TEXAS A&M UNIVERSITY
Engineering

Quadruped Project

Table of Contents

Project Goal

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Design and manufacture a robot capable balancing and maneuvering on four legs

Inspiration

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MIT *Cheetah*
Boston Dynamics *Spot*
Nathan Ferguson's *Dingo*
James Bruton's *OpenDog*

Initial Progress

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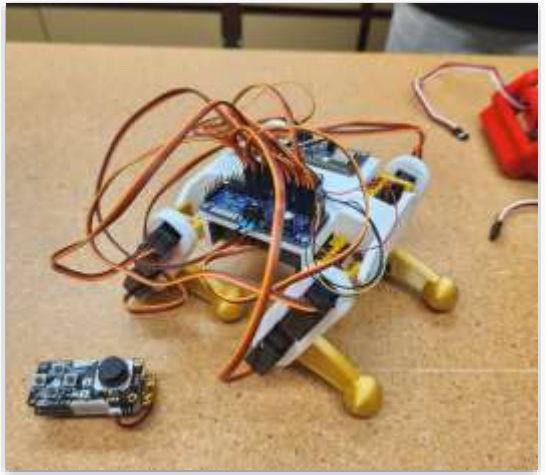
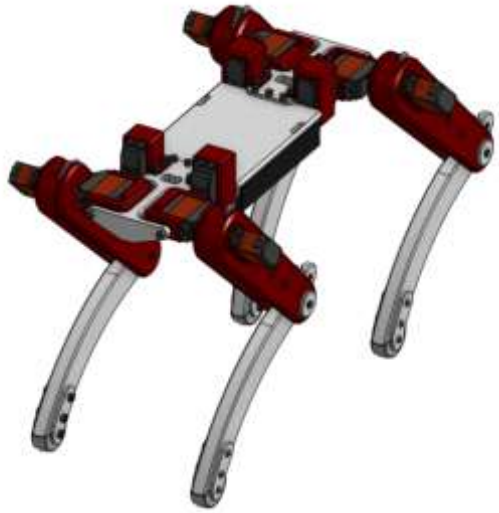
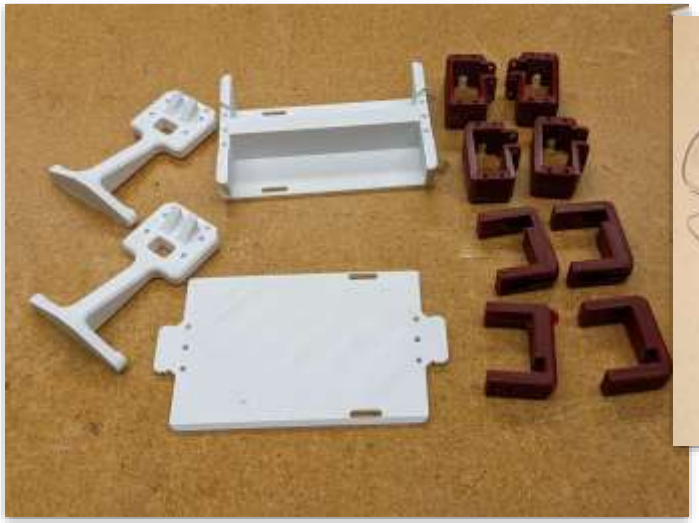
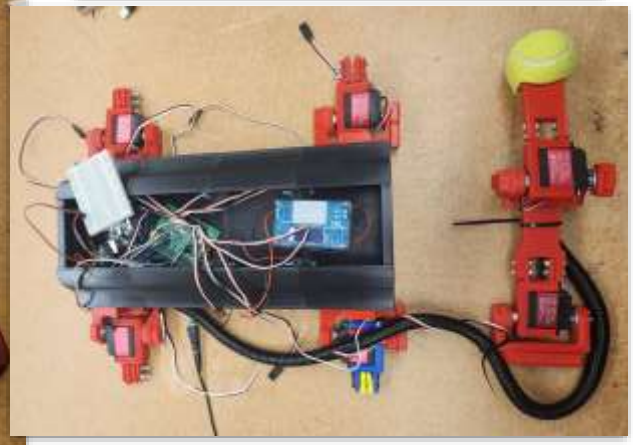
- Unpacked original QUAD project
- Ian's Quadruped design
- Calculated motor strengths and max weight
- Created models for V1
- Manufactured part of V1









