Weeks 10-11

Situation

This week's lab focused on development of the code to guide the AEV to course completion. The team completed two variations of code to bring the AEV to a stop in front of the gate, and analyzed both versions of the code for consistency and energy efficiency. The first code stopped the motors part of the way through the AEV's travel, and let it coast to a stop in front of the first gate sensor. The second code stopped the motors before hitting the first sensor and immediately reversed them to act as a "brake" for the AEV.

Following analysis of both codes, the team used the concept second code (which braked the AEV) to develop the remainder of the course. Once the entire code was developed, the team continued to make small adjustments in order to ensure the reliability and accuracy of the code on both tracks. This was done in order to ensure the team developed and tested a code that could be agreed upon moving forward. Multiple code solutions were put alongside each other for the team to eliminate poor solutions, similar to how the designs were eliminated when put against one another. After comparing multiple solutions the team came to a consensus on a code to be used.

Results and Analysis

The approach taken by the team consisted of testing multiple solutions to each portion of the track. This generated multiple possibilities the team could use as software for the AEV. For example, stopping the AEV had two solutions. One solution used a high power setting of 80 percent power for half a second, while the other code used a 50 percent power setting for a full second. Considering the team's objective with the code was to have a consistent product that can be reliable for final testing, the higher power setting solution was the better of both solutions. This solution brought the AEV to an immediate stop with little to no coasting, whereas the smaller power output resulted in a small amount of coasting of the AEV. Another noticeable discrepancy is the approach to the load. The two possibilities the team tested consisted of another high power reverse causing the AEV to stop near the load while shortly coasting afterward, or using a lower power setting from a distance away, allowing the AEV to coast into the load after braking. The team decided to use the second option which allowed for the AEV to coast into the load from a greater distance away. This option is not as consistent as the first, however, the difference is negligible. This approach bumps the load into the foam padding lightly, before carrying it back to the start position. This option was chosen with energy efficiency in mind. Less power was used to slow the vehicle, and it travels part of the distance to the load without using any power at all.

As the code now stands, the AEV accelerates until it approaches the gate at a steady pace before halting to a brake. This consists of approximately the first 13.15 feet of the track. The AEV then pauses for 7 seconds before taking off again. When the AEV begins to move it accelerates until it reaches its designated speed. After travelling 7.15 feet, 20.3 feet from the start of the track, the AEV will brake and use a light reverse to make the AEV coast the remaining distance to the cargo. This brake function is used on the AEV for 7 seconds. After this time is up, the AEV travels 13 feet to the gate at a constant power of 65 percent, more power than the 35 percent used for the AEV itself. After the first 12.5 feet, the AEV uses another quick stop to stop at the gate. After waiting 7 seconds, the AEV travels 13.5 feet with the load to the starting position and uses a light brake to take the cargo slowly to the starting position.

Takeaways

1) AEV – The vehicle is much more consistent if it is "braked," rather than being allowed to coast to a stop.
2) AEV – The vehicle stops more consistently with a high power output in the reverse direction for a short time, than a lower power output used for a slightly longer time.
3) AEV – The trip back with the load will use higher power settings and use more energy.
4) General – It is helpful to test more than one solution to a problem—the results of both solutions may not be what you expect.

Week 12

Situation

In the upcoming lab, various sequences of code will be tested to see which best optimizes energy use for the AEV while traversing the monorail. Important factors to be analyzed include the power percentage the motors are set to while travelling the length of the track and whether or not to have the AEV grind to a halt or brake suddenly. These will be analyzed by using the MATLAB script and trying both methods, after which we will progress with the best performance. Because will not be an issue, the group is doing this to focus on using as little energy as possible to achieve the goal of an energy efficient vehicle. Additionally, a draft of the CDR oral presentation will be reviewed by the instructional staff on Thursday April 6 and feedback given that will be incorporated later when the actual CDR oral presentation is given.

Weekly Goals

1. Complete a draft for the CDR oral presentation.
2. Test various Arduino codes to see which is the most energy efficient.
3. Find best power setting for the motors.

Weekly Schedule

Task	**Teammate(s)**	**Start Date**	**Due Date**	**Time Needed**
Oral presentation draft brainstormed	All	4/3/17	4/6/17	30 minutes
Code tested for energy optimization for stopping vs drifting	All	4/3/17	4/3/17	55 minutes
Code tested to reliably end at the gate on the return track	All	4/5/17	4/5/17	55 minutes
Code tested for energy optimization regarding the power used when pulling the load	All	4/6/17	4/6/17	55 minutes
Meeting for oral presentation draft (content compiled, parts divvied, etc.)	All	4/5/17	4/6/17	60 minutes
Analyze the data from each run	Alex	4/3/17	4/5/17	30 minutes
Create graphs to compare data from each run	Nick	4/3/17	4/5/17	45 minutes

Appendix A – Arduino Code

```
/*
 * Travel to the gate and stop. The AEV will travel to a certain
 * position
 * and reverse the engines to quickly stop the vehicle at the first
 * sensor.
 */
celerate(4,0,30,4);
motorSpeed(4,30);
goToRelativePosition(100);
celerate(4,30,25,2);
motorSpeed(4,25);
goToAbsolutePosition(333);
brake(4);
reverse(4);
motorSpeed(4,80);
goFor(0.5);
brake(4);
goFor(7);

/*
 * Travel to the payload. The AEV will brake itself but not completely
 * stop,
 * so that it coasts onto the caboose and connects itself.
 */
 reverse(4);
 celerate(4,0,30,2);
 motorSpeed(4,30);
 goToRelativePosition(100);
 celerate(4,30,25,2);
 motorSpeed(4,25);
 goToAbsolutePosition(740);
 brake(4);
 reverse(4);
 motorSpeed(4,80);
 goFor(0.3);
 brake(4);
 goFor(5);

 /*
  * Travel back to the gate and activate it. Motor speed is adjusted for
  * carrying the payload.
  */
  celerate(4,0,40,4);
  motorSpeed(4,40);/*
  goToRelativePosition(-100);
  celerate(4,40,35,2);
  motorSpeed(4,35);*/
  goToAbsolutePosition(460);
  brake(4);
  reverse(4);
  motorSpeed(4,80);
  goFor(1);
  brake(4);
```

```
goFor(7);

/*
 * Finally, travel back to the starting point. As with before, the AEV
 * will brake, but not stop, so that it can coast back to the original
 * position.
 */
reverse(4);
celerate(4,0,40,2);
motorSpeed(4,40);/*
goToRelativePosition(-100);
celerate(4,40,35,2);*/
goToAbsolutePosition(20);
brake(4);
reverse(4);
motorSpeed(4,80);
goFor(0.3);
brake(4);
```

Appendix B – Team Meeting Notes

Date: 23 – Mar – 2017
Time:
Members Present: Alexander Morales, Cody Valentine
Topics Discussed:

Objective:

- Determine what factors to test regarding the energy optimization of the AEV.

To do/Action Items:

- Come up with alternate methods of moving/stopping for the AEV that could result in less energy used.
- Test aforementioned ideas using MATLAB.
- Establish different code to be used in different rooms due to length differences.

Decisions:

- The group will move forward using a push configuration on the forward track and a pull configuration on the return.

Reflections:

- After the mishap with a broken piece, it seems that a more compact and better-proportioned design is more durable. Now that the design is remade and stable, the group is going to be focusing on writing code to finish the track with as little energy as possible. A couple ideas to test include how the AEV stops and how much power the motors need.