Week 6(Backwards Looking Summary)

Situation

The objective of lab 5 was for us to compare and analyze the AEV designs that we had. Each of the designs were rated according to both the concept screening and concept scoring matrix. Concept screening mainly involves in plus, minus or zero to determine if the designs were more or less efficient compared to the reference design. The concept scoring matrix on the other hand deals with different aspects such as weightage and the ratings of the criteria. Both weighted criteria and ratings are multiplied together to see where the importance of the success criteria stands.

On the 1st the design, the group was unsatisfied with is as it was not well balanced when it turns. The group suspect that it was due to center of gravity. On the 2nd design, the center of gravity improved as we spread the weight across our AEV and managed to produce a design with much better center of gravity.

Results & Analysis

The lab began with programming a set of code for testing the several different AEV designs on the straight track. This code had the AEV accelerate, decelerate, and reverse directions to test the features of the various designs. The groups then began testing the designs, starting with the original reference design. At first, there was an issue with the arduino code that wasn't allowing the AEV to move the distances given in the lab manual but this problem was soon fixed.

The reference design had issues with it's center of gravity which showed in testing. The majority of the weight was fixed toward the back of the AEV, so when the AEV began moving it wasn't able to move as efficiently as it should.The back wheel was firmly on the track while the front was basically doing a "wheelie". Taking this information from the test the reference design was given a success criteria rating of 2.675(see table 1.). Next was design #1, this design was somewhat of an oddball. The motors were attached to a small moveable piece of the plastic board, The idea was that the small pieces along with the slim base body would allow for a lightweight efficient design. During testing the motor arms did not work as planned and the AEV was barely able to move. However, the design had a decent center of gravity and only used a limited amount of pieces. Design #1 was given a success criteria rating of 2.86, surpassing the reference. Design #2 was a basic t-shaped frame with the track connecting arm located in the center and both the arduino and battery holster located on top. The design of this has an almost perfect center of gravity and even weight distribution. The motors were located in the front of the AEV along with the battery, while the arduino was towards the back. When tested this design

worked the best of the three it was able to move smoothly along the track with no issues. It also didn't require a lot of pieces to construct. For these reasons design #2 was given a success criteria rating of 3.65, topping the other two designs. This design won in almost every category and because of this the group will continue to work and improve upon this design.

Other than the design of the AEV, the scenario codes play a significant role in contributing the success of the run as well. During the test run ,the motors were set to travel at 25% power. What we realized was that the power input was greatly significant compared to the power output, meaning that the power efficiency of our AEV was not as ideal as we thought it would be. Moreover, when our AEV model turns, it tends to lean outwards of the track, making it wobbles vigorously when it returns to straight line. This concerns us as we fear that it might leave the track. Hence, modification of the code is required to achieve optimum result.

Takeaways

The first takeaway the group learned from the Lab 05 was to use concept screening scoresheet to analyze the different AEV designs. The group was expected to make a list of success criteria that fits the AEV design and then compare the AEV design to a reference design. According to the comparison, the group rated it and counted the final score of it. For example, the group took balance of the AEV, minimal blockage, center of gravity, maintenance, durability and cost into account. This method helped the group to analyze the performance of the AEV design more objectively. The group could easily select the optimal design by comparing the final scores of the designs. The second takeaway was to learn about how to use success criteria matrix, which was considered as another way to evaluate the AEV designs. The group had to figure out the proportion of each criteria and compute the final score based on the percentage. It provided the group with another method to analyze the AEV designs, which could help the group to know the AEV design more specifically and avoid with the decision-making error. The general project learning from this lab was that the group discussion could help group members to know other members' ideas better. In addition, team collaboration could help the group improve work efficiency. For example, the team was divided into two small groups. The first group was in charge of the AEV assembly and the second group was asked to finish the code at the same time. The group splitted the whole lab task into small pieces, which got every group member involved and everyone would be more eager to work for the group.