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QUAD Version 1

Manufacturing

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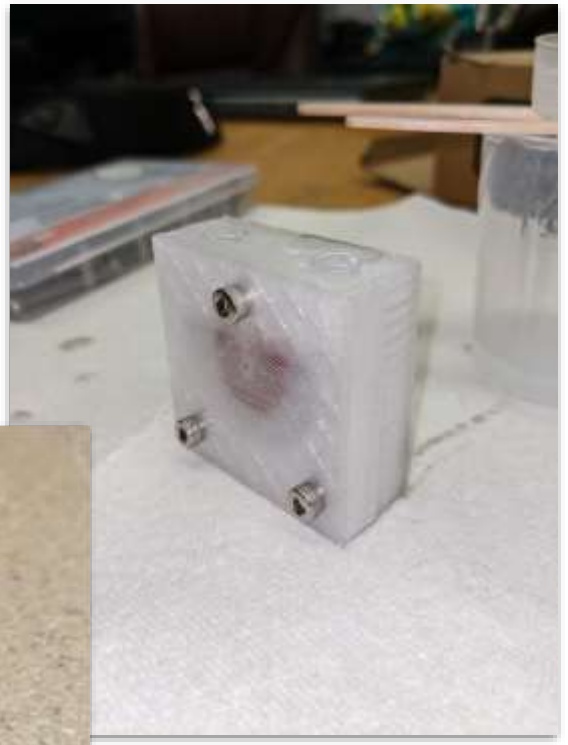
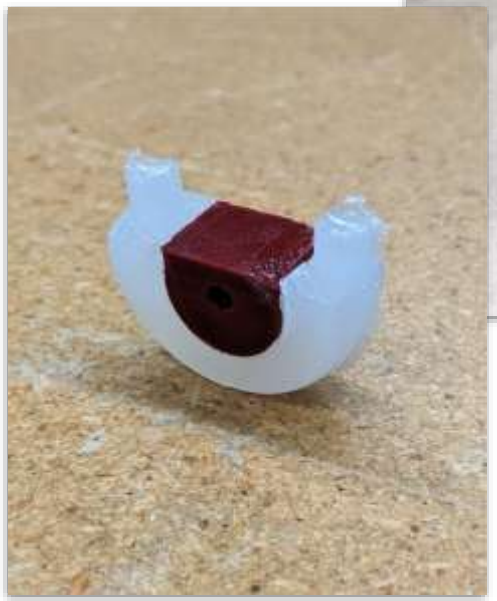
- Chassis, Legs, and Shoulders
  - FDM with PETG
- Feet
  - Silicone resin casting (inspired by *OpenDog*)





Assembly

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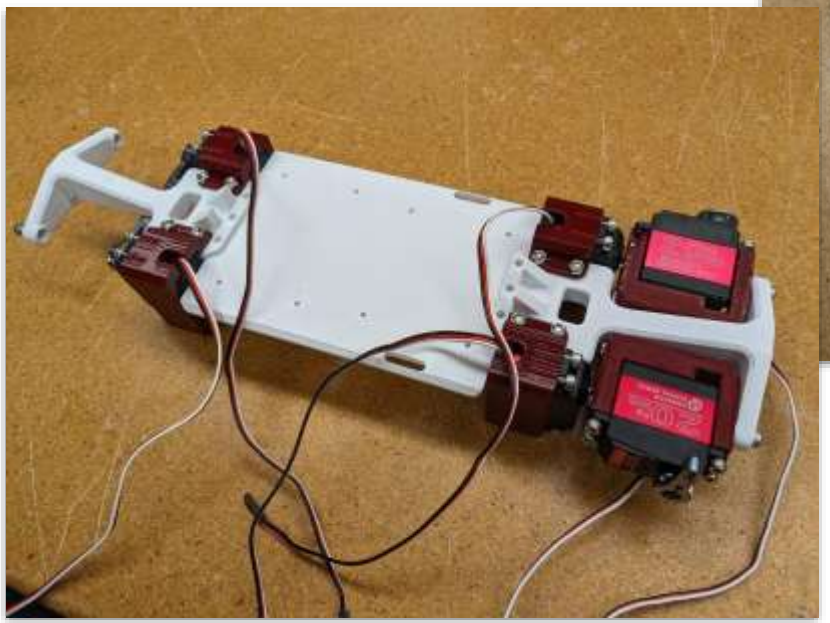
- Leg and Chassis Assembled
- Remaking parts for legs with proper clearance



