Week 5

Situation

In Lab 4, the group created a code to make the AEV run along the track so that data could be collected from the movement. The original run did not work because the propellers could not generate enough power to move the vehicle. After changing from the 2510 propellers to the 3030 propellers, the AEV was able to run around the whole track with the code used. Once the AEV ran through its code, the Arduino controller was connected to the computer with a USB cord. The Arduino EEPROM data recorded during the run was then loaded onto a MATLAB file. The data was then analyzed using MATLAB calculations and plotting along with the Design Analysis Tool.

This activity was done during Lab 4 so that the group knows how to do a performance analysis as they continue to work on their AEV. As different designs and codes are used, the group will want to see how the AEV performed in each test run. With the skills gained in this lab, the group will be able to analyze the data collected on each trial and use it to determine what needs to be improved between the design of the AEV and the code. When changes are made, the performance analysis will show if this change was an improvement or not, providing a way for the group to measure its progress and success of its AEV.

Results and Analysis:

The first run attempted did not result in much movement from the AEV vehicle when using the 2510 propellers, even when using a relatively high percent power. After switching to the 3030 propellers, the AEV moved much better across the track and was coded to successfully make it from the beginning point to the end point, where it came to a slow stop. The code is listed at the end of the Results and Analysis. The data from the run was then uploaded to MATLAB to analyze. MATLAB converted the data into an Excel sheet with corresponding variables for each column in the Excel sheet. The variables were used to calculate the physical parameters of the variables tested, including time in seconds, current in amps, distance in meters, and relative position in meters.

The graphs provided feedback on power used throughout the run. In addition, they provided specific power feedback at each time of the run. Looking at the graph, the most power was from the time 0 to 0.06 seconds, in which the supplied power jumped from 1.136 to 10.361 volts, which shows the power needed to start and get the motor speed to the desired amount. The total energy used in this phase was 0.899 J. After, the supplied was consistently around 8 volts plus or minus 0.2 volts. This stage of the code, which lasted 7.976 seconds, was the phase in which the motors ran at a consistent percent power and used 62.282 J. After this phase, however, the power from the motors was cut completely, and the power dropped to 0 volts, occasionally reading a small portion of power (even with the code telling the battery not to supply any power). This corresponded to the last phase of the AEV vehicle moving around the track in which it allowed its momentum from the previous phases to carry itself to the end point of the track. The total energy used in this phase was 0.348 J.

Adam - My role on the team is to contribute to research what materials is best to use for the AEV. I will weigh the different pieces that are given to the group in the AEV kit, and find an approximation

for the weight of pieces that would be created using the 3-D printer. I will also examine the results of the concept screening for Sketch A from Lab 4 to determine how the sketch can be improved or if the idea should just be abandoned altogether. I will also be in charge for most of the writing of the progress reports in the future. It will be my job to write the backwards and forwards looking situations along with takeaways and weekly goals. These writings will have to be reviewed by the other team members to ensure that no mistakes were made and all information is included. I also am responsible for uploading documents to the project portfolio when they are turned in.

Spencer - My role on the team is to be as handy as possible and help where help is needed. Every week I am in charge of writing the Weekly Meeting Notes for the Progress Report. The progress Reports are a key piece of information in this project and we worked together as a team to make sure that it is completed in a timely manner and without any mistakes. I also have been tasked with the responsibility of assembling the AEV so that there are no issues. Whenever there are problems with the construction of the AEV, I am normally the team member that the rest of the team turns to to resolve those issues. Along with these responsibilities I will be apart of the team to make accurate and informed decisions on which AEV design that the team moves forward with. This going to take a lot of careful preparation by all team members so that we can therefore have an efficient vehicle.

Aaron - My role on the team is creating and analyzing the code that makes the vehicle move on the track, and I also help physically prepare the vehicle for the track. I work with sketchbook to format the correct arduino code, and make adjustments to it where necessary for the group. One of my main tasks every lab is to properly run the AEV and collect data from it to be analyzed by the rest of the team. From there is where improvements are made on the design, while I implement those changes into the vehicle physically or on the code. I also provide input on design innovations, and the results and analysis that get presented in our reports.

Christian - My role on the team is to analyze the results of the labs, often organizing and evaluating the data through programs such as Excel and MATLAB, and integrate the results into the design of the AEV vehicle. In addition, I help with the coding to make sure the logic makes sense and the language is correct. In the lab, my job is to help with the recording the data. Furthermore, I help with the design of the vehicle, including materials used and dimension specifications.

<u>Takeaways</u>

1.) The 3030 propellers will have to be used because the 2510 did not produce enough thrust, contrary to what we previously had thought.
2.) Start with low power and work up to higher power to avoid the AEV crashing at the end of the track.
3.) Find a task for each group member even when there is nothing obvious to do in order to use time effectively.

