Instructor: Dr. Bixler, GTA: Miranda McGrothers
04/07/2018

Backwards Looking Plan

Situation-

Performance test one consists of accelerating the AEV to a point between two sensors, waiting for five seconds, and proceeding through the gate. In performance test one the team used time to control the AEV's motors, and they investigated the amount of variation in our performances. The team discovered that the amount of variation between each run on the track was too much and therefore unreliable in the performance test, however we were unable to switch from the design and had to use time for the first performance test. Luckily, the team was able to complete a successful run during the performance test on the second try.

Performance test two consists of accelerating the AEV to a point in the middle of the track between two sensors, proceeding through the gate, picking up the caboose at the opposite end, and pulling the caboose out of the loading zone. To combat the inconsistency problem, the team decided to switch to using sensors and absolute position for the second performance test. They tested with both relative and absolute position and found absolute to be the most reliable in getting consistent data and consistent distances on the track. Switching to absolute position meant almost completely rewriting the code, but once it was completed the team had much more reliable and consistent runs on the track and were able to complete the second performance test on the first attempt with more confidence in the AEV.

Results and Analysis-

Performance test one optimized two different designs. The first design used a horizontal base with both motors on one end [*Figure 1*], either both pushing or both pulling depending on the direction of the AEV was traveling. As shown by the power vs distance graph [*Figure 3*], the AEV was unable to stop and was going to glide through the gate, hence the it stopped before the test could be completed. Design one's pull/push only method did not allow for quick stopping and would cause even more problems when the AEV would have to carry the caboose back. Design two for performance test one was more compact and vertical [*Figure 2*]. It optimizes push propeller configuration by having one motor on the front and one on the back. Design two was able to complete performance test one flawlessly, and was able to stop very suddenly before the gate. This can be seen in the power vs distance graph [*Figure 3*] as the large orange spike appears. The AEV was able to break so much because of the front propellers push in the opposite direction. Due to the compact design, better ability to stop, and results of performance test one, the team decided to move forward with design two over design one.

Performance test two used AEV design two and tested two different codes to complete the run. The first code used had both propellers running and was the teams original concept. Both motors were running at the same time for most of the run and the AEV had noticeable power and fast breaking abilities. The run was able to be completed in about 39 seconds [*Figure 6*]. The second code that the team tested just used one motor. The back motor was used for its ability to push. The team was astounded as the AEV was able to complete a full run on just one motor. It breaked less and was therefore able to slide into the first gate. It was also able to pull the caboose out of the connecting zone enough. The one motor code completed the run in about 40 seconds [*Figure 6*], only one second later than the code that used both motors. Furthermore, the one motor code used half the energy that its counterpart used [*Figure 5*]. This test proves just how much effect push propeller configuration has and how little pull has. Totally eliminating pull did not change end end result or effect the successfulness of the run, but made it more energy efficient for only one second longer. Unfortunately, the team will not be utilizing the one motor configuration for safety concerns involving one motor being overused and the controller shorting out. But, this test has provided valuable information for the team, in which they have planned to minimize energy usage by giving less power to the motor pulling.

Takeaways-

The team would like to continue using reflectance sensors and absolute position in the code we use to complete final run. The team learned that using absolute position rather than relative position and time is much more consistent when it comes to stopping the AEV at the correct position on the track. Time management was huge factor in being able to complete both of the performance tests on time. Communication skills within the team were improved in order to satisfy the requirements of the performance tests on time. Due to inconsistent runs leading up to each test, the team had to learn to solve problems concerning the design of the AEV and the code more efficiently.

Forwards Looking Plan

Situation-

There will be four main projects that the team will be completing in the upcoming weeks including the final performance test, final oral presentation, CDR, and final website update. The final performance test will optimize everything the team has taken away throughout the semester including previous progress reports, oral presentations, research, and trial and error. This will be completed in the upcoming week by first practicing and then being tested on a monorail. The

final oral presentation is assigned to put everything the team has done into a presentation to show their understanding of the work completed and to inform fellow classmates. The presentation will take a lot of preparation and will need to be practiced several times before it is due. The CDR, being very long, will take a few days of dedicated work to complete, but it will put what the team learned into words. It will be completed by splitting up the large amount of work among team members. Lastly, the final website displays all of the teams' work for others to view. This is important because it identifies what is important to the team and how displaying results easily and conveniently is necessary.

