Progress Review 7

Cole Gulino

Team C / Column Robotics

Teammates: Job Bedford, Erik Sjoberg, Rohan Thakker

ILR # 6

January 28, 2016

Individual Progress

This project I mainly worked on getting the high-speed connection working between the pixhawk flight controller and the Odroid XU4 on-board computer.

Figure 1 shows a diagram of the electrical connections between the pixhawk and Odroid XU4.
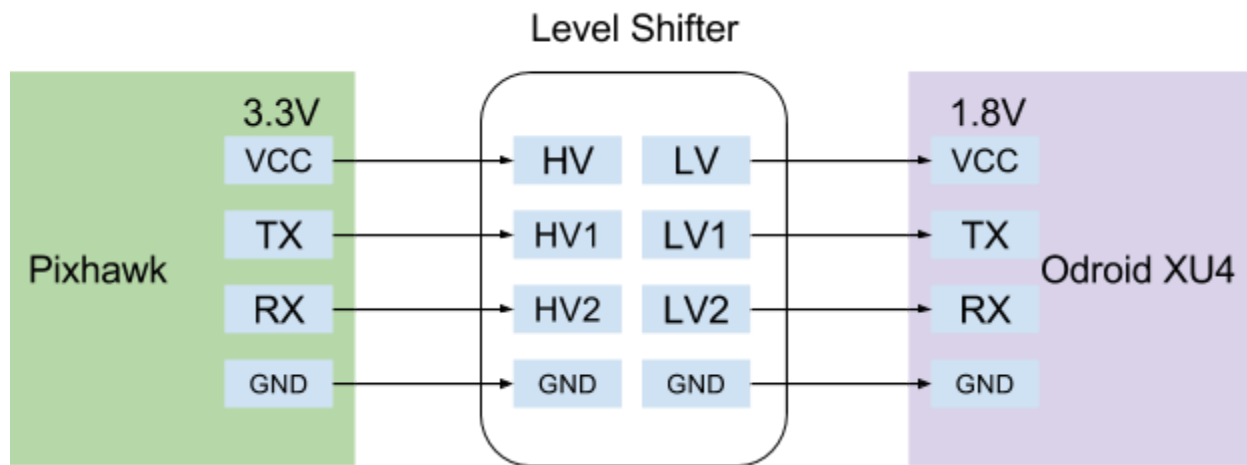

Figure 1) Electrical Diagram of Communication Between Pixhawk and Odroid

Most of the individual work I did was to test and fabricate the wiring to furnish this connection. The rest of the work was done together with Rohan Thakker as described in the Teamwork section.

Challenges

The major challenges were in getting the hardware to interact correctly. There are multiple ports on the Pixhawk that publish data from the IMU through a UART connection. We desired a UART connection due to its speed and reliability. The firmware that we were running the Pixhawk on provided many difficulties. The first major difficulty was that the documentation was very poor for the original firmware [1]. One of the major challenges was that the current firmware did not allow communication from some of the ports. We attempted to communicate using one of the ports, but the firmware would not initiate sending of information unless we sent a command to slow down the data transfer. This resulted in lower speeds. Another major problem was that the apm firmware only published global reference information from the IMU. The local topics were never published.

After many hours of working with the original firmware, we shifted to the PX4 firmware [2]. Unlike the APM firmware, the PX4 firmware is designed with developers in mind. Because of

this, the documentation is much stronger and there are more things you can do with the firmware. The PX4 firmware also publishes the local position estimates from the IMU. By switching to the PX4 firmware, we were able to get high speed communication between the PX4 and the Odroid.

Teamwork

Most of the work I did during the last two weeks was done in conjunction with Rohan Thakker. Together we worked on the software and hardware communication. As described above in the Challenges section, we were able to get global, position, and optical flow information published from the Pixhawk to the Odroid XU4.

The communication protocol that we used was MAVlink [3]. In order to utilize the information from the MAVLink protocol, we used the ROS wrapper, mavros [4]. Using this method, we were able to get the communication speeds as shown in Table 1.

Information	Speed (Hz)
IMU data	200
Position Estimates	90

Table 1) Information and Transfer Speed from Pixhawk to Odroid XU4

The teamwork aspect worked very well. There was a lot of work and research that needed to be done in order to get the communication up and running. It also helped to have multiple eyes on the problem. When debugging the many hardware and software issues, it was helpful to have fresh eyes, because we often missed simple things.

Another teamwork trick that we utilized was with having two Iris+ drones. While we were working on one Iris+ drone, Erik was working on the second Iris+. At first he was repeating the work we did last semester, but towards the end, he started working on the PX4 firmware first. By working in parallel we were able to see that the PX4 was the way to go without the risk of wasting time on it. This parallel work on difficult problems was a great tool that we shall be using in the future.

Future Work

In the next two weeks, me and Rohan will be extending the work that we do. We will be working on utilizing the messages from the IMU and the optical flow camera in order to see how accurate the position estimates are and how we can utilize the data. The end result will be a demo on autonomous hovering of the Iris+.

Job will continue working on the AR.Drone for our risk mitigation strategy while also working on April tag tracking which will be extensible to the Iris+.

Erik will be working on using the RGB-D sensor on the front of the drone to do SLAM. He will be using this to map a location in the B-level basement in order to see if we can do proper global localization there.

Resources

[1] APM Firmware
[2] PX4 Firmware
[3] MAVLink
[4] mavros