Individual Lab Report 4

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Team A / The Avengers

Teammates: Tushar Agrawal, Pratik Chatrat, & Adam Yabroudi

ILR04

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1. Individual Progress

Over the past two weeks, I've (a) rebuilt and performed initial tests on the Pioneer 2, (b) built sensor mounts, (c) contributed to the UAV build, and (d) assisted Pratik with sensor testing.

a. Pioneer 2 Rebuild

The major work done last week was a complete teardown and rebuild of the Pioneer 2. The work done on the UGV prior to the team acquiring it caused me concern over the past few weeks. Not that any specific issues were noticed, but had not been reassembled correctly. That indicated to me that there may be other issues "beneath the hood."

After careful disassembly, I was able to identify several obstacles with the help of Adam Yabroudi. Numerous internal cables had been disassembled and a DC-to-DC power converter (visible in Figure 1) had been mounted under the top panel.

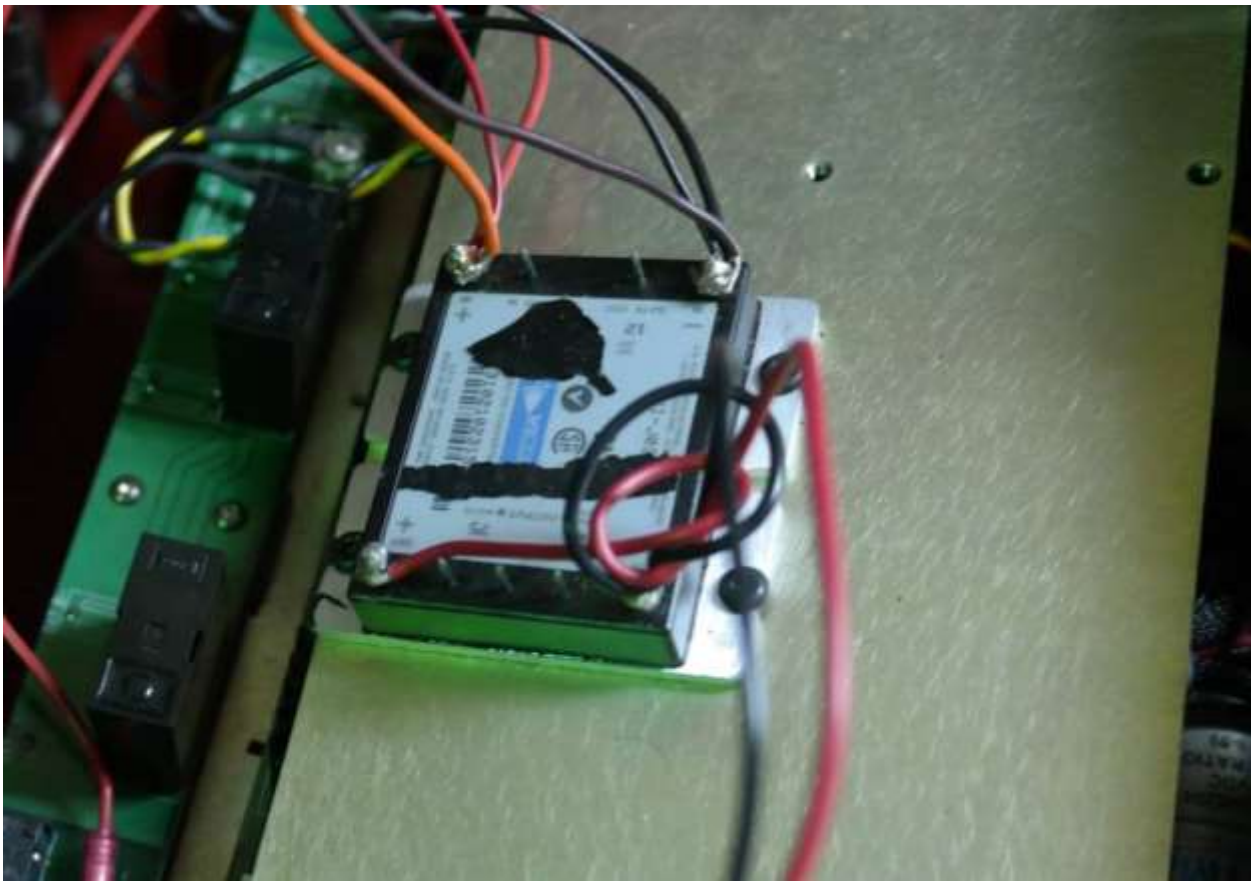

Figure 1: DC-to-DC Power Converter installed in the Pioneer 2

The power converter seems to have been installed due to damage on the battery terminals within the robot. Several of these contacts are bent or mashed into their housing, which would prevent a reliable connection with the batteries. For this reason, I may reinstall the power converter. However, the robot was successfully powered by the desktop power supply. Confirmation of this is given in Figure 2. We will continue to test the system from this setup for the time being.

