# Disaster Response Observation Network (DRON)


**Project Lead: Ian Wilhite**

***Subteam Leads: Chris Ambroziak, Aidan Briggs, Ryo Kato***

**Members: Om Bhatt, Luke Breedlove, Visith So, Riya Shah, Matthew Shi, Jackson Shouba, Owen Thomas, Charlie Weatherspoon, Drew Wheaton**

TEXAS A&M UNIVERSITY Engineering

TEXAS A&M UNIVERSITY ROBOTICS TEAM & LEADERSHIP EXPERIENCE


## Problem Definition

The Disaster Response Observation Network (DRON) is a proof-of-concept initiative that aims to leverage unmanned aerial vehicles (UAVs) to gather intelligence during structural fires and aid first responders in scene assessment and emergency response.

## Methodology

Autonomous swarm functionality allows DRON to assist in emergency situations with minimal required human input. DRON is designed around ease of use, speed of deployment, and the delivery of high-volume, high-quality data

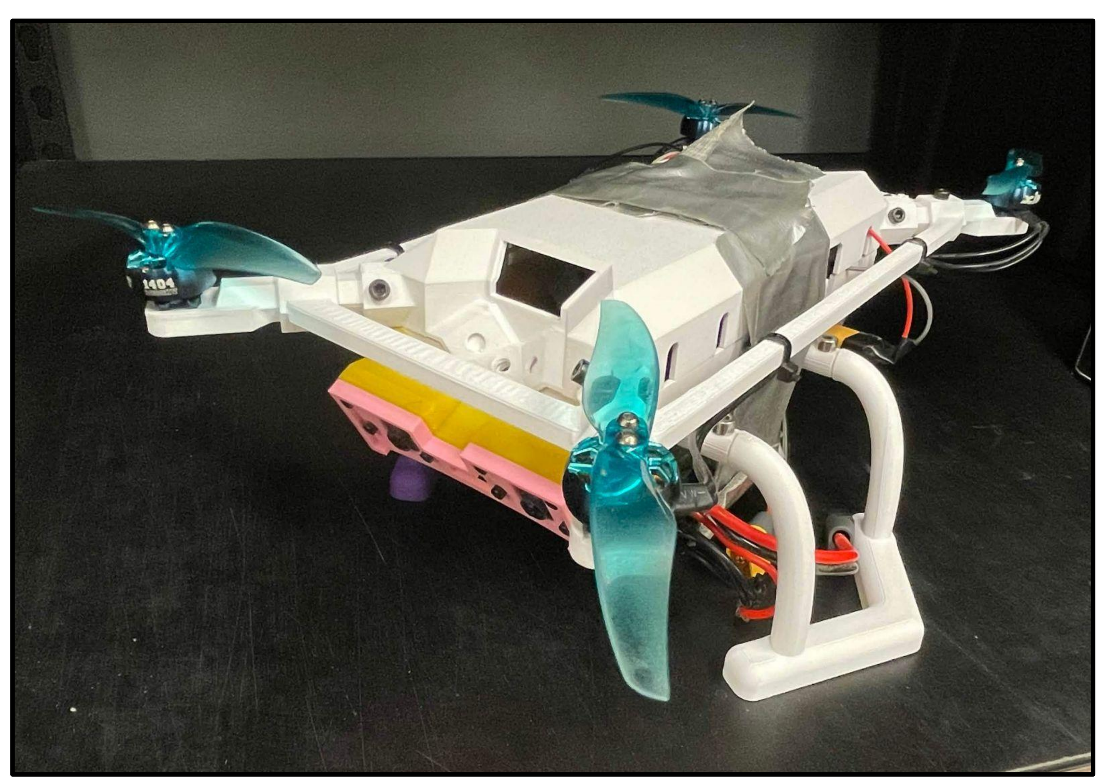

***Figure 1:*** *Prototype "Ducktape" Drone*

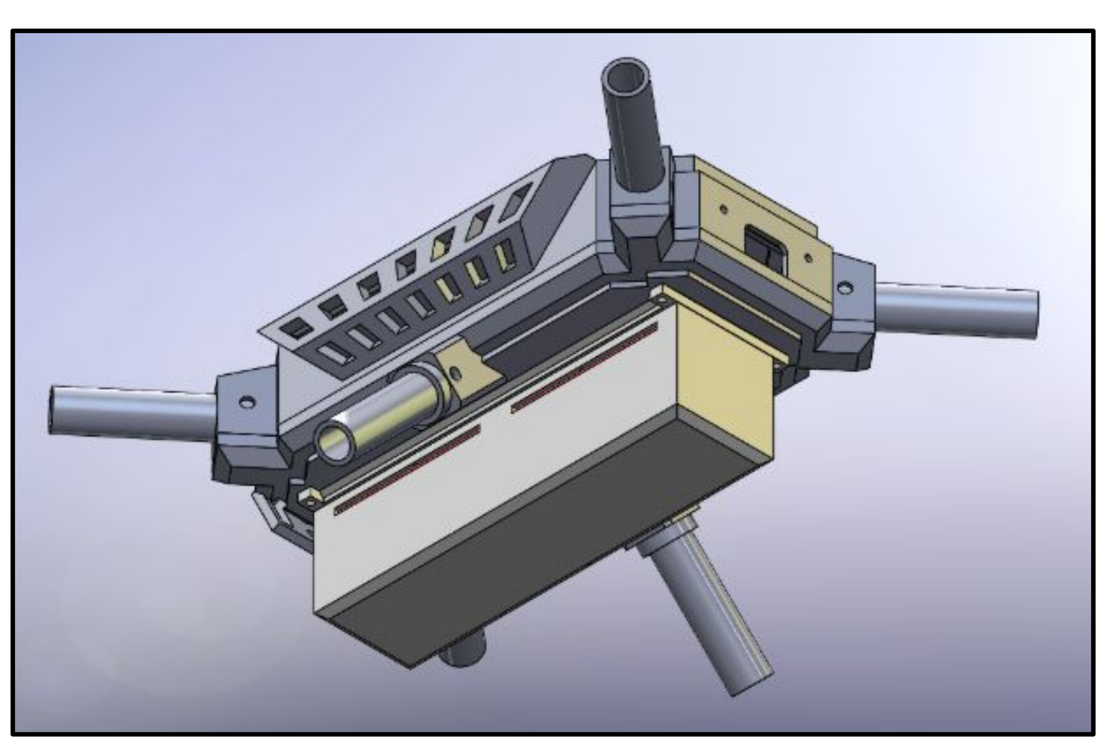

***Figure 2:*** *V4 Chassis CAD View*

## Mechanical

DRON is designed to balance weight, structural stability, and modularity to withstand the high stress involved in a flight - namely torque from the propellers and internal stresses from payloads.

DRON has adopted the use of carbon fiber tubes in the arms of the next design (V4) to minimize potentially devastating vibrations during flight. All parts are connected via heat inserts and screws for ease of repair and maximum durability.

