

EE CprE SE 492 – MAY15-28

MicroCART Senior Design Team

Weekly Report 27

April 13 – 19

Faculty Advisers

Phillip Jones

Nicola Elia

Member	Position	Weekly Hours	Total Hours
Paul Gerver	Key Concept	17	231
Tyler Kurtz	Key Concept	8	190.5
Ravi Nagaraju	Webmaster	4.5	129
Adam Campbell	Webmaster	6	130.5
Joe Benedict	Communications	12	249.75
Jacob Rigdon	Communications	6	130
Matt Vitale	Team Lead	6	159.75
Matt Post	Key Concept	8	68.5

Progress

- 1) A beautiful poster was made
- 2) Manual flight was successful
- 3) It was confirmed that 10" propellers are required for adequate thrust using the current set of motors. Steeper blade pitch returns increased agility as well as possible instability while shallower pitch offers increased stability with less responsiveness

Plan of Action

- 1) Complete presentation poster due April 19
- 2) Finalize PID tuning for client demonstration on April 20
- 3) Implement and test hardware-based kill switch
- 4) Integrate camera data with analysis tools and quad

Pending Issues

- 1) Insecure knowledge of tri-state signals needed for Ping Sensor – Matt will look into this throughout this coming week.
- 2) The website and YouTube account need to be populated with videos

- 3) If the quadcopter is turned on while the RC transmitter is not on, the motors may start spinning with garbage values.
  - o Course of action: Add protection to not start main flight loop until consistent numbers from the transmitter are received.
- 4) Exact replacements for props (10" x 3.8) are difficult to source. Alternative options are 10" x 4.5 in and 10" x 5.5 made from plastic or carbon fiber

## Contributions

### Paul – 17 Hours, 231 Total

- Helped Tyler with Kill Switch implementation - 3
- Manual Flight - 4
  - o Tested quad for vibration off of one-axis wooden dowel stand
    - There was less vibration
    - Bumped up digital low pass filter on sensor board to 6 (was 4)
  - o Worked with Joe to test fly manual flight
  - o Tried 9.5" blades with 4.5" pitch on quad (unsuccessful, would need to be re-tuned)
  - o Implemented better quad disarming by having pilot move throttle stick down AND to the right
- Poster - 10
  - o Worked with Joe and Matt V to get poster populated, formatted, and finished for Sunday deadline

### Tyler – 8 Hours, 190.5 Total

- Implemented and tested kill switch
- Developed hardware mixer in VHDL
- Added I2C master into VHDL design
- Added Euler to Nautical component into VHDL design
- Added sqrt and atan components into VHDL Design (Needed for above component)
- Note: Incremental testing of components in simulation and hardware before combining

### Ravi – 4.5 Hours, 129 Total

- Meeting w/client - 1
- Updated website - 0.5
- Helped provide feedback on poster - 0.25
- Met with Lee to get remaining parts in stock and ask about PCBs - 1
- Organized and labeled all PCB components to speed up build process - 1.75

### Matt V. – 6 Hours, 159.75 Total

- Started work on the ping sensor, currently working on getting it to export - 6

Adam – 6 Hours, 130.5 Total

- Finished up the packet receive/send mechanism on the quad/base station - 3
  - Able to receive VRPN updates reliably at ~50Hz
  - QuadLog program working fine - must have been that Paul had screen open while trying to use it so it wasn't get data
- Started looking into incorporating the sending of command/update packets through the existing GUI - 3
  - Was able to locate 2 versions of the GUI: the version that's used during Demos and has the grid drawing, and a version that was made by last year's team that only has two tabs (it's shown on their poster from last year)
  - Not sure which of these we want to use, but in either case it should be relatively easy to have the GUIs (which run C++) call the C code to send commands and VRPN updates to the Quad

Matt P. – 8 Hours, 68.5 Total

- Integrated 10" CF blades - 5
  - Mounting holes were not large enough, required drilling
  - Blades were not balanced, required balancing
  - Tested on quad and noticed significant vibration
- Client Meeting - 1
- Looked at MultiWii attitude calculations - 2
  - They're using rotation matrices (highly optimized but appear to be what Matt is suggesting to use)
  - They are also using small angle approximations as much as possible. I believe this is for optimization and not something required at this time

Joe – 12 Hours, 249.25 Total

- Client meeting and team clerical duties - 2
- Worked on presentation poster with Paul G. Contributed to pictures, formatting, verbiage and form - 3.0
- Researched various small hardware items - 2.0
  - Recommended optimal battery for Zybo power
  - Replacement propellers
  - Fastening systems for batteries
- Lab work - 5.0
  - Worked with Matt P and Paul G to troubleshoot vibration issues causing Bluetooth to eject from vehicle
  - Tested 9.5" x 4.3 props as possible replacement for 10" x 3.8 props
  - Worked with Paul G. to fine-tune transmitter controls and complementary filter to facilitate controlled manual flight in confined area
  - Completed and documented multiple takeoff and landings of quadcopter under manually controlled flight

Jacob – 6 Hours, 130 Total

- Team Meeting - 1
- Team Documentation – 1
- Website Work - 4
  - Made a Weebly account using the new Controls Lab Gmail acct.
  - Populated website
  - Looked through current videos that should be put on YouTube and on our site

Meeting Minutes

1) Manual flight demonstration

- Awaiting delivery of replacement blades before testing can resume
- Aiming for Monday, April 20 for client demonstration

2) PID tuning

- D component is tuned in the outer loop the final PID tuning
- Matt Rich advised of a possible issue with simultaneous rotation on multiple axis
  - It may return poor Euler angle data
  - He suggested applying another matrix to the gyroscope data to correct this

3) Camera system

- Camera data is now being sent to the quad via the base station through the Bluetooth connection
- Bluetooth transmission is using packets
- Next step: Integrate camera's pitch and roll data into the analysis tool for comparison with the quad's onboard pitch and roll data (yaw?)

4) Kill Switch

- Tyler created hardware-based control
- Continuously checks the PWM output signal
- Stops the system if signal is unchanged for 0.7 seconds

5) Robust connections

- Matt P. installed IDC connectors on the Zybo board for the sensor board inputs, receiver power, receiver input signal and ESC output signal
- ESC ground wires soldered together as a common ground

6) Zybo power

- Awaiting delivery of v2.0 regulator PCB
- Source 7.4V 2-cell LiPo batteries to replace current 4 AA batteries
  - Determine ideal package size and capacity requirements for 2-cell battery (current pack supplies 1300mAh or 2100mAh depending upon the batteries)