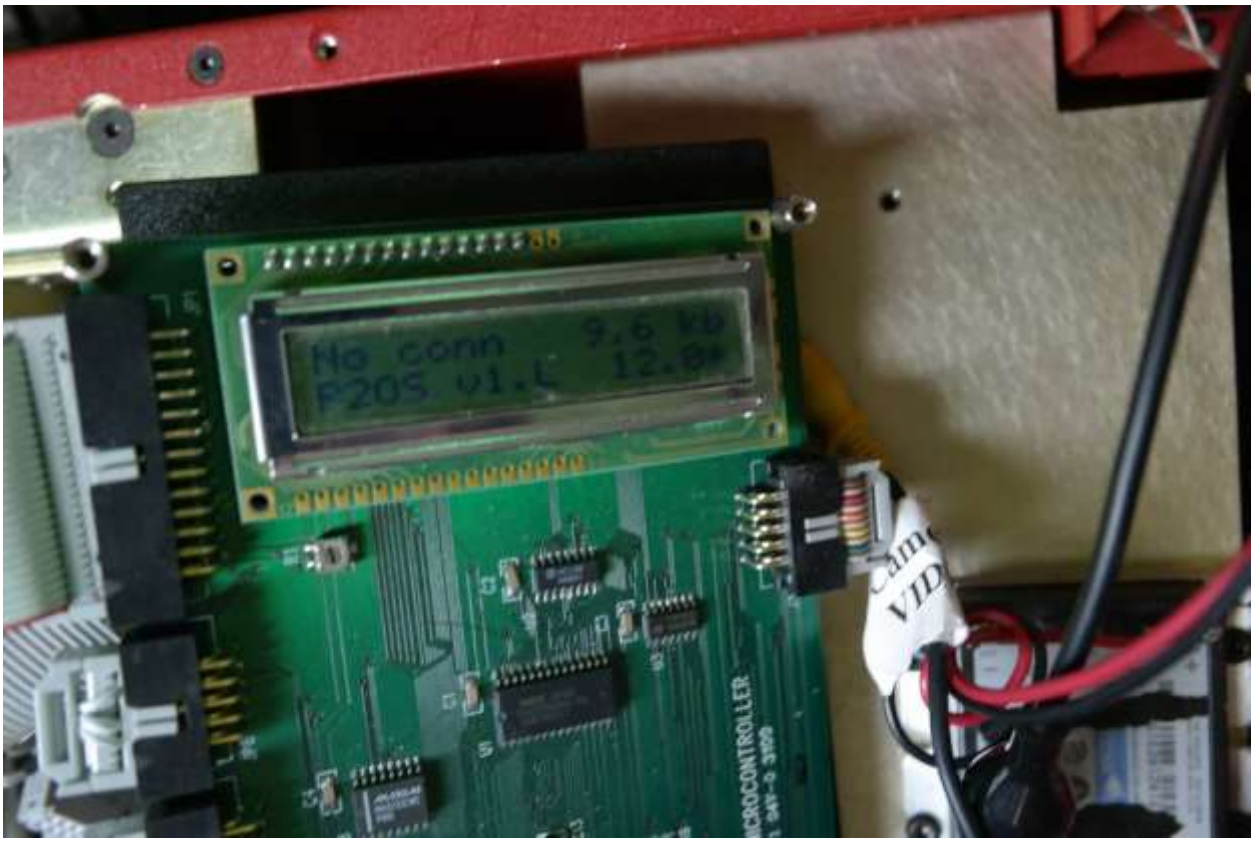

Figure 2: LCD Readout of Pioneer 2

Additionally, Adam and I noticed that the sonar arrays within the Pioneer had been disconnected. This was likely due to wiring problems associated with incorrect reassembly by the previous team. I reattached the sensors and install RosAria in Ubuntu. Through that setup, I was able to view a live feed of the readings via the <*rostopic echo*> command in ROS.

b. Sensor Mount

In order for Pratik to test sensor arrangements, I built several simple mounting brackets for him. The mounts were cut from a thin piece of sheet metal scrap found in the lab. An example can be seen in Figure 3.

