

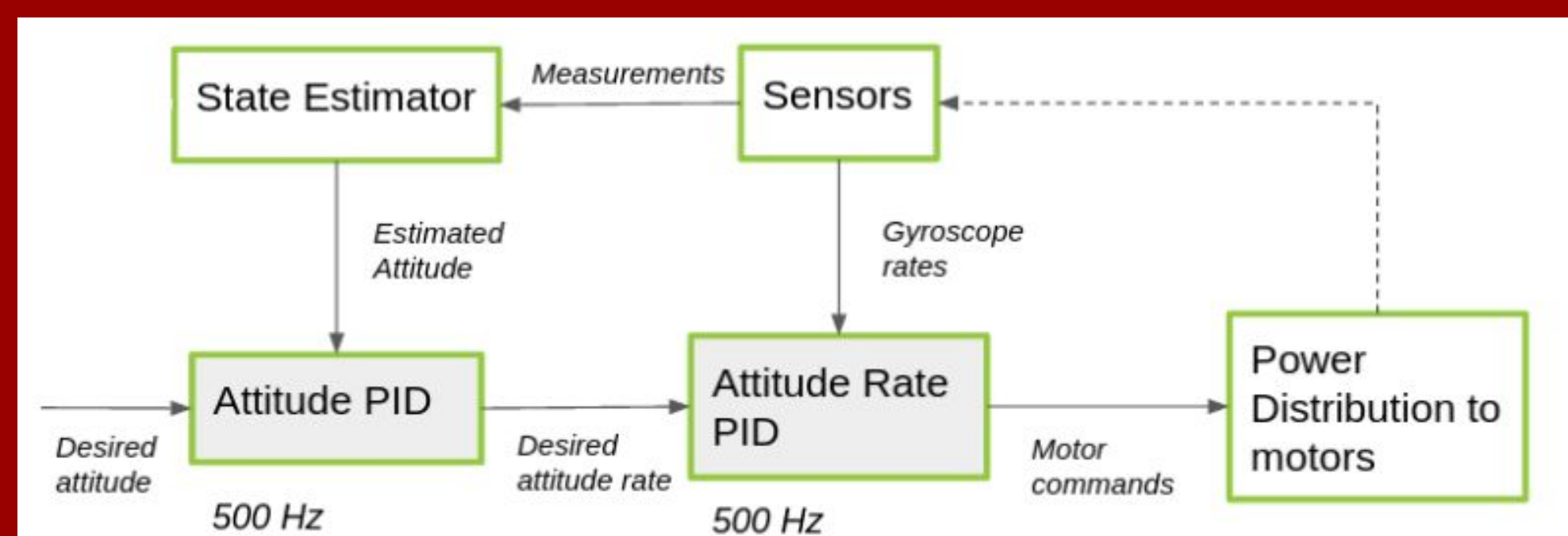
# Microprocessor Controlled Aerial Robotics Team

## The Project

- Design Custom Quadcopter to act as a research platform
- Update and support CPRE 488 MP4 Lab
- Develop impressive demos of systems to show to prospective students



