**Week 11 (Backwards Looking Summary)**

**Situation**

The objective for lab 11, was to complete the design of AEV and complete test runs to ensure that AEV can complete the tasks it must complete. In lab 10 the team decided to use the servo motor in the attempt to have a more controlled braking system while also using the motor as a way to counterbalance the weight. The team decided to let the servo motor press against the wheel to stop the AEV from moving rather than it pressing against the track.

Other changes that are worth mentioning is that our team also planned to use the code goFor() instead of goToAbsolutePostion() by measuring the time used by our AEV to reach the gate and the kabooze. This is because our team agreed that by using the code goFor(), a more consistent result will be obtained.

**Results & Analysis**

This week of lab testing didn't have any serious results or findings. Last week the group had added the servo motor to the AEV, this has had some implications on the performance of the AEV. The servo motor addition serves two purposes, to work as a break to stop the wheel from moving and the AEV from coasting and to equal out the center of balance of the AEV. The servo motor is located at the front of the arm that attaches to the track. Previously the center of gravity was off-balanced, favoring the rear. The group's main issue with this project has been consistency, the goal of the servo motor was to help aid in solving this problem. The servo motor has provided some additional resistance and the AEV is able to slow down faster and a little more consistent than the previous designs. This addition required a few changes to the original code to account for some added break/ slowing power. However there are still some issues. If the AEV is able to successfully complete the first gate the rest of the run will go smoothly but getting to the gate and within the sensors has been extremely difficult. The group has tested countless variation of several codes to try and find one that works and that hasn't happened. The issues could be with the material used as the brake for the servo motor or problems with the. These results come through trial and error and have made the group reconsider many aspects of the AEV design and code.

**Takeaways**

The first takeaway that the group learned from the lab was to learn how to use the micro servo. The function "rotateServo()" is used to change the angle of the servo arm. The group measured the angle between the arm and the front wheel and programmed it as "rotateServo(30)" which means that servo arm would rotate counterclockwise 30 degrees. The second takeaway that the group learned was to assembly the micro servo on the front wheel. The micro servo was

expected to attach the front wheel to slow it down just like a brake. Therefore, the group assembled it on the other side of the arm in order to attach it to the same side of the front wheel. In addition, the group banded the servo on the arm by using some electric tapes. The third takeaway that the group learned was to optimize the code. The group decided to use both the micro servo and the motor reversion to let the AEV make a relatively sudden stop. The previous code segment is

```
"rotateServo(30);
 goFor(9);
 reverse(4);
 motorSpeed(30);
 goFor(2);
 rotateServo(0);"
```

If the group used the code above, it would make AEV reverse motors after nine seconds when the servo rotated at 30 degrees. After the group discussion, the group changed this code segment to