Gained Understanding

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- Silicone feet work well
- Feet should encapsulate the leg for secure attachment
- Heat-set inserts

Improvements

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- Make silicone resin encapsulate the foot
- Use heat-set inserts
- Add a clearance to 3D-printed parts
- CAD with SolidWorks

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Mini-QUAD

Purpose

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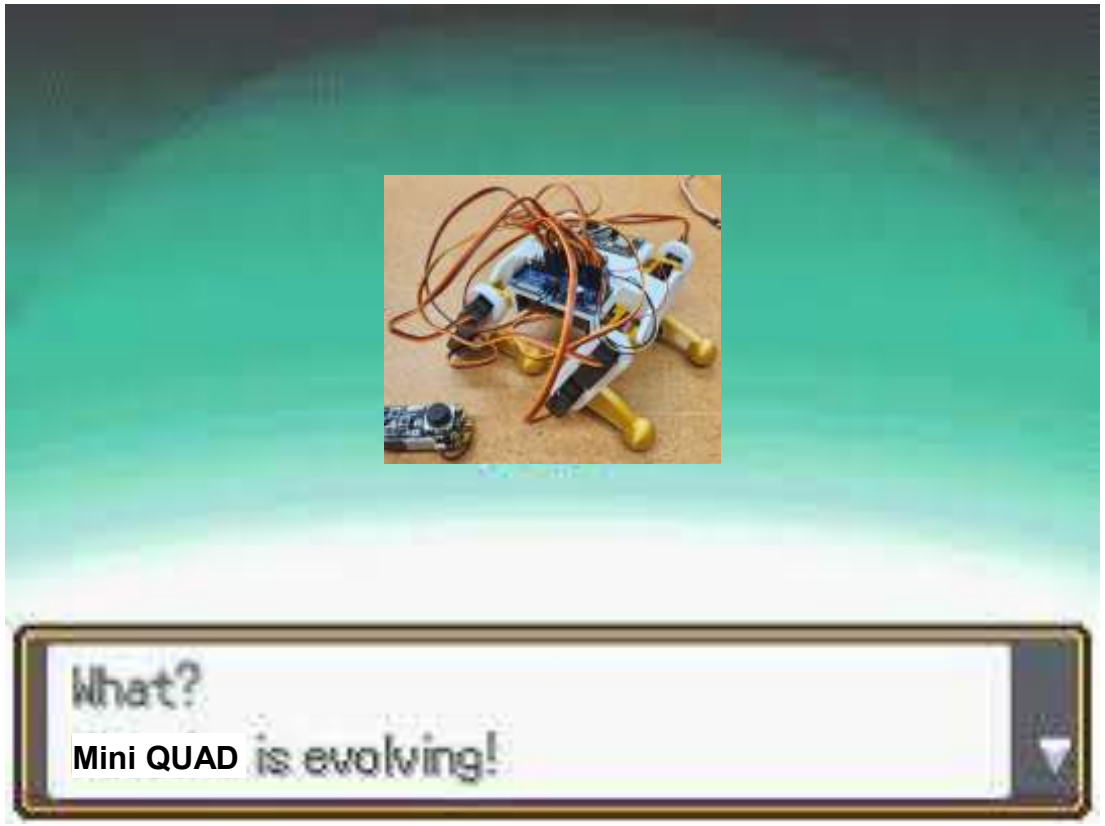
The purpose of this subteam is to create a miniature version of the original quadruped robot to use as a software platform for future iterations. Will include attempts at lidar & computer vision, model based control, path planning, and much more!



Design Requirements

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Mini-Quad:

- Must walk on four legs
- Must support twice its weight
- Modular design (designed to evolve)
- Compatible with software for QUAD convoy