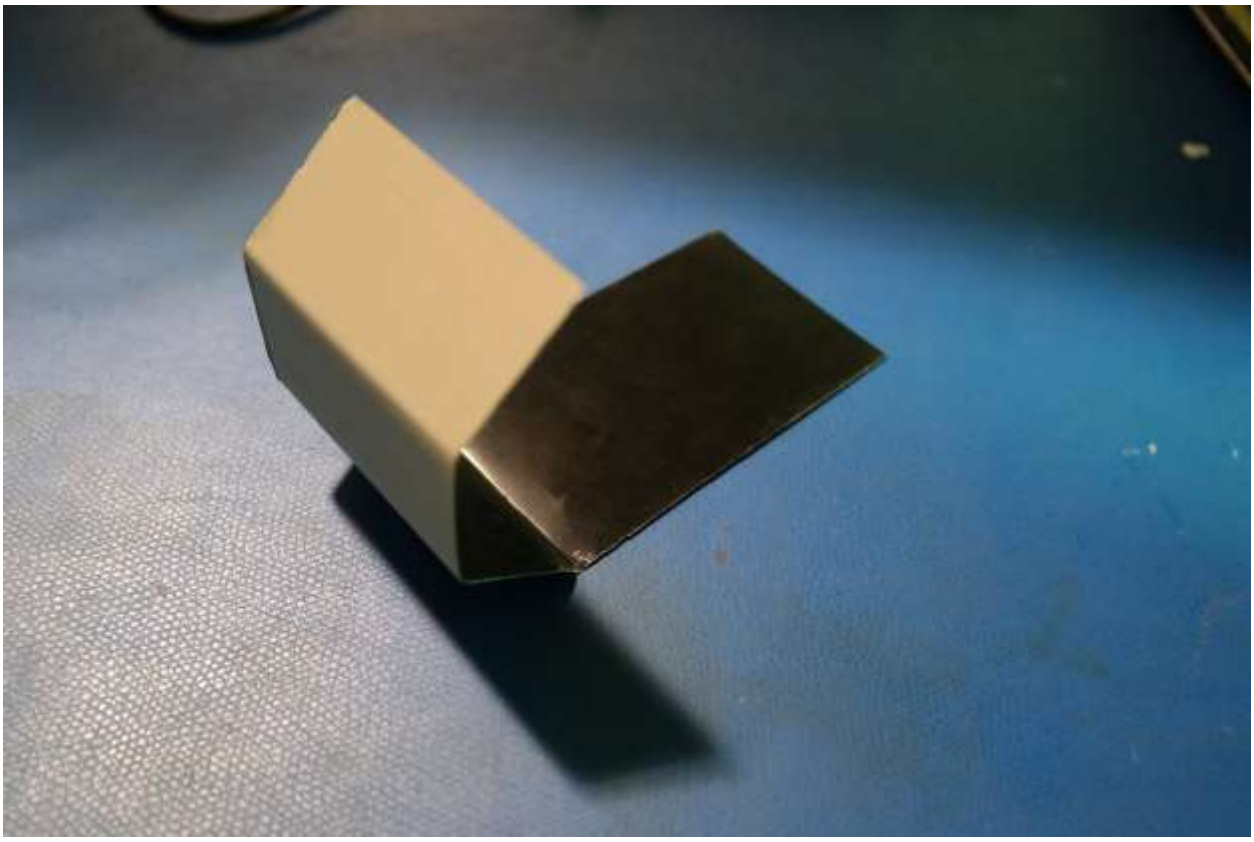

Figure 3: Basic Sensor Mount

The long, flat portion of the mount attached to the drone mockup we've been using to test sensor and wiring layouts. IR and ultrasound sensors were mounted on the three smaller portions. In the arrangement shown, sensors could be angled at 45°, 90° (horizontal), and 135° relative to the mounting surface. Through testing, Pratik settled on a slightly modified version of the above, angling the sensors at 90° (horizontal), 135°, and 180° (ground facing). The final setup can be seen in Figure 4.