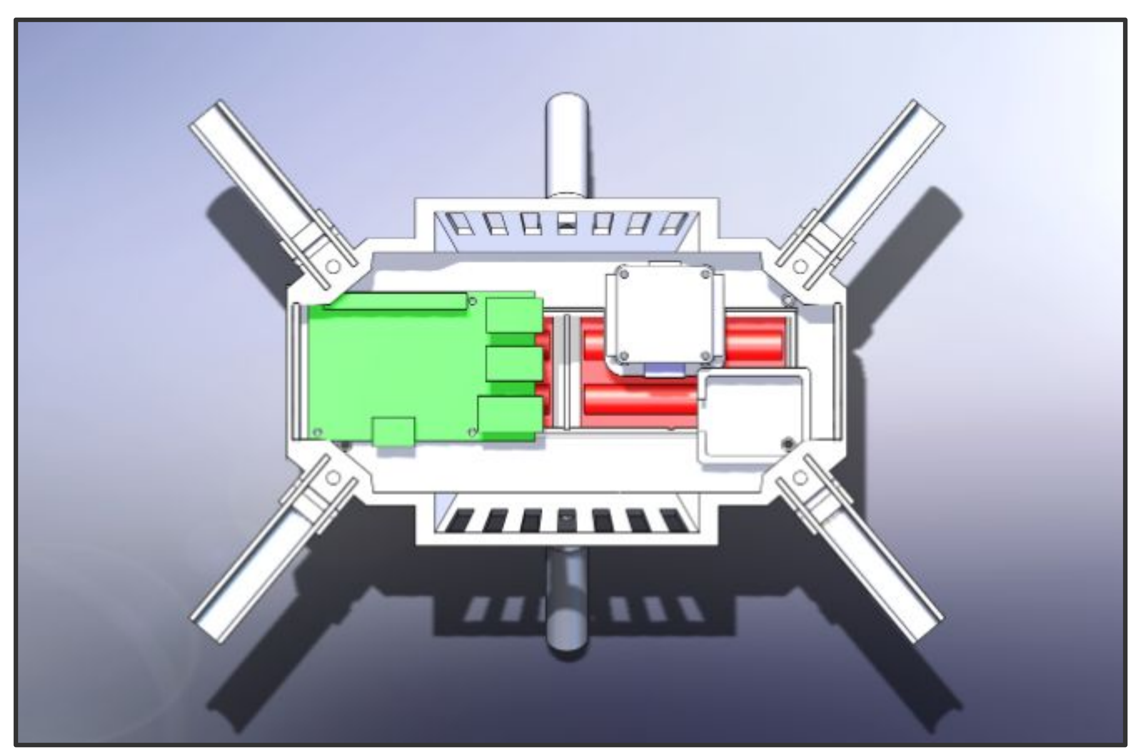

***Figure 3:*** *Top View of V4 Drone*

## Visualization

This software has the role of managing communications between components, detecting hotspots, and 3D mapping the environment. Two stereo cameras were successfully calibrated to capture depth of their surroundings. Stereo images are published through a ROS2 node into Unity where they are visualized.
The software stack relies on many modules and libraries for flight control, data gathering, image processing, and environment visualization in 3D.

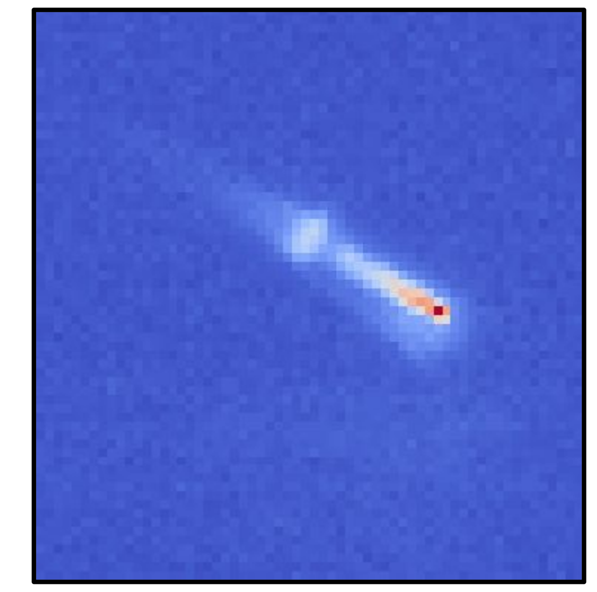

***Figure 4:*** *Thermal View of Soldering Iron in Fig 5*

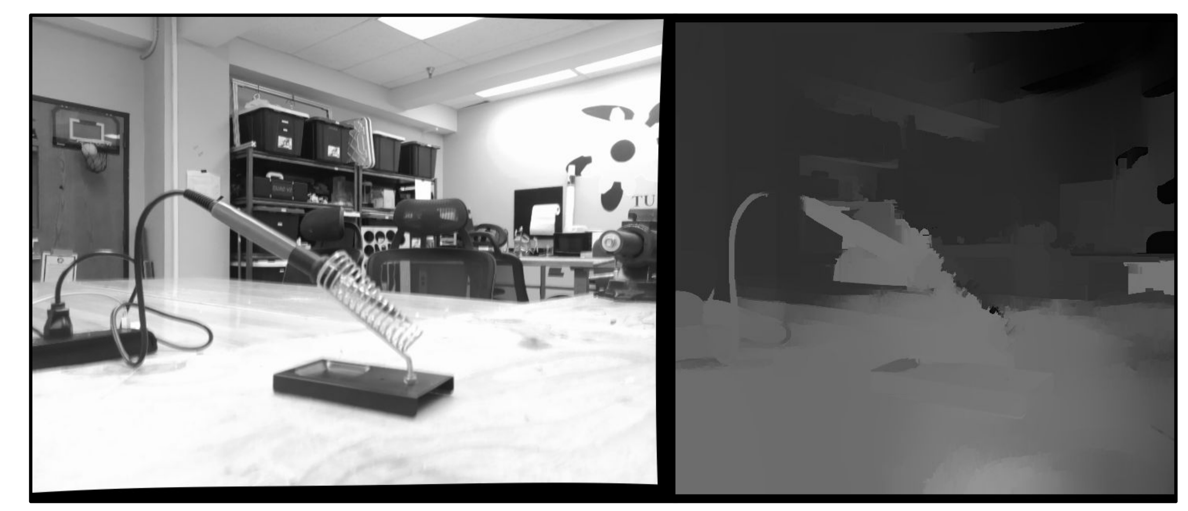

***Figure 5:*** *Generated Depth Map of soldering iron*

## Autonomy

UAV autonomy is being realized through PX4 firmware simulation and deployment, and is interfacing with PX4 via the uORB messaging API. The team demonstrated multi-agent Software-In-The-Loop (SITL) simulation through Gazebo, with sensor output published to ROS 2.