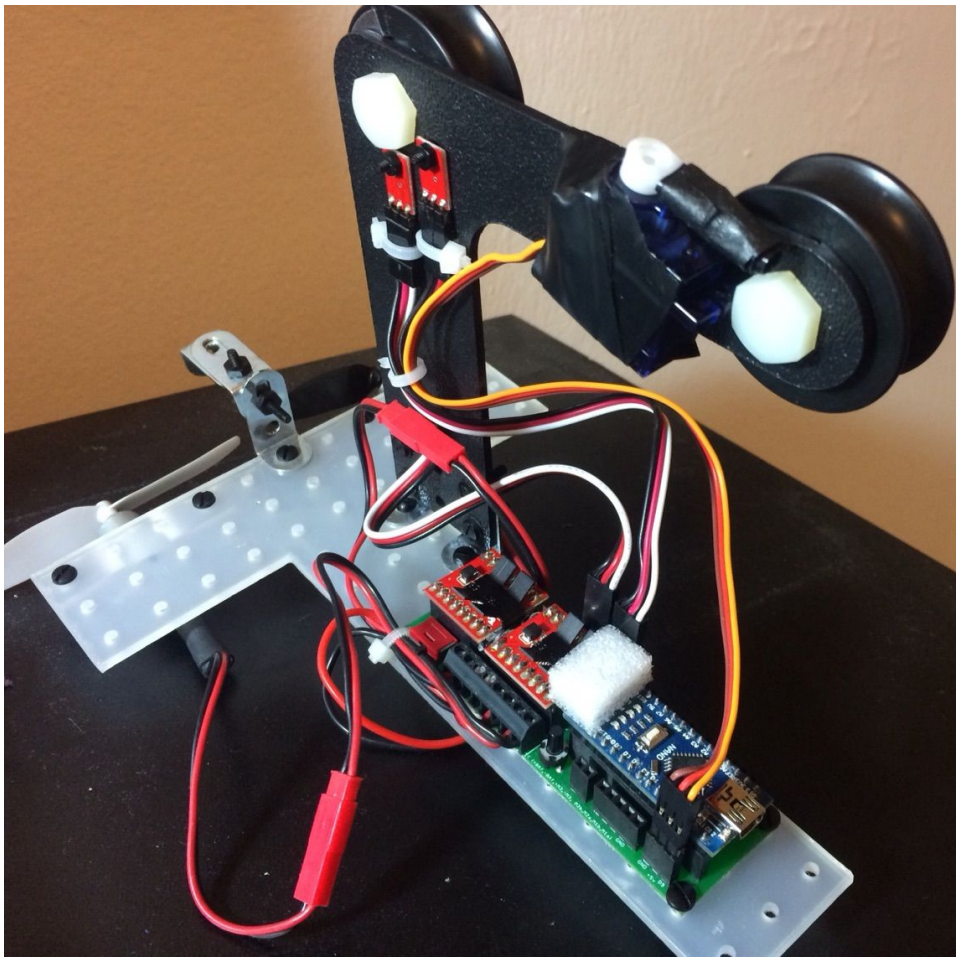
```
"rotateServo(30);
 reverse(4);
 motorSpeed(30);
 goFor(2);
 rotateServo(0);
 brake(4);
 goFor(9);"
```

Using the second segment, it could make sure that the AEV could reverse motors right after servo rotation. The general project learning from this lab was that the group discussion could help group members to know other members' ideas better. For example, when the group got stuck on the code problem, the group discussion helped us with providing multiple ideas about the code so that the group could solve this problem. In addition, team collaboration could help the group improve work efficiency. For example, when the group was testing the code, one of the group member was recording the time so that the group could figure out how long the AEV travelled on the track. Other three members were assigned to stand at three different spots to make sure that the AEV would not fall down the track.

## Tables & Figures

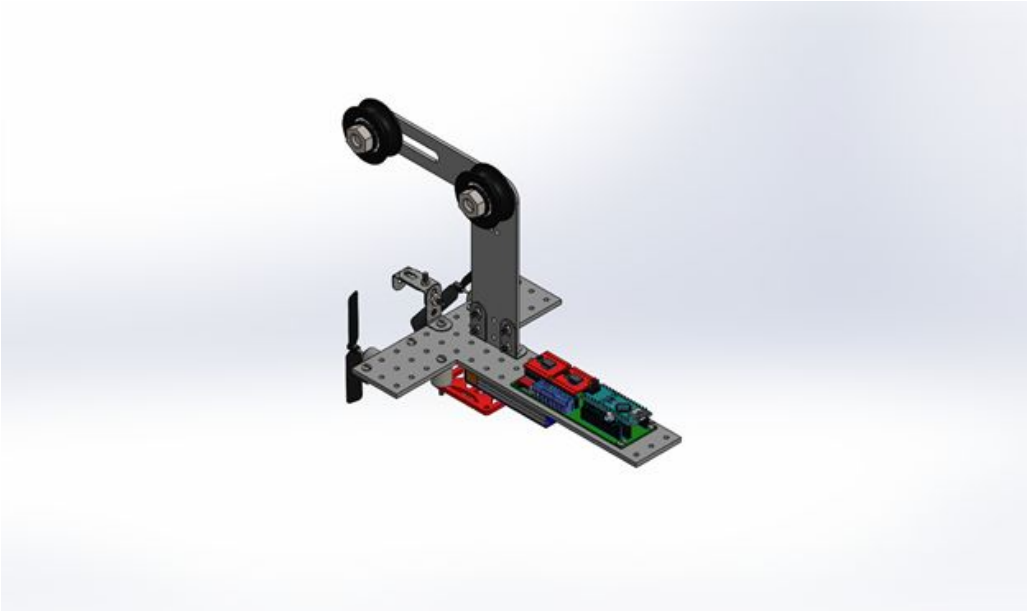
Relevant data/information summarized in clear and concise manner to support summary

