EE CprE 491 – Fall 2019
MicroCART Senior Design Team
Weekly Report 12

Feb 2nd - Feb 13th

Faculty Advisors: Phillip Jones, Matt Cauwels, James Talbert

Team Members:

Evan Blough -- Technical Team Lead, Embedded Software Lead
Kynara Fernandes -- Ground Control Station Lead
Aaron Szeto -- Controls Lead
Joe Gamble -- Embedded Hardware Lead
Shubham Sharma -- Crazy Fly Implementation Lead, Website Manager
Jacob Brown -- Physical Hardware Lead

Summary for Progress this Week

The past week we have worked on things to prepare for the upcoming Scholar's day demo on the 29th. We continue to investigate Crazyflie integration. We have started developing for the turntable system.

Past Week Accomplishments

- Working on implementing a flight draw feature for the GCS (Evan, Kynara)
    - Created drawing pad tool for Ground Station in QT. Found and implemented built in QT classes like QPainter, QImage and QPen for this widget.
    - Mapping points into a 20x24 square grid to reduce complications when creating set points for the drone to fly to.
    - After the flight script is generated (see next accomplishment), We have an option to save it under a name to the script path.
- Wrote a .cpp file to procedurally generate flight scripts(Evan)(Appendix 1)
    - FlightScriptGenerator class
    - Takes in array of setpoints and a desired filename, scale, and orientation as constructor arguments
    - Opens a .sh file and appends take of script
    - After appending takeoff commands, it adds setpoints desired setpoints a time offset to allow the drone to adjust position accordingly
    - Closes script and grants executable permissions
- Ran a flight test with new VRPN calibration (Evan, Kyanra)
    - After re-calibrating the ground plane of the VPRN camera system
    - In order to navigate properly the drone needs to receive position data in the same manner as before
    - We referenced previous position measurements(Appendix 5) to match the x, y, and z axes to the proper locations
    - We also have to invert the roll value coming from the VPRN system to match the actual orientation of the quad.
- VRPN between the new camera system computer and the ground station works. (Evan,Shubham)

    - The ground station system had a firewall that was causing communication issues with the camera system. This is now fixed.
    - Old project folders are added to the computer, hence retrieving the original camera calibration.
- Tested communication interval speed between the new camera system and the ground station. (Shubham, Evan)
    - Based on 2000 UDP packets sent, the average time in between position packet arrivals is 9ms
    - View Appendix 2 for breakdown of packets sent.
- Interfaced with Microstick II (Joseph)
    - Interfaced software and firmware on the Microstick II platform to begin development
        - Utilized Microchip tools such as MPLab IDE X and MPLab code configurator
    - Working to determine which microcontroller to utilize to interface with shaft signals the options are:
        - PIC32MX - General purpose 32-bit microcontroller
        - PIC33F – 16-bit signal controller, Contains a QEI (Quadrature Encoder Interface) which will interface directly with one of the two shaft encoders

Pending Issues

- Fixing Adapter for CF.
    - Research on the approach used in the previous CF adapter. Found here.
    - Based on the previous approach work on a plan to create a new version of the adapter
- Drone not flying under new camera system
    - Possibly recivining wrong position data from GCS
    - Tried viewing flight data logs from quad to view error, but that is another issue
- Log files from drone flight currently not being generated
    - Communication is occurring between the drone and the GCS, but no packets that contain log info are being received from the quad
    - To diagnose issue we will run drone software in debug mode and ensure log packet breakpoints are being reached

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Evan Blough	Developed .ccp class for backend functionality of draw flight script feature. Reconfigured VPRN camera system to match old axes mappings. Ran flight test.	13	23
Kynara Fernandes	Designed and implemented GCS Draw to Flight Path tool. Ran a flight test with new VRPN calibration.	12	22
Joe Gamble		13	23

