Progress Report Lab 8

Group F – Abbey Hamilton, Merveille Kavota, McKenzie Kennelly, and Xinjie Li

Instructor-Professor John Schrock, GTA-Rahel Bayene 03/06/2017

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# Lab 7:

Situation:

Lab 7 consisted of the team creating and presenting the Preliminary Design Review Oral Presentation. The presentation included a concise overview of selected takeaways from Labs 1 through 6 and a detailed plan as to what the team's future schedule looked like. The takeaways were meticulously chosen by identifying which realizations truly impacted the team's current AEV design. Regarding the looking forward portion of the presentation, the team honed in on the precise way in which each performance test would be executed, along with set goals to be accomplished. Presenting to supervisors and colleagues created an atmosphere in which the team could receive feedback, whether that be positive or constructive. As a whole, the presentation acted as the first step into the team's completion of the Critical Design Review Oral Presentation at the end of the project.

Results and analysis:

Before creating the presentation for Lab 7, the team thoroughly discussed the AEV design progress that occurred in Labs 1 through 6. Identifying major decisions and conclusions made in previous labs allowed for the team to understand their progress. For the first 5 weeks, the team recognized that their initial AEV design was simply the reference design. Instead of manipulating the AEV to create a unique design, the team chose to run all tests on the reference AEV design. This resulted in the team being at a loss in regards to the fact that all data collected each week, whether that be data about the AEV's functionality, energy efficiency, or overall design, was insignificant in respect to their unique team design. For example, the team measured the EEPROM data for the reference design, and concept scored/screened the reference design. If the team had done these tests on their individual team design, they would have been able to identify any weaknesses of that design and modify accordingly. Additionally, the team addressed takeaways concerning the necessity to correctly write all command calls and to properly set up the AEV Controller, including correct placement of the reflectance sensors and propellers. Looking at the propellers specifically, the team mentioned in the PDR how they chose the 3030 puller propellers after deciding to look particularly at the propulsion efficiency of different configurations of different types of propellers. The team continued to discuss how, in week 6, they created a new team design, taking a step away from the reference design. However, after identifying apparent issues in that design, the team altered the design one more time, creating their current design. The team believes the current design is environmentally friendly, durable, maintainable, of a smaller mass, and cost effective.

However, the team is aware that certains aspects of their current AEV design may not fulfill criteria set in the Mission Concept Review. Specifically, the team is focused on the balance of the AEV, its ability to attach to the cargo, and its overall energy efficiency. As to why the team is fixated on these specific elements will be discussed further in the situation of Lab 8.

After the presentation, the team was presented with feedback from their colleagues and supervisor that provoked further thought. A colleague asked the team to discuss what immediately was their next step post- PDR presentation. The team concluded that the best next step for their overall success in the project would be to immediately test their current AEV design on the overhead track as they had not done that yet. All feedback from colleagues and superiors was highly taken into consideration by the team as it allowed for new improvements and ideas to be considered.

Overall, Lab 7 led the team to develop a thorough understanding of their design process and of what steps they were going to take moving forward. The oral presentation allowed for the team to see where other teams were at in regards to their progress and future plans. This helped to give the team a sense of where they were compared to other groups. In addition, it allowed for the team to see other team's ideas. This gave the team a better comprehension of what was expected of their AEV in the eyes of other colleagues. The PDR, essentially, established the team's previous knowledge, whilst generating new insight.

Takeaways from Lab 7:

1) Labs 1 through 6 were all vital in the design process to the team's current design. Takeaways, regarding the syntax of the Arduino code, the setup of the reflectance sensors, the specific propellers that were chosen, and testing that was done with the reference design, all were identified and analyzed.
2) The moving forward plan was created. It included goals for each specific performance test, and for the project, as a whole. A detailed schedule was also created.
3) Feedback from colleagues and supervisors was taken into consideration.
4) Oral presentation skills were tested and graded.

