EE CprE 491 – Fall 2019
MicroCART Senior Design Team
BiWeekly Report 13

Feb 14th - Feb 27th

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

We have finished implementing the second large drone. We now have two platforms to test new features on. We started integrating the crazyflie adapter. The quad turntable's embedded systems have been planned out more in depth. The quad turntable physical component models are in the process of being designed.

Past Week Accomplishments

- Flashed a ESP2866 wifi chip with client mode firmware and in the process of testing integration with GCS software (Evan)
- Retook drone sensor measurements and made excel Sheet (Appendix) (Evan)
    - Slight differences in orientation readings of IMU accounted for flight instability of quad 2
    - Soldered and attached a new IMU unit to the quad and autonomous flight for both quads is supported
- Embedded system structure determined (Joe)
    - 2 QEI interfaces, one shaft encoder
    - Built on the MSP430 using code composer IED
- Fixed Data logging issue. RTdatalogs didn't work with current GCS, so I re-enabled old log printing. Sample output (Appendix)
    - Postflight data logging will help users and developers use our system by allowing advanced diagnostics
- Got the old teams crazyflie adapter to compile (Shubham)
    - The errors were mainly Makefile configuration issues which is now fixed
    - Working on configuring the config files to work with the new camera system.
- Took more detailed readings of 5000UDP packets from both the old & new camera system. (Shubham)
    - Conclusion: Both computers perform similarly with a response time of avg 9.9ms
    - Graphs are attached in the appendix.
- Building models of drone test platforms (Jacob)

Pending Issues

- Connecting crazyflies to GCS
    - Confirmation packet sent to crazyflie, but not received by crazyflie

Individual Contributions

Team Member	Contribution	Bi-Weekly Hours	Total Hours
Evan Blough	I diagnosed the second drone's flight issue. I Re-enabled old postflight logs, because the current backend doesn't support RT logging anymore.	13	36
Kynara Fernandes	(She has not been in ames for the past week because she has been dealing with a family emergency)		
Joe Gamble	Researched QEI and ADC Interfaces and began writing test code. Found a viable system to build the embedded system. Soldered an IMU	12	35
Jacob Brown	Building models of drone test platforms	15	30
Aaron Szeto	Began researching code for new QEI. Tested my codes on the old encoders. Looked into applying encoders in Matlab	12	30
Shubham Sharma	Got the old teams crazyflie adapter to compile. Took more detailed readings of 5000UDP packets from both the old & new camera system.	16	34

Plans for Coming Week

- Development of QEI and ADC test code
- Setup rotary encoders to evaluate performance
- Work on configuration of the Crazyflie adapter to work with the new systems.
- Develop Flight scripts and tune drone autonomous navigation accuracy for demo on saturday
- Begin validating client mode configuration for drone wifi chips

Appendix:

Drone sensor readings taken from xsdk debugger to diagnose IMU issue.

