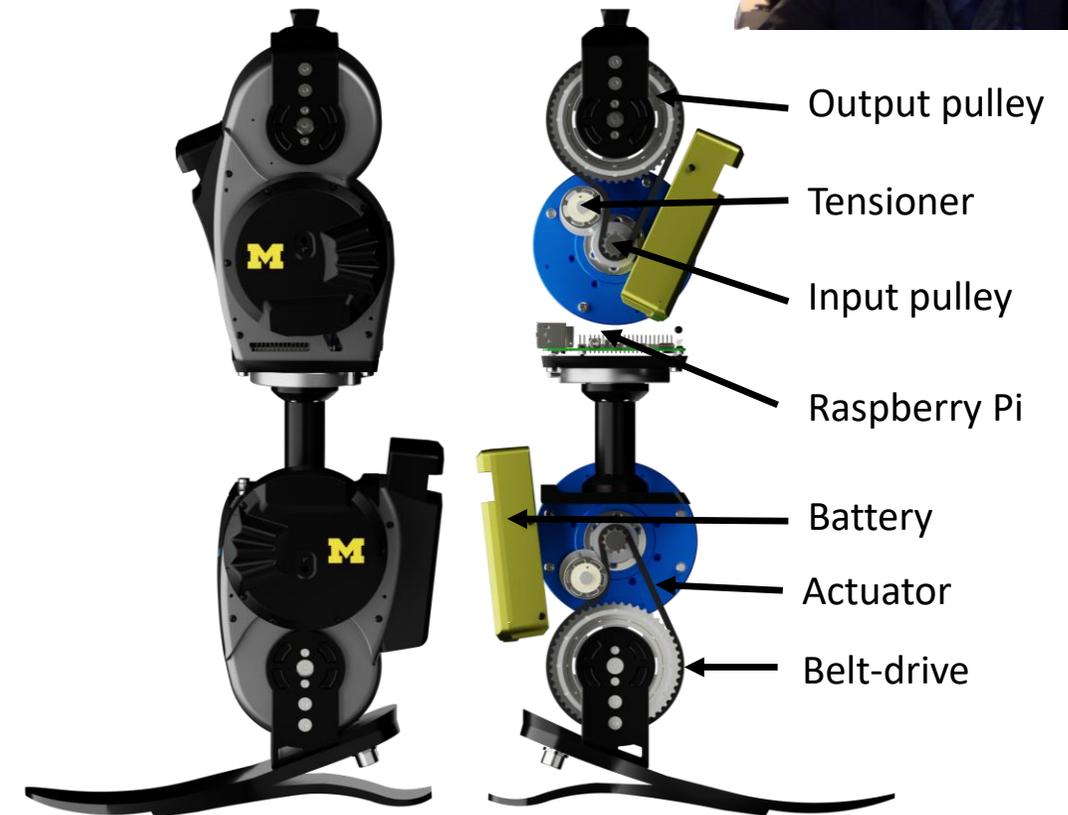
Motivation

- Goal: Develop an open hardware platform for robotic leg prostheses that
 - Eases comparison across different control strategies
 - Reduces the expense of developing custom prostheses to test control
 - Lowers the barrier for researchers in related fields to get involved



