Week 3 (Backwards Looking Summary)

Situation

Lab 02 began with a tutorial on how to use the lab wind tunnel. The wind tunnel contains various measurement devices that allow for amps, wind speed, power, RPM's, and thrust data to be collected. During the tutorial sample data was collected using a set of propellers and varying the voltage percent setting of the attached power supply. This gave example data for all of the measurements mentioned earlier. Having this data allows the groups to solve for things such as the calibrated thrust, the power input, and power available, these things will be taken into account when designing the AEV.

After the lab demonstration the group did work to catch up on Lab 02. During lab two the arduino our group used had some issues that cause problems when trying to run the code. The group received a new working arduino and were able to test our code on the motors of the AEV. Because of this, the groups was able to finally test the code which ended up having some minor issues. By the end of lab all issues were resolved to an extent and the group was able to advance onto Lab 03.

Tables & Figures

Results & Analysis

The results from Lab 02 came from the wind tunnel demonstration and testing the AEV. From this the group found what voltages produce the greatest thrust and which produce the most efficient thrust. The wind tunnel gave reading from varying the power supply from 0% to 60%. This resulted in a thrust range of 138.3-184.3 grams, respectively along with 0-9000 RPM. From the power supply the current measured ranged from 0.16-1.16 amps. Using this data the group was able to determine the power input/output and propulsion efficiency. These were then tested using two different types of blades that produced varying amounts of this information. Having this allows the group to make a decision on what power, design, and speed the AEV should run on to produce highest efficiency.

From testing the AEV on the track the group found that were a few errors with the code and the physical design of the AEV. The first software error was that the AEV would run in the opposite of what was wanted. To fix this the direction was established as negative in the beginning of the program. The next software issue was with the brake command and the timing that was made in Lab 01. Through testing the AEV this issue was resolved. For the physical problem, the AEV wouldn't hang completely vertical when suspended from the track. With the help of a TA, the issue was found to be in the placement of the arm connecting the AEV to the track. The arms was screwed onto the AEV in the incorrect position, to fix this issue the arms was removed and re-screwed in the correct orientation.

Additional requirements (Answer questions)

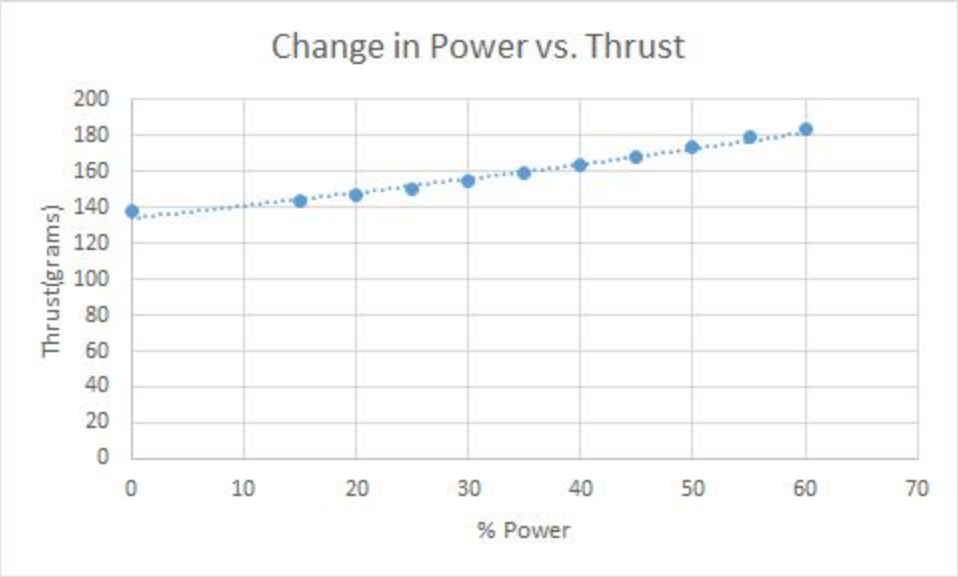
Question 1: Our AEV was able to move across the track without any problems, the problems our group had were from the code. The AEV was able to make it through the entire loop but wasn't to stop or execute the brake command. By the end of lab the group was able to solve the issue but we still weren't able to get the break timing perfect.

Figure 1-Wind Tunnel Data

CURRENT	THRUST SCALE READING	RPM	ARDUINO POWER SETTING
amps	*grams*	*RPM*	*%*
0.16	138.3	0	0
0.35	144.1	2900	15
0.45	146.5	3800	20
0.54	150.0	4600	25

0.64	154.4	5400	30
0.74	159.1	6100	35
0.83	163.2	6700	40
0.92	168.5	7300	45
1.00	173.2	7900	50
1.09	179.0	8600	55
1.16	184.3	9000	60

Figure 2- Power vs. Thrust Plot



Question 2: From the data and calculations collected it was found that Propeller Type EP-2510 was most efficient. For this reason, the group with use this type to maximize the EV's efficiency. It was also noted that the orientation of the propeller and point where they are connected to the motor can affect the efficiency of the AEV.

