

# EE CprE 491 – May 1718

## MicroCART Senior Design Team

### Week 1 Report

*September 3 – 12*

*Faculty Advisors: Phillip Jones, Nicola Elia*

#### Team Members:

Kris Burney — *Key Concept Holder*

Joe Bush — *Key Concept Holder*

Jake Drahos — *Key Concept Holder*

Eric Middleton — *Key Concept Holder*

Tara Mina — *Key Concept Holder*

Andy Snawerdt — *Key Concept Holder*

David Wehr — *Key Concept Holder*

#### Summary for Progress this Week

This week, we mostly got things set up for the semester. This includes setting up a Google drive and giving everyone access to edit the documents in it, creating a Slack team for quick messages between specific team members, as well as creating a group alias email so that we can easily send an email to everyone on the team. We also go to meet everyone on the team, as well as the people that will be helping us throughout the semester, including our advisors and previous team members. Creating some basic objectives during our first meeting, we came up with some general goals we want to meet this semester and discussed some possible goals that we want to accomplish in the spring. In addition, some preliminary testing and development was performed by some team members, including testing of wifi communication and started running and doing some small changes to the ground station code.

#### Past Week Accomplishments

- Wifi communication testing – David Wehr
  - Researched ESP8266 capabilities
  - Learned how to flash custom firmware on ESP8266
  - Wrote UDP echo program for ESP8266
  - Tested UDP latency, began testing serial latency
- Met with our advisors – All team members
  - Learned about the history of MicroCART
  - Discussed our main objectives for this semester
  - Met members from previous senior design team
  - See detailed meeting notes in last section of report
- Scholars' Fair demo – All team members
  - Ran basic demo of the project from last year's MicroCART senior design team
  - Met RADA, another senior design team in the controls systems lab
- Reading over the last team's documentation - All team members
  - Getting started
  - PID document

- Ground station guide
  - Building Xilinx projects
- Ground station code re-design – Kristopher Bueurney and Eric Middleton
  - Reading through last years code
  - Understand last years modular design
  - Concentrate on modern c++ code design
- Set up a Google Drive – Kris Burney
  - Called MicroCartF2016
  - We will keep track of important documents here, including weekly reports, documentation, meeting notes, etc.
- Set up a new Slack team – Joe Bush
- Set up a group email address – Tara Mina
  - Email address: [microcart\\_f2016@iastate.edu](mailto:microcart_f2016@iastate.edu)
  - Includes all team members, both faculty advisors, and a few of last year's team members who will continue to help advise us throughout the semester
- Set up weekly report template – Tara Mina
  - Shared with everyone on the Google Drive folder: MicroCartF2016

### Pending Issues

- Team member roles need to be determined
- Need to determine our first steps in meeting this objectives of this semester
- Create a Trello board for our team to keep up to date with our current progress

### Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Kris Burney	Demo, familiarization, ground station, meetings	12	12
Joe Bush	Demo, meetings, slack setup, reading documents	5	5
Jake Drahos	Demo, reading documentation, meetings	5	5
Eric Middleton	Demo, familiarization, ground station, meetings	15	15
Tara Mina	Demo, setting up, reading thesis, meetings	8	8
Andy Snawerdt	Demo, reading thesis, familiarization, meetings	8	8
David Wehr	WiFi, demo, familiarization, meetings	12	12

### Comments and Extended Discussion

We have not experienced any major issues so far, since we are only getting started and setting up our modes of communication and record-keeping for tracking our time and general documentation. In addition to coming up with some basic objectives for this semester, we are also looking into the possibilities for what we want to accomplish over the course of the next two semesters. Because we are generally adding to the capabilities of the quadcopter, we can choose what we want our specific tasks to be and what we want to accomplish. As a result, we have been exploring different possibilities for what this project can become by the end of next spring. For example, we have considered possibly having the quadcopter flying outside, autonomously, using GPS navigation, and going to certain waypoints defined by the user of a web interface, which could be integrated with

Google maps imaging to represent a clickable location that matches what the user can see at the specific site at which he or she is located. We may not choose to accomplish this particular goal next semester, but regardless, our objectives for this semester will be the same. These exploratory ideas are simply extensions of what we can do with the fundamental platform we develop over the course of this semester. Ultimately no matter what autonomous applications we choose to develop on the quadcopter this year, we will definitely need to meet core objectives, including having a good user interface to define waypoints easily as well as creating a solid control system that allows the quadcopter to maintain its current position.

### Plans for Coming Week

- Read more of Matt's thesis – Tara Mina and Andy Snawerdt
  - Title: *Model Development, System Identification, and Control of a Quadrotor Helicopter*
  - Written by Matt Rich, a previous team member specially for senior design
  - Will help us gain insight on how to model the mechanical physics of the quadcopter, which is a first step in understanding how to create an optimal control system
- Test TCP and Serial latency - David Wehr and Eric Middleton
  - Need to determine how fast we can communicate between ground station and quadcopter, both for guaranteed and non-guaranteed delivery
  - Work together to measure serial latency, so we can get an idea of the total communication time
- Create documentation for WiFi communication - David Wehr
  - How to flash custom firmware to chip
  - SDK and libraries available for WiFi
- Start implementing new ground station - Eric Middleton and Kristopher Burney
  - Replacing the previous team's mostly C-based backend with a modern C++ version
  - Adding modular design to easily allow different parts of the quadcopter control loop to be switched between the quadcopter and ground station

### Summary of Weekly Advisor Meeting

This week we met our advisors and team members, learned about MicroCART and its history, defined some key objectives for this semester, and discussed some possible objectives and end-goals for next semester which will become more definite as we progress this year.

- MicroCART history
  - Has been a senior design team for many years, starting in 1998
  - First version of MicroCART began as a gasoline-burning helicopter
  - Current version of the quadcopter is now undergoing its 3rd year of development
- Talked about current setup of MicroCART
  - Currently most code is written in C
  - Has an autonomous mode that is supposed to hold the current position of the quadcopter
    - Does not work unless the current position is very stable, without any wavering
    - If we suddenly switch from manual to autonomous mode, the behavior of the quadcopter is not well-known, since little testing was done with this action

- Autonomous mode is unstable: it tends to create oscillations that increase in amplitude gradually until the quadcopter loses control
    - Code has been made somewhat modular by last year's team
- Goals to accomplish by November:
  - Want to have a GUI interface with clickable waypoints
  - Have a redesigned base station following a modular design written in modern C++
  - Reliable autonomous flight
- Got to meet previous members of the MicroCART senior design team from last year, including:
  - Ian McInerney
  - Matt Rich
  - Joe Avey