Weekly Goals-

Week 12

- Final oral presentation draft due Tuesday, April 10th
- Work on final performance test - final test by Friday, April 13th
- Start final oral presentation
- Start CDR
- Update website for final submission

Week 13

- Work on final oral presentation - present either Wednesday,18th or Friday, 20th
- Work on CDR - due Friday, April 20th
- Work on final website - due Friday, April 20th

Week 14

- Class complete

Weekly Schedule-

- The final oral presentation draft will be started on Sunday, April 8th. Each team member will have to have their slides complete by Monday night to be turned in. The work will be split up equally and each member will have what section they will need to complete the slides about and present about the following week. The draft should only take each team member 30 minutes each.
- During class on Tuesday, Wednesday, and Thursday the whole team will work on the final performance test. Jordan will be the lead coder and will man the middle section of the track. Joe will start the AEV and Nicky will be on the opposite side. Tyler will be timing and looking for improvements that can be made. This task will only be worked on during class time and could be completed as early as Wednesday, the 11th even though it is not due until the 13th.
- The final oral presentation will be prepared for on the weekend of the 14th. Each team member will work on their portion of the presentation separately on their own time.

Each team member is expected to be completed with their section by Tuesday, the 17th. A final powerpoint presentation needs to be turned in by Tuesday night.

- The final CDR will be started the weekend of the 14th. At this time all team member will have what part they need to complete assigned to them. Each team member is expected to spend at least 2.5 to 3 hours completing their sections. Due to the formatting that will need to be completed prior to turning in, the team will need to be finished with the CDR by thursday, the 19th.
- The final website update will be worked on throughout week 13. Each team member will have different tasks including making meeting notes, uploading graphs, pictures/videos and code, describing the course and the problem, and final touches. Each team member is expected to spend 1 to 1.5 hours on the website update and be completed with their portion by Thursday evening, the 19th.
- There is no class week 14 and nothing is due this week. Team members will be studying for finals.

Appendix

Meeting Notes

Meeting 11

Date: 3/20/18

Time: 3pm

Location: Hitchcock 224

Attendees: Joe Malinak, Jordan Thrash, Nick Study, Tyler Szekely

Topics Discussed:

- Finish building the new AEV design
- Find the right absolute position to complete performance test 1

Upcoming tasks:

- Finish Performance Test 1
- Start on Performance Test 2

Meeting 12

Date: 3/21/18

Time: 3:55 pm

Location: Hitchcock 224

Attendees: Joe Malinak, Jordan Thrash, Nick Study, Tyler Szekely

Topics Discussed:

- Finished Performance Test 1

- Start to plan out what needs to be done for Performance Test 2

Upcoming tasks:

- Performance Test 2
- Start CDR draft

Meeting 13

Date: 3/23/18

Time: 3pm

Location: Hitchcock 308

Attendees: Joe Malinak, Jordan Thrash, Nick Study, Tyler Szekely

Topics Discussed:

- Start on CDR draft and figure out everyone's roles.
- Continue progress on Performance Test 2.

Upcoming tasks:

- Finish CDR over weekend
- Final runs for Performance Test 2 next week

Meeting 14

Date: 3/27/18

Time: 3pm

Location: Hitchcock 224

Attendees: Joe Malinak, Jordan Thrash, Nick Study, Tyler Szekely

Topics Discussed:

- Continue Performance Test 2
- Fininalize absolute position values

Upcoming tasks:

- Committee Meeting 2

Meeting 15

Date: 3/30/17

Time: 3:55 pm

Location: Hitchcock 224

Attendees: Joe Malinak, Jordan Thrash, Nick Study, Tyler Szekely

Topics Discussed:

- Finished Performance Test 2
- Preparation for Committee Meeting 2

Upcoming tasks:

- Committee Meeting 2
- Progress Report 3
- Performance Test 3

Meeting 16

Date: 4/3/18

Time: 3pm

Location: Hitchcock 224

Attendees: Joe Malinak, Jordan Thrash, Nick Study, Tyler Szekely

Topics Discussed:

- Work on Performance Test 3
- Begin work on Progress Report 3

Upcoming tasks:

- Finish Performance Test 3
- Finish Progress Report 3
- Study for second midterm

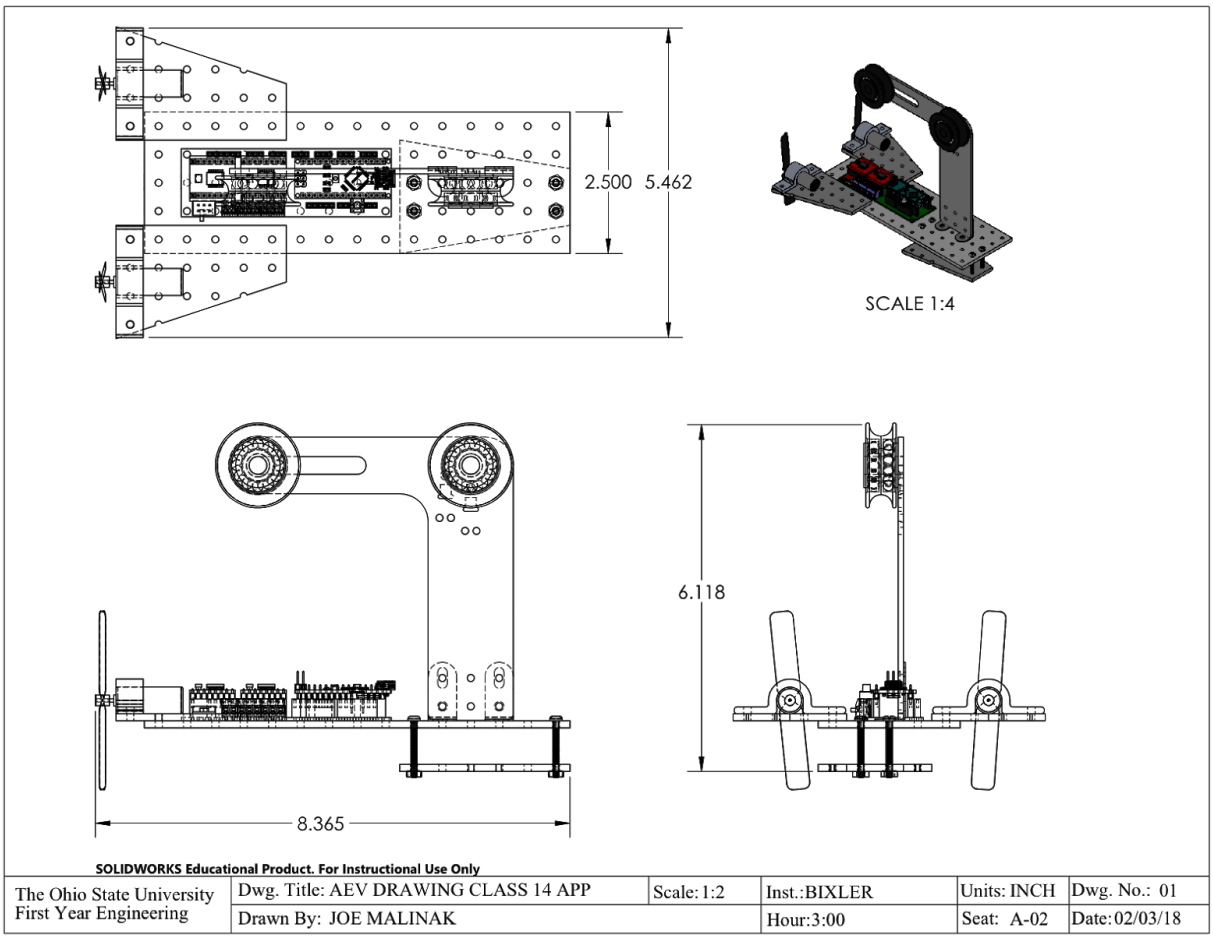
Code

Performance Test 1

