Individual Lab Report 3

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Team A / The Avengers

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1. Individual Progress

Over the past week, I acquired batteries for the Pioneer 2 UGV, assisted Pratik in testing the IR & ultrasound arrays, and coordinated with BirdsEyeView Aerobotics (BEVA).

Just prior to the PR on Thursday, I located the batteries for our UGV. The robot requires 12v 7ah batteries according to the manuals located online. I hope to put them in the Pioneer 2 this week for a functional test. Once confirmed, I will notify the TAs so that they can annotate the MRSD inventory which batteries go with the UGV for future classes.

Testing of sensors was my most important contribution to the project this week. Following the PR last Friday, Team A discussed test design and what information we would need. Pratik and I worked Sunday to execute initial tests. Sensors used were the IR Sharp GP2Y0A02 and Ultrasonic LV MAXSONAR EZ MB1010 & MB1040. The setup can be seen in Figure 1.

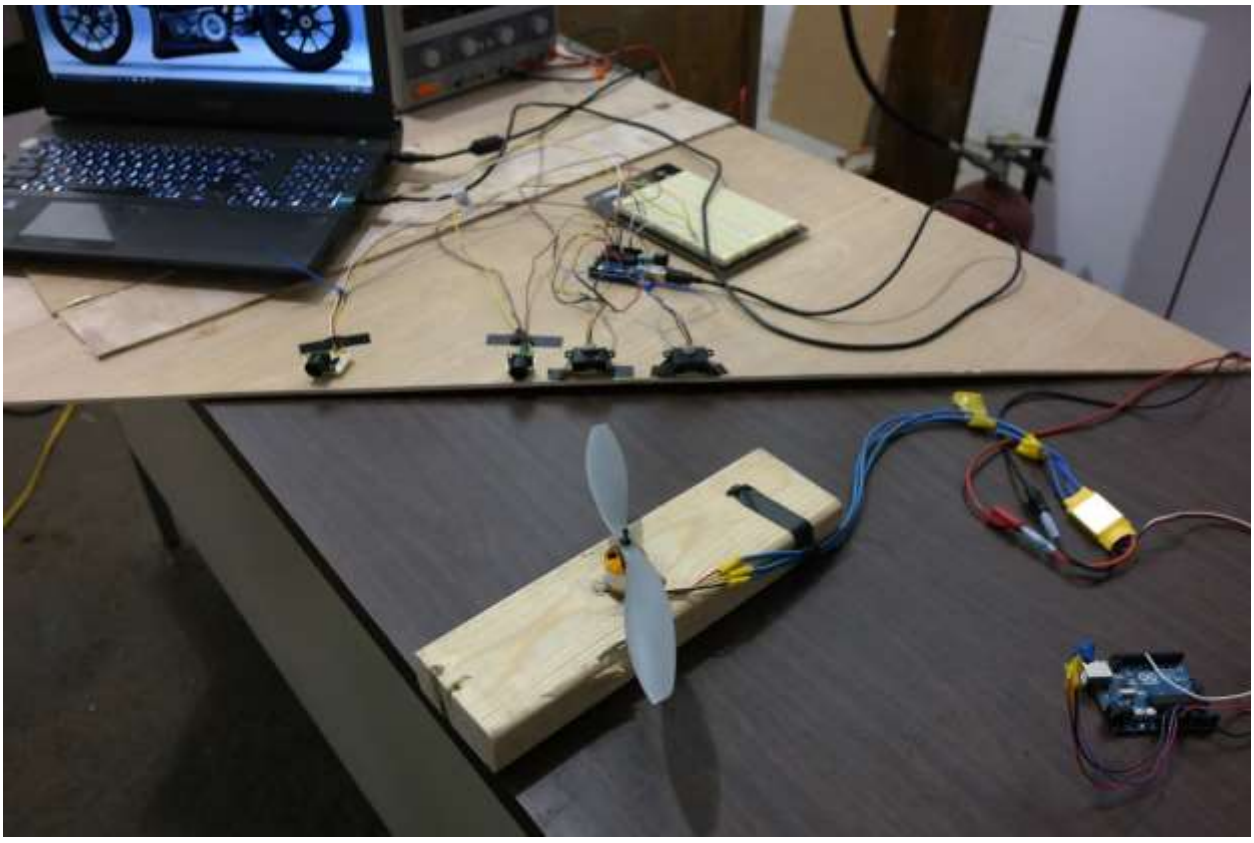

Figure 1: Sensor array and test motor.

Using the back wall of the lab, we measured the range and accuracy of the IR and ultrasound sensors. Since our goal was object detection and not measurement, we determined that the sensors could be used in a wider range than specified by the manufacturers. For

instance, the IR was able to detect the wall up to 2.5 meters away. However, the distance measurement was inaccurately reading 400 cm.

Next, we measured the width of the beam of each sensor. The IRs had the most narrow detection width, smaller than the diameter of a pencil at the maximum range. The Ultrasounds were most interesting. The MB1010 had a broad cone that extended at roughly 45° out to 60cm before narrowing to 25cm at 140cm. The MB1040 however had a 10 cm beam throughout its range.

The final test we performed involved moving the sensors together to test for interference. The Sharp IRs could physically touch both vertically and horizontally without any interference. In contrast, the readings from the ultrasounds increased in noise as they were moved closer together. It is unclear where the usable cutoff on noise is from the sensors. However, we did notice a cyclic pattern to the noise even when pointed in opposite directions suggesting that we need to take a closer look at our setup. This is further discussed below in the Challenges section. Final results are given in table 1.

Table 1: Sensor Test Results

Finally, Team A had an opportunity to conference call with Adam Sloan, CEO of BEVA, on Monday. The information gained was worth the work put into the NDA and will simplify the problem for our project. Additionally, he informed us that two FireFLY6 frames were in the mail. Assembling them will be my priority in the coming week.

II. Challenges

The largest challenge faced this week involved noise in the ultrasound sensors. I noticed a cycling pattern of the noise that remained consistent. A third of the readings from the first ultrasound would stray followed by a third of the readings from the second after the first had returned to normal. I observed this pattern even when the ultrasounds were pointed 90° apart and two feet removed. This amount of erroneous reading would increase as the ultrasound sensors were moved closer together.

Discussing this issue with Adam and Ander, we identified a few culprits. The most obvious is that we are measuring using analog readings on the Arduino with long wires which exposes us to induction problems. The next possible source of interference is from the timing used on the sensors. Quadrature is a common problem with ultrasonic sensors and we need to pay closer attention to how we structure the readings from the sensors. Moving to PWM on the ultrasounds should minimize both of these problems.

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 pushed forward on testing the vision system and possible tags. Additionally, he tested different vision algorithms for identifying objects and the tags.

Adam Yabroudi

Adam interfaced with BEVA technical support to adapt to the changes in the code and the unique design of the FireFLY6. Additionally, he built a motor and propeller setup to test interference with the ultrasound sensors for Pratik.

Pratik Chatrat

Pratik completed initial testing of the sensor arrays to include the IR in direct sunlight and noise from motors. His work was cut short by a trip to Austin this week.

IV. Plans

Before the next PR, I will be assembling both the FireFLY6s once they arrive. These will be stored in the third room of the lab. Additionally, I will continue working with Pratik to eliminate the noise in our system from the ultrasounds and testing the batteries in the UGV. If time permits, I will functionally test the Pioneer 2 to identify any problems in using it later in the project.