Individual Lab Report 2

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Team A / The Avengers

Teammates: Tushar Agrawal, Pratik Chatrat, & Adam Yabroudi

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1. Individual Progress

Over the past week, I pursued side projects in order to enable Adam Yabroudi and Tushar Agrawal to focus on the flight systems we will be employing. Projects I covered included building a mockup of the drone for sensor testing, conducting preventive maintenance of the Pioneer 2, and working with manufacturers to acquire system components.

I.a Drone mockup for sensor testing

Having woodworking experience and a TechShop membership, I volunteered to build a test platform so that Pratik could test different sensors and their limitations. The mockup was in the profile of the drone viewed from above. The dimensions of the FireFLY6 is 40” long and 60” wide. I was able to locate a 4’ by 4’ piece of plywood and hinges at HomeDepot. Details of the build are shown in

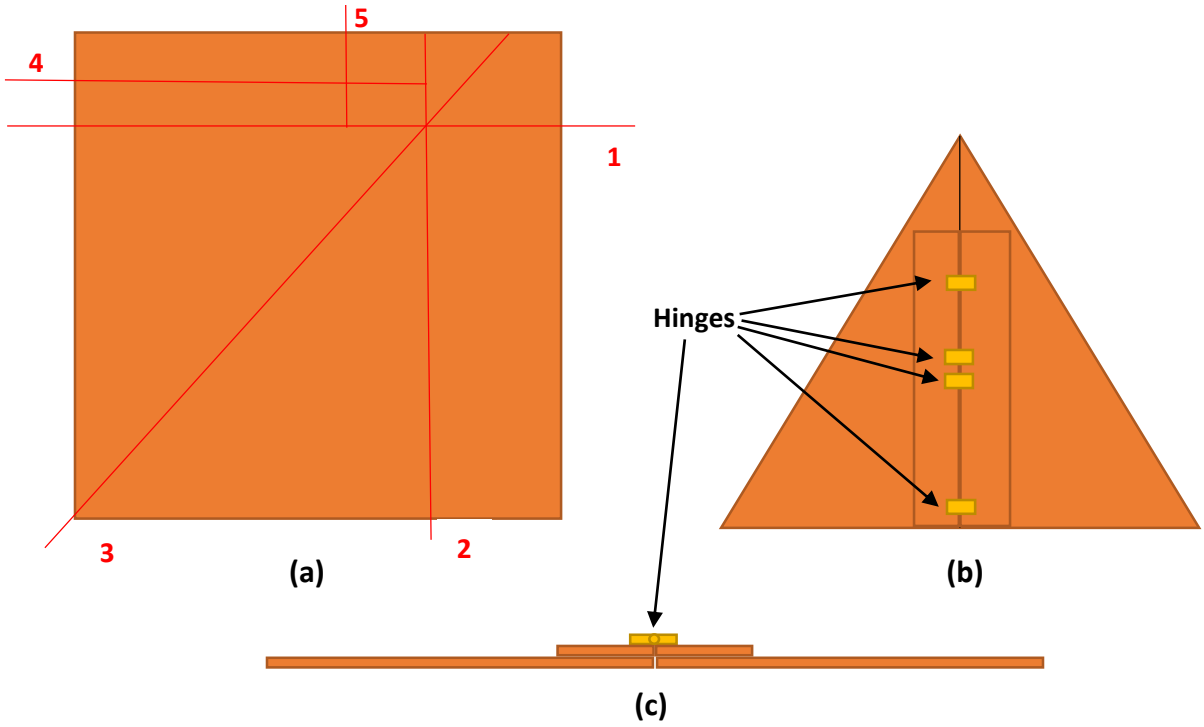

Figure 1: Test Platform Plans

Figure 1.a shows the five cuts needed to shape the test platform. Cut 1 removed 8 inches from the board to get the 40” needed for the drone’s length. Cut 2 reduced the board to a 30” width. The third cut shaped the wings into 30”x40”50” symmetrical triangles which would serve as the wings. Cuts 4 and 5 finished the hinge support panels. Wood glue was used to permanently affix the hinge supports to the wings. After letting the glue set for 24 hours, four hinges connected the two wings.