Electronics

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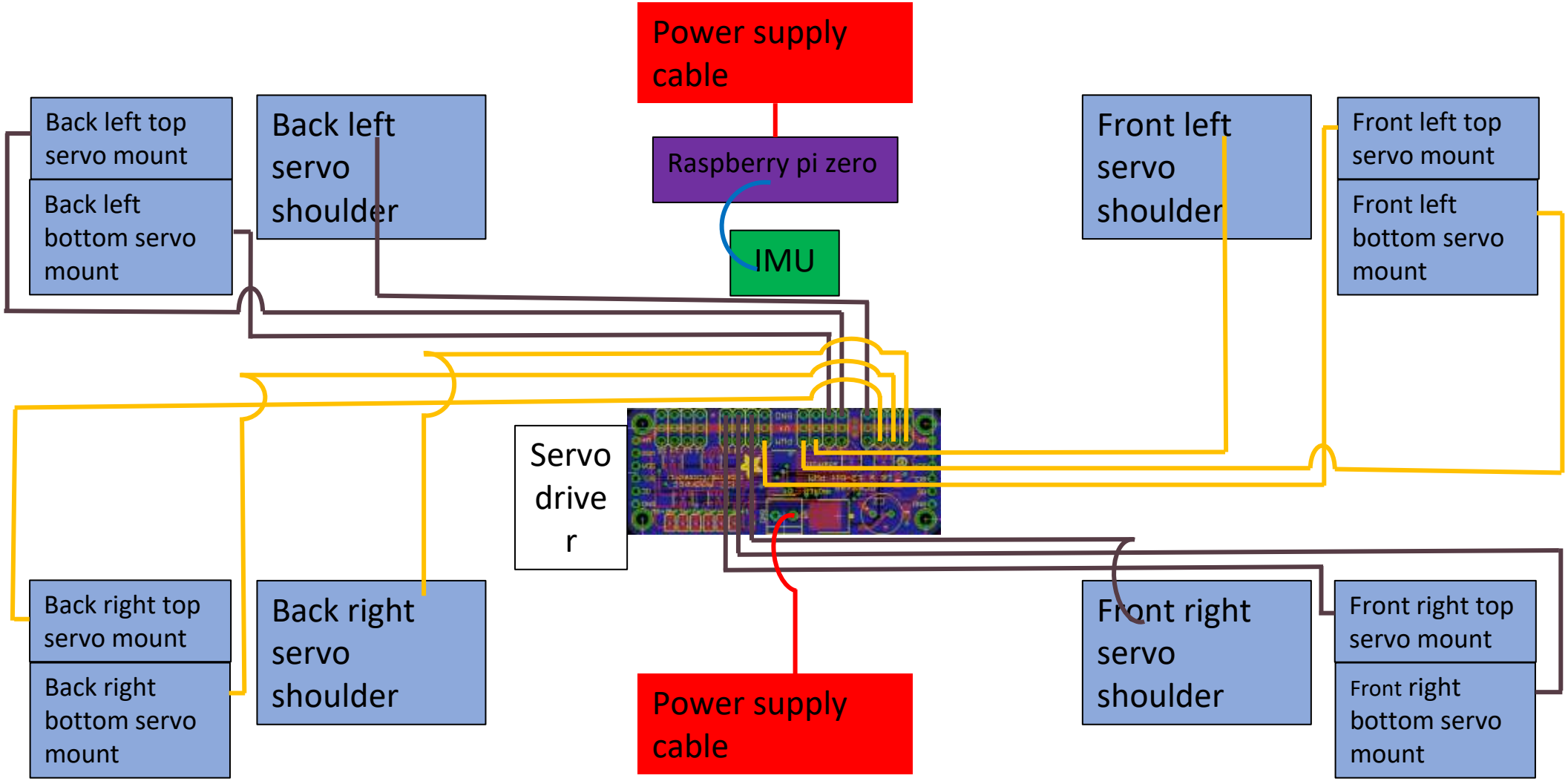

