MicroCART Mini

Detailed Design

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Client & Faculty Advisor: Dr. Phillip Jones

Project Overview

MicroCART: Microprocessor Controlled Aerial Robotics Team

- Design mini quadcopter platform to be used in CPRE 488 and for Controls & Embedded Systems researchers
- Develop mini quadcopter printed circuit board (PCB), containing a Microcontroller, RF, IMU, and Wi-fi chip
- Develop software to stabilize and communicate movements
- Develop base-station to communicate with quadcopter
- Create and improve documentation and video tutorials for future teams

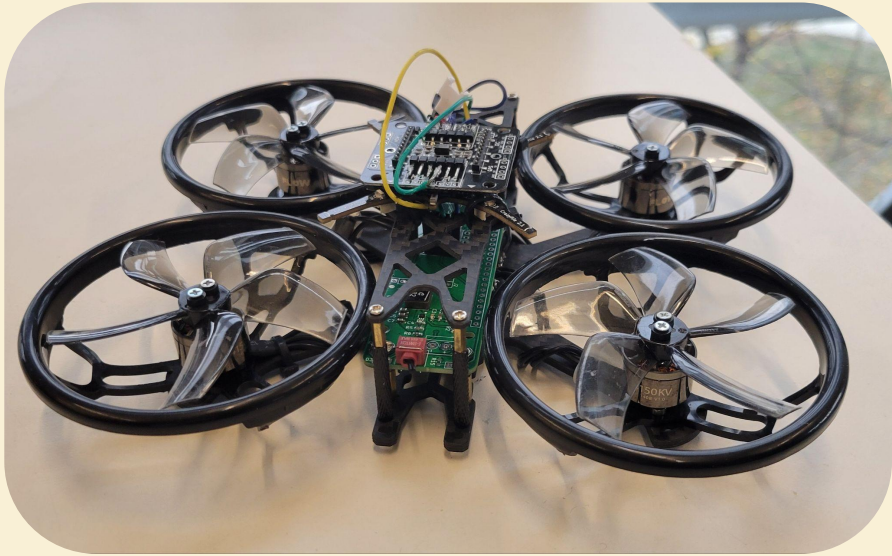
CrazyFlie micro-quadcopter

Our Goals

- Design/Improve a quadcopter platform integrating both hardware and software to be used for hands-on learning in CPRE 488.
- Ensure both remote accessibility and usability for future users through documentation and tutorials

Project History

- Project began in: 1998 - Now
- Student designed test-stand
- Project YouTube channel
- Sizeable code repository
- Bitcraze CrazyFlie
- Fully student-designed Drone



Users

- CPRE 488 Students
  - Lab 4
- Successor Project Team
  - Next years MICROCART team
- Project Advisor/TAs
  - Dr. Jones, TAs assisting with Lab 4
- Prospective ISU students
  - People observing our demonstrations

How our users will make use of our Project

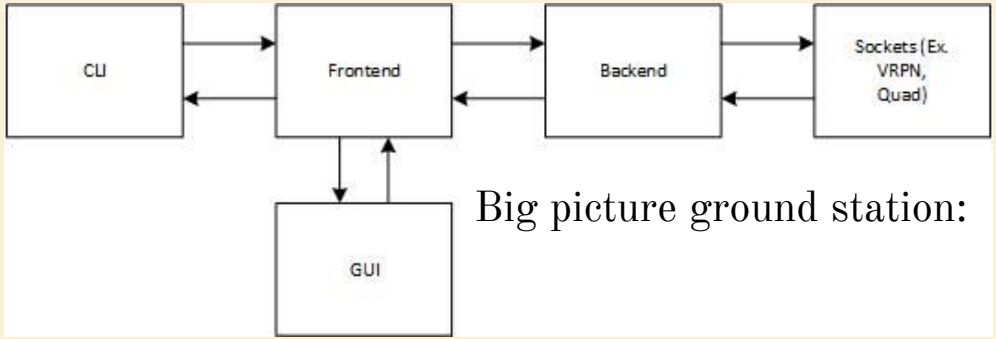
488 students - Gain a deeper understanding of PID controllers and embedded programing.

