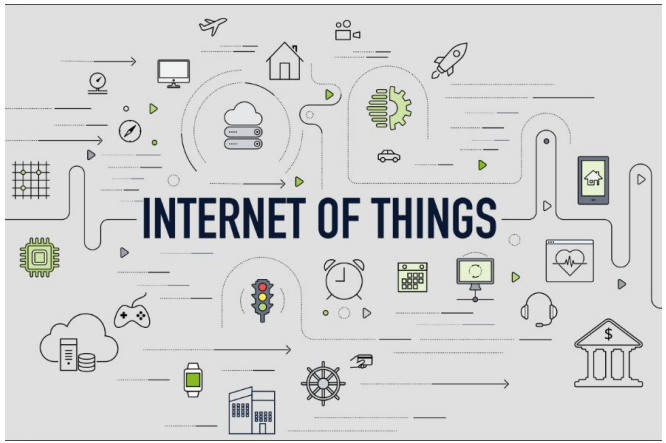
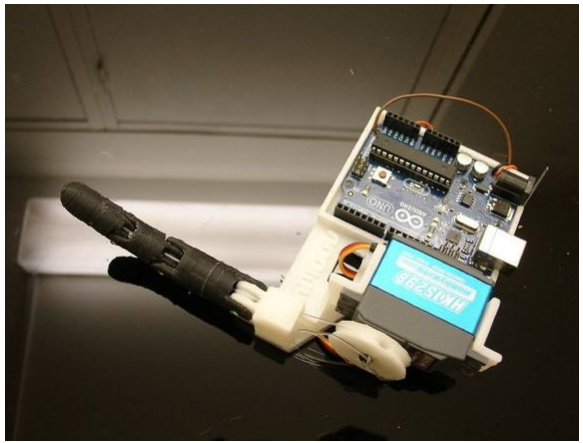
IoT Enabled InMoov Robot

Thesis Presentation





By: Numad Cheema and Daniel Izadi

Background & Objectives

Background

- Gael Langevin designed an open source 3D printable robot controlled with Arduino microcontrollers

Team Objectives

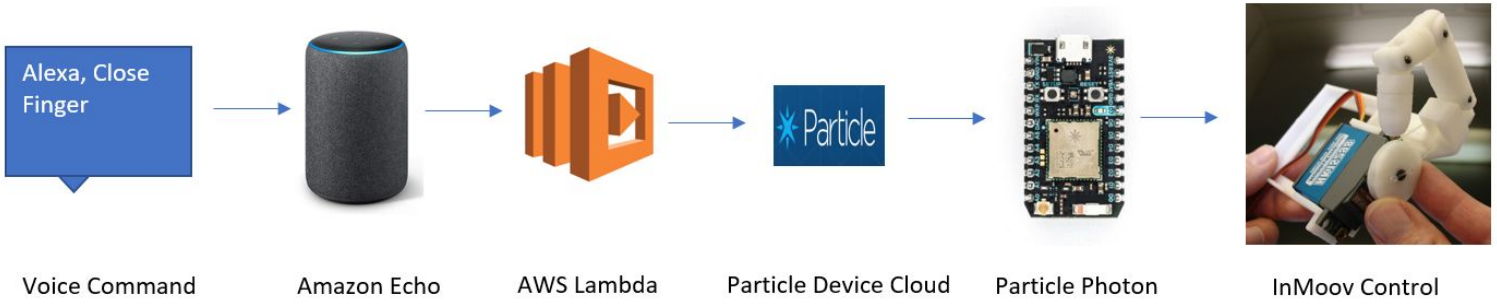
- Develop electrical, mechanical, and computer engineering skills through a cutting edge research project

Project Objectives

- 3D print and partially construct the InMoov Robot as designed by Gael Langevin
- Integrate Amazon Alexa into InMoov control system to make InMoov an IoT device

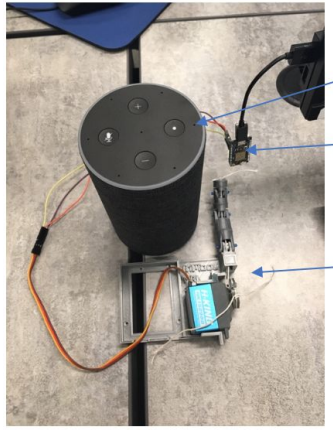
Methods

- Particle Photon IoT development board to replace Arduino microcontroller
  - Particle has its own IoT cloud service for preconfigured in its devices called the Particle Device Cloud
- Communication loop between Alexa and InMoov
  - Voice commands to Alexa call Amazon Skills Kit code from AWS Lambda
  - AWS Lambda calls function embedded in Photon board from the Particle Device Cloud
  - Embedded code in Particle Photon for servo motor control



Results

- Hand and forearm construction of InMoov Robot
- Created a novel communication loop between InMoov and Amazon Alexa
- InMoov Finger starter is now an IoT device
- Proof of concept for full-scale IoT InMoov
- Improvements to original design:
  - Ability to control InMoov with Amazon Echo
  - Ability to communicate and transfer data via IoT
  - Creation of custom gestures greatly simplified
  - Improved speech recognition



InMoov hand and forearm assembly

Demonstration

Next Steps

- Full InMoov Robot assembly
  - 3D print remaining components
  - Assemble mechanical components and wire electrical components
- Full scale Alexa integration
  - Translate existing gestures from MRL to Alexa Skill code
  - Replace Arduino Mega board with suitable Particle development board for scaled project
    - Photon does not have enough pins or processing power to control the full robot
    - Particle Device Cloud allows for IoT communication network between Particle Devices and AWS Lambda

Significance

- InMoov Robot is now a “smart device”
  - InMoov control with Amazon Echo
  - IoT InMoov can communicate and transfer data with other IoT devices
  - Easier custom gesture creation and improved voice recognition with Amazon Alexa
  - Capabilities of the robot will grow as the IoT develops further
- IoT InMoov robot application sectors:
  - Artificial Intelligence
  - Manufacturing
  - Defense
  - Healthcare monitoring
  - Home automation