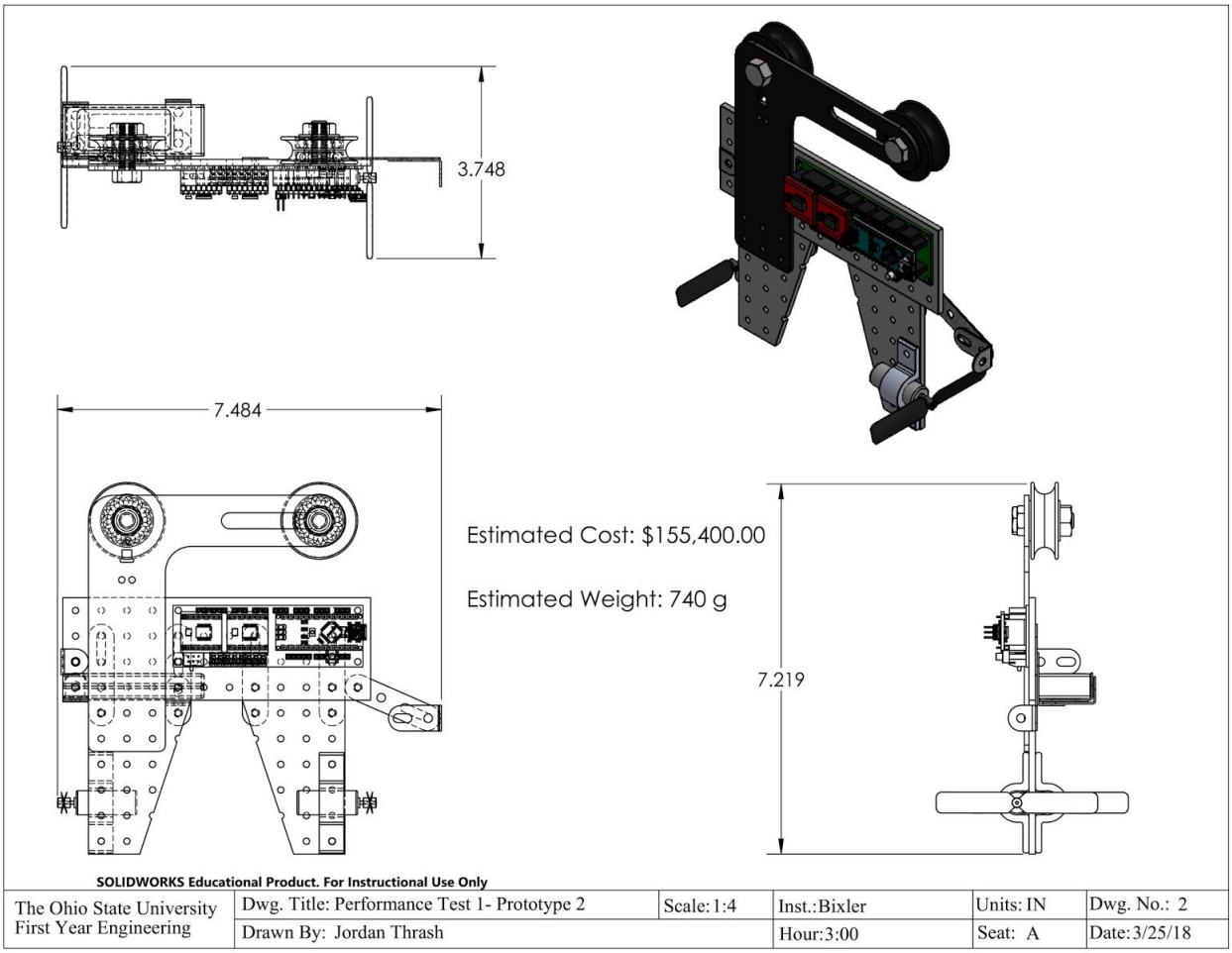
```
//accelerate up the track and cut power at top
celerate(4,0,40,1.5);
motorSpeed(4,40);
goToAbsolutePosition(-220);
motorSpeed(4,0);
goToAbsolutePosition(-236);

//stop at the gate and wait for 7 seconds
reverse(4);
motorSpeed(4,80);
goFor(0.55);
brake(4);
goFor(8);

//proceed through gate
reverse(4);
celerate(4,0,30,3);
goToRelativePosition(-200);
reverse(4);
motorSpeed(4,40);
goFor(.5);
```

