

# Pizza Delivery Drone

## Team 4

Compton Bowman, Usman Jalil, Quentin Clark, Ahmet Caliskan, Yafei Chen

# Project Overview

- Food delivery faces delays and added costs due to reliance on human drivers
- Third party delivery services can charge up to 30% of the price of a pizza for delivery → impacting restaurant profitability
- Restaurant owners struggle with driver availability during peak demand
- Customers dissatisfied due to long wait times and cold food
- Specifically focusing on Pizza deliveries. Target market is 2.5 billion deliveries annually in U.S. mainland (not including PR, USVI, AS etc)

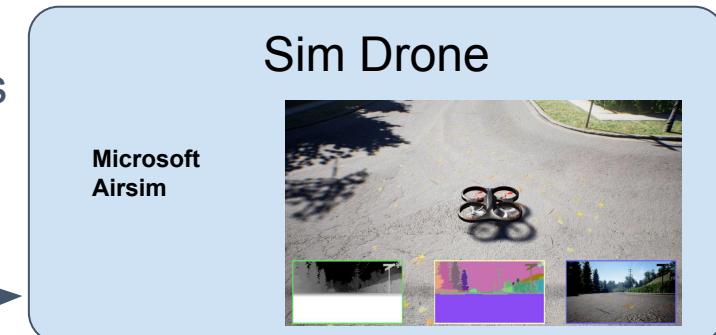
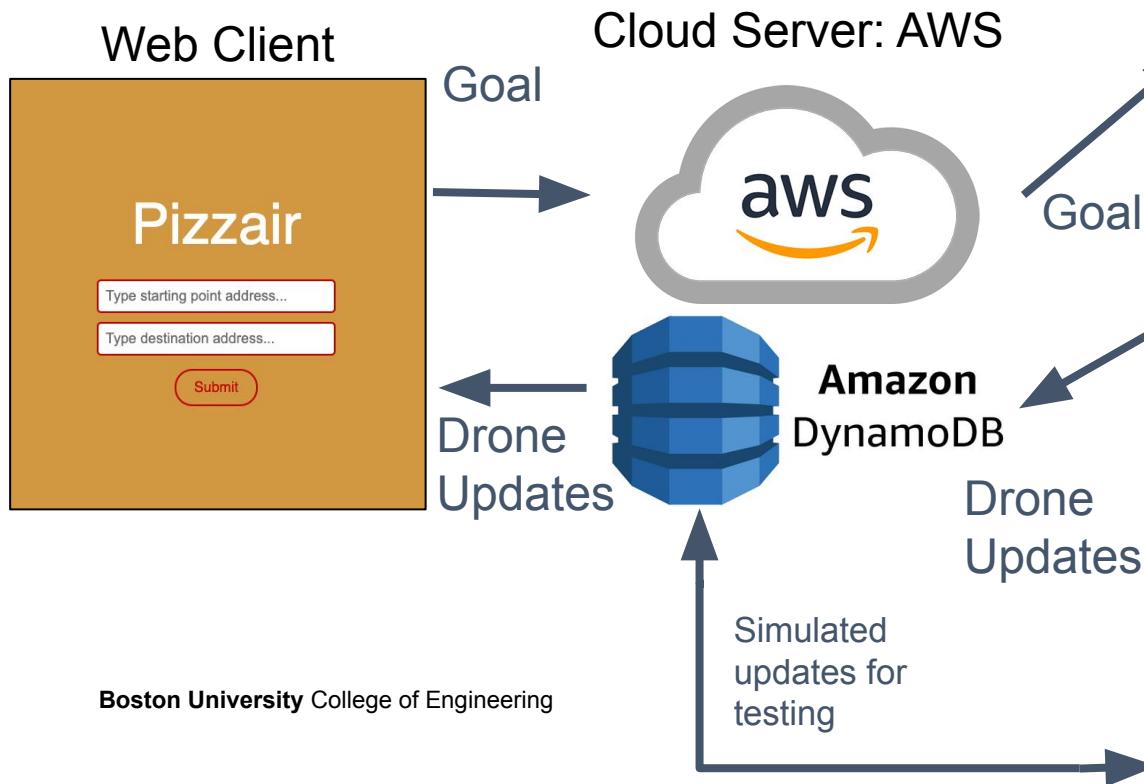


