Sprint 2 - Accuracy Design Document

April 11, 2022

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1. Executive Summary

1.1 Project Overview

This document includes some of the documents, files, and other information required for the accuracy-sprint portion (Sprint 2) of the CS104 Robotics Triathlon as outlined in the CS 104-01 Class syllabus for Spring 2022. The robot must complete a figure-eight course on the floor of room HH-208. A video will be taken to show the robot completing its task.

1.2 Purpose and Scope of this Specification

Describe the purpose of this specification and its intended audience. Include a description of what is within the scope and what is outside of the scope of these specifications. For example:

In scope

- This part includes the testing for the Accuracy (figure-eight) course only, this is further explained in section 2.1

Out of Scope

- This part does not involve the testing for Agility and Endurance

2. Product/Service Description

2.1 Product Context

This project is part 2 of the robotics triathlon containing three different sprints. The three sprints are Endurance, Accuracy, and Agility. This part contains the Accuracy section of the project. Each section will be presented via video format.

2.2 User Characteristics

Our group contains three students testing, recording, and fixing the robot when it needs to be. A final video is to be presented at the end of the project. Our group members have little experience having used this type of robot only in the first sprint, but we have some experience working with the block code.

2.3 Assumptions

We are using a robot called the SPRK+ and we will be using Sphero Edu for the programming and block code. This app can be used on our phones or laptops, but we programmed the robot using our laptops. The course we are following is inside room HH-208. We will be using an iPhone 13 when filming the robot.

2.4 Constraints

Some constraints for this project included the room and course not always being available to use, this limited the time we had to work together to test and make changes to the robot. Other constraints included finding the right time for us all to meet up and work together on the project. Some members had busy schedules which caused major time constraints. Some other problems included other groups using the room at the same time as us, which made it harder when both robots were on the same course.

2.5 Dependencies

Some dependencies include the robot being charged in order for it to work. The robot to be up to date in order for it to follow the block code successfully. Other dependencies are making sure the robot can accurately repeat coded loops so it may repeat the figure eight course with precision and accuracy.

3. Requirements

3.1 Functional Requirements

Req#	Requirement	Comments	Priority	Date Rvwd	SME Reviewed / Approved
ACCR_01	Robot must star tin the middle of the figure 8		1	4/7	4/7
ACCR_01	Robot must complete a circle		1	4/7	3/7
ACCR_01	Robo must stay on the tape		1	4/7	4/7
ACCR_01	Robot must complete another circle in opposite direction	This was the hardest part it would stray every time	1	4/7	4/7
ACCR_01	Robot must put both circles together		1	4/7	4/7
ACCR_01	Robot must complete 5 cycles of the figure 8	After the first cycle it would start to move off the tape, we had to fix this problem	1	4/7	4/7
ACCR_01	Robot will speak “I am the Winner” upon completion		1	4/7	4/7
ACCR_01	Robot will flash multi colored lights		1	4/7	4/7

3.2 Security

3.2.1 Protection

The key for the protection of the software and hardware was with the group's overall accountability. The robot itself was always with one of the group members at all times and each time it was used was with all members present. In addition, each time the software was manipulated and changed, the progress was saved and logged.

3.2.2 Authorization and Authentication

Pubcookie will be used for authorization of each user trying to use the software. Users simply trying to use the software for their own personal trials will be authenticated as “guest” and the group members associated with the overall project will be authenticated as “Accuracy.”

3.3 Portability

Due to the fact that the Sphero Edu program is portable on most systems, the code used in this project can be easily used on many different devices and networks. All any user must do is download the appropriate version of Sphero that corresponds to their operating system. The only portion of the project that is not portable is the course itself.