Cuts 1, 2, 4, & 5 were done on a table saw. Cut 3 was made on a bandsaw and was difficult with the tools available. This is discussed in the challenges section below.

Figure 1.b & 1.c show the final test platform from the top and rear respectively. The hinges have the added benefit of making it easier the platform easier to transport, especially through doorways.

With this platform, Pratik was able to complete initial tests of the IR and Ultrasound sensors. Work will continue in this area next week.

I.b Preventive maintenance of Pioneer 2

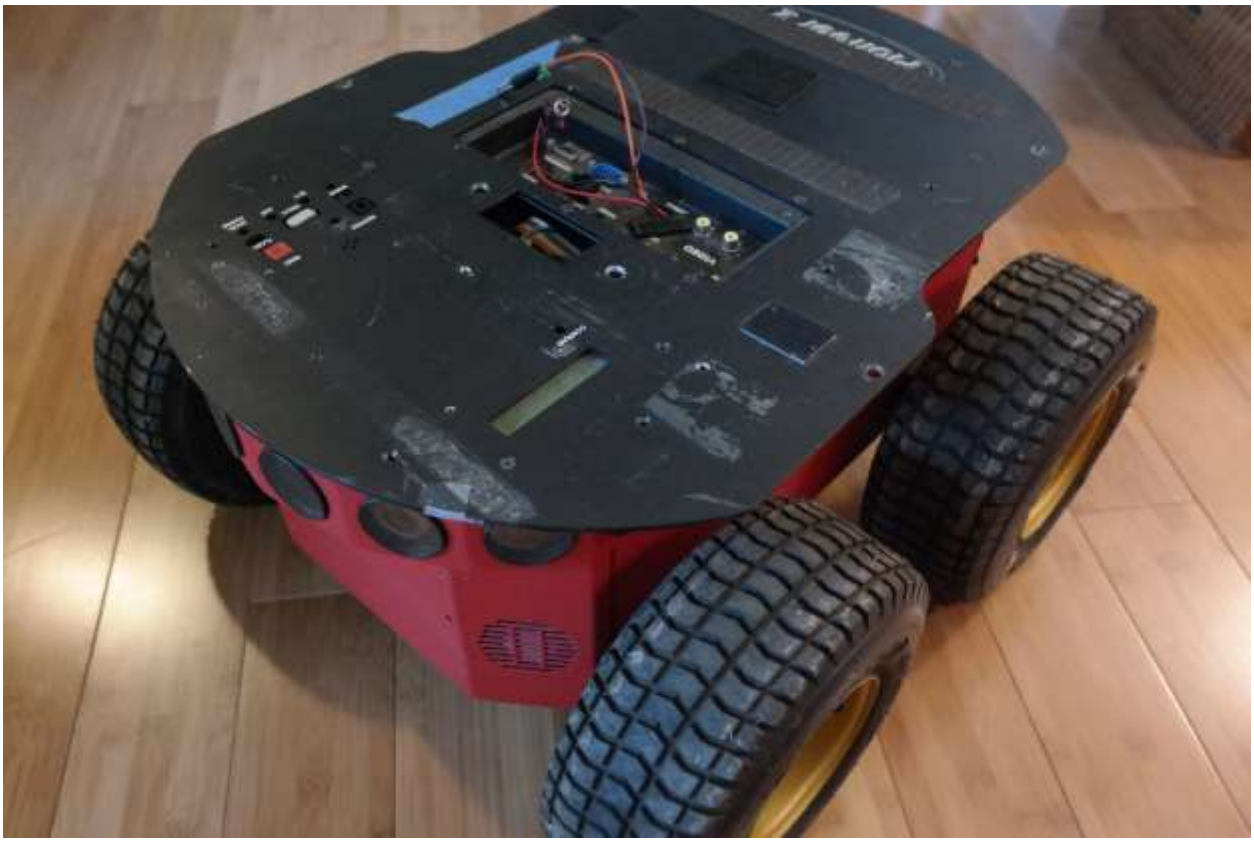

Figure 2: Pioneer 2 after cleaning and maintenance

My next task was to clean the Pioneer 2 and conduct preventive maintenance. Incorporating a UGV is a reach goal for Team A. However, we are attempting to avoid avoidable problems should the opportunity arise to include the system.