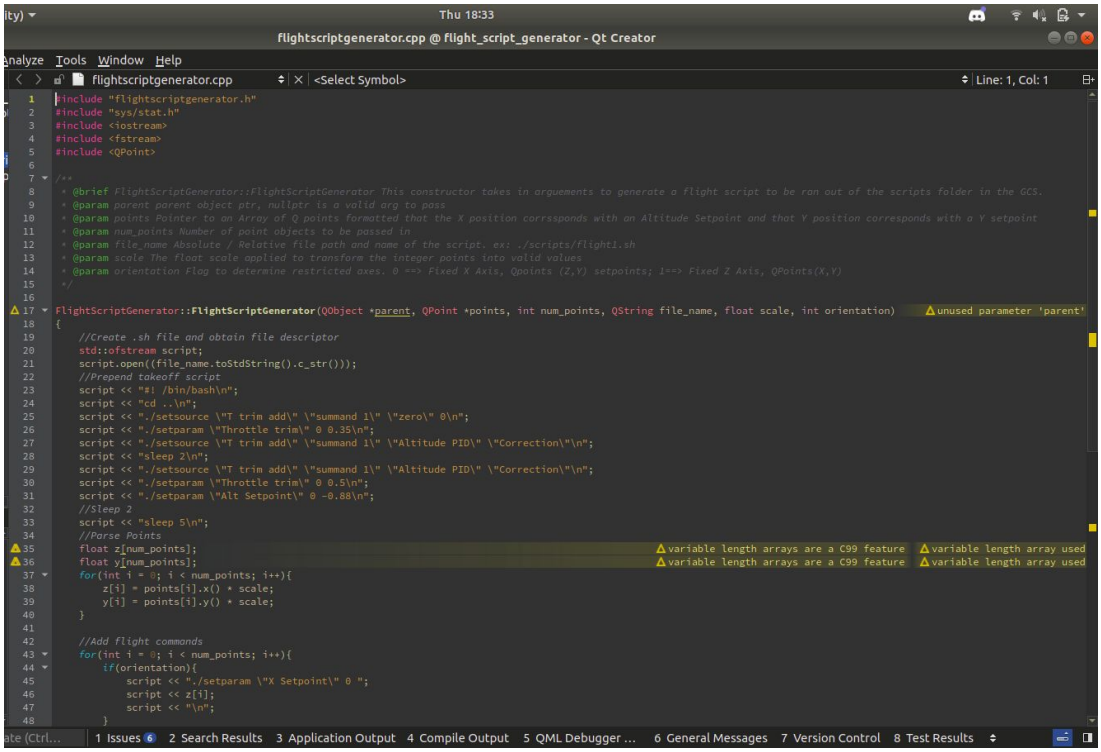
Jacob Brown	Model of crazyflie testing platform - still need to plan wire routes and bearing/encoder placement	8	916
Aaron Szeto			9
Shubham Sharma	VRPN between the new camera system computer and the ground station works. Tested communication interval speed between the new camera system and the ground station.	12	24