Performance Test 2

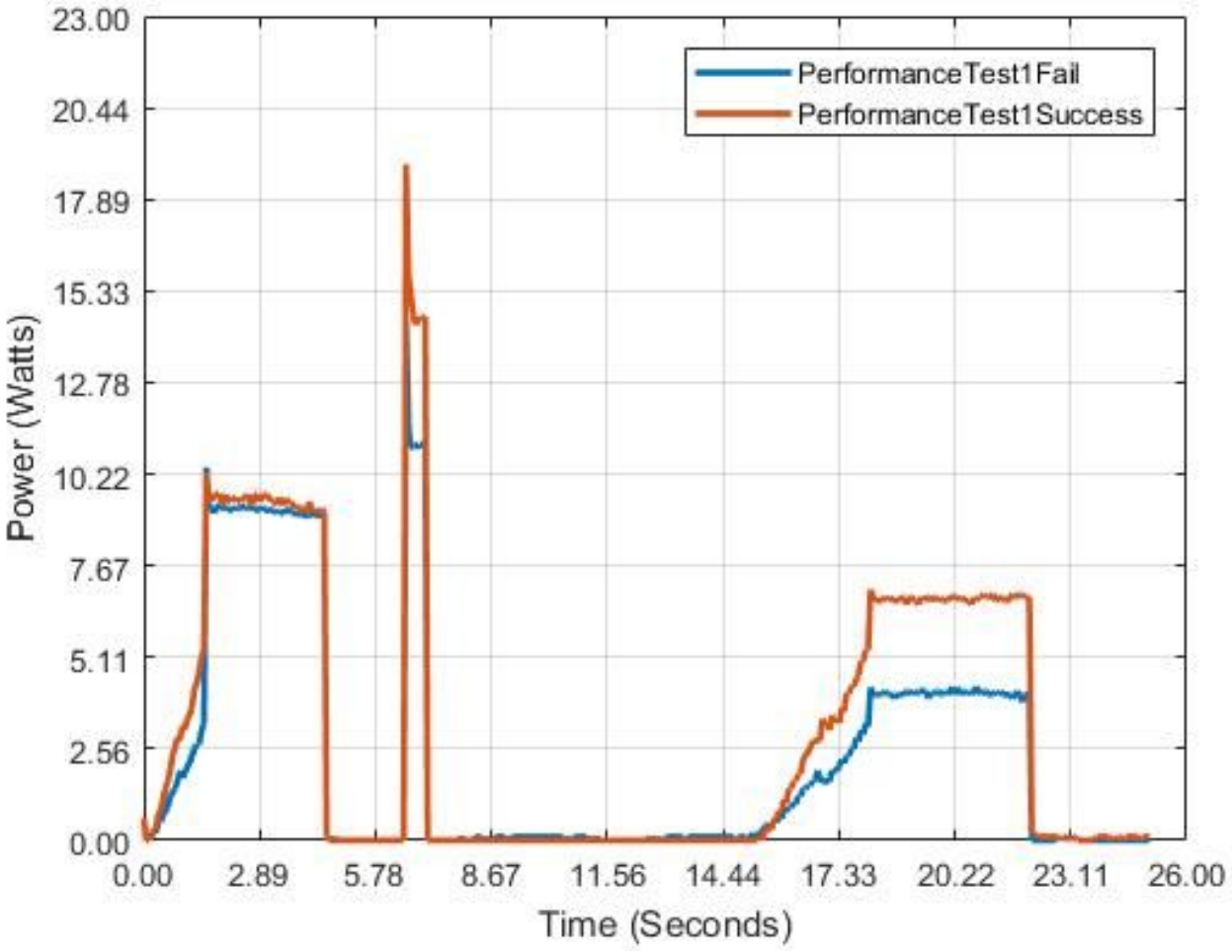
```
//accelerate to the top
celerate(4,0,40,1);
motorSpeed(4,40);
goToAbsolutePosition(-220);
motorSpeed(4,0);

//roll to gate and brake
goToAbsolutePosition(-264);
reverse(4);
motorSpeed(4,80);
goFor(0.55);
brake(4);
goFor(8);//stop at the gate

//proceed through gate
reverse(4);
celerate(4,0,40,3);
motorSpeed(4,40);
goFor(2.75);
motorSpeed(4,0);
goToAbsolutePosition(-520);

//slow down before connecting to caboose
reverse(4);
motorSpeed(4,25);
goFor(.6);
motorSpeed(4,0);

//wait for 5 then pull caboose
goFor(10);
celerate(4,0,60,2);
goFor(4);
```



