

Anthropomorphic Manipulator for Remote Operation

Lute Chen, Adam Evangelista, Nuthan Hegde, Gabriel Lima, Bruno Vu
Advisor: Professor Ian Harris



Background

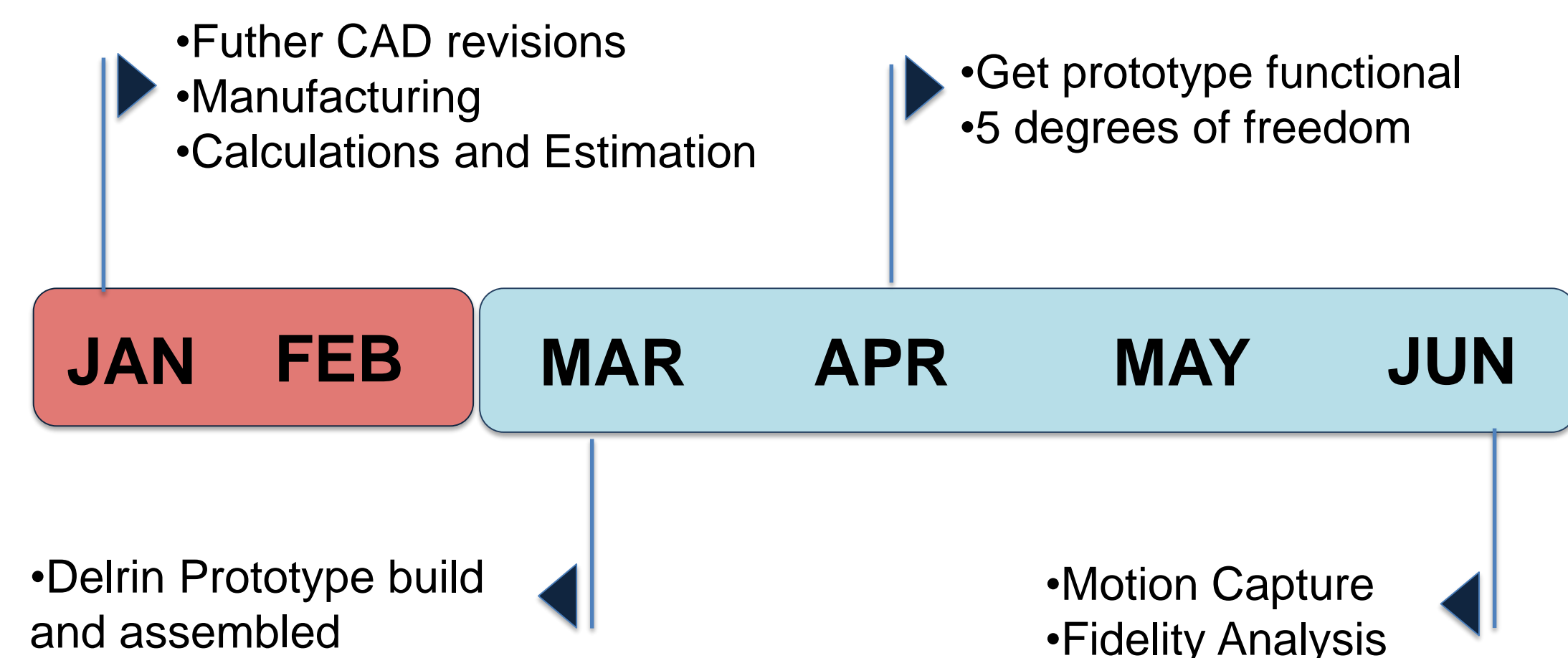
In recent years, there has been increasing interest in the mechanics and optimization of robotic manipulators, largely due to the wide range of potential applications. The design of robotic hands for dexterous grasping and manipulation can be utilized as a tool in minimally invasive surgery or prosthetics, or to reach loads in hazardous environments. By creating a robotic manipulator in form of a human hand, its capabilities and range of motion are similar to our own. Anthropomorphic manipulators are familiar and intuitive.