*Courtesy of phillyvoice.com*

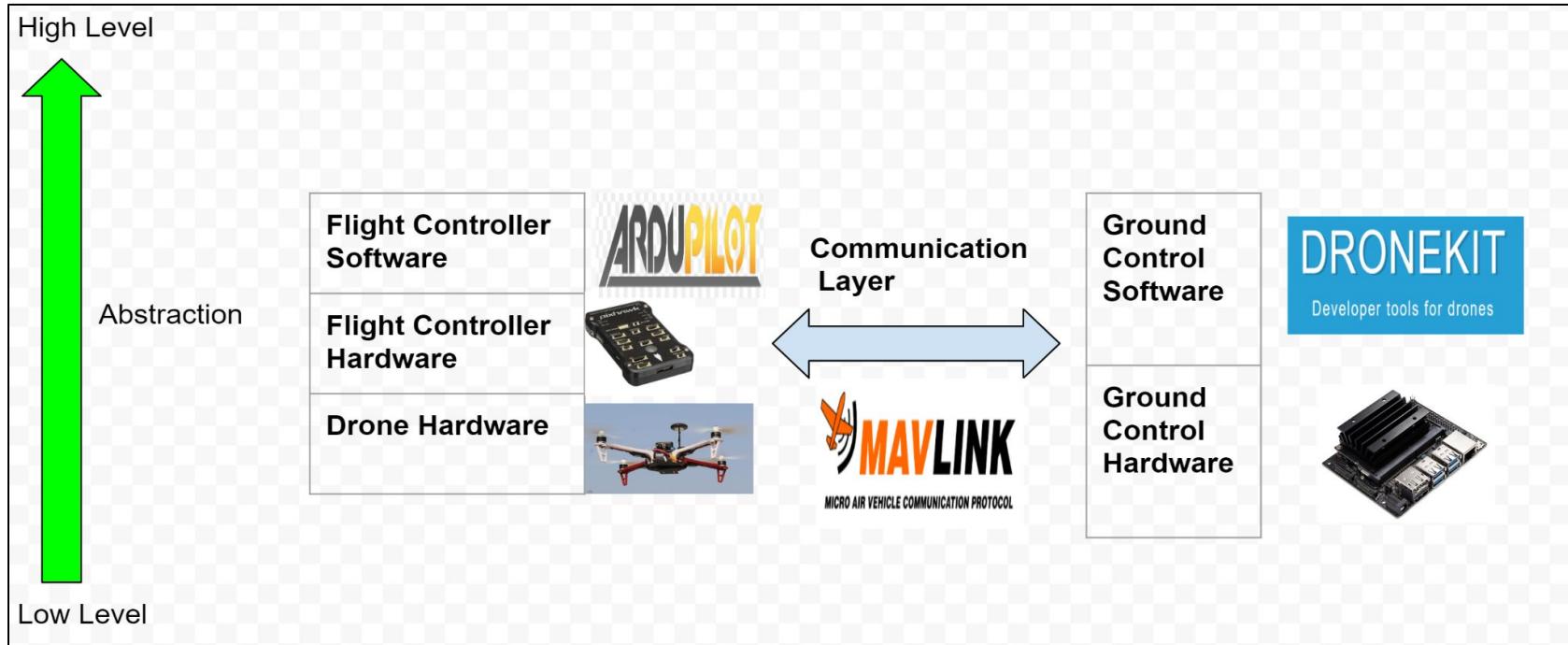
# Completed Work:

- Beta versions of web application, web client, full drone control software stack
- Tested imitation learning algorithm extensively in simulation
- Constructed two full-sized drones
- Autonomous flight missions on DroneKit SITL simulation

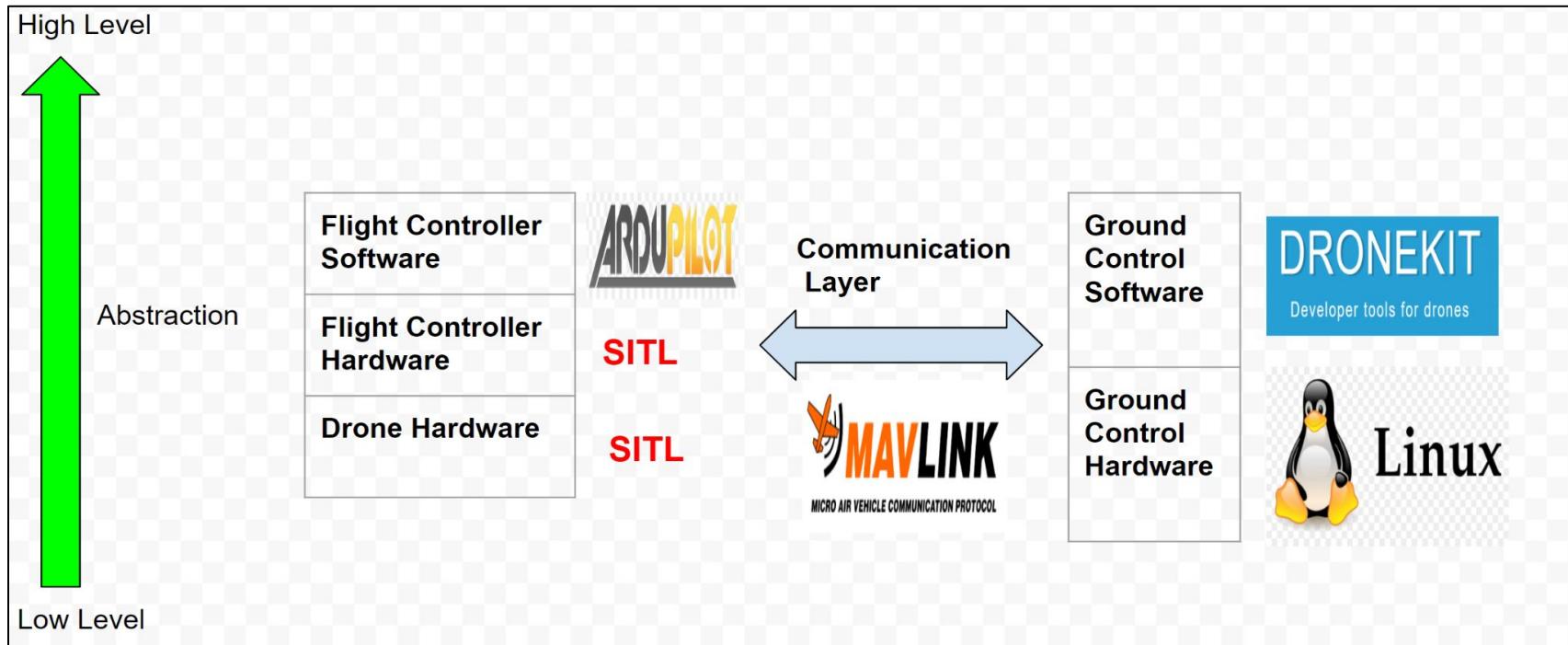
# Pizzair: Software Architecture Diagram