**Figure 1 - Current AEV Model with Servo Motor**



The servo motor was added precisely a week ago to try and stop the AEV from it's tendency of passing through the first gate sensors. The motor is attached just by basic electrical tape. The arm the straddles the wheel is the same material of tape but wrapped around multiple times to increase the surface area that connects with the wheel.

**Figure 2 - Solidworks AEV Model**



The current 3D model of the group's AEV. This design is a well-balanced and efficient model that the groups has tested with the previous 4 weeks.

**Week 12 (Forwards Looking Plan)**

**Situation**

In the upcoming week the team will ensure that the AEV can accomplish the tasks that it is required to complete. This is important because it will allow the team to be ready to run its final test for a grade. The team will accomplish this by doing as many test runs as possible in the classes leading up to the evaluation. Also in the upcoming week the team will make the AEV run more consistently. This is important because during the final test the team needs the AEV to run consistently to avoid having any errors occur during the final test. The team will accomplish this by doing many test runs of the AEV and do last minute adjustments to the servo motor to help the AEV run more consistently. In the upcoming week the team will also finish the online portfolio of the progress made throughout the AEV project. This is important because it will allow the team to showcase their progress throughout the project in an organized manner. The team will accomplish this by meeting twice in the week in order to get everything completed before the end of the project. The team will also check the efficiency of the AEV to ensure that it is following the criteria the team set forward scoring sheet from previous labs. This is important because it is the last thing the groups needs to complete the project. The team will accomplish this by testing the data that is obtained from the test runs we complete during the week and analyzing it in the MATLAB software.

**Weekly Goals**

1. The team will complete the online portfolio. This will allow the team to have an organized way of displaying their progress throughout the project. The team will meet once outside of lab to complete the portfolio.
2. The team will finish develop of the servo motor. This will allow the team to have a more consistent braking system. The team will meet during the lab period to complete the servo motor installation.
3. The team will begin to prepare for the oral presentation on their AEV project. This will allow the team to showcase their project to the other groups in the class. The team will meet twice out of lab this week to accomplish this.
4. The team will do final testing on Wednesday. This will allow the team to have time to finish any other aspect of the project that needs to be completed. The team will meet during lab in order to make sure the AEV will be ready by that time.

**Weekly Schedule**

| Tasks | Teamates | Start Dates | Due Date | Time Needed |
|---|---|---|---|---|
| Finish the final test | All | 4/10/17 | 4/14/19 | 1-2 hours |
| Finish CDR | All | 4/10/17 | 4/14/17 | 2-3 hours |
| Prepare Oral Presentation | All | 4/14/17 | 4/21/17 | 2-3 hours |

## Appendices

### Team Meeting Notes

Prior week meeting(s), identifying when and where, who discussed what, why decisions were made, and when items are to be completed.

Date: 4/9/2017
Time: 4:00 PM -- 6:00 PM (Face-to-Face)
Members Present: Nick Waugh, Marcus Williams, Yinuo Wang, Yao Chong Chow
Location: Room 324, Hitchcock Hall

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Objective:
This week meeting was aimed to summarize the work the group did on the Lab 11 and schedule a plan for the next week. In addition, the group was supposed to talk about how to optimize the code so that the AEV could be more effective and boost energy efficiency. What's more, the group was expected to make a plan for the final test.

