# Sprint 2 - Accuracy Design Document

## April 11th, 2024

# Table of Contents

# 1. Executive Summary

## *1.1 Project Overview*

In this project, we are testing our group's and our individual ability to problem solve, quantify, organize, document, code, test, and present a software system. This process is called 'software engineering'. We will display this ability through the programming of a robot to perform the task of traveling around a figure eight path which is laid on the classroom floor. The intended audience for this project is Professor Eckert, and our classmates.

## *1.2 Purpose and Scope of this Specification*

**In Scope**

This document addresses requirements related to Sprint 2 of the Robotics Project:

- Modification of code to travel in a figure 8 motion to meet requirements.
- Modification of Performance optimization for this sprint
- Use of code to ensure speed and accuracy align with project requirements

**Out of Scope**

The following items in sprint 1 and 3 of the robotics project are out of scope:

- Modification of code to travel around an obstacle course.
- Modification of code for robot to travel in the square of the classroom

# 2. Product/Service Description

## *2.1 Product Context*

This product is a robot which can be controlled by the user. This sets it apart from other robots that can function without the user programming the function, as this one cannot. This robot allows for the user to program things such as color, sound, speed and direction at which it travels. It is also an independent product and does not interact with many related systems.

## *2.2 User Characteristics*

- Students, professors, and staff will use this product.
- Must have a computer or a phone that is compatible with the Sphero Edu application.
- Must have some coding experience to program the product.
- Needs some technical expertise.

## *2.3 Assumptions*

- Assumed that a member of the group has access to the sphero application, if not the group must be changed, or the requirement must change.
- Assumed user has access to the test room, if not they will be unable to complete tests.
- Assumed user must understand and know how to use the features of the Sphero application, if not they must learn before testing begins.

- Assumed user has access to specific project requirements, these are needed to complete the project properly.
- Assumed the user has internet connection

### *2.4 Constraints*

- If the robot is damaged.
- Old software being used to try run the code.
- Different software being used to try run the code.
- The device that has the code doesn't have Bluetooth.
- If the language is not Sphero Edu block code.

### *2.5 Dependencies*

- A MacOS or iPhone is needed to conduct the code.
- Application must be downloaded to the device.
- The code must be current.
- Bluetooth must be on and connected to the device.
- Robot must be working and properly charged.

# 3. Requirements

### *3.1 Functional Requirements*

| Req# | Requirement | Comments | Priority | Date Rvwd | SME Reviewed / Approved |
|---|---|---|---|---|---|
| ENDUR_01 | Robot travels around the figure eight course 5 times | Required for full credit | 1 | 04/11 | Approved |
| ENDUR_02 | Robot will start in the square provided | Required for full credit | 1 | 04/09 | Approved |
| ENDUR_03 | Robot travels around the right circle first with a circumference of 5'2", traveling in a clockwise direction | | 1 | 04/09 | Approved |
| ENDUR_04 | Robot travels past the starting box | | 1 | 04/09 | Approved |
| ENDUR_05 | Robot travels around the left circle with a circumference of 5'2", traveling in an anti-clockwise direction | | 1 | 4/10 | Approved |
| ENDUR_06 | Robot travels past the starting box and repeats requirements 03, 04 and 05 four more times. | | 1 | 4/10 | Approved |
| ENDUR_07 | Robot will finish and say "I am the winner" | Required for full credit | 1 | 4/11 | Approved |
| ENDUR_08 | Robot will finish and flash multicolored lights for 5 seconds | Required for full credit | 1 | 4/11 | Approved |

| Req# | Requirement | Comments | Priority | Date Rvwd | SME Reviewed / Approved |
|---|---|---|---|---|---|
| ENDUR_09 | Robot will stay on the path laid out on the floor | | 1 | 4/11 | Approved |
| ENDUR_10 | Robot will finish in the square provided/ the same place it started | Required for full credit | 1 | 4/11 | Approved |
| ENDUR_11 | Robot doesn't collide with anything | | 2 | 4/11 | Approved |
| ENDUR_12 | The speed of the robot is tbc | We cannot confirm the exact speed as different floor surfaces change the speed the robot goes. For example, the robot would go faster on a smooth concrete floor, compared to a rough one. | 3 | 4/11 | Approved |

### *3.2 Security*

#### 3.2.1 Protection

- Encryption
- Password login
- Log of user activity
- Data integrity checks
- Private server

#### 3.2.2 Authorization and Authentication

Only members of our group (Lucy, Callan and Alexander) and Professor Eckert will have access/ be responsible for creating the code, and will have access through a link provided by one group member. GitHub has strict authorization protocols which means our link is protected. This precaution ensures that the code is not changed by anyone.

### *3.3 Portability*

- The robot is 100% host dependant
- The environment must have a flat and smooth surface for the robot to travel on
- The device that is writing the code must have Sphero Edu
- The language used is block code
- GitHub and Sphero Edu are very portable programs and allow for use on multiple devices so all group members can have access.