Results

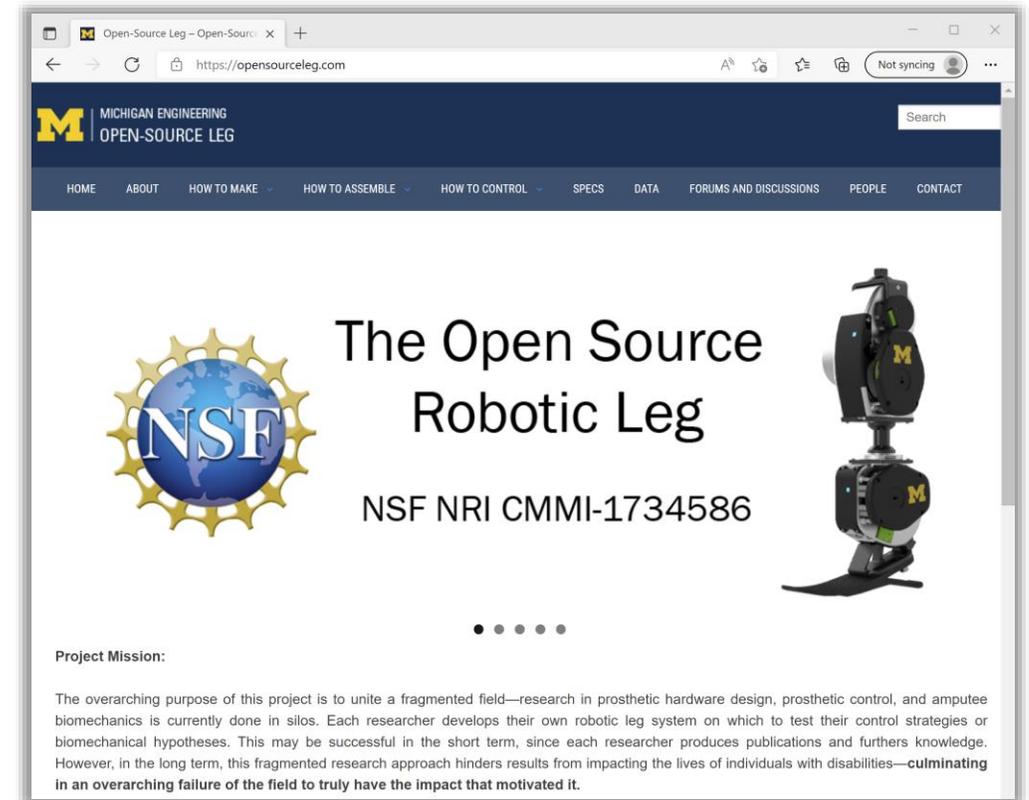
- Designed v1 and v2 versions of the modular 2-DOF ankle-knee prosthesis
- Characterized BLDC motors implemented in design
- Characterized performance of position / current controllers
- Developed open-source FSM control infrastructure and datasets
- Demonstrated performance in study with persons with amputation



2nd Generation Version
Open-Source Robotic Leg

Dissemination

- Developed project website
 - Specifications
 - Solid model files
 - Bill of materials
 - Manufacturing instructions
 - Step by step assembly instructions
 - Open-source data
- Website receives ~500 unique visitors / month



www.opensourceleg.com

Broader impacts



Shirley Ryan
Abilitylab
Northwestern



humotech

UNIVERSITY of
WASHINGTON

UF UNIVERSITY of
FLORIDA

CHALMERS
UNIVERSITY OF TECHNOLOGY

VA | U.S. Department
of Veterans Affairs

**Carnegie
Mellon
University**



**Georgia
Tech** 

 **PROTEOR**

**Imperial College
London**

Broader impacts

Dissemination in trade magazines

Dissemination in popular media



Happenings

Researchers Debut Open-Source Artificially Intelligent Prosthetic Leg

Scientists at the University of Michigan (UM) and Shelby Ryan AbilityLab have developed an open-source "smart" prosthetic leg that is available to the scientific community. Led by Elliott Rouse, PhD, core faculty at UM's Robotics Institute, and Lovi Hargrove, PhD, director of the Human Engineering for Prosthetics and Cereatics Laboratory at the Shelby Ryan AbilityLab, the research team debuted the technology during the IEEE International Conference on Robotics and Automation (ICRA) in June.

The prototype features a modular design that can act as a knee, ankle, or both. The research team adapted and incorporated advanced motor technology popular in the drone industry. The device's artificial intelligence-based control system can adapt the motions of the bionic leg to allow the user to switch activities—for example, to switch from walking on a flat surface to navigating stairs. This control is enabled using muscle-contracting signals and sensor data from within the robotic prosthesis to anticipate the user's next move and respond appropriately.

"While the design and code are free, the leg is still a high-end, state-of-the-art machine," Hargrove said. "It's a simple plug-and-play system that allows scientists to speed research and development costs in the millions of dollars and

MachineDesign

An Open-Source Bionic Leg
Freely available designs could help drive advanced control systems
By Charles G. Choi

05 Oct 2020 | 15:00 GMT

Open-Source AI Bionic Unified Platform for Prosthetics
Open-source design and programming advances by offering a unified platform across the field of prosthetics.
Stephen J. Mraz
JUN 11, 2019

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Photo: Joseph Xu/Michigan Engineering

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QUARTZ

An artificially intelligent, open-source bionic leg could change the future of prosthetics
By TERESA CAREY

digitaltrends

Open-Source Leg: The quest to create a bionic limb that anyone can build
By Luke Dormehl
October 17, 2020

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The 10 most innovative robotics companies of 2020
Zipline's drone-delivered medicine, robotic knees and legs, and even a robot that sorts the recycling.
7. MICHIGAN ENGINEERING NEUROBIONICS LAB
For ushering in the future of bionics with its Open Source Leg

Thank you



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