Successor groups of MicroCART - Take what previous groups have accomplished and optimize or create new features.

Advisor/TAs - Help guide students through Lab 4 with the use of documentation from the MicroCart team.

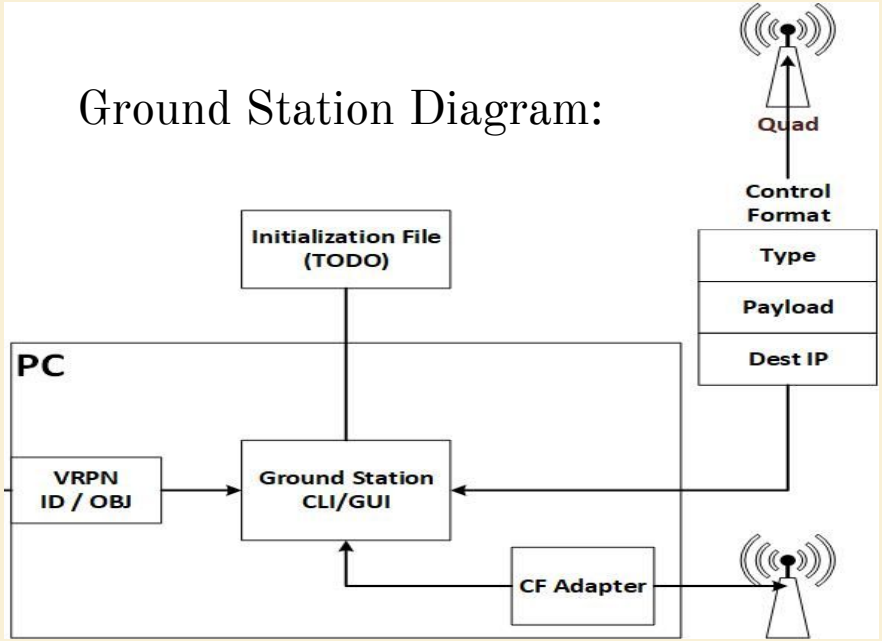
Potential ISU students - Individual larger drone project design. The drone will be used as a demo at college fairs and touring highschool students.

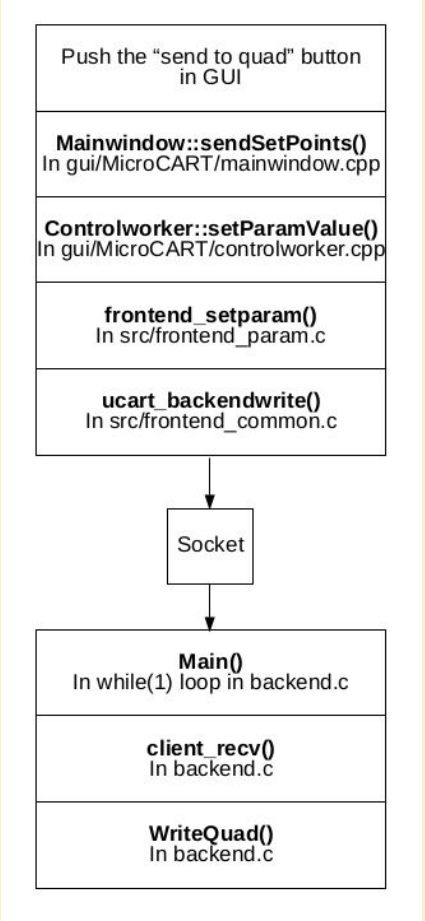
Software



Big picture ground station:

Ground Station Diagram:





Ground Station Call Stack:

Technology Considerations

- Virtual Machine
  - Project environment and means of deployment
  - GUI & remote connection
- BitCraze - CrazyFlie mini quadcopter models
  - Open source software and hardware for CrazyFlie
- Network technology / Radio Communications
  - The communication pipeline
- Microcontrollers/Low-level programming
  - Drones onboard software
- PCB fabrication
  - Battery retention

Radio Dongle

Demo

Do the physical demo (alt-tab to virtual machine)

Areas of concern and potential development

Deployment

- Make sure the VM contains only the essentials, No experimental work

Enable full usage of Test Stand

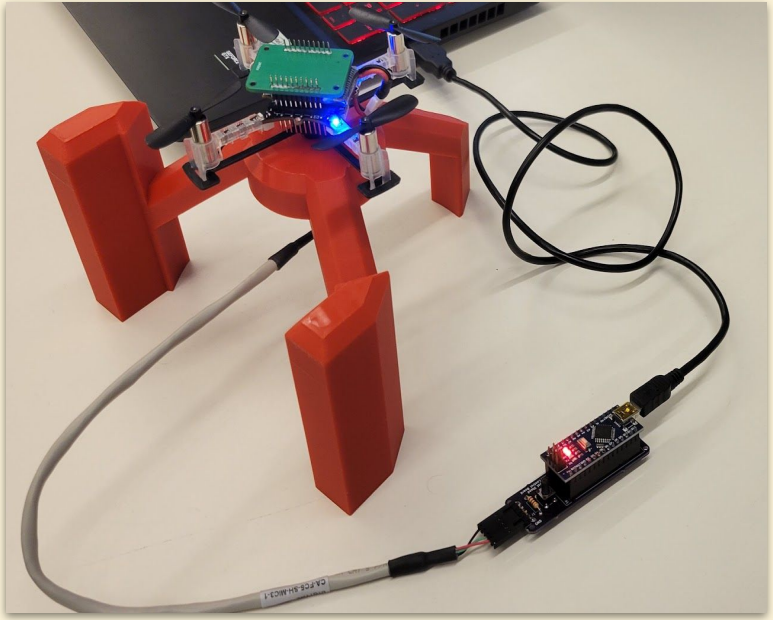
- Utilize a microcontroller to read the sensor in the test stand

Ready for a new senior design team

- Ensure future team(s) knows our intent and plan
- Documentation for navigating the burgeoning code base

Improve organization

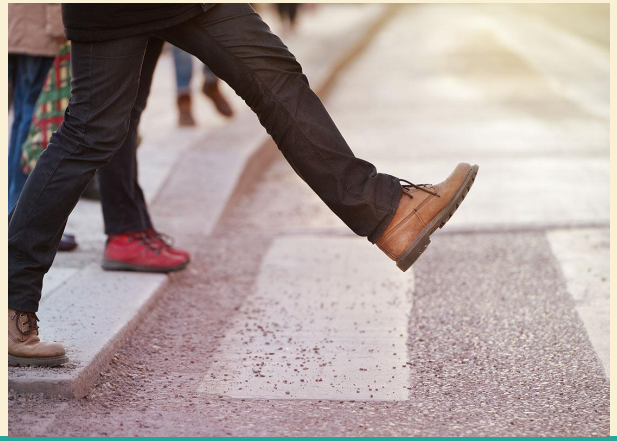
- Reorganize the startup document to be up to date



Test Stand

Conclusions

- We have to create the lab materials for next years CPRE 488 class
- Keep documentation and quadcopter statuses up to date to ensure CPRE 488 students have a good experience with their Lab 4
- Perform extensive testing of software with the drones to find any bugs



Works Cited

- Jones. “CprE 488 - Embedded Systems Design.” Iowa State University, https://class.ece.iastate.edu/cpre488/schedule.asp
- “Follow These 4 Steps to Plan Your Career - Alis.” *Alis.alberta.ca*, alis.alberta.ca/plan-your-career/follow-these-4-steps-to-plan-your-career/