Tables & Figures

Table 1- Success Criteria Matrix

		A REFERENCE		DESIGN 1		DESIGN 2	
Success Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Balanced	30%	3	0.9	3	0.9	4	1.2
Minimal blockage	10%	3	0.3	4	0.4	3.5	0.35
Center-of- gravity	20%	2.5	0.5	3.5	0.7	4	0.8
Maintenance	10%	3	0.3	2	0.2	4	0.4
Durability	15%	2.5	0.375	2	0.3	3	0.45
Cost	15%	2	0.3	3	0.45	3	0.45
Total Score			2.675		2.86		3.65
Continue			No		No		Yes

This table details the three designs the group constructed and tested.There were six categories tested for each with varying weight on percentage. The rating that was used was a scale of 1-5. The first is the reference design, this was the most basic design the group had. This design due to it's basic structure only had a total score of 2.675. The design was a good start for the group but had some issues with stability and structure. Design 1 was a unique design with movable motors and a fairly even weight distribution. This design has a score of 2.86, a score that isn't great but is to be considered. Design 2 used a basic T-shaped base but was the lightest of the three. Because of this the design got a 3.65, the group's highest. The design was fairly basic; however it had a great center of gravity and moved the smoothest on the track.

Table 2- Success Criteria Scoresheet

	Success Criteria	Reference	Design A	Design B
2	Balance In Turns	0	-	0
3	Minimal blockage	0	0	0
4	Center-of-gravity	0	-	+
5	Maintenance	0	0	0
6	Durability	0	-	+
7	Cost	0	0	0
8	Environmental	0	0	0
9	**SUM +'s**	0	0	2
10	**SUM 0's**	7	4	5
11	**SUM -'s**	0	3	0
12	**Net Score**	0	-1	2
13	**Continue?**	NO	NO	YES

This table further examines the designs the group tested, in a different method. This scoresheet looked at the criteria and only scored them using a +1,0, or -1 score. The table shows the

reference as a steady point for the design, the fact the design A/ 1 is the worst, and design B/2 is the group's best. For this reason, the group chose design B/2 to move forward on.