Notch 8 (Quad 2)		Quad 2 IMU		Quad 1 IMU				

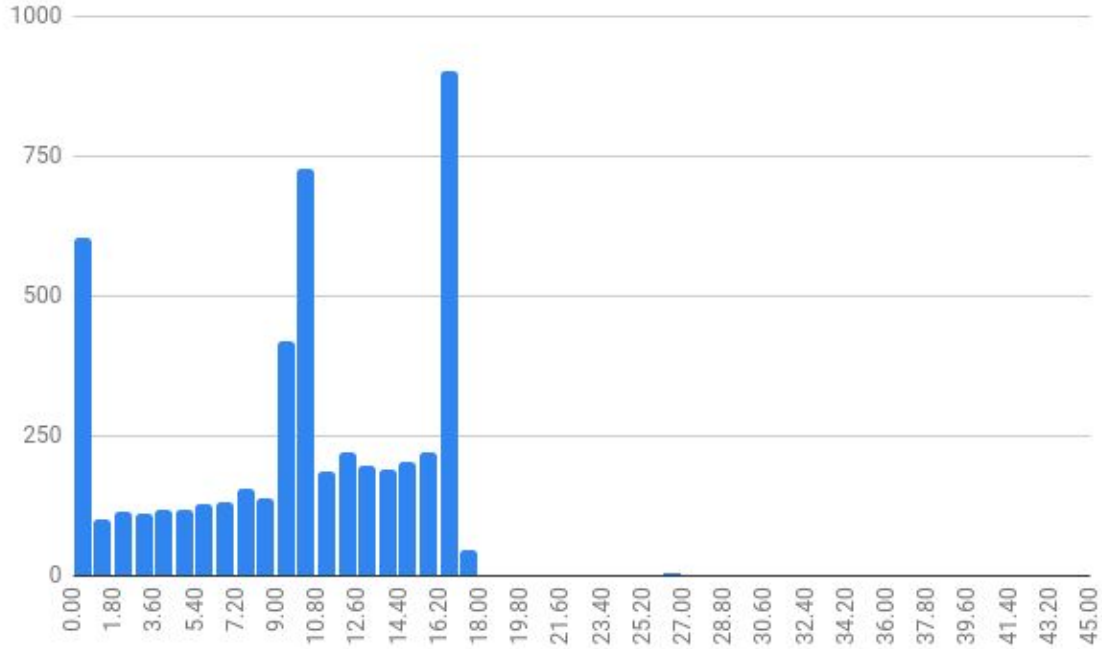
Motor 1	1	gyr_x	0.014	gyr_x(degrees/sec)	0.0015			
Motor 2	1	gyr_y	-0.0002	gyr_y	0.00615			
Motor 3	0.791	gyr_z	0.0221	gyr_z	0.00287			
Motor 4	0.6522	pitch_angle_filtered	-0.0001789	pitch_angle_filtered	-0.0001494	0.0000295	radians	
Notch 8 (Quad 1)		roll_angle_filtered	0.0004433	roll_angle_filtered	-0.000109	0.0005523	radians	
Motor 1	1	yaw_angle_filtered	-1.16	yaw_angle_filtered	0.38			
Motor 2	0.767	acc_x	0	acc_x	0			
Motor 3	1	acc_y	0	acc_y	0			
Motor 4	0.77	acc_z	0	acc_z	0			
		lidar_alt	-0.163	lidar_alt	-1.11			
Measurements from sensor_processing	Right on Y Axis	Left on Y Axis	Regular Y	Forward X Axis	Back X Axis		Pitch value/degree	Roll value/degree
pitch_angle	0.000212	0.0006	0.0001	-0.014	0.012		0.000072222222222	0.000073888888889
roll_angle	0.0123	-0.0143	0.0007	0.00095	0.0009			
						Roll Diff	0.0000295	0.39924812003
			Range Pitch	0.026		Pitch Diff	0.0005523	7.647230769
			Range Roll	0.0266				