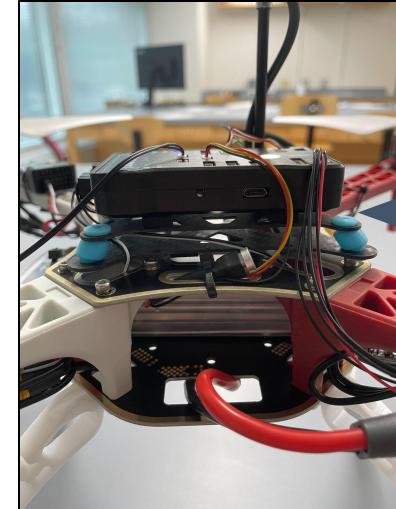
# Drone Architecture



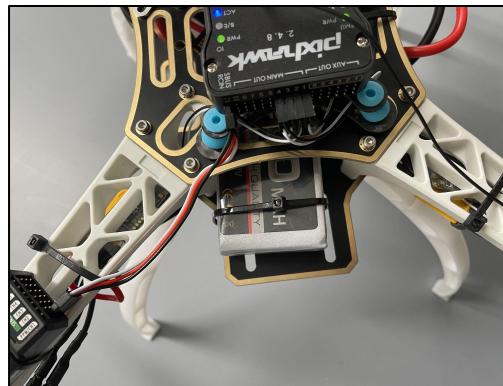
# Drone Architecture: Simulation



# Drone Structure

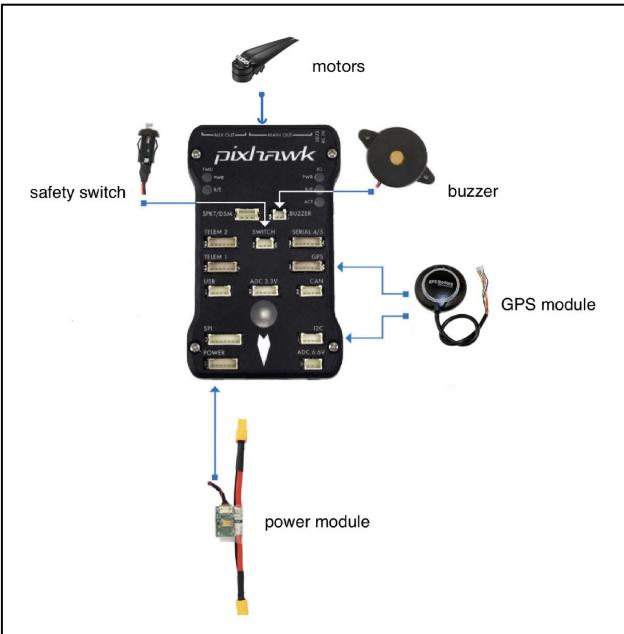


vibration  
dampening  
plate