Figure 1-Reference Design

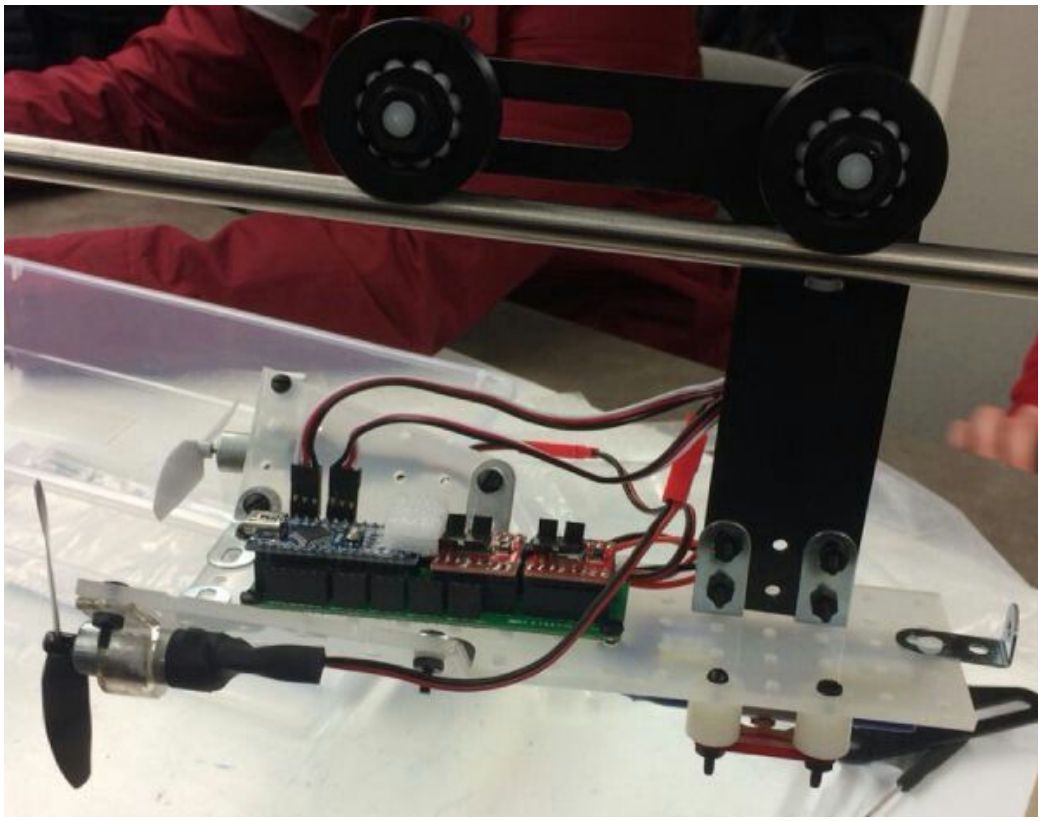


Figure 2 - Design #1

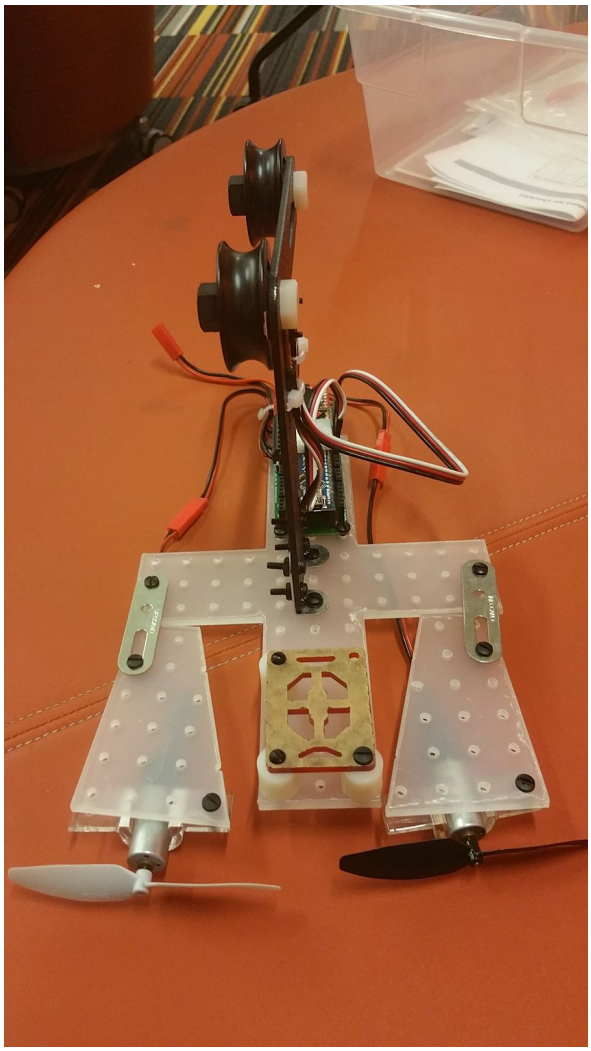
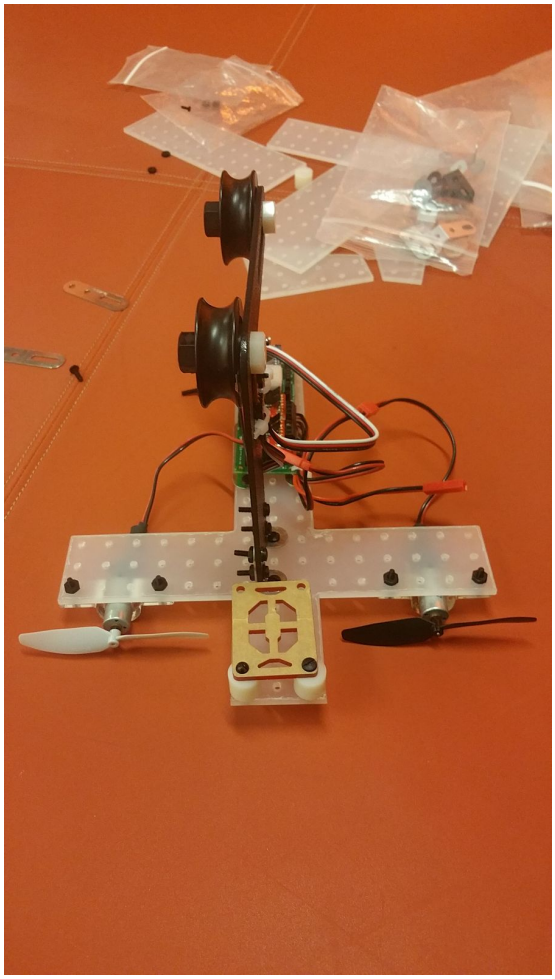