4. Requirements Confirmation/Stakeholder sign-off

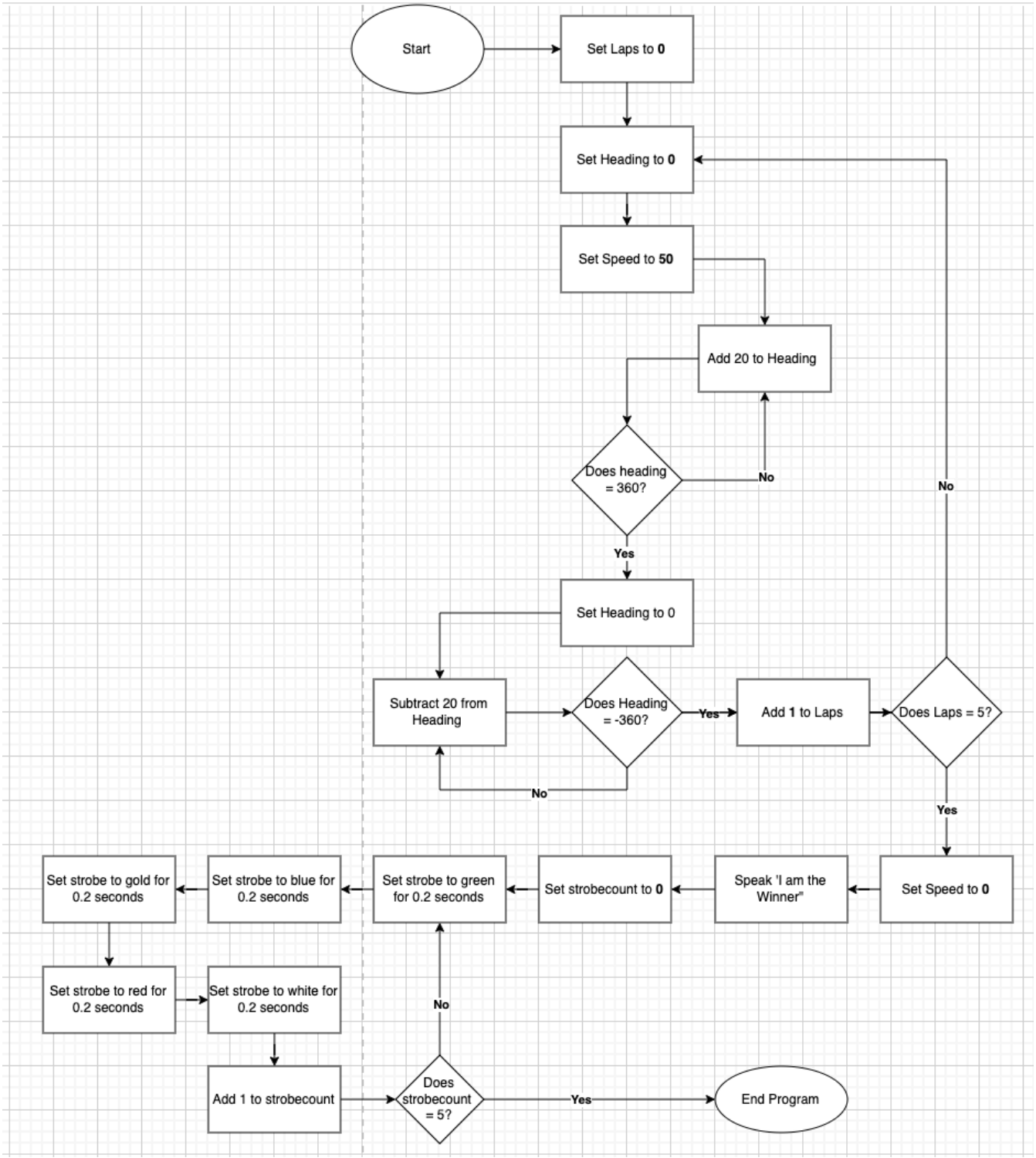
Meeting Date	Attendees (name and role)	Comments
04/04/22	Chalen, Jack, Dennis	Met to test the robot
04/07/22	Chalen, Jack, Dennis	Met to test the robot

5. System Design

5.1 Algorithm

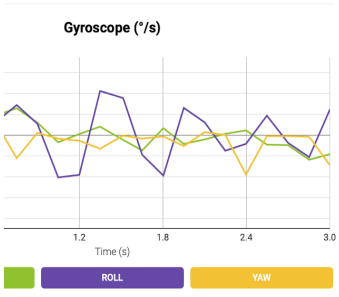
1. Start
2. Set laps to 0
3. Set heading to 0
4. Set speed to 50
5. Add 20 to heading
6. If heading is less than 360 repeat step 5
7. set heading to 0
8. Subtract 20 from heading
9. If heading is greater than 360 repeat step 8
10. Add 1 to laps
11. If laps is less than 5, repeat steps 5 - 10
12. Set speed to 0
13. speak “I am the Winner”
14. Set StrobeCount to 0
15. Set strobe to green for 0.2 seconds
16. Set strobe to blue for 0.2 seconds
17. Set strobe to gold for 0.2 seconds
18. Set strobe to red for 0.2 seconds
19. Set strobe to white for 0.2 seconds
20. Add 1 to strobe count
21. If strobe count is less than 5 repeat steps 15-20
22. End program