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To do/ Action Items:

- Questions -(All members)
- Lab 11 -PT4 -(All members)
- Discussion on code -(All members)
- Schedule of the final test -(All members)

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Decisions:

- The group decided to make sure the AEV could pass through the gate and finish the whole test
- The group decided to add rubber onto the micro servo to increase friction force

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Reflections:

- Yao thought that using both the micro servo and motor reversion could let the AEV make a sudden stop.
- Yinuo said that the group should finish at least two full tests by the lab on Wednesday.
- Nick pointed out that the group should find out the actual time that the AEV passes through the gate.
- Marcus thought that sliding on the track makes the AEV run inconsistently.
- We need to make sure the AEV could run consistently on the track and pass the final test.

### Arduino code

The code (or codes) used in lab to perform tests and/or gather data

Code#1

```
motorSpeed(4,25);              //run all motors at a speed of 25%
goFor(6.1);                    //run it for 6.1 seconds
reverse(4);                    //reverse all motors
motorSpeed(4,30);              //run all motors at a speed of 30%
goFor(3);                      //run it for 3 second
brake(4);                      // brake all motors
goFor(10);                     //run it for 10 second
//After the gate is open
reverse(4);                    //reverse all motors
motorSpeed(4,30);              // Set all motors to 30%
goToRelativePosition(250);     //run it until AEV travels 250 more total wheel counts
reverse(4);                    //reverse all motors
motorSpeed(4,30);              //run all motors at a speed of 30%
goFor(1);                      //run it for 1 second
brake(4);                      // brake all motors
goFor(3);                      //run it for 3 seconds
//After attaching the magnet
reverse(4);                    //reverse all motors
motorSpeed(4,25);              //run all motors at a speed of 25%
goToAbsolutePosition(261);     //run it until AEV travels 261 total wheel counts
reverse(4);                    //reverse all motors
motorSpeed(4,30);              //run all motors at a speed of 30%
goFor(3);                      //run it for 3 second
brake(4);                      // brake all motors
goFor(10);                     //run it for 10 second
//After the gate is open again
reverse(4);                    //reverse all motors
motorSpeed(4,30);              // Set all motors to 30%
goToRelativePosition(250);     //run it until AEV travels 250 more total wheel counts
reverse(4);                    //reverse all motors
motorSpeed(4,30);              //run all motors at a speed of 30%
goFor(1);                      //run it for 1 second
brake(4);                      // brake all motors
```

Code#2

```
motorSpeed(4,30);   //run all motors at a speed of 30%
goFor(6.24);         //run for 6.24 seconds
rotateServo(35);     //rotate the servo at 35 degrees
reverse(4);          //reverse all motors
motorSpeed(4,30);   //run all motors at a speed of 30%
goFor(2);           //run it for 2 second
rotateServo(0);      //reset the servo
brake(4);           //brake all motors
goFor(9);           //brake for 9 seconds

//After the gate is open
reverse(4);                 //reverse all motors
motorSpeed(4,30);       // Set all motors to 30%
goFor(8.7)                 //run al  motors at a speed of 30% for 8.7 seconds
rotateServo(35);      //rotate the servo at 35 degrees
reverse(4);             //reverse all motors
motorSpeed(4,30);   //run all motors at a speed of 30%
goFor(2);           //run it for 2 second
rotateServo(0);      //reset the servo
brake(4);           //brake all motors
goFor(3);           //brake for 3 seconds

//Attach the cargo vehicle
reverse(4);              //reverse all motors
motorSpeed(4,60);     // Set all motors to 60%
goFor(8.7)               //run al  motors at a speed of 30% for 8.7 seconds
rotateServo(35);      //rotate the servo at 35 degrees
reverse(4);             //reverse all motors
motorSpeed(4,30);    //run all motors at a speed of 30%
goFor(2);               //run it for 2 second
rotateServo(0);       //reset the servo
brake(4);               //brake all motors
goFor(9);               //brake for 9 seconds
motorSpeed(4,60);    // Set all motors to 60%
goFor(6);               // go for 6 seconds
reverse(4);            //reverse all motors
motorSpeed(4, 30);   // Set all motors to 30%
goFor(3);             //go for 3 seconds
brake(4);             //brake all motors
```