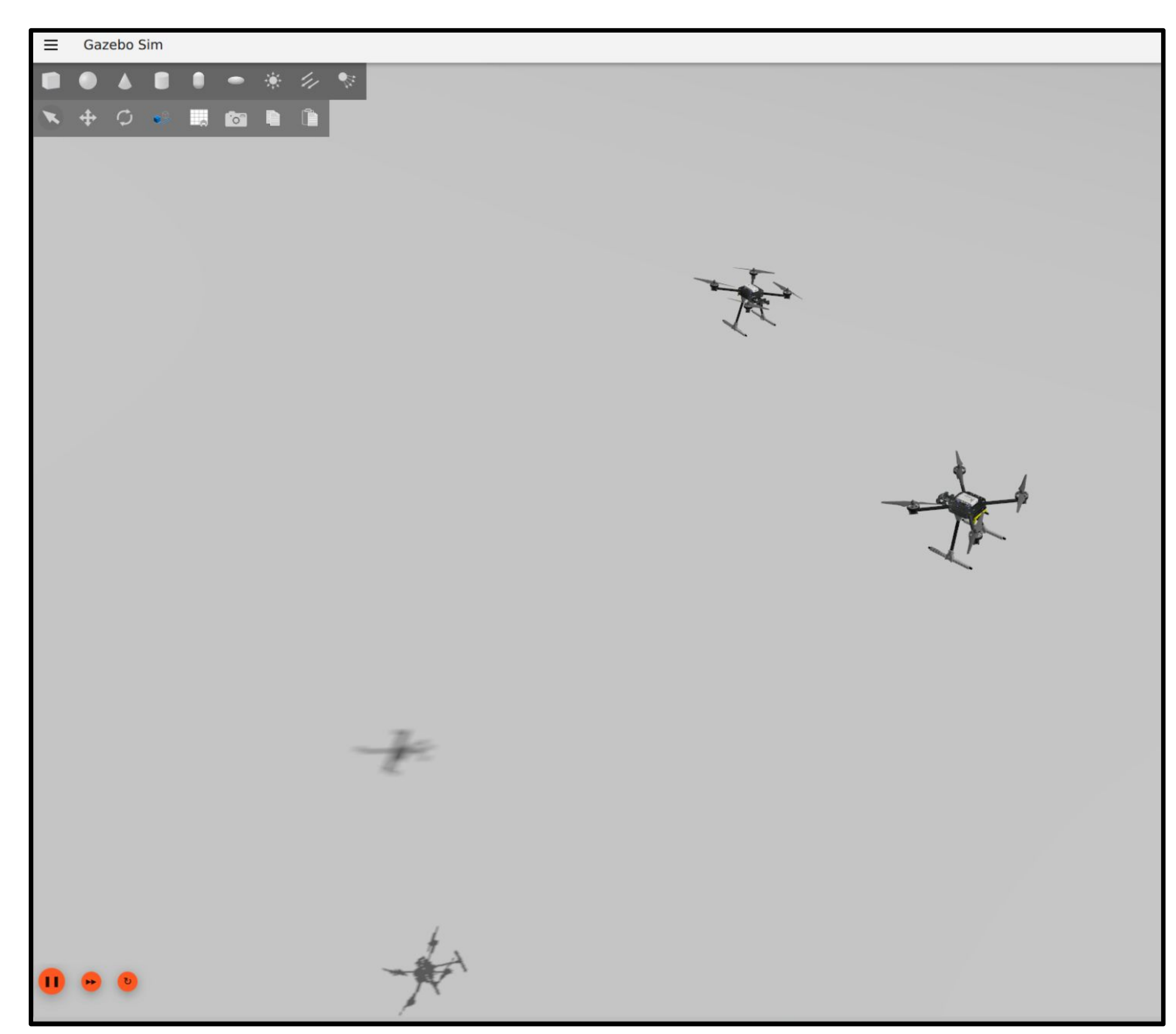

***Figure 6:*** *Multi-Drone simulation through Gazebo, using PX4*

## Electrical

Configuring INAV as the centralized Ground Control Station (GCS) for use with the Flight Controller (FC) and Electric Speed Controller (ESC) stack.

The GPS and IMU provide low-level waypoint based autonomy. The Raspberry Pi collects sensor data and uses wifi to transmit information and receive flight commands.