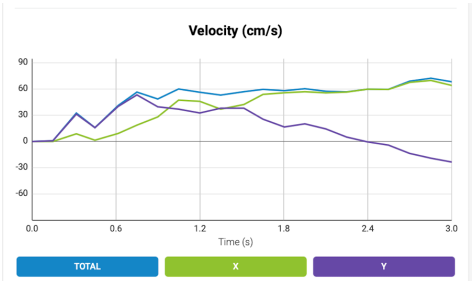
5.2 System Flow

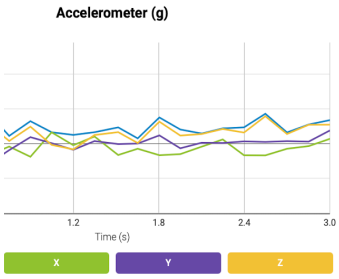


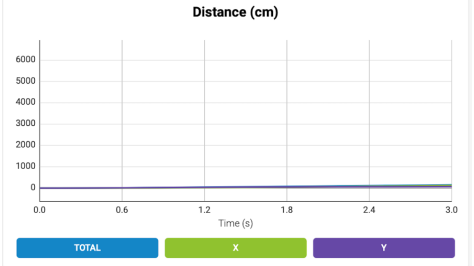
5.3 Software

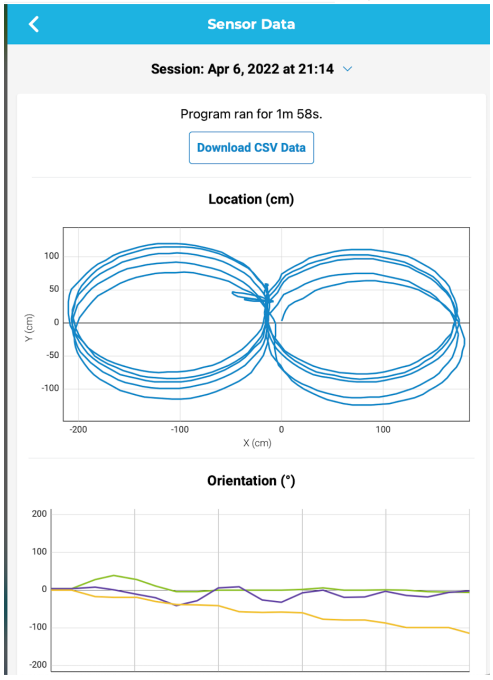
- Sphero Edu program version 6.3.5
- macOS Big Sur Version 11.4 operating system











5.4 Hardware

- 2013 MacBook Pro (Late 2013)
- 2.4 GHz Dual-Core Intel Core i5 processor
- 8 GB 1600 MHz DDR3 memory