Week 6

Situation

In Lab 5, the group will create a code to make the AEV perform certain actions designated in the lab manual. After completing the test run, the group will create success criteria that will be used to evaluate each of the team's designs. Some examples of this criteria may be balance, efficiency, and cost. Once the success criteria has been established, the group will perform a concept screening for designs made in Lab 4 to evaluate the different parts of each. The concept screening will be done by taking a reference design and comparing it to the designs established in Lab 4. The group will then determine for each success criteria whether the design being examined is better or worse than the reference design. A final score will be calculated from each of these individual scores to determine which design is the best according to the success criteria, and to find which parts can be improved. The concept screening is a useful tool because it compares different aspects of designs and shows which of these aspects need to be improved. It is also a good way to compare different designs to find which one is more effective in accomplishing the goals of the group.

Weekly Goals

1.) Determine at least 6 success criteria for the AEV designs before the test run in lab is completed.
2.) Perform a concept screening for every group members' design that was created for Lab 4 using the success criteria by the end of the lab period.
3.) Choose which design is the best defined by the concept screening and determine which aspects of it should be adjusted by the end of the lab period.

Weekly Schedule

Task	Teammate(s)	Start Date	Due Date	Time Needed
Lab 5 Progress Report	All	2/11/17	2/15/17	3 Hours
Lab 5	All	2/15/17	2/15/17	1 Hour 20 Min
Pre-lab reading/quizzes	All(separately)	2/14/17	2/15/17	30 mins
Update Portfolio	Adam	2/15/17	2/21/17	30 mins
Determine Materials	All	2/15/17	2/21/17	45 mins
Improve Designs	All (separately - everyone takes one)	2/15/17	2/21/17	1 hour

Appendix

Team Meeting Notes

Date: 12-Feb-17
Time: 5:00pm
Members Present: Aaron Mckinley, Adam Boes, Christian Considine and Spencer Lohmeier
Topics Discussed: Week 5 Progress Report and Week 4 Post-Lab

Objective:
Today's focus was to work on the Week 5 Progress Report and to complete Week 4 Post-Lab assignments.

To do/Action Items:
- Progress Report (AM, CC, SL, AB)
- MatLab Code (CC)
- Meeting Notes (SL)
- Backwards Situation (AB)
- Results & Analysis (AM)

Status Summary:
All members of the group have completed a design for the AEV. The final design has been chosen, but there will be improvements made with the tests that will be completing in the coming weeks. Thoughts and changes will continue to be made to the design and ideas behind the final design of our AEV.

Reflection:
- More time in class/labs needs to be spent splitting up work so that the assignments gets completed during class time
- Aaron and Christian worked well together on the MatLab assignment

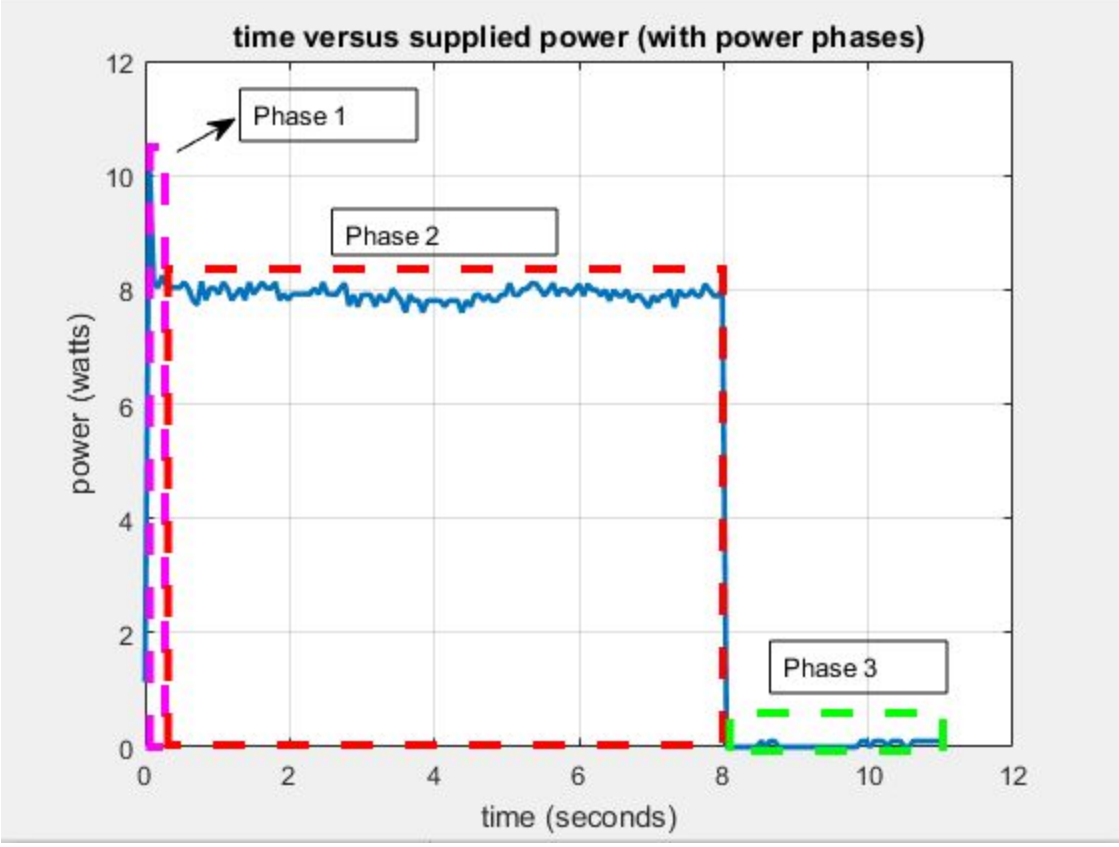
- Notes need to be taken during lab to remember what needs to be put in the portfolio later