The battery selected is rated for 3000mAh and can deliver enough power to sustain maneuvering flight for ~12 min, and low speed flight and hovering for ~15 min.

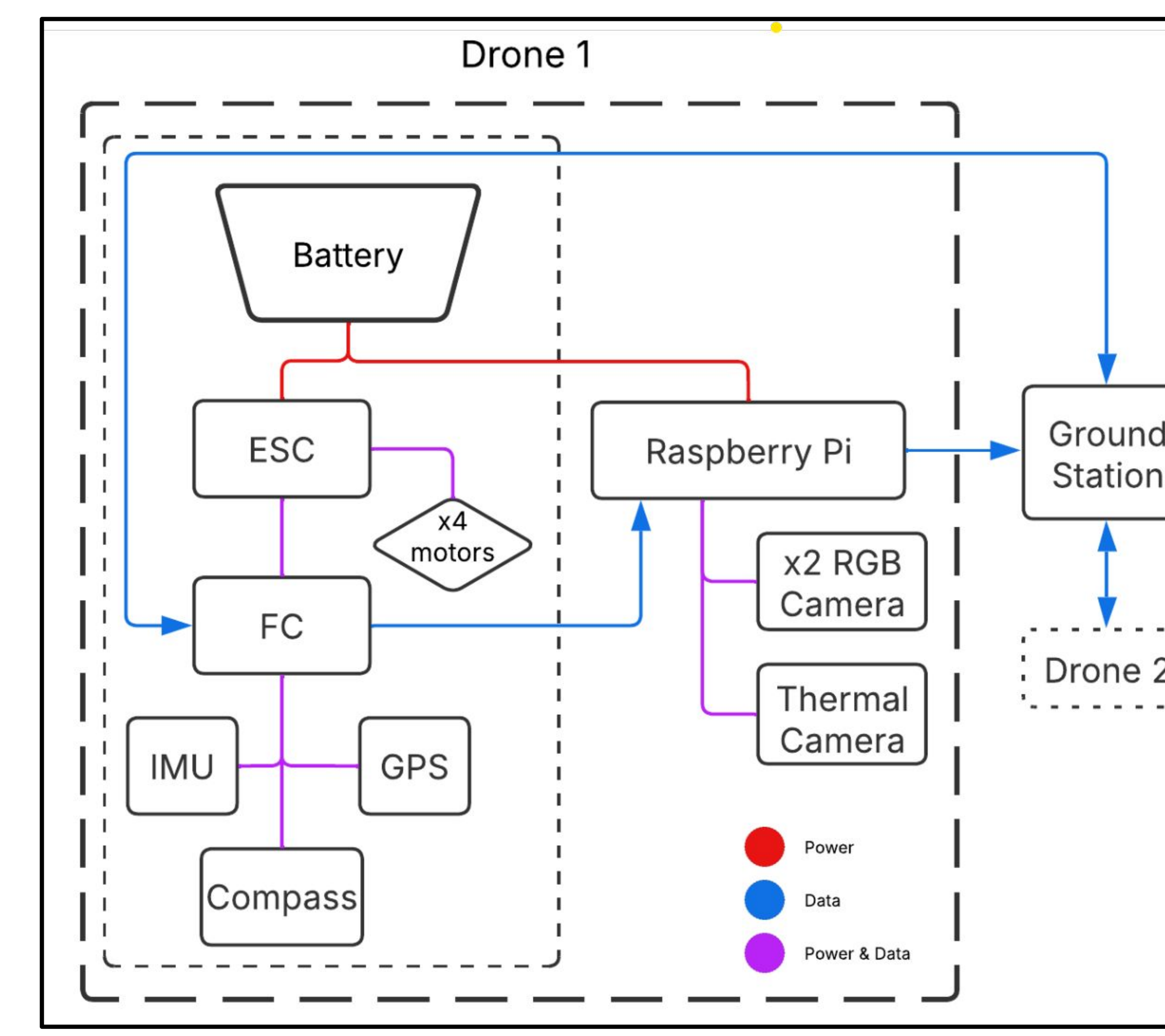


***Figure 7:*** *Revised system architecture illustration*

## Next Steps:

**Mechanical:** Start final manufacturing and assembly

**Autonomy:** Deploy autonomy on hardware for field trials; deploy autonomous multi-agent swarm.

**Visualization:** Processing a live data feed and consolidated tests of sensor fusion in plotting and visualization from multiple frames.

***Texas A&M University Robotics Team and Leadership Experience (TURTLE) Lab***