Figure 3 - Design #2



Week 6(Forwards Looking Plan)

Situation

In the upcoming week the team will make sure they are caught up with the production of the AEV final project. This is important to the team because it will allow for the AEV project to meet deadlines that are essential for the team to meet. The team will accomplish this by looking at past labs and determining things that have been still need to be completed and finishing them during the lab period. Also in the upcoming week the team will have a conversation with the TA's and determine how to be able to meet all deadlines thereafter and to discuss how the group can accomplish things more effectively. This is important because it will allow the team to function more effectively and allow the team to meet all deadlines before the final project is due. The team will accomplish this by talking to the TA's during the lab period and brainstorming ways to move forward.

Weekly Goals:

1. The team will make sure the online portfolio is up date this week. This will allow the team to determine if any aspects of the project is incomplete. The team will meet during lab this week to upload everything into the portfolio.
2. The team will also finish the oral presentation worksheet. This will allow the team to make progression to giving an oral presentation on the AEV progression. The team will be meeting during lab this week to complete the worksheet.

Weekly Schedule

TASKS	TEAMATES	START DATE	DUE DATE	TIME NEEDED
Complete Lab 4	All	2/22/17	2/22/17	1 ½ hours
Lab 7 Progress Report	All	2/22/17	3/1/17	2 hours
Improve on design and code	All	2/22/17	3/1/17	N/A
Finish Portfolio	All	2/22/17	3/1/17	4 hours
Regular Team	All	2:00 PM 2/24/17	4:00 PM 2/24/17	2 hours

Meeting				

Appendices

Team Meeting Notes

Time: 4:00 PM -- 6:00 PM
Date: 2/21/2017
Location: Room 324, Hitchcock Hall

This week meeting was aimed to summarize the work the group did on the Lab 06 and schedule a plan for the next week. At the beginning of the meeting, the group reviewed the content of the Lab 06 and every group member give his own comment on three AEV design. Enoch talked about the first AEV design. He held the view that the first AEV design had a minimal blockage which made it possible for the AEV run smoothly on the track. Nick pointed out that the second AEV design had a good performance on balance which was the most important factor of the design. Marcus and Charles discussed about the proportion of each criteria. Finally the whole group agreed on the standard for evaluation which was posted on "Tables & Figures" part. And then the group split up the task of the Lab 06 progress report and everyone was assigned to take charge of specific part. The group was supposed to finish the Lab 06 progress report by 2/22/2017.

Arduino code

```
reverse(4);              //reverse all the motors
celerate(4,0,25,3);      //Accelerate all motors from start to 25% in 3 seconds
motorSpeed(4,25);        //Run all motors at 25% power
goFor(1);                //Run it for 1 second
motorSpeed(4,20);        //Run all motors at 20% power
goFor(2);                //Run it for 2 seconds
reverse(4);              //reverse all the motors
motorSpeed(4,25);        //Run all motors at 25% power
goFor(2);                //Run it for 2 seconds
brake(4);                //Brake all the motors
```