## Lab 8:

Situation:

Before performance test 1, the team has to prepare a code that will allow the AEV to perform all necessary tasks on the overhead track. This includes the AEV starting and traveling to the first gate, stopping before the first gate, waiting seven seconds, traveling to the loading zone, waiting five seconds, connecting to the cargo, traveling back to the first gate, waiting for seven seconds, and then traveling to the starting point. In addition to preparing a code, the team must create a second design and have all components necessary to construct this design. The second design will be similar to the current design; however, the difference between the current design and the second design will be the use of a T-shaped arm rather than an L-shaped arm. The team will test balance and cargo attachment for both designs on the overhead track. The team considers balance to be one of the most important criterion, as the balance of a design determines the AEV's ability to not only stay on the track, but also how efficiently it will be able to transport the cargo. Therefore, transportation of the cargo is considered another important criterion, as a design's ability to do this determines how much of the MCR it fulfills. While energy efficiency is also an important feature to test in both designs, this component will be tested in the future, during performance test 3. In order to test balance, the team will visually inspect which design is more balanced while executing the code on the track. In order to test which design better transports the cargo, the team

will make observations while the AEV is in transit. The team will then decide the final design based on which design is best balanced and can attach and transport the cargo whilst on the overhead rail.

In order to create a final design that successfully balances turns, minimizes blockage, has a center of gravity, minimizes cost, and is environmentally-friendly, well maintained, and durable, the team compared the two designs that will be tested in performance test 1 to the reference AEV design using concept screening and scoring techniques. As each individual design was screened and scored, the strengths and weaknesses of each design were clear.

In comparison to the reference AEV design, the team concluded that both the L-shaped arm design and the T-shaped arm design rank higher in minimal blockage while travelling through gates on the track, balancedness on the track, maintenance, durability, and environmental factors, as both designs have a smaller width, are easier to assemble, and use less equipment than the reference design, the team scored these designs. However, the team believes the T-Shaped arm design will have a similar center-of-gravity in comparison to the reference design and a slightly better center-of-gravity than the L-shaped arm design. In terms of cost, the T-shaped and L-shaped designs will be comparable to the reference design.

As both designs were compared to the reference design, it became clear that the team believes the T-Shaped arm design will better meet the balanced and transportation of cargo requirements set forth by the team. However, the data collected in Lab 8 will determine if this assumption is correct, or if the L-Shaped arm design better meets these requirements.

Tables and Figures:

**Table 1: Concept Screening Scoresheet**

| Success Criteria | Reference | Design A -L-Shaped Arm | Design B - T-Shaped Arm |
|---|---|---|---|
| Balanced in Turns | 0 | + | + |
| Minimal blockage | 0 | + | + |
| Center-of-gravity | 0 | - | 0 |
| Maintenance | 0 | + | + |
| Durability | 0 | + | + |

| | | | |
|---|---|---|---|
| Cost | 0 | 0 | 0 |
| Environmental | 0 | + | + |
| | | | |
| Sum +'s<br>Sum 0's<br>Sum -'s | 0<br>7<br>0 | 5<br>1<br>1 | 5<br>2<br>0 |
| | | | |
| Net Score | 0 | +3 | +4 |
| Continue | Combine | | Yes |

**Table 2: Concept Scoring Matrix**

| | | A Reference | | Design X - L-Shaped Arm | | Design Y - T-Shaped Arm | |
|---|---|---|---|---|---|---|---|
| **Success Criteria** | **Weight** | **Rating (0-5)** | **Weighted Score** | **Rating** | **Weighted Score** | **Rating** | **Weighted Score** |
| Balanced in Turns | 5% | 3 | 0.15 | 4 | 0.20 | 4 | 0.20 |
| Minimal blockage | 15% | 3 | 0.45 | 4 | 0.60 | 4 | 0.60 |
| Center-of-gravity | 10% | 2 | 0.20 | 2 | 0.20 | 3 | 0.30 |
| Maintenance | 25% | 3 | 0.75 | 4 | 1.00 | 4 | 1.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Durability | 15% | 2 | 0.30 | 3 | 0.45 | 3 | 0.45 |
| Cost | 20% | 3 | 0.60 | 3 | 0.60 | 3 | 0.60 |
| Environmental | 10% | 3 | 0.30 | 4 | 0.40 | 4 | 0.40 |
| Total Score | | | 2.75 | | 3.45 | | 3.55 |
| Continue | | No | | No | | Develop | |