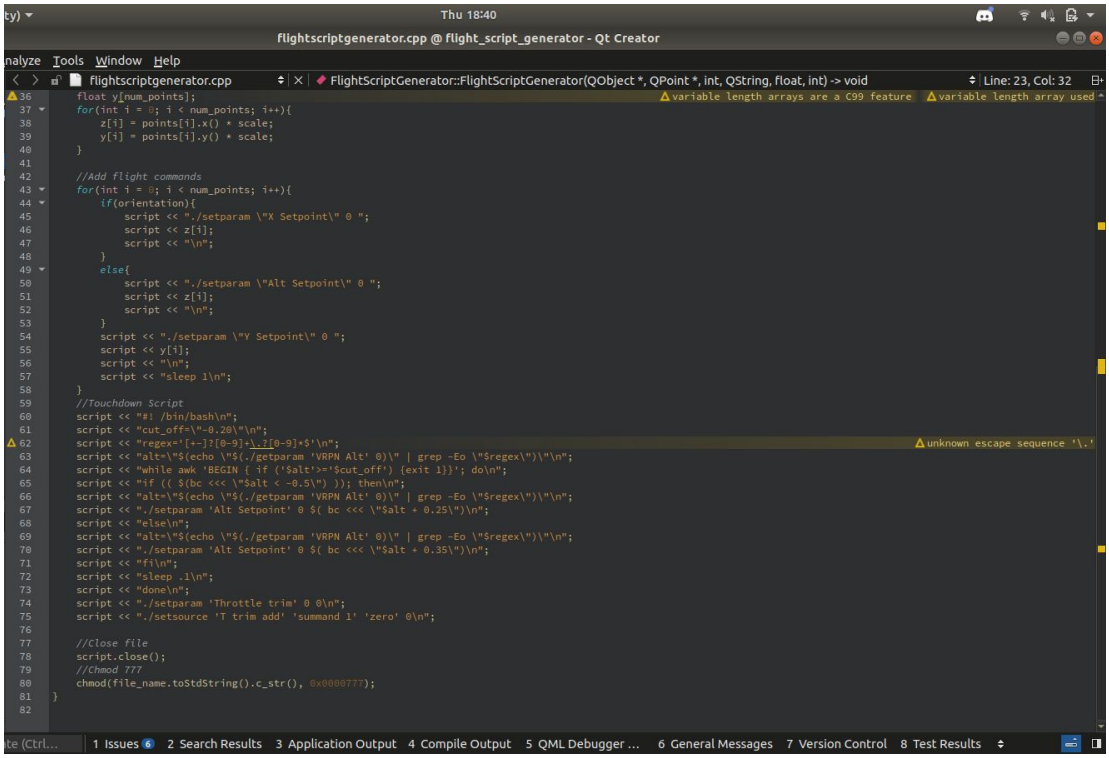
Plans for Coming Week

- Modularity for GUI. Create a design for other control algorithms GUIs
- Backend code modification to set up communication between the new camera system computer and the ground station
- Fixing CF Adapter
- Writing documentation for setting up the camera system and the calibration.
- Attempt to interface with QEI
- Completing the draw to the flight path feature for the GCS.
- Crazyflie test model wiring plan and encoder placement

Appendix:

1 FlightScriptGenerator Class



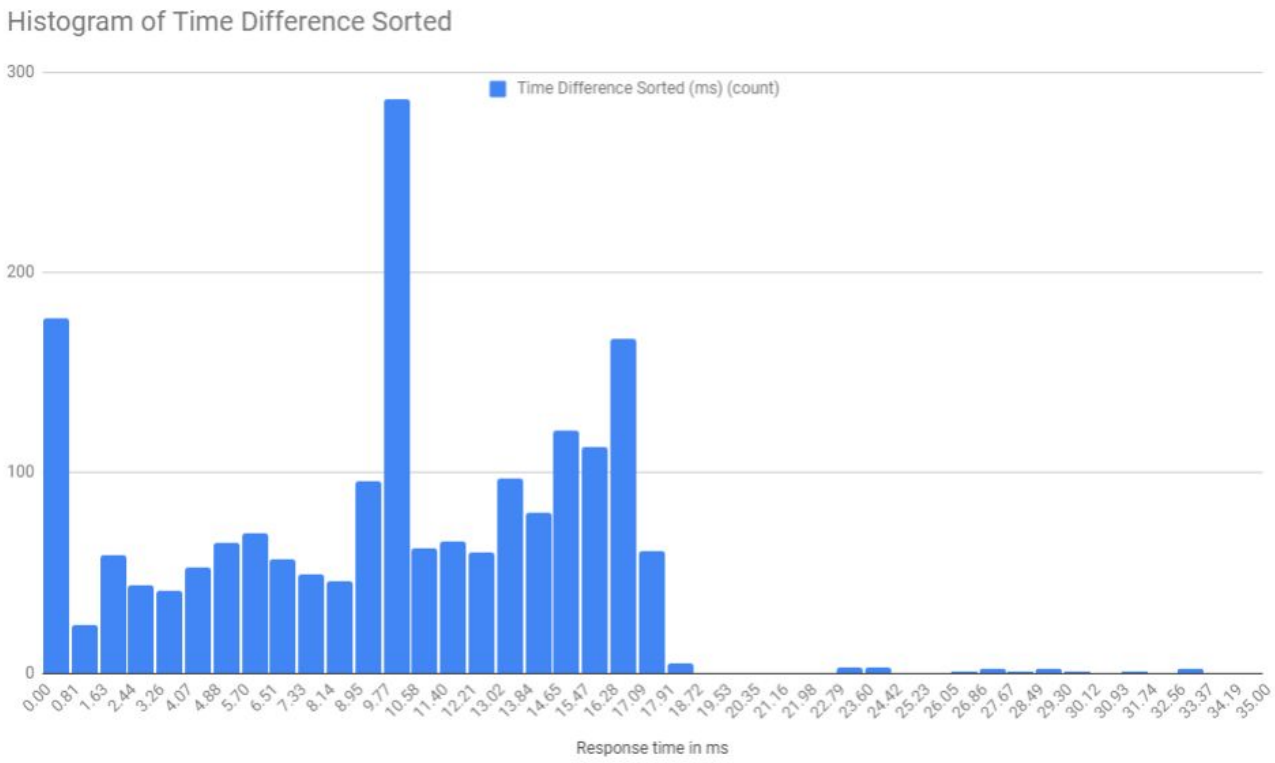



```
    float y[num_points];
    for(int i = 0; i < num_points; i++){
        z[i] = points[i].x() * scale;
        y[i] = points[i].y() * scale;
    }

    //Add flight commands
    for(int i = 0; i < num_points; i++){
        if(orientation){
            script << "./setparam \"X Setpoint\" 0 ";
            script << z[i];
            script << "\n";
        }
        else{
            script << "./setparam \"Alt Setpoint\" 0 ";
            script << z[i];
            script << "\n";
        }
        script << "./setparam \"Y Setpoint\" 0 ";
        script << y[i];
        script << "\n";
        script << "sleep 1\n";
    }
    //Touchdown Script
    script << "#! /bin/bash\n";
    script << "cut_off=\"-0.20\"\n";
    script << "regex='[+-]?[0-9]+\.?[0-9]*$'\n";
    script << "alt=\"$(echo \"$(./getparam 'VRPN Alt' 0)\" | grep -Eo \"$regex\")\"\n";
    script << "while awk 'BEGIN { if ('$alt'>='$cut_off') {exit 1}}'; do\n";
    script << "if (( $(bc <<< \"$alt < -0.5\") )); then\n";
    script << "alt=\"$(echo \"$(./getparam 'VRPN Alt' 0)\" | grep -Eo \"$regex\")\"\n";
    script << "./setparam 'Alt Setpoint' 0 $( bc <<< \"$alt + 0.25\")\n";
    script << "else\n";
    script << "alt=\"$(echo \"$(./getparam 'VRPN Alt' 0)\" | grep -Eo \"$regex\")\"\n";
    script << "./setparam 'Alt Setpoint' 0 $( bc <<< \"$alt + 0.35\")\n";
    script << "fi\n";
    script << "sleep .1\n";
    script << "done\n";
    script << "./setparam 'Throttle trim' 0 0\n";
    script << "./setsource 'T trim add' 'summand 1' 'zero' 0\n";

    //Close file
    script.close();
    //Chmod 777
    chmod(file_name.toStdString().c_str(), 0x0000777);
}
```