Question 3: From the wind tunnel demonstration the group learned that the highest power or greatest thrust isn't the most efficient way of moving the AEV. The ratio for propulsion

efficiency shows that there is a level that creates the most thrust with a limited power supply. We also learned that there were some issues with our code from Lab 01. By the end of lab we were able to figure out the issue (brake command) but not entirely fix it. There were also a few physical issues with the orientation of the AEV but this were fixed relatively quickly.

Takeaways

The first thing that group members learned from learned from the Lab 02 was to have a good command of some new function calls like “GOTORELATIVEPOSITION(M)” and “GOTOABSOLUTEPOSITION(C)”.Using these two function calls would help the group to run the whole AEV on the inside track and make it possible for the group to keep track of the every movement of AEV. And also “reverse(m)”, one of the function calls that the group learned last week, was specifically useful for the group to move AEV forward because the vehicle used to move in backward direction. The second takeaway was to learn the principle of reflectance sensor. For example, the wheel has a circumference of about 3.9 inches. Therefore the conversion from marks to distance traveled is 3.9 inches per 8 marks or 0.4875 inches/mark. Knowing this data could help the group to accurately figure out how much the vehicle is supposed to travel. The inside track is about 13.5 feet (162 inches). That means that the vehicle should travel 332.31 marks. The third thing that the group learned from the Lab 02 was to become familiar with wind tunnel testing equipment. Therefore, the group could figure out the optimal speed for the motor and the best propeller configuration. The first general project learning was to stick to the weekly goals and schedules because it could enhance work efficiency. The second thing the group learned from this lab was having an efficient discussion among all the group members. Every group member should take responsibility for expressing his opinion. It definitely helps the group to get the work done. The last thing that the group learned from the Lab 02 was to split up the whole complicated task and nail them one by one.

Week 4 (Forwards Looking Plan)

Situation

In the upcoming week the team will learn the two techniques of brainstorming and keeping a project portfolio to assist in the physical construction of the AEV. Learning the two techniques are important because it will allow the team to get all of their ideas down on paper and use each others idea to construct the optimum AEV design. This will be accomplished by each team member using orthogonal paper to brainstorm and draw their own potential design of the AEV. The team will also put all essential lab documentation on the team's website, which will be used as a project portfolio. Also in the upcoming week the team will become familiar with the obstacles associated with creativity. Learning about the obstacles with creativity is important to the project because it will allow the team to be able to avoid these obstacles and be able to have an easier coming up with ideas about the design of the AEV. The team will become familiar with the obstacles associated with creativity by reading the background information provided in the lab manual and by taking the information that was learned and applying it to the designs the team create during the lab. In the upcoming week the team will also becoming more familiar with the components in the AEV kit. This important to the project because this will allow the team to know exactly what type of materials and components that are available for use in the construction of the AEV. The team will accomplish this by going through the AEV kit and making observation of the different materials available and brainstorm different ways the material can be used in the design of the AEV. Also in the upcoming week the team will learn about the basics of orthogonal drawings. This is important to the project because it is essential in order for the team to be able to successfully display their ideas about how the AEV should be designed by drawing it on orthogonal paper. The team will accomplish this by using the orthogonal paper that is provided and draw the designs on the orthogonal paper allowing for the team to learn the basics of orthogonal drawings. In the upcoming week the team will individually construct AEV concept sketches. This is important because it will allow the team to each display their ideas about how they believe the AEV should be design and allow the team to use each other's ideas in order to create the final AEV design. The team will accomplish this by using the orthogonal paper and drawing their ideas.

Weekly Goals

- By Thursday the team will have final draft of the front of the AEV completed, which will allow for progress toward completion of the whole AEV design. The team will meet on Tuesday and put together each others views about the front design of the AEV.
- By Saturday the team will have the sides of the AEV completed, which will further the progress of the AEV design being completed. The team will meet Friday to put together each other views about the side design of the AEV.

Weekly Schedule

Tasks	Teammates	Start Date	Due Date	Time Needed
Complete Lab 4	All	2/8/17	2/8/17	2 hours
Complete Lab 4 Progress Report	All	2/2/17	2/8/17	3 hours

Appendices

Team Meeting Notes

The group had a meeting at Room 324 in Hitchcock on last Thursday. The group mainly talked about the distribution of the Lab 02 tasks coming in the next week and the solution to the problems encountered during the Lab 01. The whole group decided that Charles and Nick would be in charge of assembling AEV and Enoch and Marcus would take responsibility for programming. And then the whole group would bring up some ideas to optimize the code. In addition, Nick would be on behalf of the group to participate in wind tunnel testing lan activity. When talking about the problems, Enoch asked that the difference between the function calls "motorSpeed()" and "accelerate()". The group discussed about this question and finally figured it out. The group held the view that "motorSpeed()" was more likely to apply to the constant speed and "accelerate()" was applied to the speed change. What's more, the group discussed the schedule of working on the Lab 03 progress report. The group decided to complete it by the next Wednesday.

Arduino code

```
reverse(4);                    //reverse all motors
motorSpeed(4,25);              //run all motors at a speed of 25%
goFor(2);                      //run for 2 seconds
motorSpeed(4,20);              //run all motors at a speed of 20%
goToAbsolutePosition(333); //travel a total distance of 16 feet
reverse(4);                    //reverse all motors
motorSpeed(4,30);              //run all motors at a speed of 30%
goFor(1);                      //run for 1 second
brake(4);                      //brake all motors
```