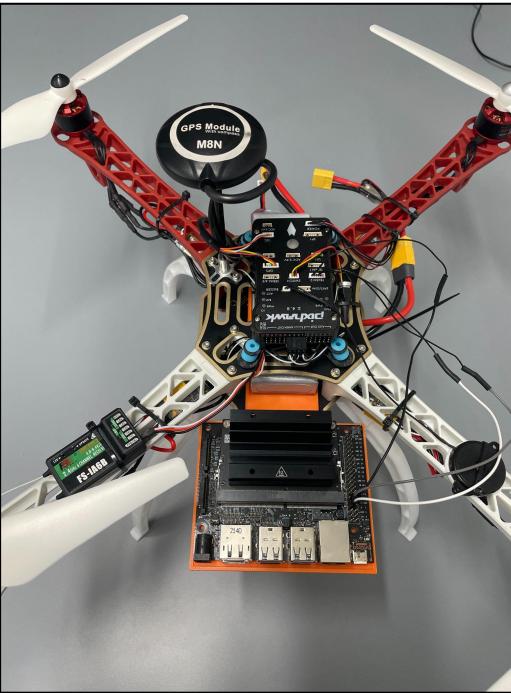
secured parts and  
organized wires

# Wiring Pixhawk

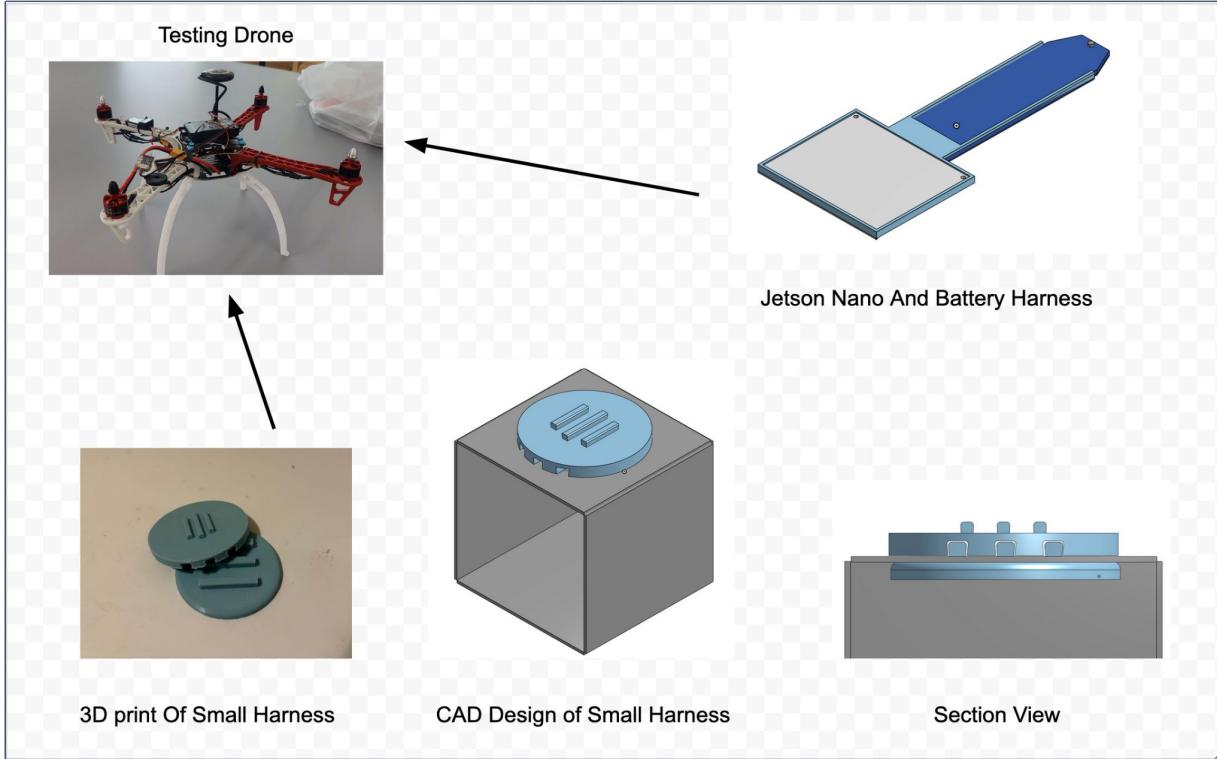


RTL will start when signal lost

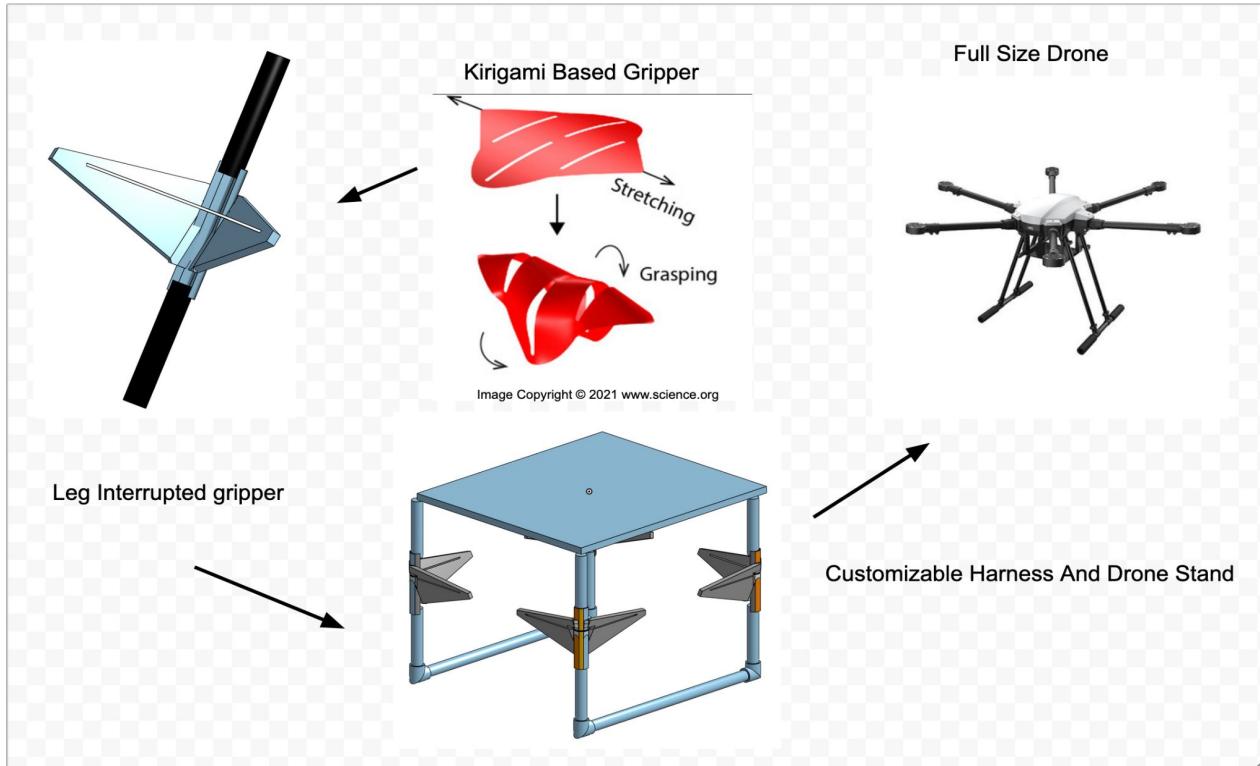
# Installed Jetson Nano and Harness



# Test Drone And Harnesses



# Full Size Drone And Gripping Mechanism



# Control:Learning to Fly by Gaming

Fly in games, learn to fly in reality

- Deep Imitation Learning
- Bespoke dataset from two realistic open-world games and real-world
- Test results in AirSim environment

