

EE / CprE / SE 491 – sdmayAB-CD

PROJECT TITLE

Week N Report

Start Date – End Date

Client: ACME

Faculty Advisor: Phillip Smith

Team Members:

Brendan Johnson — *Controls Software Key Concept Holder*

Kris Williams — *Ground Station Key Concept Holder*

Joe Jones — *Quadcopter Software Key Concept Holder*

Jake Brown — *Team Webmaster*

Eric Davis — *Hardware Maintainer*

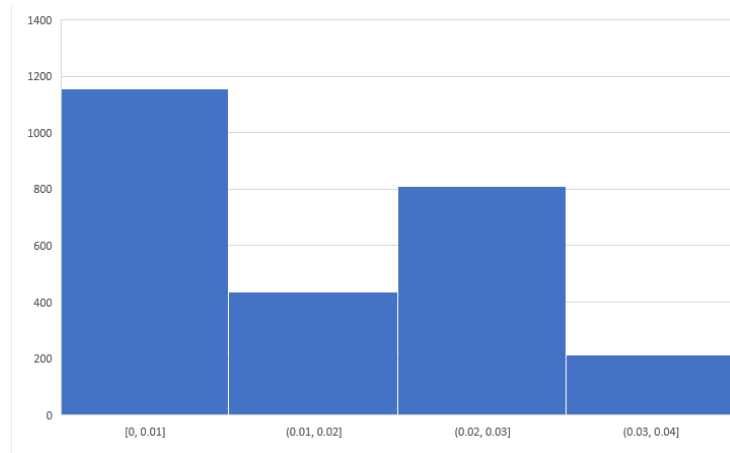
Tara Miller — *Team Communications Leader*

Andy Wilson — *Control Systems Key Concept Holder*

David Moore — *Team Leader*

Past Week Accomplishments

- VRPN Latency Investigation - David
 - Investigated ground station \leftrightarrow quad link, and found that Nagle's algorithm was resulting in bundling of up to 13 VRPN updates. Was able to recreate the issue in a standalone script. Set socket option TCP_NODELAY which fixed the issue.
 - Re-ran timing on camera system computer after a restart and router restart, and still saw 20ms delays.
 - Implemented dynamic sampling time adjustment to account for time difference in arrival of VRPN updates. The sampling time (The time that the derivative is divided by, and the integral is multiplied by) is determined by multiplying the difference in packet ID by 10ms.
 - Discussed with Matt, and it sounds like it should help approximate the derivative and integral terms better.
 - Distribution of arrival packet ID differences on quadcopter:



- - Computation Graph Updates - David
 - Implemented logging. Can simply provide a list of nodes, with outputs and parameters to log. Space for the entries is allocated, and stored upon each loop iteration.
 - Logs are returned as a csv, and can be immediately opened with Excel/LibreCalc, or imported to Matlab.
 - Was able to increase log storage to 8192 entries (41 seconds) because we only store the actual float values now, instead of a larger log_t struct.
 - Debugged and fixed bug where all controllers had output of infinity (noticed after implementing logging)
 - The implementation of having blocks only execute if their inputs have been updated, to allow for different sampling rates, resulted in an edge-case bug.
 - Now we only clear “updated” flag for nodes that were actually processed, instead of all of them, which fixes the issue.
 - Added check for bug in regression tests.
 - GUI Work - Jake
 - QT project created in a branch (gui-dev)
 - Main tab - manages backend
 - Starting backend internally works, as does connecting to standalone backend
 - Signal/Slot infrastructure in place to manage connections of all workers based on connection status from this tab
 - Tracker tab - shows XYZ/PRY from VRPN
 - Worker and worker thread implemented
 - Timer/manual refresh
 - LIDAR Library implemented on Quad - Brendan
 - Functions have been tested and are ready for use.
 - Following up on pitch/roll causing height errors
 - Laser has a 0.5 degree divergence, so it sounds like we are dealing with a fairly straight beam, not a sonar like wave.
 - Laser can operate at 40m, and at that height, we would experience about 60 cm of error at a 10 degree pitch or roll.
 - In the lab, we can only operate at about 3m, and a 10 degree roll pitch would case a 4 cm height error.
 - Analyzed IMU filter data - Tara and Andy

- o Determined standard deviation and mean of all filters on IMU
- o Mean was about the same for all
- o Variance decreased with decreasing filter bandwidth
- o Matt briefly looked at compiled data, believes we should use the highest bandwidth filter and implement our own filters
- Fixed I2C bus freezing issue - Brendan
 - o Solution was to copy and paste the polling function we were using for writes, and then to simply add a check for the NACK in the completion while loop.
 - o More information available on gitlab: <https://git.ece.iastate.edu/sdmayAB-CD/issues/1>
- Prepare and gave midterm presentation - Everyone
 - o Gave it to 492 professor
 - o Discussed project and our current setup
 - o Additionally discussed our accomplishments so far, and our goals
 - o We were given critiques for things to improve for our final presentation:
 - Include a summary of what was discussed
 - Keep the detail we were discussing, he said he preferred a large amount of detail
 - Do not have our team picture at the end

Pending Issues

- VRPN packets are getting bunched into 2's and 3's - Everyone
- Quad seems to be flying backwards in autonomous? - David
 - o Pretty sure the trackable is just rotated 180, but need to log yaw orientation to verify.

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Brendan Johnson	Fixed I2C freezing issue, presentation	7	207
Kris Williams	Mainly talked about what I needed to do with others. Planning for this week.	8	149
Joe Jones	Continued software development on quad control	6	187.5
Jake Brown	GUI - Managing Backend / Worker Threads	6	107
Eric Davis	Presentation, revised schematics	8	225
Tara Miller	Analyze IMU filter data, Helped test autonomous	5	203
Andy Wilson	Presentation, IMU filter data compilation	8	212
David Moore	Work regarding VRPN latencies, logging in computation graph, bug in computation graph, presentation	12	260

Plans for Coming Week

- GUI - Jake
 - o Redirect stdout from internal backend to the GUI

- Actually connect tracker worker to backend
 - Tracker will maintain ownership of connection
 - Connect/Disconnect slots activated by the Start/Stop buttons on the main tab
- Work with Kris on doing the controller-graph tab
 - Needs frontend_getnodes and frontend_getparams(node)
 - Render graph with dot, and then use dropdowns to configure params
- Create a worker for handling controller parameters
- Create a setpoint worker/setpoint tab
- Continue investigating VRPN latencies - David
 - Try wiring the camera computer directly to the ground station
 - Will try flight test with dynamic sampling time to see if it improves response
 - Might try some “network tweaks” on camera computer to prioritize low-latency
- Shared Folder - Kris
 - Shared folder between quad code and ground station code
 - A number of files are effectively shared, they just aren’t physically being shared yet.
 - Moving files into folder and verification that system still works as before
- Backend ← → Quad Commands - Kris
 - Update to the new controller network implementation
 - Dynamic controller configuration and identification