Arduino Code

```
%************************************************%
% Name: Team O *********************************%
% Date: 2/12/17 ********************************%
% Class: 10:20 *********************************%
%
% Program Title: Performance Analysis ************%
%
% Program Description: Conversion of EEPROM data *%
%
%************************************************%
time=te/1000;
current=(ie/1024)*2.46*(1/0.185);
volt=(15*ve)/1024;
dist=0.0124*marks;
position=0.0124*pos;

for i= 1:184
power(i)= volt(i)*current(i);
end
power;

for i= 1:183
e(i)= ((power(i)+power(i+1))/2)*(time(i+1)-time(i));
end
e;

sum(e);

fprintf('\n The total energy of the code for one run is %f',sum(e))
plot(time,power,'LineWidth',2) title('time versus supplied power') xlabel('time (seconds)')
ylabel('power (watts)')
plot(time,power,'LineWidth',2) title('time versus supplied power (with power phases)') xlabel('time
(seconds)') ylabel('power (watts)')
grid on
box on
for i= 1:2
2
   incremental_energy(i)= ((power(i)+power(i+1))/2)*(time(i+1)time(i));
End
```

fprintf('\n phase 1 = %f',sum(incremental_energy))
fprintf('\n phase 2 = %f',sum(e(3:133)))
fprintf('\n phase 3 = %f',sum(e(134:183)))
The total energy of the code for one run is 63.529528 phase 1 = 0.899979 phase 2 = 62.281658 phase 3 = 0.347890

Plots



Sample from Excel Sheet and Phase Description

System Analysis											Phase	Code	Time		Total Energy
											1	motorSpeed(4,25)	0.06	0.899979	0.8999791687
Reference Voltage	2.46										2	goFor(8)	7.862	62.281658	62.28165838
											3	brake(4)	2.94	0.347789	0.347890292
														63.529426	
EEProm Readouts						Conversions to Physical Parameter						System Analysis 1			
Time (ms)	Current (counts)	Voltage (counts)	Marks (Cumulative)	Marks (Position counts)	Angle (counts)	Time (s)	Current (A)	Voltage (V)	Distance (m)	Relative Position (m)		Supplied Power (W)	Incremental Energy (J)		Total Energy (J)
0	11	543	0	0	0	0	0.142842061	7.954101563	0	0		1.136180259	0.3449114568		0.3449114568
60	102	534	0	0	0	0.06	1.324535473	7.822265625	0	0		10.3608683	0.5550677119		0.8999791687
120	80	535	0	0	0	0.12	1.038851351	7.836914063	0	0		8.141388764	0.4854303051		1.385409474
180	79	535	0	0	0	0.18	1.025865709	7.836914063	0	0		8.039621405	0.4884833259		1.8738928
240	81	535	0	0	0	0.24	1.051836993	7.836914063	0	0		8.243156124	0.4884833259		2.362376125
300	79	535	0	0	0	0.3	1.025865709	7.836914063	0	0		8.039621405	0.4823772843		2.84475341
360	79	535	0	0	0	0.36	1.025865709	7.836914063	0	0		8.039621405	0.4823772843		3.327130694
420	79	535	1	1	0	0.42	1.025865709	7.836914063	0.0124	0.0124		8.039621405	0.4823772843		3.809507978
480	79	535	1	1	0	0.48	1.025865709	7.836914063	0.0124	0.0124		8.039621405	0.4849737786		4.294481757
540	80	534	1	1	0	0.54	1.038851351	7.822265625	0.0124	0.0124		8.126171215	0.4845229587		4.779004716
600	79	534	2	2	0	0.6	1.025865709	7.822265625	0.0248	0.0248		8.024594075	0.4753810161		5.254385732