Weekly goals:

1) Update the Project Portfolio
2) Narrow down number of possible designs from two to one
3) Make modifications to final design that is chosen
4) Prepare two codes that will be used in performance test 2
5) Work on extra credit video

Weekly schedule:

When it is time to write the sixth progress report, the entire team will meet on Monday, March 20 from 8 P.M. to 10 P.M. in the Thompson Library. They will complete the progress report and prepare for performance test 2.

# Progress Report Lab 8

| | No. | Task | Start | Finish | Due Date | Est Time | Abbey Hamilton | Merveille Kavota | McKenzie Kennelly | Xinjie Li | % Complete |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Performance Test 1 | 1 | AEV Design 1 Construction | 1-February | 21-March | 21-March | 8 h | 0.5 h | 1 h | 0.5 h | 1 h | 100 |
| | 2 | AEV Design Testing | 15-February | 21-March | 21-March | 2 h | 0.5h | 0.5h | 0.5h | 0.5h | 20 |
| | 3 | AEV Design Data Analysis | 15-February | 21-March | 21-March | 2 h | | | | | 0 |
| | 4 | AEV Design 2 Construction | 15-February | 21-March | 21-March | 2h | 1h | 1h | 1h | 1h | 100 |
| | 5 | Lab 8 (PT1) Progress Report | 6-March | 7-March | 7-March | 5 h | 3h | 3h | 3h | 3h | 100 |
| | 6 | Lab 9 Progress Report | 7-March | Before 22-March | 22-March | 5h | | | | | 0 |
| | 8 | Performance Test 1 | 7-March | Before 21-March | 21-March | 8 h | | | | | 0 |
| | 9 | Preliminary Design Report | 21-February | Before 24-March | 24-March | 10h | 2h | 1h | 2h | 1h | 20 |
| | 10 | Project Portfolio | 18-Januaty | Before 21-April | 21-April | 20 h | 0h | 0h | 5h | 0h | 30 |
| | 11 | Extra Credit Video | 15-February | Before 28-February | 21-April | 20 h | 0h | 3h | 0h | 3h | 25 |

# Appendix:

Team Meeting Notes

**Date:** 03/06/2017
**Time**: 8PM (Face-to-Face)
**Members Present:** Abbey Hamilton, Merveille Kavota, McKenzie Kennelly, and Xinjie Li
**Topics Discussed:** Lab 7 Post-Lab

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**Objective:**
Today's main focus was to work on the progress report for lab 8, update the project portfolio, and finalize the second possible design that will be used in performance test 1.

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**To do/Action Items:**
- Complete code that will be used in performance test 1 by Tuesday, March 6 (Abbey H, Merveille K, McKenzie K, Xinjie L)
-Continue updating project portfolio (McKenzie K)

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**Decisions:**
- The reflectance sensors must be moved from the L-shaped arm to the T-shaped arm when it is time to test the second design.
- Both designs must be tested on the overhead track.

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**Reflections:**
-Because the current and the second designs have not been tested on the overhead track, the code used during the performance test will most likely need to be adjusted during lab.

Arduino Code:

```
motorSpeed (4,45);              //both motors move at a speed of 45%
goToRelativePosition (295);     //the AEV moves to a position of 295 marks
brake (4);                      // both motors stop
goFor (9);
motorSpeed (4,45);              //both motors move at a speed of 45%
goToRelativePosition (172);     //the AEV moves to a position of 172 marks
brake (4);                      // both motors stop
goFor (7);
reverse (4);                    //both motors reverse direction
motorSpeed (4,45);              //both motors move at a speed of 45%
goToRelativePosition (172);     //the AEV moves to a position of 172 marks
brake (4);                      // both motors stop
goFor (9);
motorSpeed (4,45);              //both motors move at a speed of 45%
goToRelativePosition (295);     //the AEV moves to a position of 295 marks
brake (4);                      // both motors stop
```