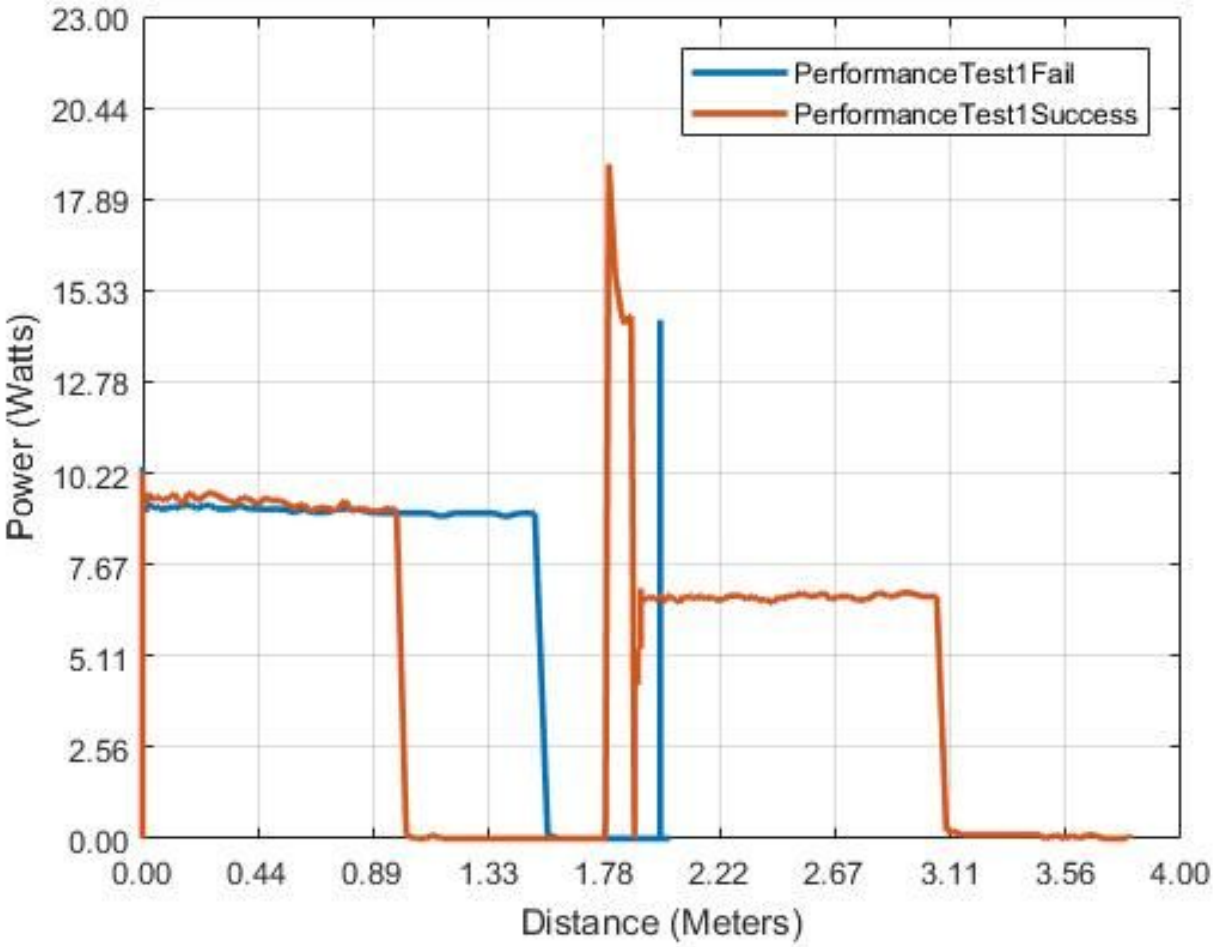
[Figure 1] AEV Design One



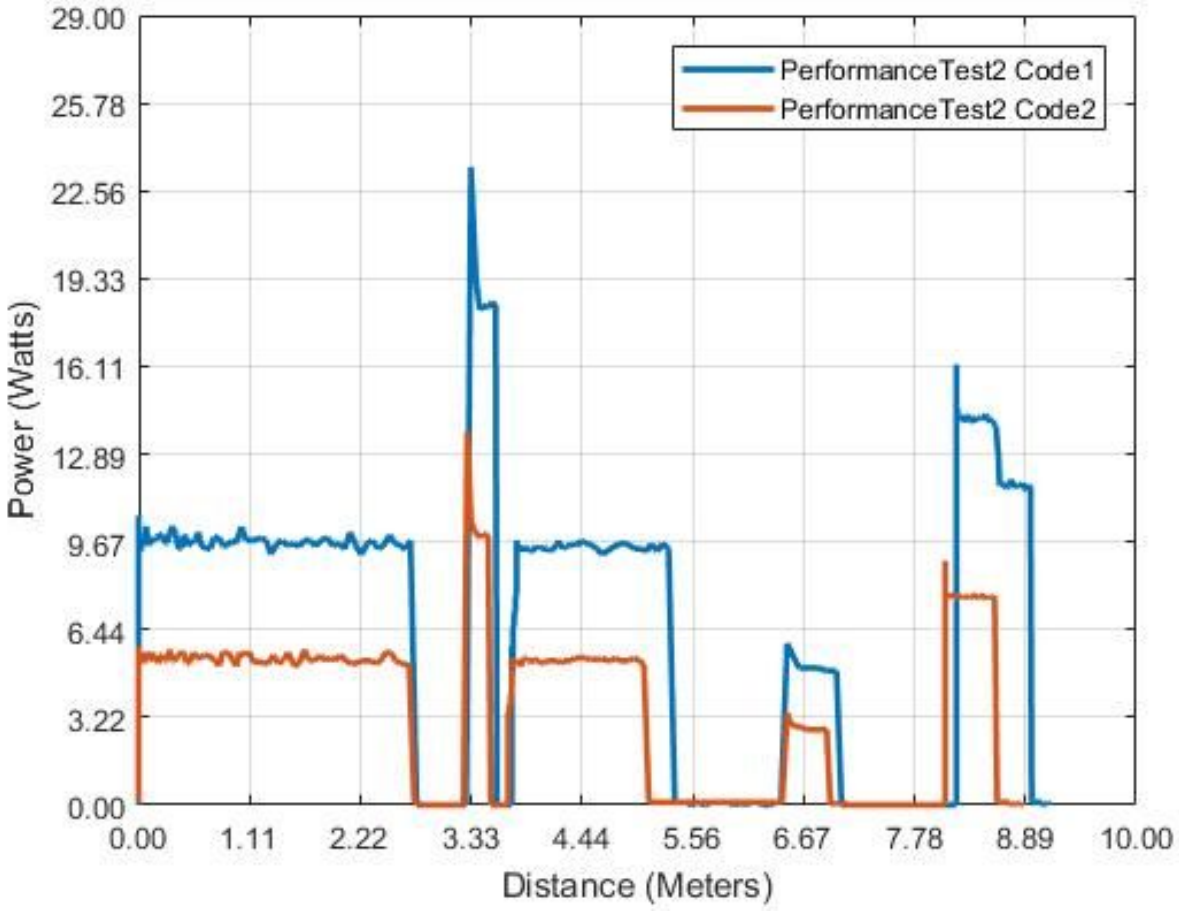
[Figure 2] AEV Design Two