Output log from drone

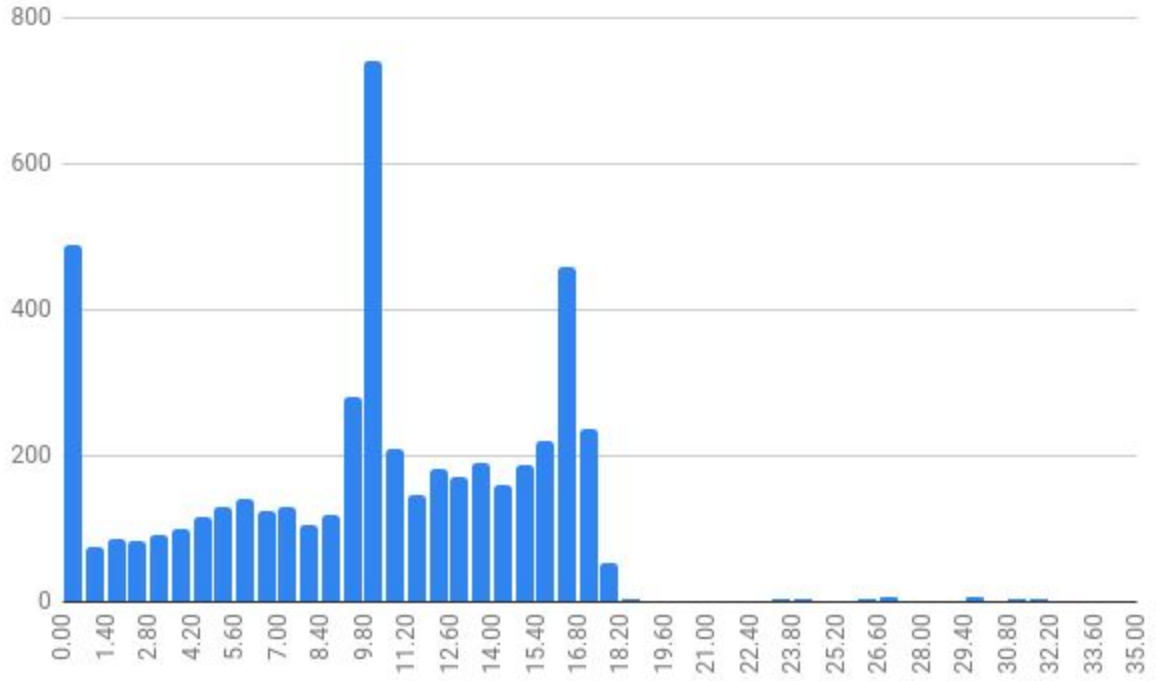
Open ▾ 2020-02-23_7:55_0.txt ~/Desktop/MicroCART/groundStation/logs Save

```
# MicroCART On-board Quad Log
# Sample number: 31235
# IMU IIC failures: 0
# LiDAR IIC failures: 0
# Optical Flow IIC failures: 31237
# Roll PID :     Kp = 35.000000 Ki = 0.000000 Kd = 1.000000 Alpha = 0.880000
# Pitch PID :    Kp = 35.000000 Ki = 0.000000 Kd = 1.000000 Alpha = 0.880000
# Yaw PID :      Kp = 2.600000 Ki = 0.000000 Kd = 0.000000 Alpha = 0.000000
# Roll Rate PID :       Kp = 0.030000 Ki = 0.000000 Kd = 0.005000 Alpha = 0.880000
# Pitch Rate PID :      Kp = 0.030000 Ki = 0.000000 Kd = 0.005000 Alpha = 0.880000
# Yaw Rate PID :        Kp = 0.297000 Ki = 0.000000 Kd = 0.000000 Alpha = 0.000000
# X pos PID :    Kp = 0.550000 Ki = 0.007500 Kd = 0.000000 Alpha = 0.000000
# Y pos PID :    Kp = 0.550000 Ki = 0.007500 Kd = 0.000000 Alpha = 0.000000
# Altitude PID :        Kp = -0.098040 Ki = -0.008170 Kd = -0.073530 Alpha = 0.880000
# X Vel PID :    Kp = -0.100000 Ki = 0.000000 Kd = -0.020000 Alpha = 0.000000
# Y Vel PID :    Kp = 0.100000 Ki = 0.000000 Kd = 0.020000 Alpha = 0.000000
# X Vel :        Kp = 0.000000 Ki = 0.000000 Kd = -1.000000 Alpha = 0.880000
# Y Vel :        Kp = 0.000000 Ki = 0.000000 Kd = -1.000000 Alpha = 0.880000
%Time    accel_x accel_y accel_z gyro_x  gyro_y  gyro_z  mag_x   mag_y   mag_z   Roll_Constant   Yaw_Constant    X_Setpoint_Constant     Y_Setpoint_Constant     Alt_Setpoint_Constant   Yaw
  Setpoint_Constant       Lidar_Constant  VRPN_X_Constant VRPN_Y_Constant VRPN_Alt_Constant       Flow_Vel_X_Constant     Flow_Vel_Y_Constant     Flow_Quality_Constant   Altitude_PID_Correction  X_pos
  PID_Correction  Y_pos_PID_Correction    Pitch_PID_Correction    Roll_PID_Correction     Yaw_PID_Correction      Pitch_Rate_PID_Correction       Roll_Rate_PID_Correction        Yaw_Rate_PID_Correction  Pitc
  trim_add_Sum    Signal_Mixer_MOTOR_0    Signal_Mixer_MOTOR_1    Signal_Mixer_MOTOR_2    Signal_Mixer_MOTOR_3    X_Vel_PID_Correction    Y_Vel_PID_Correction    X_Vel_Correction        Y
  Vel_Correction  OF_Offset_Angle_Rotated_X       OF_Offset_Angle_Rotated_Y       OF_Integrate_X_Integrated       OF_Integrate_Y_Integrated       PSI_Sum_Sum     Mag_Yaw_Constant
&s      G       G       G       rad/s   rad/s   rad/s   uT      uT      uT      10ns_dutycycle  rad     rad     rad/s   rad/s   rad/s   10ns_dutycycle  10ns_dutycycle  10ns_dutycycle  rad
  10ns_dutycycle  10ns_dutycycle  10ns_dutycycle  10ns_dutycycle  rad     rad     m/s     m/s     m/s     m/s     m       m       rad     rad     rad     rad     m       m       m       m       m
  m       m       m       m/s     m/s     none
0.000000        -0.000147       0.000000        0.000000        0.000000        0.000000        0.000000        -0.006005       0.000000        0.000000        0.000000        0.000000