2. Histogram with the breakdown of packets sent to the ground station.

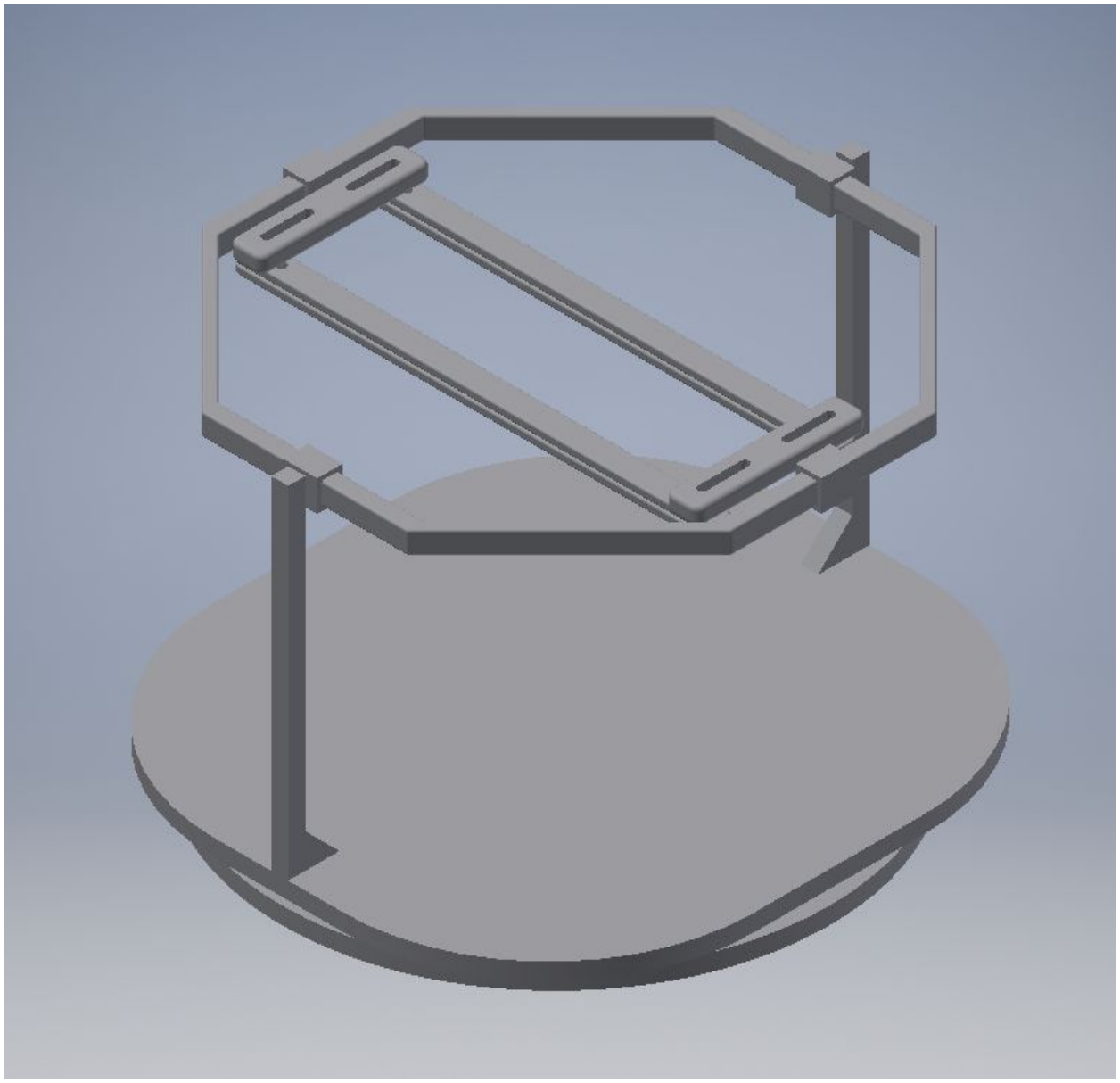


3.

Encoder datasheet links
S4T
MA3
MAE3

Microstick links
Microstick specs

4. 3-D Model of “Crazyflie” testing platform



5. Axis illustration by tile number

Y+				Y-	
GCS					
1	2	3	4	5	X-
6	7	8	9	10	
11	12	13	14	15	
16	17	18	19	20	

21	22	23	24	25	
26	27	28	29	30	X+