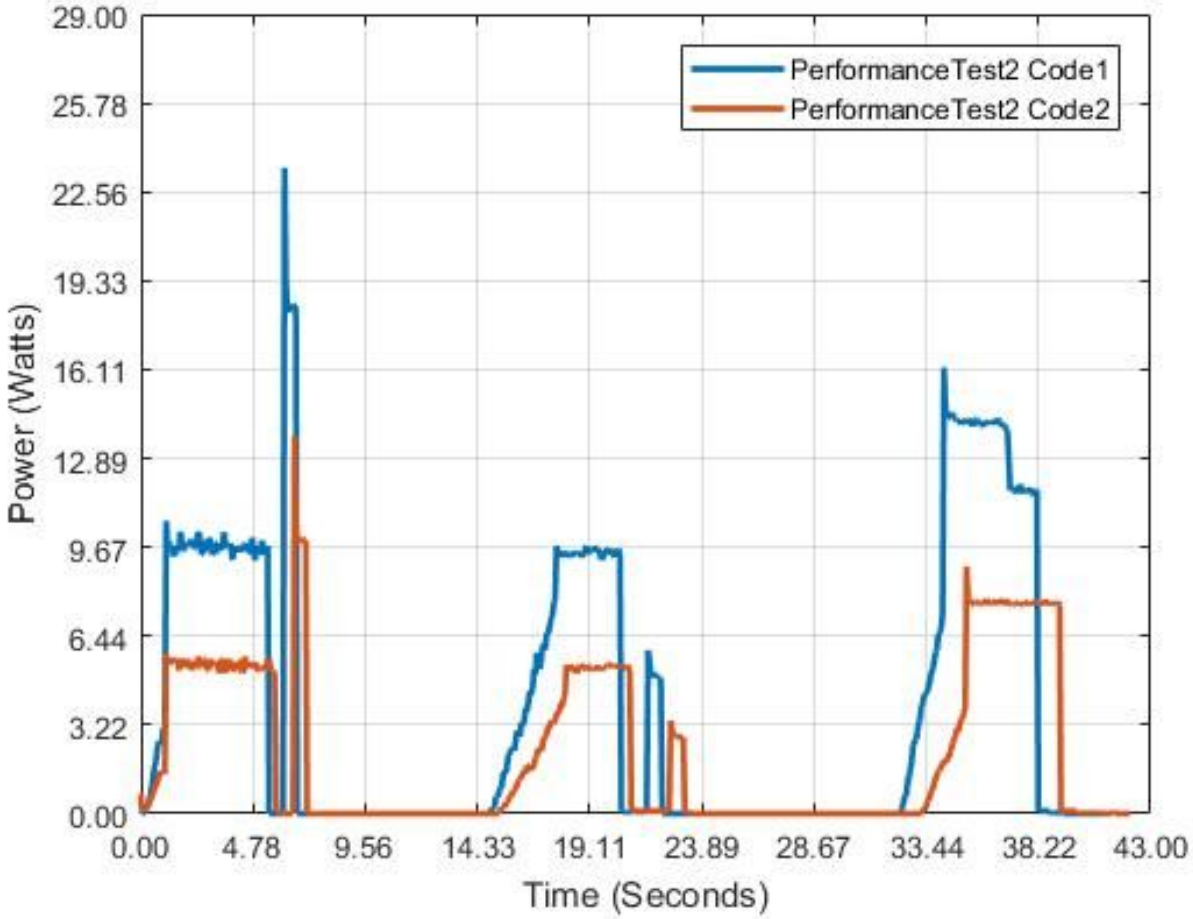
[Figure 3] Power vs Time Graph for Performance Test 1



[Figure 4] Power vs Distance Graph for Performance Test 1



[Figure 5] Power vs Distance Graph for Performance Test 2



[Figure 6] Power vs Time Graph for Performance Test 2