  0.000000        0.000000        0.000000        0.000000        0.000000        -2.022672       0.020107        0.000000        -0.060769       0.000653        0.004760        0.044488
  0.131366        0.019348        0.142192        0.011134        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000
  0.000000        0.000000
0.005003        -0.000224       0.000000        0.000000        0.000000        0.000000        0.000000        -0.008639       0.000000        0.000000        0.000000        0.000000
  0.000000        0.000000        0.000000        0.000000        0.000000        -2.029046       0.024668        0.000000        -0.061120       0.000790        0.004380        0.044252
  0.131960        0.018481        0.142380        0.011299        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000
  0.000000        0.000000
0.010006        -0.000301       0.000000        0.000000        0.000000        0.000000        0.000000        -0.011076       0.000000        0.000000        0.000000        0.000000
  0.000000        0.000000        0.000000        0.000000        0.000000        -2.015702       0.028975        0.000000        -0.060385       0.000759        0.004380        0.044014
  0.131796        0.019786        0.142075        0.012544        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000
  0.000000        0.000000
0.015008        -0.000391       0.000000        0.000000        0.000000        0.000000        0.000000        -0.013357       0.000000        0.000000        0.000000        0.000000
  0.000000        0.000000        0.000000        0.000000        0.000000        -2.003532       0.033858        0.000000        -0.060037       0.001240        0.003748        0.043786
  0.131599        0.019021        0.141575        0.014005        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000
  0.000000        0.000000
0.020010        -0.000475       0.000000        0.000000        0.000000        0.000000        0.000000        -0.015518       0.000000        0.000000        0.000000        0.000000
  0.000000        0.000000        0.000000        0.000000        0.000000        -1.992542       0.039115        0.000000        -0.059882       0.001221        0.004064        0.043569
  0.131147        0.019511        0.141717        0.013825        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000        0.000000
```

- **OLD Camera System: Windows 7**



- **NEW Camera System: Windows 10**



Notice the significant variation of response times between the two computers.

- **Notes from the histograms:**

	Windows 7 (ms)	Windows 10 (ms)
Total Average Response Time	9.923926899	9.940743803
Average Response Time for all packets above 1ms	11.26303364	11.02808404