First step was a thorough cleaning of the robot. This was easily accomplished as the system was mostly dusty. While inflating the tires, I noticed that duct tape was used on the tires at some point for reasons unknown. The residue from this was left because it didn't appear to impact the tires' performance. However, it was the first indication of several curious

modifications to the vehicle. These are discussed in the challenges section. At this time, these modifications do not pose an issue to using the UGV, but are potential risks that we need to be conscious of.

I.c Communications with component manufactures

I reached out to two manufactures we are attempting to get parts from. Previously, we had contacted BirdsEyeView Aerobotics, maker of the FireFLY6, who has graciously agreed to provide us several drones for our project. However, shipping the drones was held up by a NDA dispute. This has been resolved, and is discussed in the challenges section below. We expect the drones to be shipped next week following a conference call with the BirdsEyeView CEO on Monday.

I also contacted the manufacturer of our chosen gripper. NicaDrone makes the Electro Permanent Magnet v2.5; however, the part is currently out of stock. The manufacturer confirmed that the part will not be shipped for atleast 30 days. For these reasons, I will be partnering with Adam Yabroudi to build our own from schematics provided by NicaDrone.

II. Challenges

There were several minor challenges with this week's projects.

II.a Drone mockup for sensor testing

The only challenge in building the drone mockup for sensor testing was in the long, angled cut to separate the wings (Cut 3 in Figure 1.a). At 30", the wings were too side to fit fully into the bandsaw. I was forced to cut from both directions, but couldn't fully cut the boards. I used a handsaw to finish the final 10". This left an uneven finish. I clamped both boards and sanded them down using a belt sander to ensure that they were symmetrical with no rough edges.

II.b Preventive maintenance of Pioneer 2

Though a low priority at this time, I am attempting to get the Pioneer 2 up and running. During preventive maintenance, I noticed several curious modifications. These included duct tape residue on the tire treads, missing batteries, modifications to the power system, missing screws, and poor reassembly of the UGV.

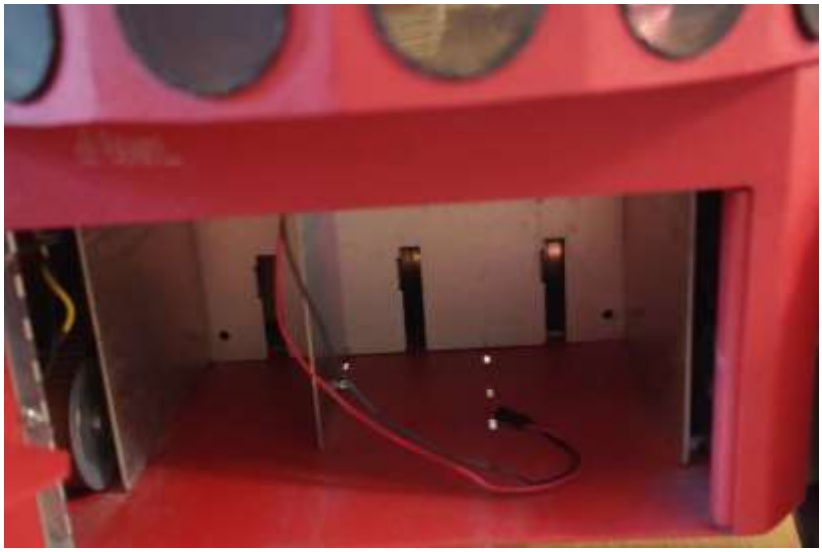

Figure 2.a: Empty Battery Bay

We will need batteries before we can further test the Pioneer 2 for functionality. I will follow up with the TAs next week to see if the correct ones are in the MRSD inventory.

Figure 2.b: Duct Tape Residue on Tire Treads

The residue on the tire treads did no appear to impact their performance. However, it makes me wonder what has been done with this UGV in the past and how much work will be needed to restore it full functionality.