Chassis

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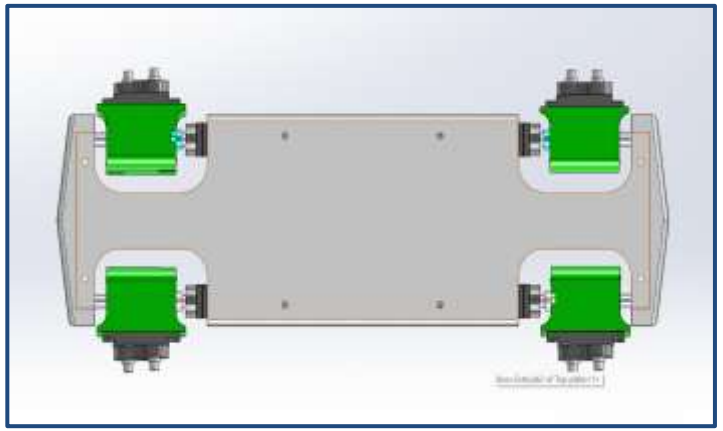
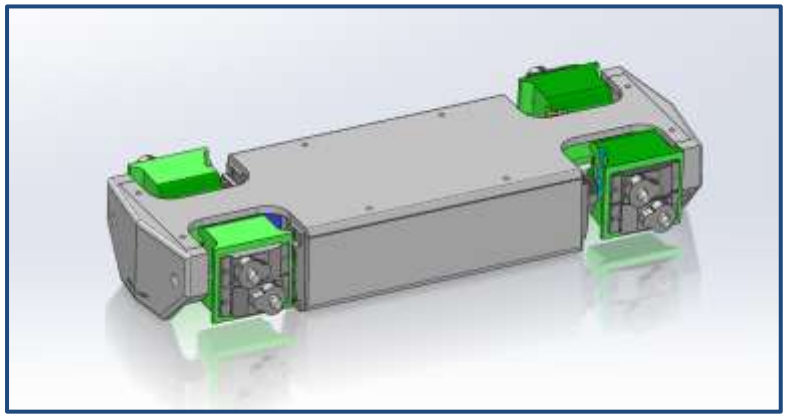
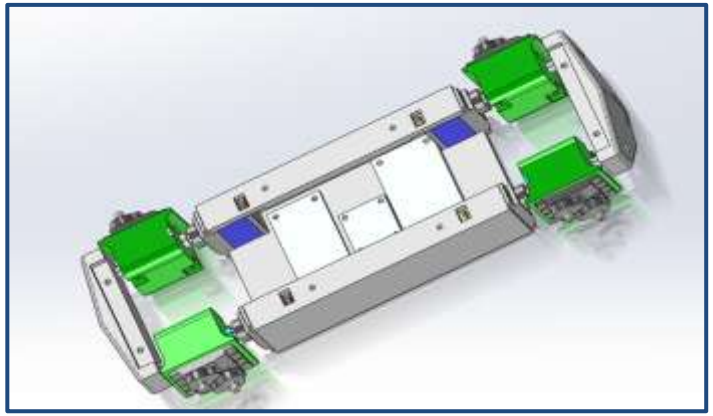
Top View:



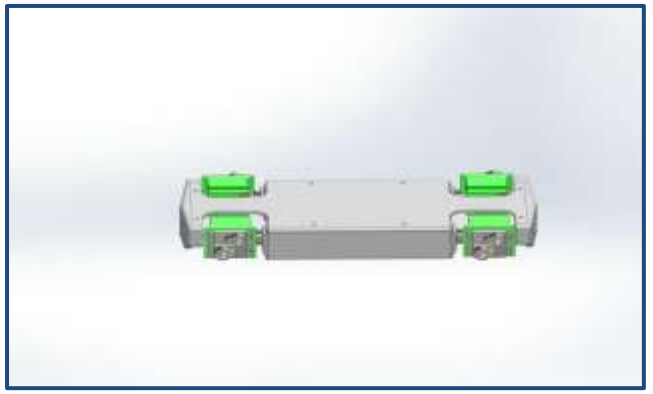
Side View:



Removed Top Plate:



Assembly:



Leg Design

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Mini Quad Leg Pros

- Tendon Drive
- Utilizes the same leg to body ratio as Spot

Mini Quad Leg Cons:

- Non-compliant mechanism.
- No encoders.

Leg Design - Foot Choice

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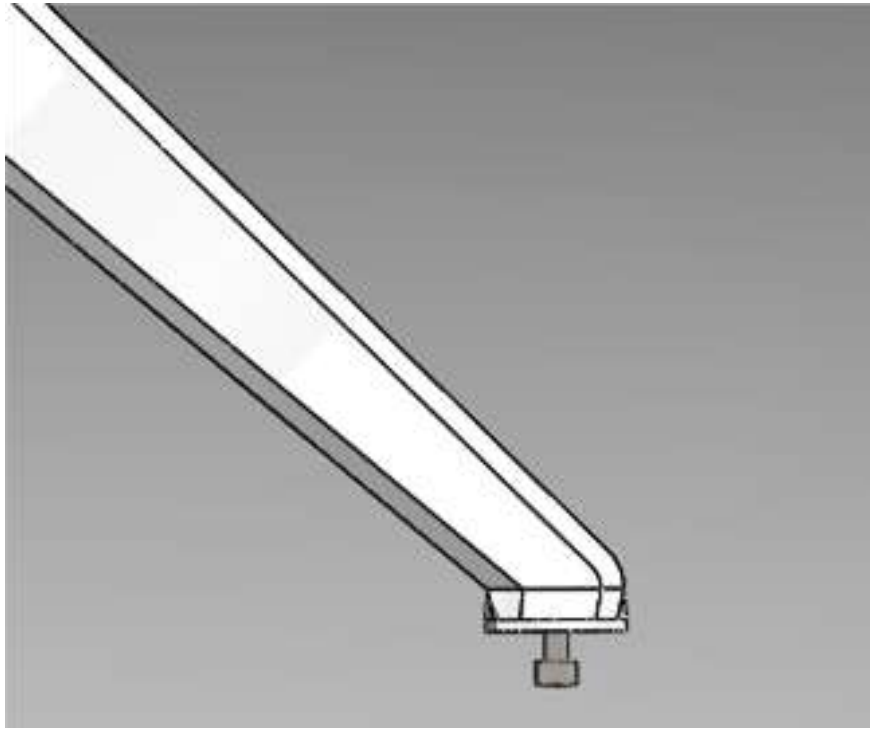
Mini Quad Feet:

- Silicone mold “slip-over” shoes. Akin to a swim cap on a head.
- Will either be screw in or slip-on feet. TBD



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Software

Design Requirements

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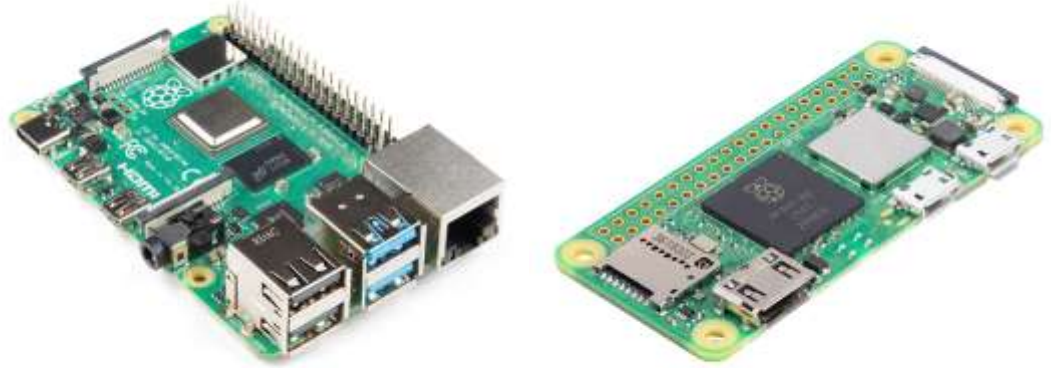
- Control the movement of quadruped from teleoperator inputs
- Must run on each of the quadruped robots (Compile for and run on Raspberry Pi)
- Be written in a single language (C++)
- Must run OpenCV



Progress

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- Algorithms ported from Arduino
- Driver written for servo board
- CMake set up
  - Cross-compiles for aarch64 (Raspberry Pi)
- Created access point
- Created script to set up operating system
- Version control on TURTLE GitHub

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Future Prospects

Future Prospects

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- Completion of QUAD V1 and Mini Quad
- Testing software to drive V1 and Mini
- Payloads
  - Camera & Vision processing
  - Lidar mapping
- QUAD V2

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QUAD Version 2

Quad V2 Plans

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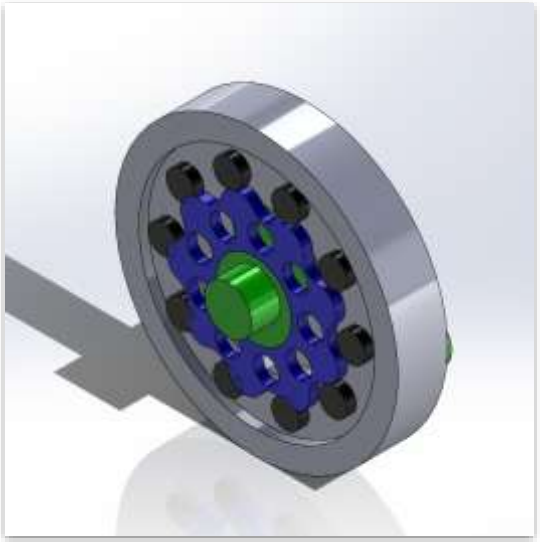
- Use experience from designing V1 & Mini
- Stronger (brushless) motors
- Backdrivable cycloidal gearboxes



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Questions