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Executive Summary

The purpose of this experiment was to become familiar with a crucial piece of equipment in regards to the AEV's performance: the external hardware sensor components. A crucial aspect of the lab included learning to program function calls using the external sensors that will be successful in the AEV's required task. This lab also contained the second component of testing the performance of the AEV after such troubleshooting techniques were used. Therefore, the advanced energy vehicle's ability to complete the task could then be evaluated and further adjustments could be made in regards to the external sensors. The objective of this lab was to understand the manner in which distance of the AEV will be tracked, in order for the final design to complete its mission across the classrooms pre-designed track.

Analysis of the marks was the main focal point. By using the external sensor system, the marks allowed for the AEV to travel a certain distance instead of the team estimating based on time and motor power percentage. The conversion between marks and distance was given to be 8 inches to 1 mark with little deviation.

The results from testing the AEV were adequate. The conversion between marks and inches was accurate with the distance of the track as it came close with little deviation in distance travelled. An interesting observation that was observed was how quickly the AEV stopped after the motors were cut off. The weight of the AEV limited its coasting after the the motor cut off and and allowed for more accurate approximation for how far it would travel instead of having to factor in the coasting distance. The weight did, however, affect the AEV during turns as it would swing more wildly then intended. The knowledge gained from this lab is crucial to the mission given to the AEV. To accurately estimate the distance and program that distance in the AEV is necessary to prevent unfavorable forceful collisions to either the R2 unit or the gate. Turns will also be able to be programed to be at lower speeds so the vehicle will not cause the R2 unit to fall off.

The distance travelled by the AEV based on the marks is the main error the lab worked to calculate. By becoming familiar with approximations of the AEV's coasting distance it would be possible to program it with adaptations to resolve the error. A form of inherent error in the lab is the mark system itself in arduino. The usage of marks only allows for whole numbers meaning that it is limited to going certain distances. This cannot be solved with the current software and must be dealt with using approximations and in the future applying a different distance measuring system. Another recommendation would be the team being given a sample AEV to test the external sensor hardware components in order to see how the AEV behaves compared to the designed AEV in order to compare results.

The group members were able to familiarize themselves with the external hardware components, allowing for the calculation of the distance the AEV was programmed to travel. The team now has the knowledge and tools to program the vehicle to move certain distances as desired. To accurately secure the R2 unit with precision every time allows the team to worry less about deviations from the plan and focus more on design improvement. This is key to being able to retrieve the R2 unit with as much precision and efficiency as possible. As long as any problems that arise are solved, the empire stands no chance.

Appendix:

Outside track code:

```
motorSpeed(4,25);              //Run all motors at a constant speed (25% power) for 2 second.
goFor(2);

motorSpeed(4,20);              //Run all motors at a constant speed of 20% power
goToAbsolutePosition(394);    //Travel a distance of 16 feet

reverse(4);                    //Reverse all motors.


motorSpeed(4,30);              //Run all motors at a constant speed (30% power) for 1.5 second.
goFor(1.5);

brake(4);                      //Brake all motors.
                               //Save program as External Sensors Outside.
```

Inside track code:

```
motorSpeed(4,25);              //Run all motors at a constant speed (25% power) for 2 second.
goFor(2);

motorSpeed(4,20);              //Run all motors at a constant speed of 20% power
goToAbsolutePosition(332); //Travel a distance of 13.5 feet

reverse(4);                    //Reverse all motors.


motorSpeed(4,30);              //Run all motors at a constant speed (30% power) for 1 second.
goFor(1.5);

brake(4);                      //Brake all motors.
                               //Save program as External Sensors Outside.
```