Of more concern is the sloppy reassemply of the Pioneer 2. The front panel wasn't reattached correctly and theres a noticeable gap left in the paneling that doesn't exist on the robot's other seams. This is visible in Figure 2.c below.

Figure 2.c: Gap in Front Panel due to Poor Reassembly

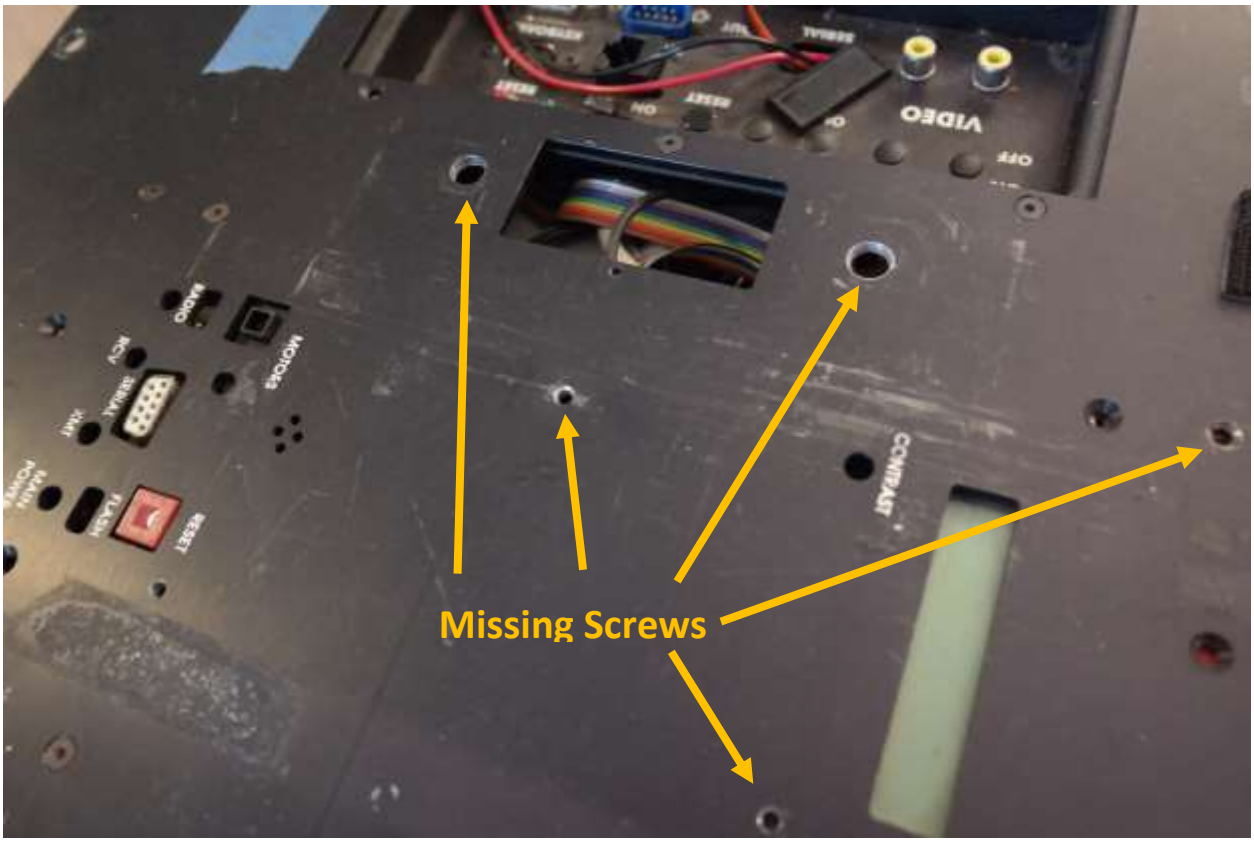

Figure 2.d: Missing Screws in Top Panel

Additionally, there are several missing screw in the robot's frame. The top panel is shown in Figure 2.d as an example. You can see the shiny metal were screws were once attached. However, I am unsure at this time if any of these modifications will impact the UGV's performance. The only modification that concerns me at this time is the changes to the power system.

