Microprocessor Controlled Aerial Robotics Team

The Project

- CPRE 488 students need a lab to learn about control algorithms
- The lab needs infrastructure to be designed
- ECPE needs an interesting demo for prospective students & sponsors


Ground Station - Backend

- Consists of: MicroCART ground station, Crazyflie adapter, Crazyflie ground station.
- MicroCART ground station: Sends commands to the custom quadcopter from previous years or other quadcopters using the adapters
- Crazyflie Adapter: In charge of packet translation
- Crazyflie ground station: saves data about quadcopter and sends command packets over radio.

Ground Station - GUI

- Provides a graphical interface for the user to connect to a crazyflie, view and set parameters, and send setpoints through the groundstastion
- Can graph test stand and quad logging data to be used in tuning the crazyflie

Crazyflie Firmware

- Low level firmware written in C
- Modified open source firmware to better fit lab's needs
- Removed complexity where not needed
- Contributed to official Crazyflie Github. Update firmware over USB
- Guided students in development of the firmware to reimplement the stabilization algorithms
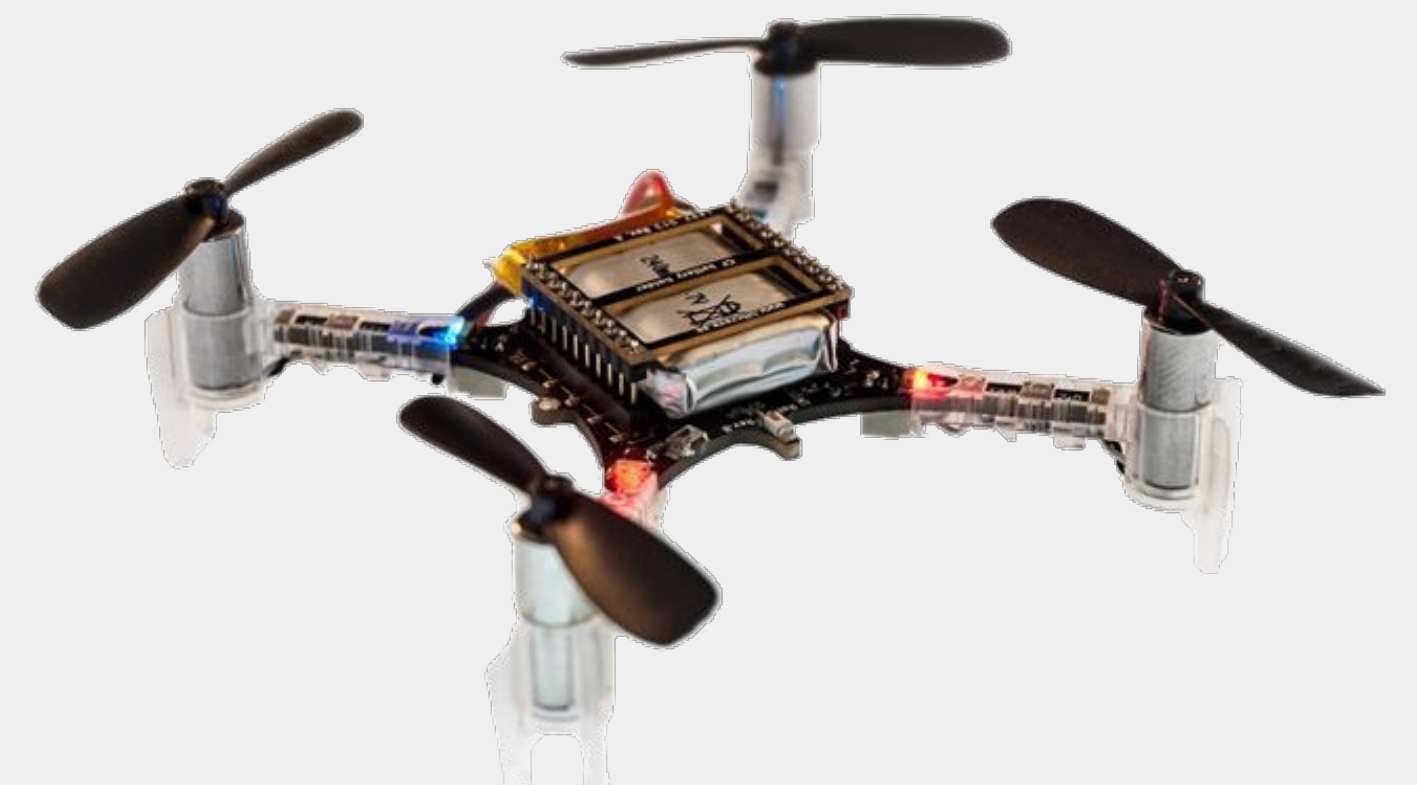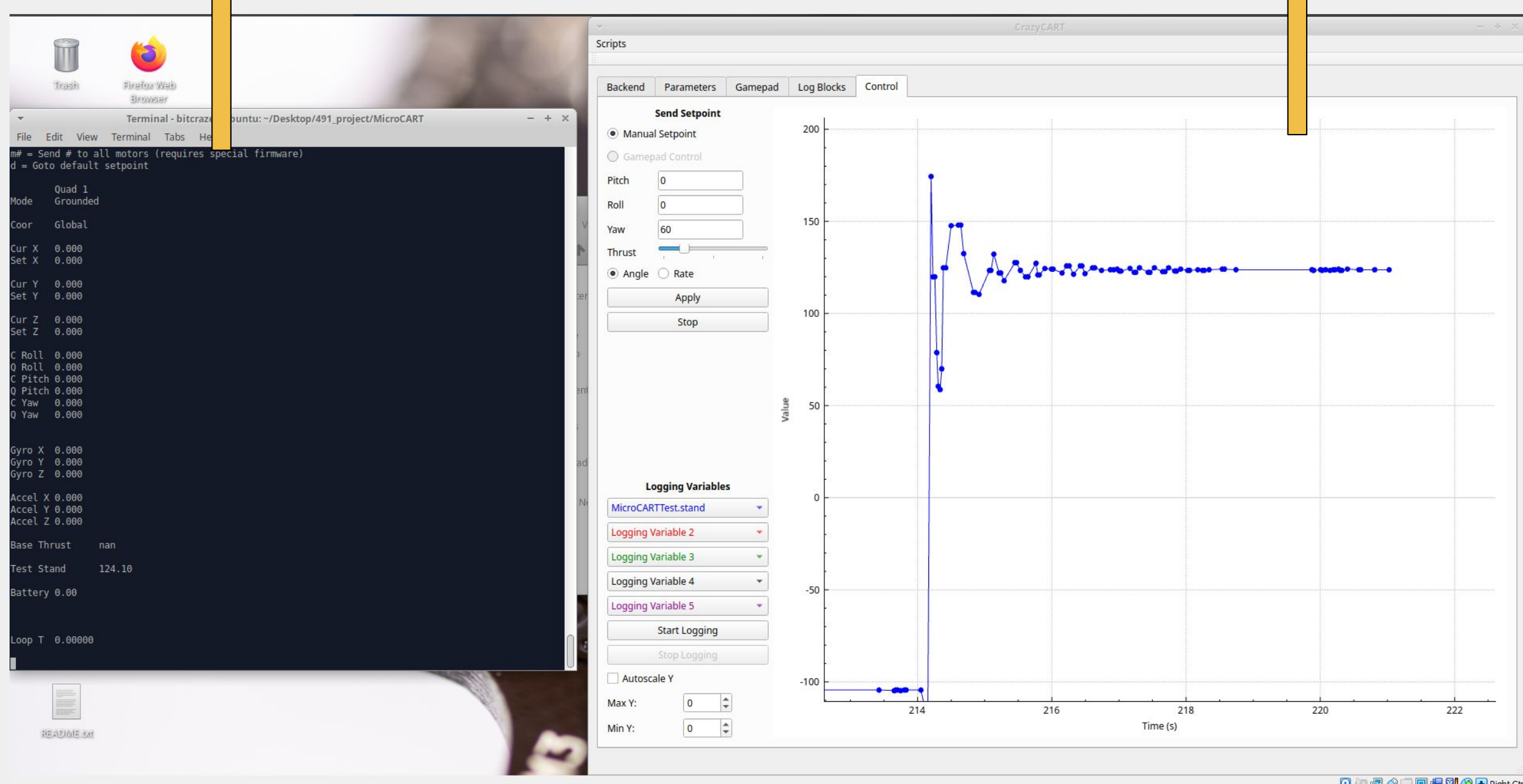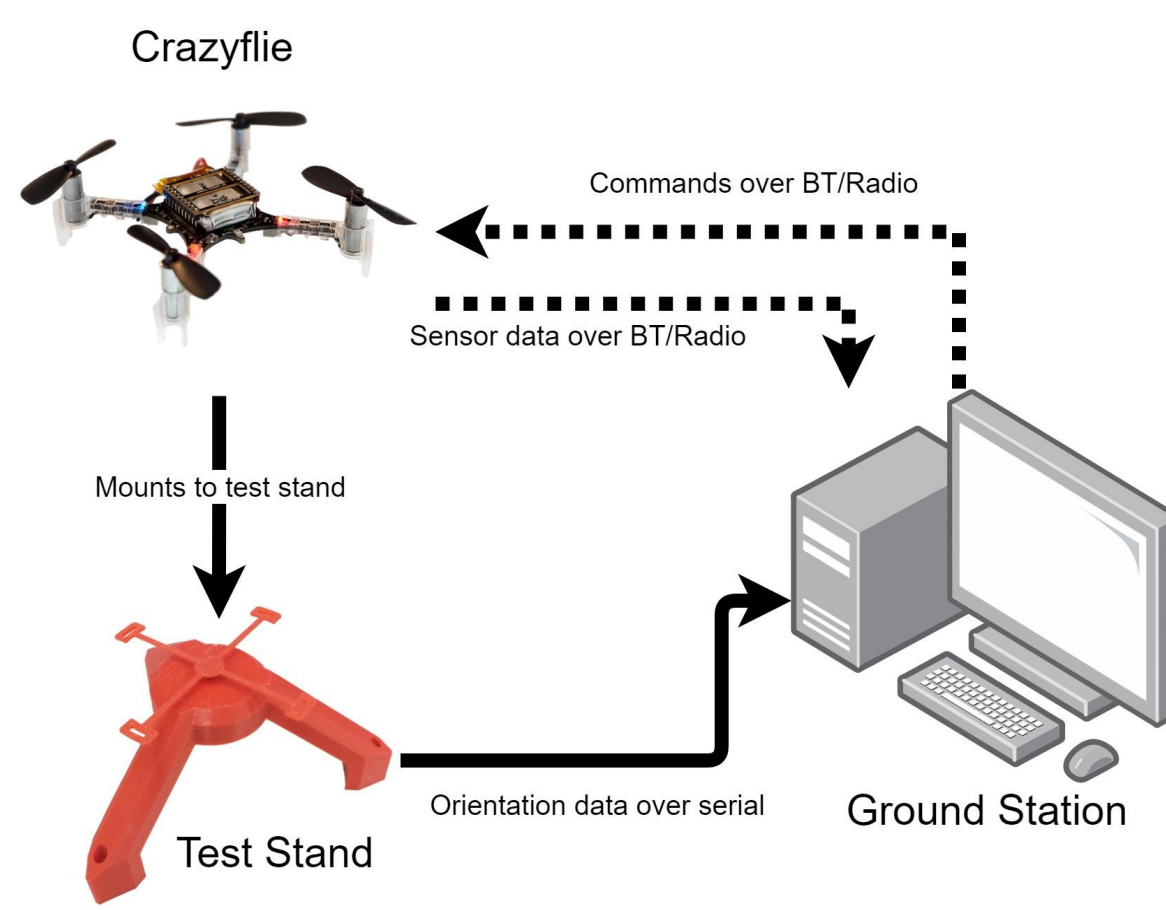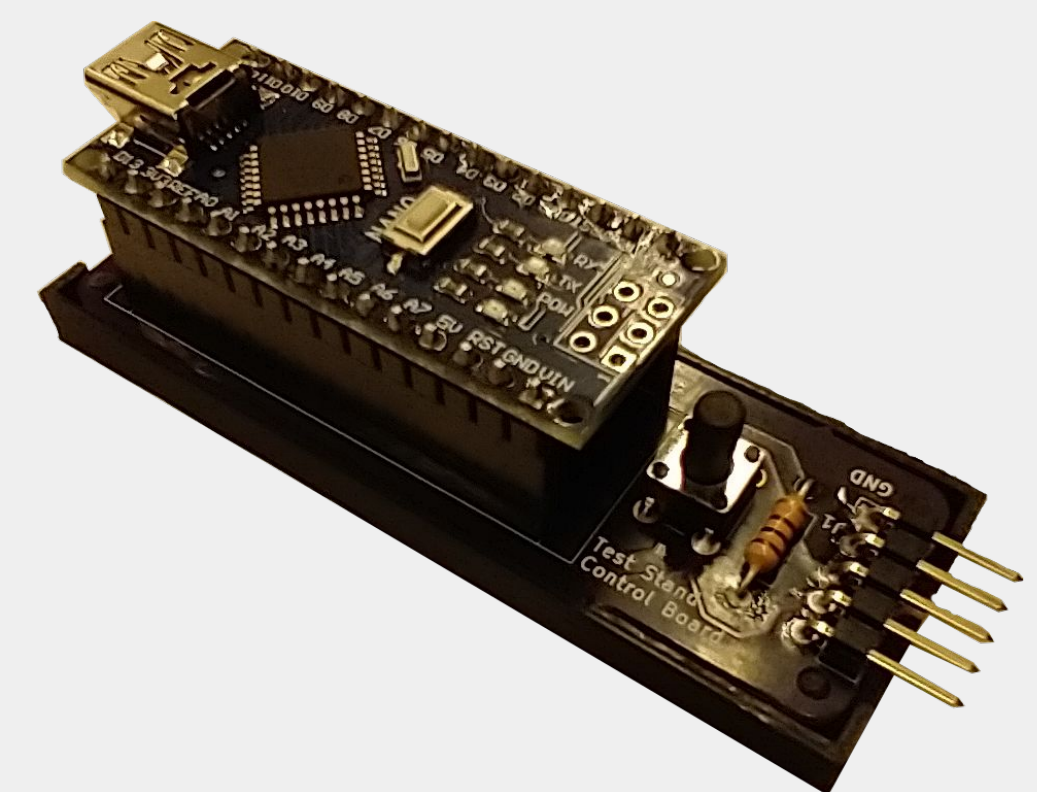

CrazyFlie Quadcopter

COTS open source quadcopter by Bitcraze, Ideal as a development platform

Test Stand Electronics

- Designed a control board to convert rotary encoder voltage to rotational position data
- Sends rotational data over serial to the ground station backend

Test Stand

- Designed & 3D printed a test stand to hold the drone in place and prevent liftoff during testing
- Also restricts rotation to a single axis to allow users to tune one at a time
- Created two different attachment mounts to support horizontal and vertical orientations

Resources:

- Private Lab, Coover 3050
- Bitcraze Virtual Machine
- SIC Makerspace
- Arduino IDE
- Fusion360 & Ultimaker Cura
- KiCAD

Lighthouse Demonstration

- Utilized Lighthouses to obtain positional control of CrazyFlie
- Used Vive controller to control CrazyFlie position and attitude

The Lab

- Students tuned PID constants
- Students wrote control algorithms in quadcopter firmware
- Students demonstrated that drone can fly with their firmware and PID values

Average difficulty: 5.7 / 10
Average instruction clarity: 6.8 / 10

Advisor:
Dr. Philip Jones

Team Members: Brandon Cortez, Zach Eisele, Colton Glick, Ryan Hunt, Carter Irlmeier, Elissa Peterson, Reid Schneyer