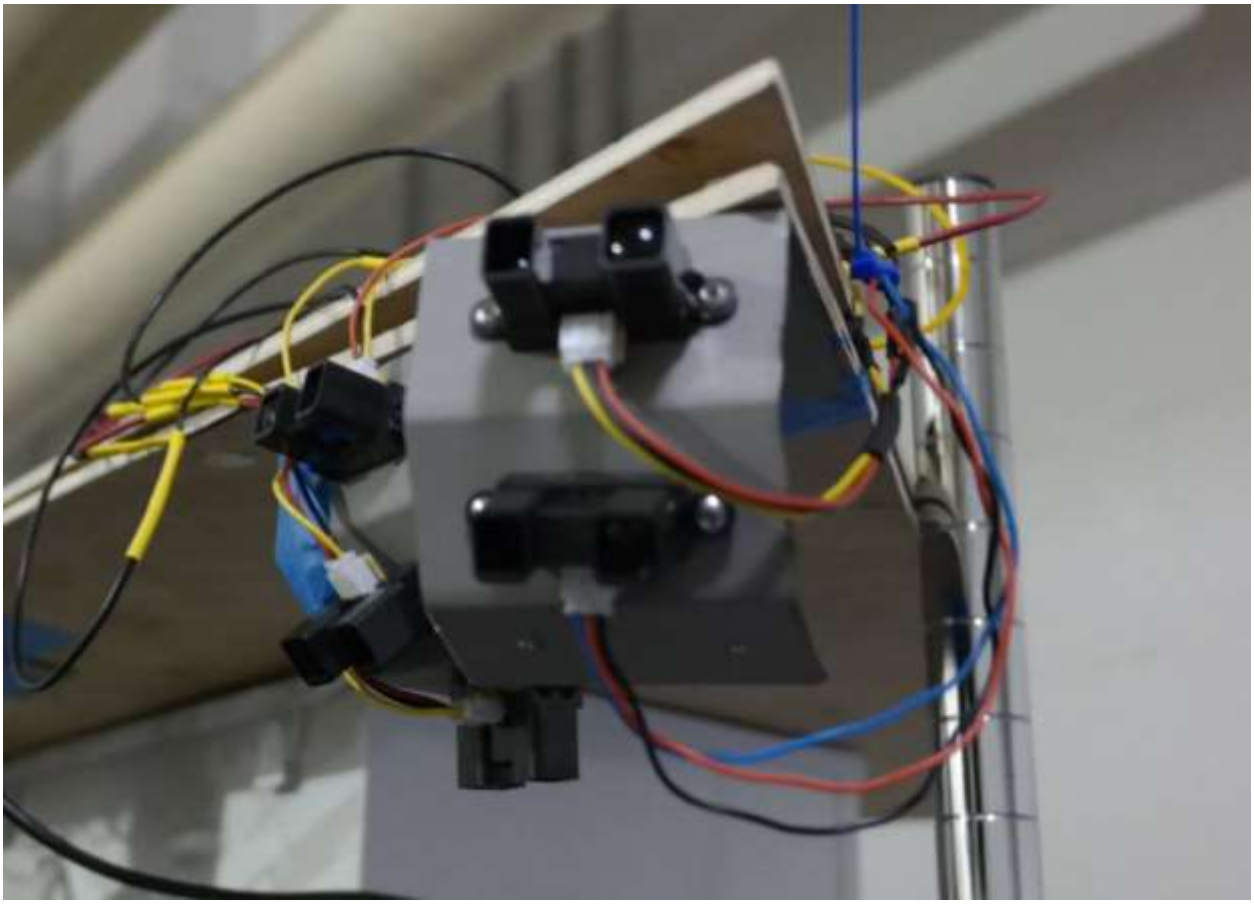

Figure 4: Final Sensor Mounting Arrangement

c. FireFLY6 Assembly

Building the FireFLY6, which arrived last Friday, was a team effort. The barebones hull and wings are visible in Figure 5.

Figure 5: Aerobot Out of the Box

Assembly was a team effort with Adam directing the group's efforts. I provided the majority of the mechanical assembly, connecting the wings, routing wires, and mounting the motors. The current status is visible in Figure 6. Much of the work now is in configuring the PixHawk Flight Controller.

Figure 6: Partial Assembled FireFLY6

d. Sensor Testing

My final contribution was in helping Pratik test different sensor arrangements. Using the sensor mounts, we were able to identify several holes in our sensor arrangement using IRs. Due to the thin beam of the sensors, an object approximately 12" wide was able to slip between the sensors undetected. If they were used for obstacle detection, the UAV would have crashed into the object. Pratik is continuing to test Ultrasounds and IRs in different arrangements.

II. Challenges

There were numerous, small obstacles in the UGV rebuild which aren't worth documenting. However, there is one outstanding issue that prevented a complete test of the sonar sensors.

I attempted to display the point cloud in RVIZ, the preferred viewer for ROS. I was able to view the sensor information from the sonar using <*rostopic echo*> as mentioned above, but RVIZ gave me a "reference frame" error. I will attempt to resolve this in the next week, and reach out to Allard if necessary.

III. Teamwork

Each team member took on different components of the task. This allowed the team to build their individual skillsets while expediting the work.

Tushar Argawal

Tushar has put considerable energy into testing the CV algorithms and incorporating the Odroid boards into the system. I worked with him to get the visual markers printed. Using these, he successfully tested the system from a distance equivalent to 10 stories.

Adam Yabroudi

Adam performed most of the work on the PCB assignment, working with Pratik to ensure useful boards were built for the sensors. Additionally, he's put in much of the skilled electrical work on the FireFLY6.

Pratik Chatrat

Pratik has put in several hours into testing the IR and sonar arrays for the project. I will continue working with him to solidify the final sensor layout for the project.

IV. Plans

Before the next PR, I will have reshaped our drone mockup to more accurately match the FireFLY6's profile when viewed from above. This should assist Pratik in answering his final questions regarding the sensor layout. If Pratik is able to complete his tests in time, I will begin modifying the aerobot to incorporate sensors into its frame. Additionally, I will continue working with Adam to complete the drone's construction.

If time permits, I will continue working to display the Pioneer 2 to display sensor readings in RVIZ.