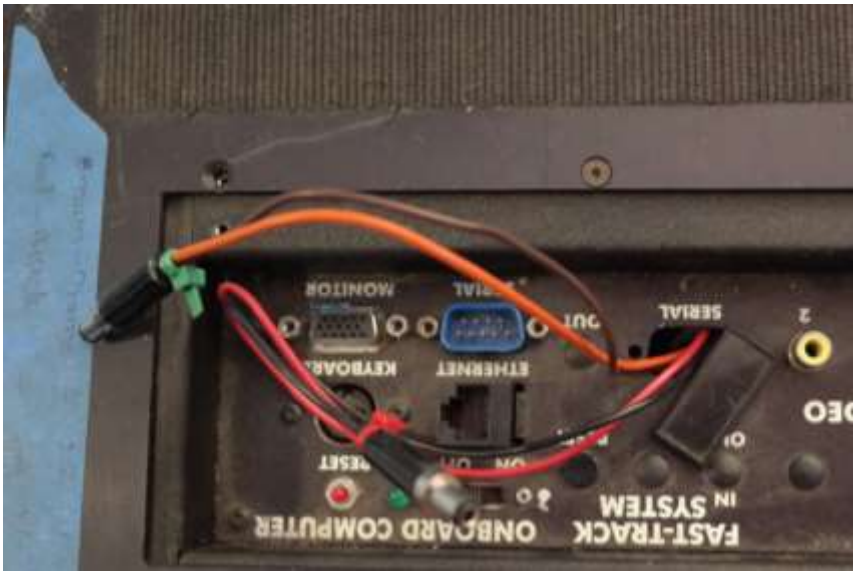

Figure 2.e: Modifications to Power System

As you can see in Figure 2.e, there are two cables coming out of the top panel of the UGV. The blue tape has a note that reads "Brown-Orange => 12v, Red-Black =>24v." It will be important to locate batteries for the Pioneer 2 to determine if these modifications have changed the way the robot is powered.

1.c Communications with component manufactures

Communications with BirdsEyeView Aerobotics has been an ongoing task. On Monday, Adam Sloan, CEO, spoke with Patricia Clark, CMU's Contracts Officer, on Monday. We received notice from Adam Sloan yesterday that he came to an agreement with CMU. He mentioned that he is unable to provide one component we requested – the high-efficiency power system. This is an issue because our drone decision was based upon that component being included in the system. Without the high-efficiency power system, the flight time of the FireFLY6 is comparable to 3DR's XM-8+ drone.

We have a conference call scheduled with Mr. Sloan on Monday were we will discuss this in addition to other support he may be able to provide.

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 & Adam Yabroudi

Tushar and Adam tested ROS on a Raspberry-Pi and BeagleBone. Due to poor performance of the Raspberry-Pi, we were able to eliminate it as an option. Additionally, they were able to connect the LIDAR to the BeagleBone.

Pratik Chatrat

Pratik conducted initial tests using the IR and Ultrasound proximity detectors. Tushar & Adam provided additional tests for him to run, which I will assist him in next week.

IV. Plans

Work will continue in the coming weeks to test the subsystems of our project. This is critical since we allotted to use ready-made components were possible. Our team broke into pairs of two in order to expedite the work being done. Adam and Tushar will be working closely in the coming weeks as will Pratik and I.

Pratik and I will test sensors. We will test the IR's in sunlight, ultrasounds near motors (a known problem), the minimum distance between sensors before they interfere with each other, and the true minimum and maximum ranges of the sensors.

Adam will power a single motor from the Pixhawk to test functionality and his understanding of the code.

Tushar & Adam will test OpenCV with ROS. If successful, they will test both on the BeagleBone

Adam and I will research building our own Electro Permanent Magnets from the schematics provided by NicaDrone.

The team will conference call with Adam Sloan on Monday. We will determine if the FireFLY6 still meets our requirements. If so, we will push to have them shipped this coming week.