ELECTRICAL AND COMPUTER ENGINEERING
COLORADO STATE UNIVERSITY

# RamBots


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## Project Overview

- Building a Ram-themed quadrupedal robot
- Low cost, fast setup time
- Open source so accessible to anyone
- Emphasis on electronics and software improvement

## Goals

- Construction of the 3D printed robot to test
- Improve the electronics to be efficient and long lasting
- Implement Machine learning to help build a platform of interaction between the robot and people

## Next Steps

- Finish chassis construction (end of semester)
- Integrate firmware ➜ get things moving
- Integrate machine learning ➜ interact with environment
- Platform development ➜ learning opportunities

## Firmware

Esp32

- Very low cost
- Rust ➜ Extensive tooling for build, debug test, etc
- RTOS ➜ Standard Library
- Xtensia architecture

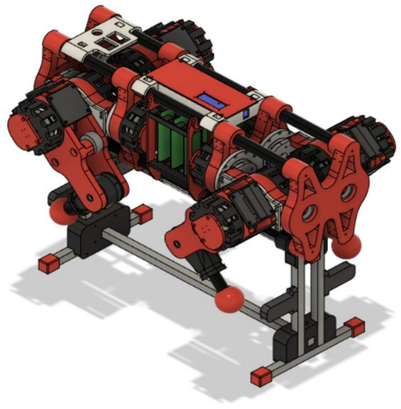

Odrives

- Issues: Firmware updates, interface compatibility
- Attempted solutions: external programmer, firmware dump, manual override (bricked)
- Working with supplier as these issues are not common

## Hardware

**Hardware Platform**

- Open source platform is used as base design and reworked and redesigned electronically for our project goals
  - Thanks to the creator (James Bruton)
- Upstream updated mid-semester
- Outsourced 3D printing to expedite the estimated 9 weeks of 3d printing needed
  - Thanks to industry contact (Ty Thourot)



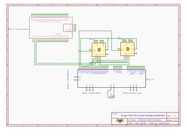
OpenDog v3

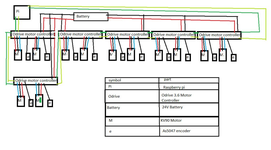
**3D Printed Parts**

- 216 3D printed parts, each taking about 12 hrs to print
- That is about 15 straight weeks of printing on one 3D printer
- Modifications for industrial 3D printers, high heat and strong PETG material to keep the dog from breaking easily

## Electronics

- 90kV brushless motors
- Odrive motor controllers
- Raspberry Pi + ESP32



## Assembly

- Integrated stand ➜ good for testing, storage, transportation, and display
- Quick assembly ➜ early testing of electronics
- A few time-sinks due to base design

## ECE Outreach Involvement

- The Robotic dog will act as a way for people to gain interest in the STEMM field
- End goal: educational platform for local middle/high schools
- Benefits: Networking, fundraising, industry contacts and services, parts sourcing

## Road Blocks

- Global supply chain crisis caused massive shipping delays
- Chip shortages made obtaining necessary electronics difficult
- No interdisciplinary support for mechanical knowledge
- Finding 3D printing places that can accommodate 216 parts in a timely and cost effective manner

## Machine Learning

- Object Detection on Raspberry Pi 4 Model B with MobileNet v2
- Hardware Acceleration with Google Coral USB TPU
- Trained with to recognize common objects (COCO Dataset)
- Displays results to LCD screen with 30 FPS