Crazyflie on test stand used in lab



CPRE 488 Crazyflie Controller Diagram

## Intended Users

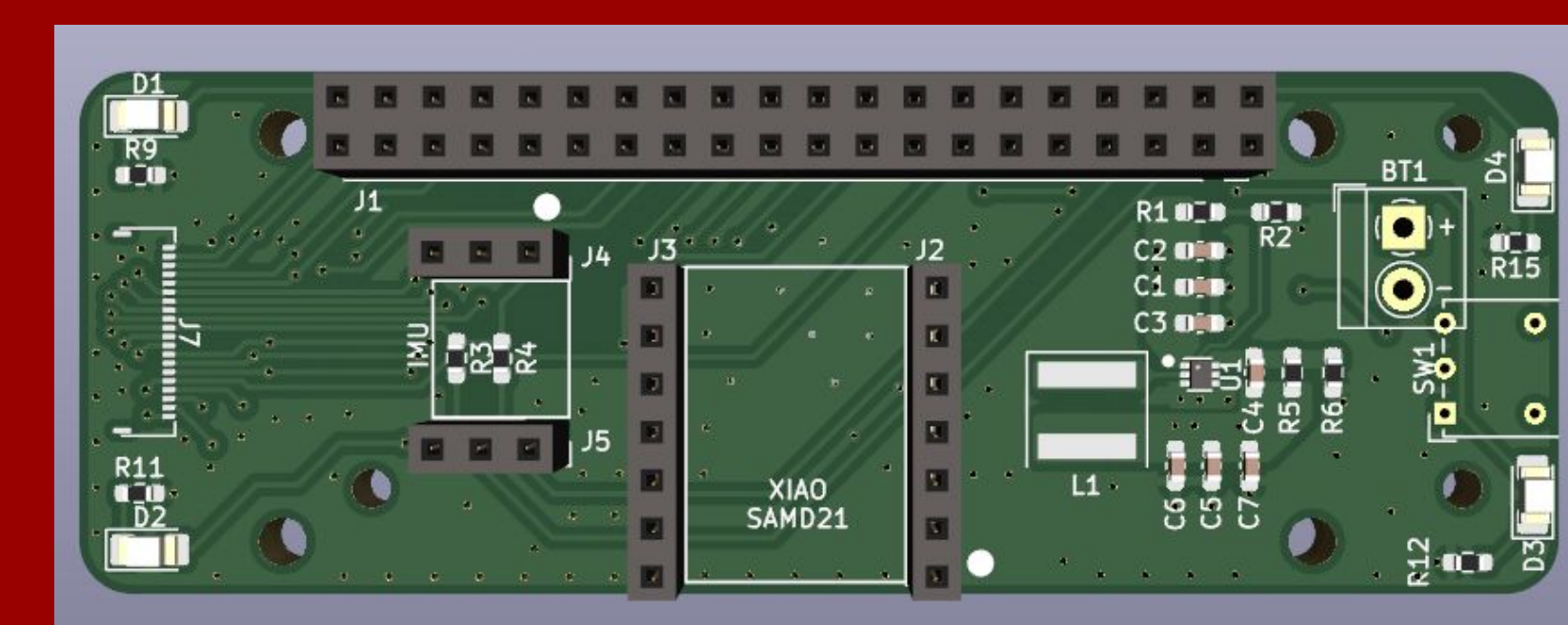
- Future MicroCart Teams
- CPRE 488 Students
- Graduate Students

## CPRE 488 Embedded Systems Design

- CPRE 488 has a legacy Microcart created lab where students tune nested PID control loops on a crazyflie
- Update and support CPRE 488 MP4 Lab by:
  - Increasing readability of instructions
  - Fixing bugs within ground station and GUI
  - Creating Youtube videos to explain different components of the lab
  - Support of Lab during the 488 class

## Fly Pi

- Designed custom quadcopter to act as a research platform for future MicroCART teams or graduate students
- Crazyflie as flight controller while Raspberry pi in development
- Raspberry Pi 2W for flight controller
  - 3 cores running Ubuntu for Wifi interface, and to enable high level controls architecture
  - 1 core running FreeRTOS Crazyflie firmware
- Custom power distribution board
  - IMU over I2C
  - Seeduino over I2C to control PWM to ESC
- Utilizing modified Crazyflie firmware for flight controller
  - Using TCP to work with CRTP data, handing packets to Ubuntu rather than AI deck
  - Custom setpoints courtesy of previous team
  - Custom ESC configuration code for motor