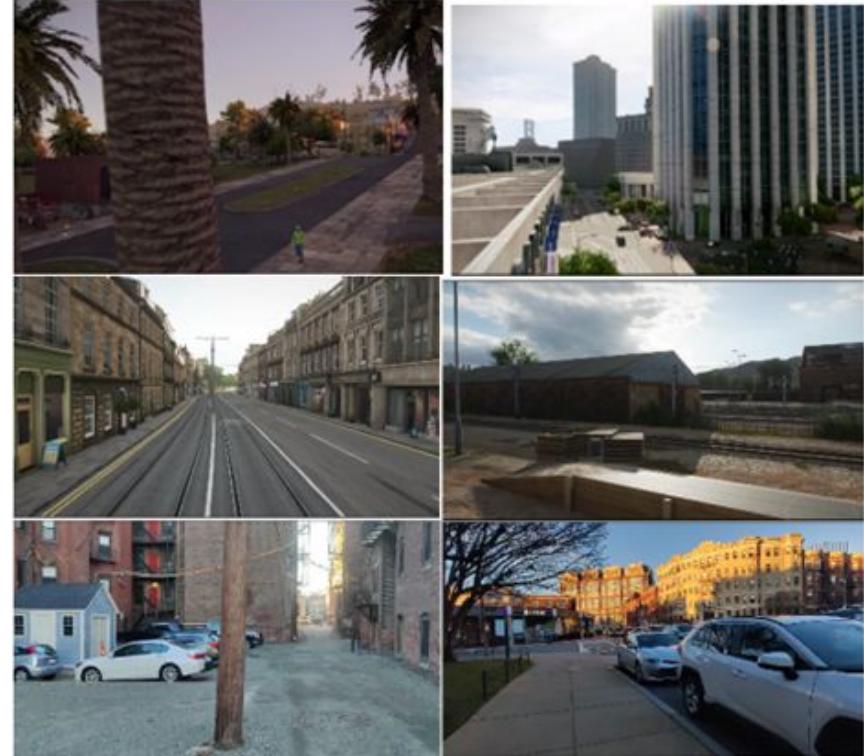


Figure 1: Samples images from our dataset. Top row: from Watch Dogs 2. Middle row: from Forza Horizon 4. Bottom row: from the real world.

# AirSim Tests

Bosto

ON  
SITY

# AirSim Tests, Continued



Boston Un

JY

Items returned (18)

	Retrieve (String)	Accelerometer	Control	GPS	Image
<input type="checkbox"/>	<a href="#">1711583172.2027051</a>	{ "x": { "N": "-0.00..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>
<input type="checkbox"/>	<a href="#">1711583182.31843</a>	{ "x": { "N": "-0.03..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>
<input type="checkbox"/>	<a href="#">1711583192.4709408</a>	{ "x": { "N": "-0.14..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>
<input type="checkbox"/>	<a href="#">1711583202.5836987</a>	{ "x": { "N": "0.013..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>
<input type="checkbox"/>	<a href="#">1711583212.6380925</a>	{ "x": { "N": "-0.16..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>
<input type="checkbox"/>	<a href="#">1711583222.6505687</a>	{ "x": { "N": "-0.12..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>
<input type="checkbox"/>	<a href="#">1711583232.685169</a>	{ "x": { "N": "-0.11..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>
<input type="checkbox"/>	<a href="#">1711583242.7880325</a>	{ "x": { "N": "-0.13..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>
<input type="checkbox"/>	<a href="#">1711583252.8370726</a>	{ "x": { "N": "-0.17..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>
<input type="checkbox"/>	<a href="#">1711583262.8514867</a>	{ "x": { "N": "-0.05..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>
<input type="checkbox"/>	<a href="#">1711583600.0957649</a>	{ "x": { "N": "-0.04..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>
<input type="checkbox"/>	<a href="#">1711583610.204962</a>	{ "x": { "N": "-0.22..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>
<input type="checkbox"/>	<a href="#">1711583620.289971</a>	{ "x": { "N": "-0.28..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>
<input type="checkbox"/>	<a href="#">1711583630.4735556</a>	{ "x": { "N": "-0.39..." }	{ "mag": { "..." }	{ "latitude": ... }	<a href="https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg">https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg</a>