- Sphero Sprk+ robot

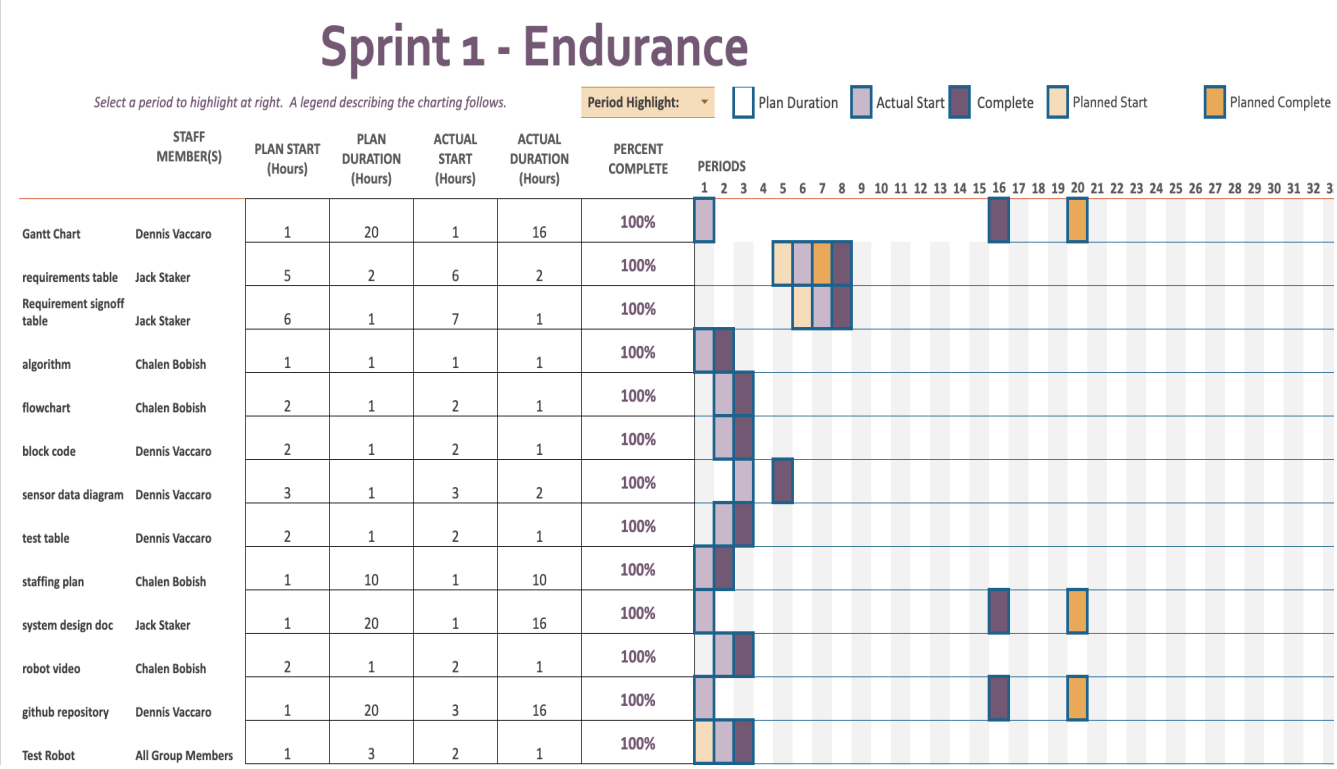
5.5 Test Plan

Include a test plan showing all unit tests performed for this application, Include test rational, test date, staff member, pass/fail status

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
Gauge approximate speed and distance needed to complete first vertical section of the course	03/30/2022	Robot will not be successful at traveling 1st measured distance	Robot went the wrong direction (improper aim)	DV	Fail
Continue to gauge approximate speed and distance needed to complete first vertical section of the course	03/30/2022	Robot will not be successful at traveling 1st measured distance	Robot was no successful at traveling 1st measured distance (to short of distance)	DV	Fail
Obtain correct distance of first leg of course	03/30/2022	Robot will travel correct distance of first leg and pivot	Robot traveled to short of distance	DV	Fail
Test figure eight looping code	03/30/2022	Robot will follow two loop codes, with instructions to travel in a circle. The two coded loops are identical besides one having negative integers in the code where it is instructed which direction to turn. The negative integers will make the robot repeat the same actions but in a the opposite direction as the first loop,, creating a figure eight	robot correctly traveled on an unspecified figure eight	DV	Pass
Expand the size of the figure eight	03/30/2022	Robot will travel in a figure eight but make wider turn radiuses	Robot was unsuccessful - Robot made one successful circle then went in a straight line	DV	Fail
Expand the size of the figure eight	03/30/2022	Robot will travel in a figure eight but make wider turn radiuses	Robot was unsuccessful - Robot made one successful circle then traveled in a series of small circles	DV	Fail
Expand the size of the figure eight	03/30/2022	Robot will travel in a figure eight but make wider turn radiuses	Robot was unsuccessful - Robot robot only traveled in one circle and failed to change direction. However the circle was the correct size as the course	DV	Fail
Make 1 successful figure eight to the exact specifications as per the accuracy sprint	03/30/2022	Robot will complete one successful figure eight around the Accuracy course	Robot achieved the expected output	DV	Pass
Travel the figure eight to the exact specifications as per the accuracy sprint (5X)	04/06/2022	Robot will travel the figure eight outlined on the ground, for 5 laps, and finish in the center	Robot traveled the figure eight successfully for one lap but failed to repeat the course accurately the second time. Robot continued the figure eight pattern but traveled further and further away from the outline course with each lap	DV	Fail
Travel the figure eight to the exact specifications as per the accuracy sprint (5X)	04/06/2022	Robot will travel the figure eight outlined on the ground, for 5 laps, and finish in the center	Robot traveled the figure eight successfully for one lap but it was observed that it was traveling past the start point before starting the second lap of the figure eight course	DV	Fail
Travel the figure eight to the exact specifications as per the accuracy sprint (5X)	04/06/2022	Robot will travel the figure eight outlined on the ground, for 5 laps, and finish in the center	Robot traveled to small of a distance - figure eight was too small	DV	Fail
Travel the figure eight to the exact specifications as per the accuracy sprint (5X)	04/06/2022	Robot will travel the figure eight outlined on the ground, for 5 laps, and finish in the center	Robot traveled to large of a distance - robot traveled far outside of the figure eight boundary	DV	Fail

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
Travel the figure eight to the exact specifications as per the accuracy sprint (5X)	04/06/2022	Robot will travel the figure eight outlined on the ground, for 5 laps, and finish in the center	Robot was successful at completing 5 laps and also stayed within a reasonable distance of the tape outlined course	DV	Pass

5.6 Task List/Gantt Chart



5.7 Staffing Plan

Insert a chart/table that depicts the roles and responsibilities of each team member that worked on this project

Name	Role	Responsibility	Reports To
Chalen	Data/Planning	algorithm, flowchart, and robot testing	Jack
Dennis	Programmer	block code, test robot, Gantt chart, Sensor data diagram maintain Github	Jack
Jack	Manager	System design document, robot testing	N/A