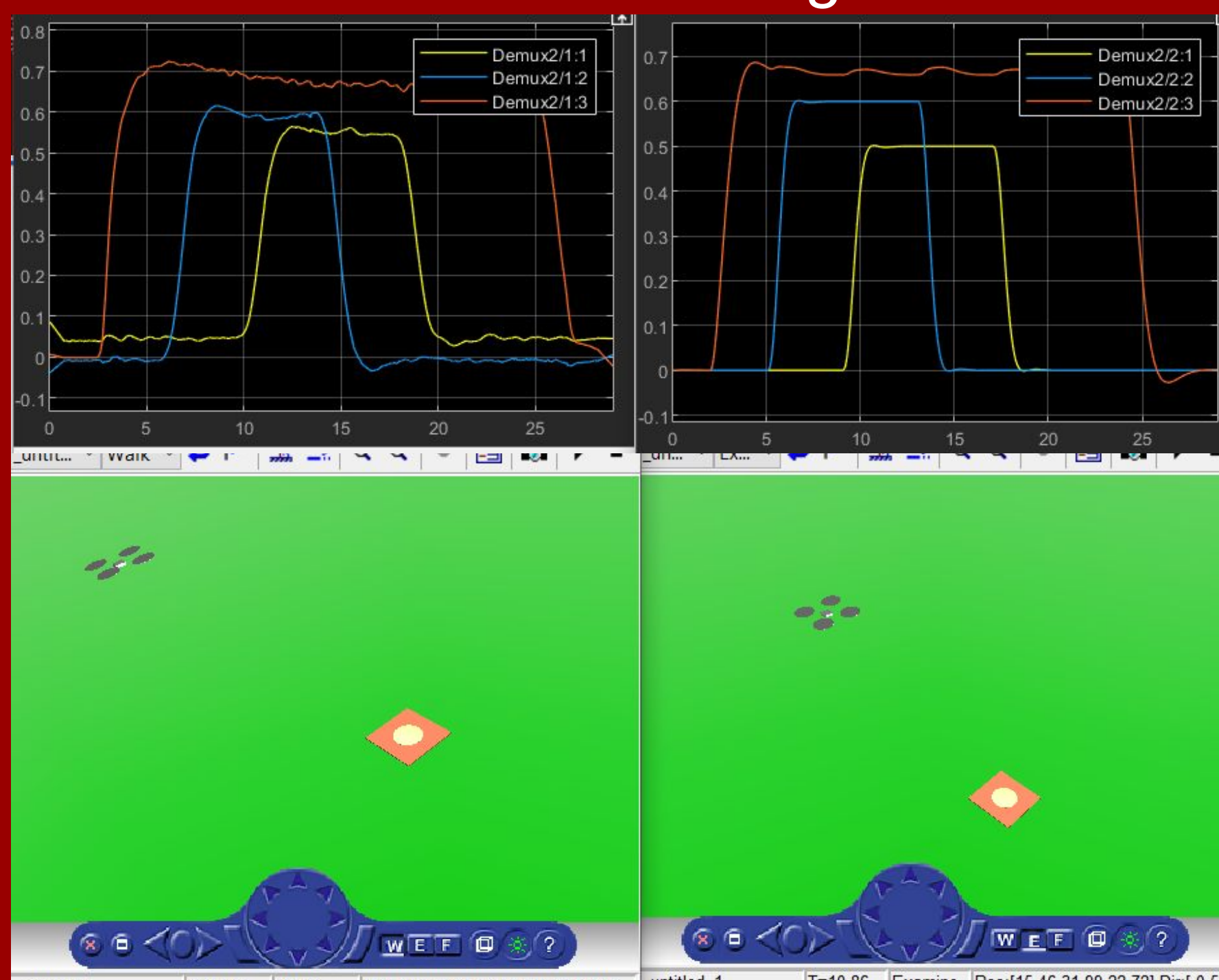
FlyPi Circuit Board



FlyPi Side View



FlyPi Front View Ready For Takeoff!



Demo of simulation vs real world of a crazyflie



Demo of Simple Swarm

## Crazyflie Drone Demos

- Simulation comparison demo
  - Implemented Simulink/Matlab simulation of simplified quad dynamics
  - Created python script in order for crazyflie to takeoff, fly in a square, land and log full pose information.
  - Logged data is visualized next to simulation of the same setpoints
- Simple swarm demo
  - Connect to multiple quads
  - Upload circular trajectories to each quadcopter and have them fly utilizing lighthouse deck

## Test Stands

- Test stand restricts quad to single axis of motion to enable simpler tuning
- Created yaw, pitch, and roll test stands for FlyPi Quad
- Created XY constrained test stand for crazyflie
  - Intended to be used for extra credit portion of MP4 of tuning a positional controller with the crazyflie lighthouse deck.



FlyPi roll and pitch stand



FlyPi yaw stand



Positional controller stand

## Resources

- Work hours: 1134 hours
- Limited Access Controls Lab
- Previous MicroCART infrastructure
- Crazyflie hardware and software
- ETG

## Client & Advisor

Dr. Phillip Jones

## Team Members

Austin Beinder  
Connor Ryan  
Grant Giasanti  
Tyler Johnson

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