## Displaying Data from Jetson Nano

### Image

<https://cdn.mos.cms.futurecdn.net/76XArwuAqGZUGwffH2inpF-970-80.jpg>

### GPS coordinates

Latitude: 47.641186529594904

Longitude: -122.14037290442175

### Accelerometer info

X: -0.05542352795600891

Y: 0.041048333048820496

Z: -10.163750648498535

### Control info

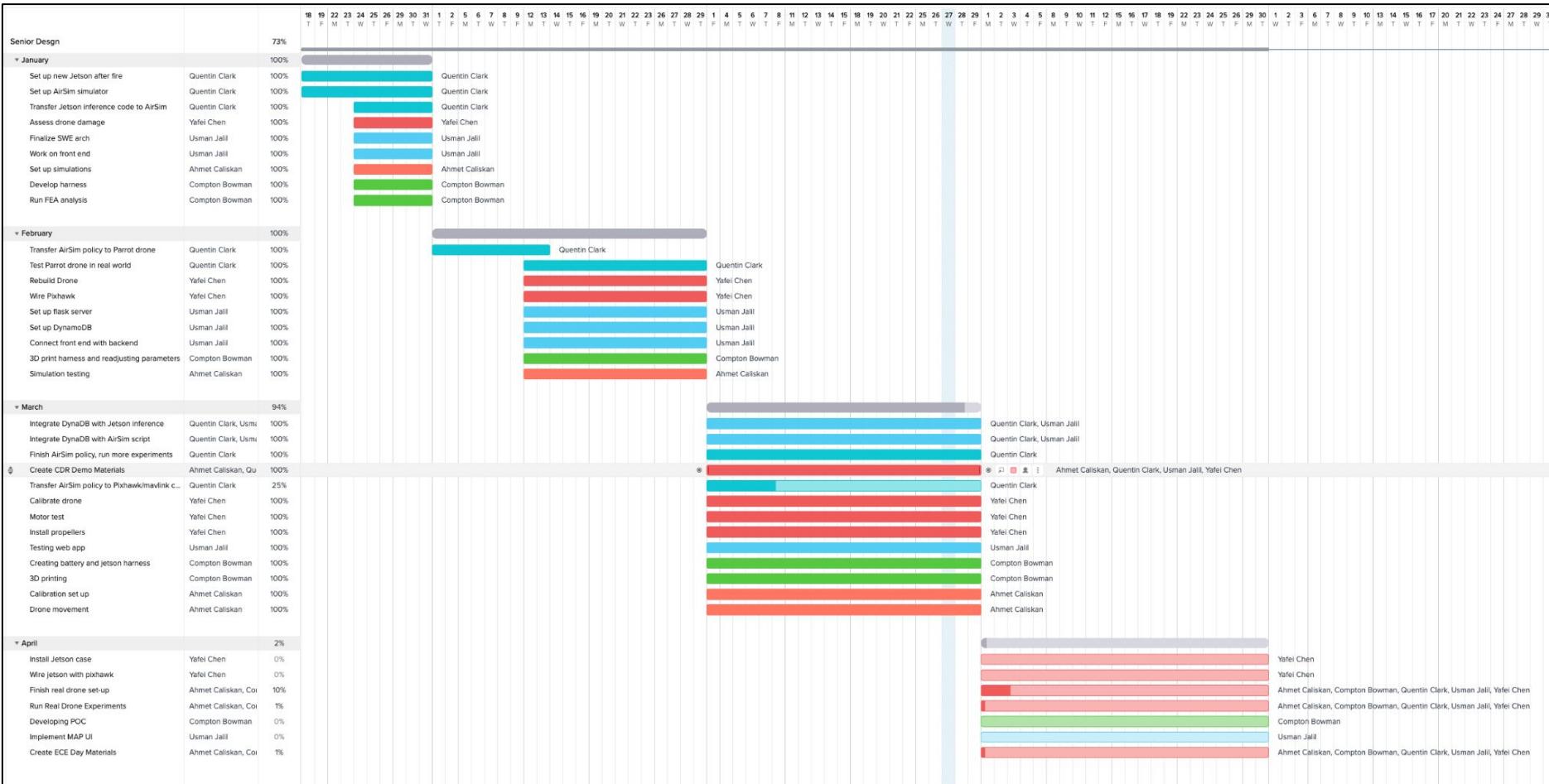
Direction: R

Magnitude: 0.36884166300296783

Safety: 1

# Future Work

- Continue working with faculty to finalize full-size drone gripping mechanism.
- Perform finite-element analysis on gripper, and fabricate a scale size prototype.
- Add mapping UI to Web Client
- Continue experimenting with improvements to policy in simulation and deep learning training details
- Begin careful tests of algorithm on real-world drone



# Thank you!