Objective and Requirements

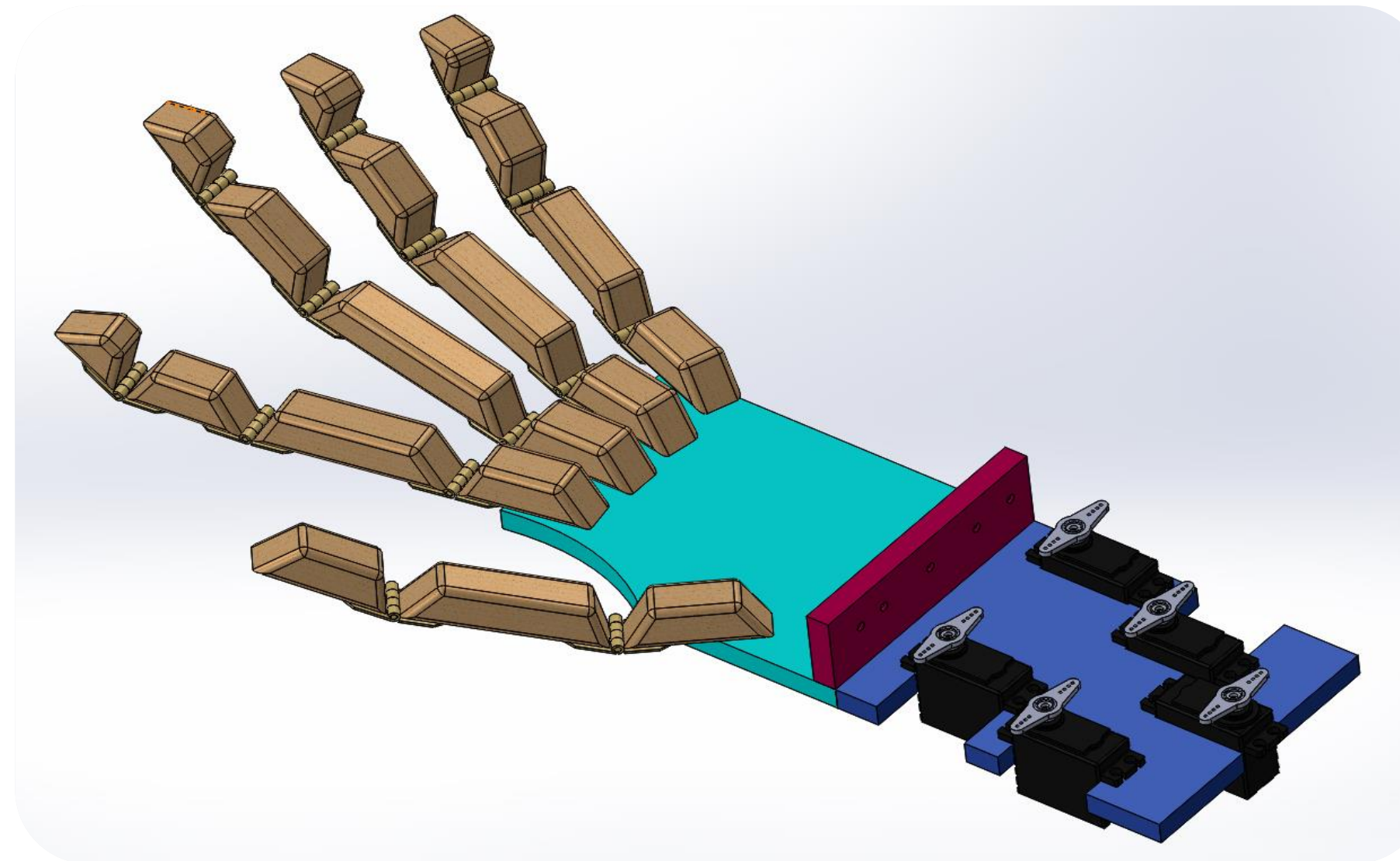
Our design aims to produce a fully functioning robotic hand actuated by the tendon-servo method and operated with an intuitive human interface device.

- High Dexterity: 10 DOF, modeled after human hand
- Intuitive Human Interface: wearable glove equipped with flex sensors to produce organic movement
- Low cost: inexpensive Delrin® construction and readily available mechanical parts such as hinges and springs

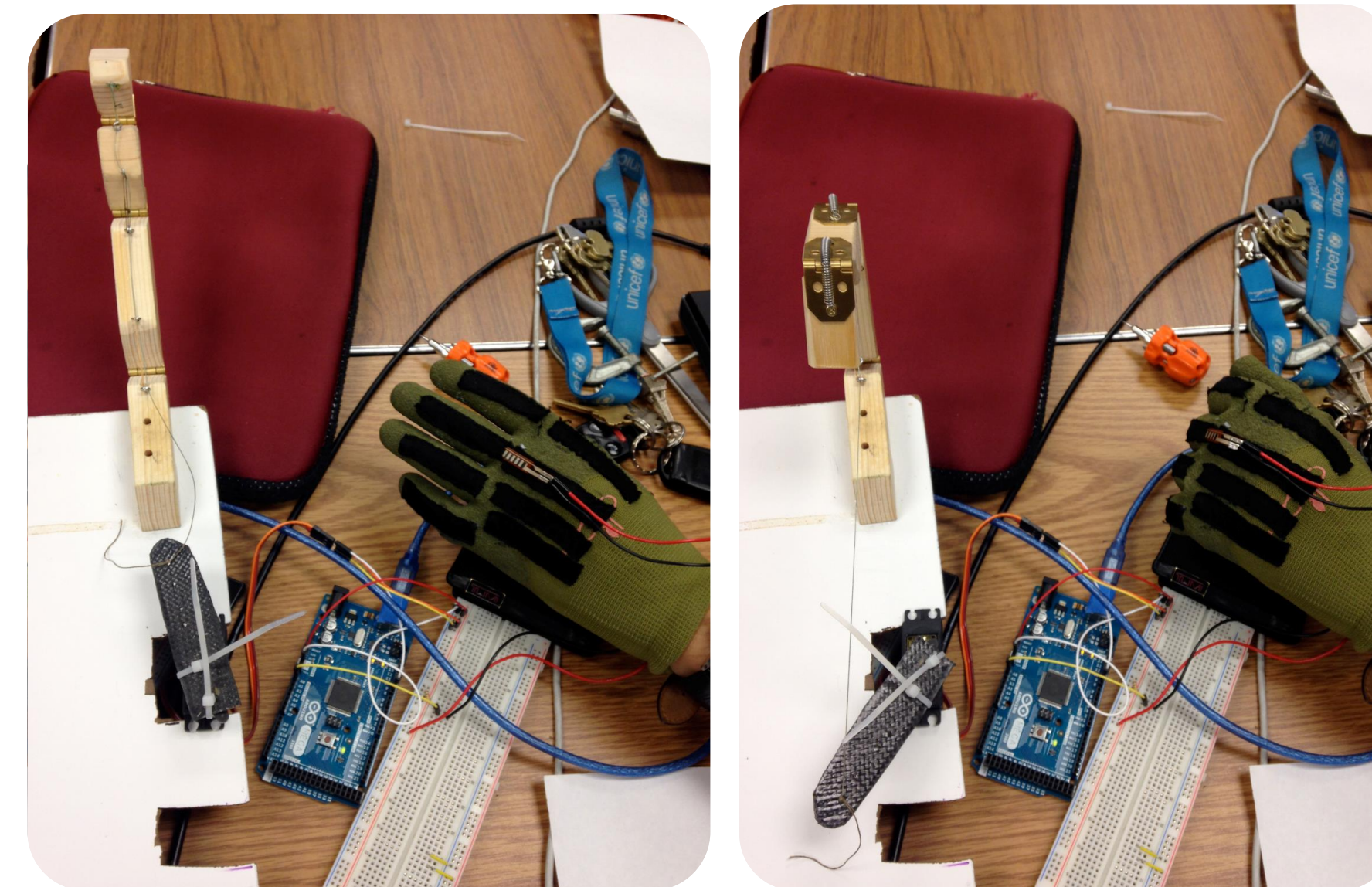
Timeline



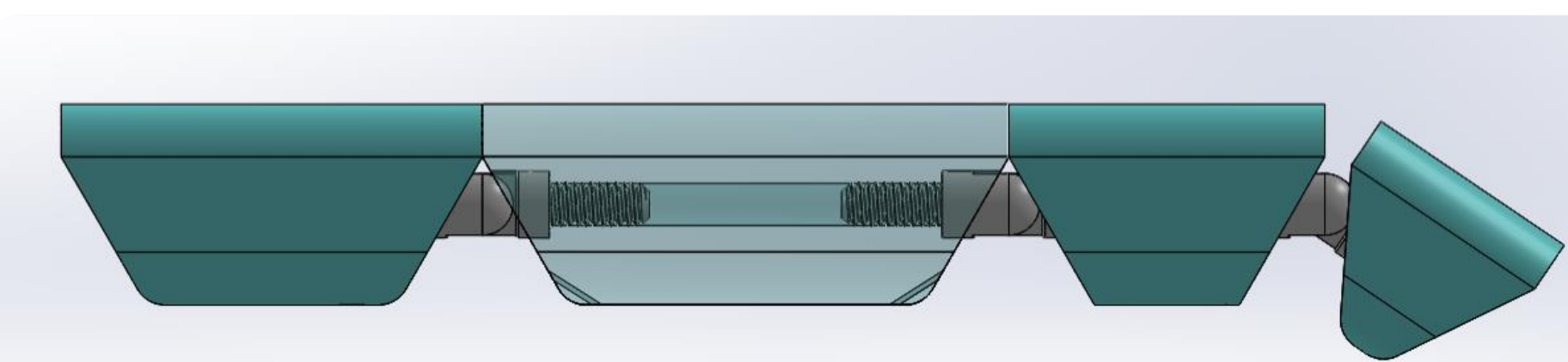
Concept and Design



SolidWorks CAD of robotic hand



One finger proof of concept- flexion and extension



SolidWorks CAD of revised prototype (Version 2)

Components

THE ROBOTIC HAND

MECHANICS

Springs on the outside of each robotic finger keep it extended. A string running through each of the joints is attached to a servo arm such that a change in position of the arm will cause flexion in the finger accordingly.

CONTROLLER

For a 10 DOF hand, we need 10 analog inputs and 10 Pulse Width Modulation pins to drive the servos. We use the Arduino Mega microcontroller. Additionally, a servo shield facilitates power management for the servo array.

INTERFACE

We obtain the system input using a glove with flex sensors. These flex sensors measure the bend of each knuckle in the hand during movement and convert them into electrical signals. The signals are translated into servo position.

Project Significance

Dexterous robotic hands currently on the market are expensive, costing up to \$100,000. Hobby level projects that are less costly do exist, but use passive mechanics that adversely affect grasp quality and control over individual joints. Our goal is to develop a low-cost and scalable anthropomorphic manipulator that offers a higher level of dexterity than those currently commercially available.

Team Contacts

Lute Chen (ME) – lutech@uci.edu
Adam Evangelista (ME) - agevange@uci.edu
Nuthan Hegde (ME) - nhegde@uci.edu
Gabriel Lima (ME) - g91mendes@gmail.com
Bruno Vu (ME) - brunov@uci.edu
Advisor: Professor Ian Harris- harris@ics.uci.edu