# 4. Requirements Confirmation/Stakeholder sign-off

| Meeting Date | Attendees (name and role) | Comments |
|---|---|---|
| 04/05/2024 | Lucy and Callan | Started SDD, and planned Gantt Chart |

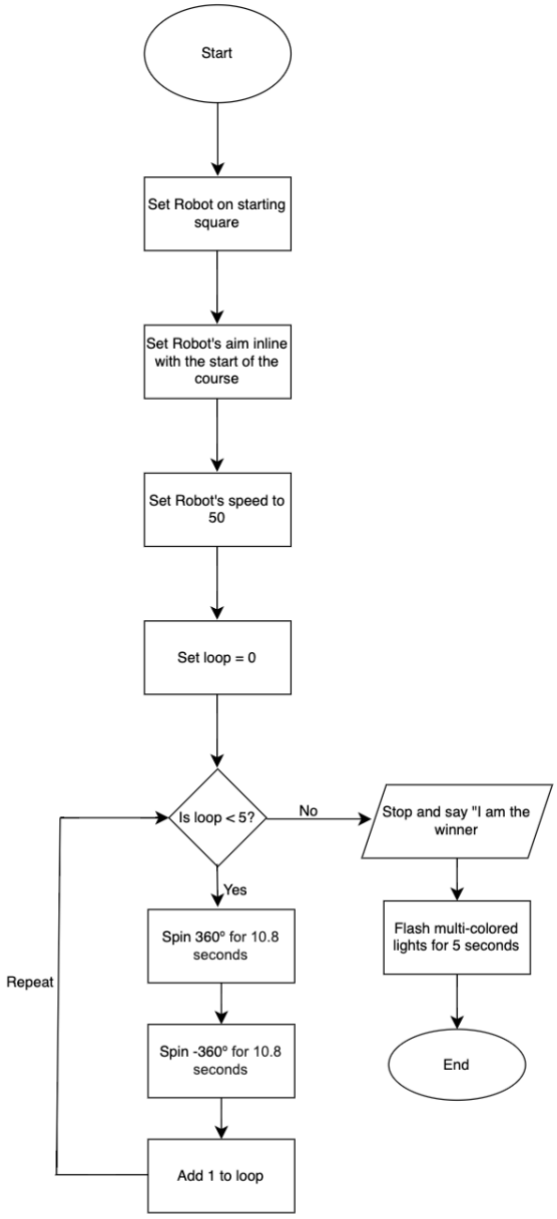
| | | |
|---|---|---|
| 04/09/2024 | Lucy, Callan, and Alexander | Confirmed requirements 1, 2, 3, and 4 |
| 04/10/2024 | Lucy and Callan | Confirmed requirements 5 and 6 |
| 04/11/20204 | Lucy and Callan | Confirmed remaining requirements and passed tests |
| 04/11/2024 | Lucy, Callan, and Alexander | Finished SDD |

# 5. System Design

## *5.1 Algorithm*

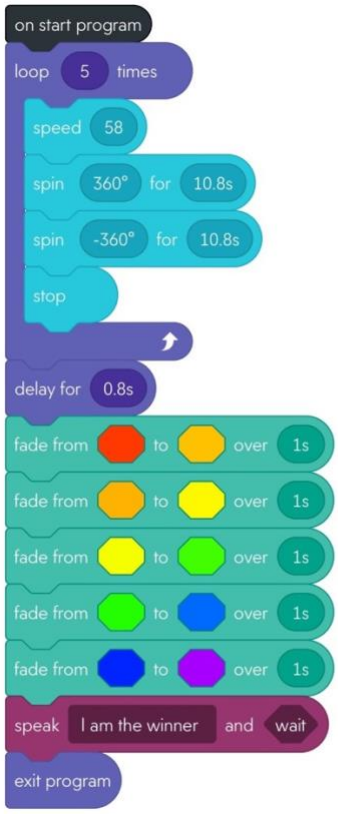
1. Place Robot in the starting box
2. Set Robot to travel around the right circle first with a circumference of 5’2” to travel in a clockwise direction
3. Set Robot to travel past the starting box
4. Set Robot to travel around the left circle with a circumference of 5’2”, to travel in an anti-clockwise direction
5. Set Robot to repeat steps 2, 3 and 4, four more times
6. Set Robot to finish in the square provided/ the same place it started
7. Set Robot to say “I am the winner”
8. Set Robot to flash multicolored lights for 5 seconds
9. Set Robot to exit program

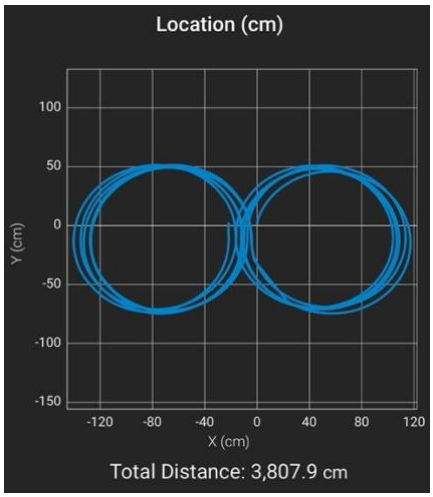
## *5.2 System Flow*



## *5.3 Software*

The software use used for this task was Sphero Edu, which is a user-friendly platform designed for educational programming. The programming language utilized within Sphero Edu was block code. Block code offers a visual and intuitive programming approach, which uses interlocking puzzle-like pieces to construct code sequences. This method simplifies programming, and is accessible for beginners by providing a straightforward way to create coding.




## *5.4 Hardware*

The hardware that we used for this sprint was a computer. We used the computer in a variety of different ways, the first being downloading the programming application Sphero Edu. We continued to use the computer for development tasks. For testing purposes, we used the Spark Plus Robot to access the functionality of our application. Furthermore, to showcase the application's capabilities, we used an iPhone to record a video that we will upload online.

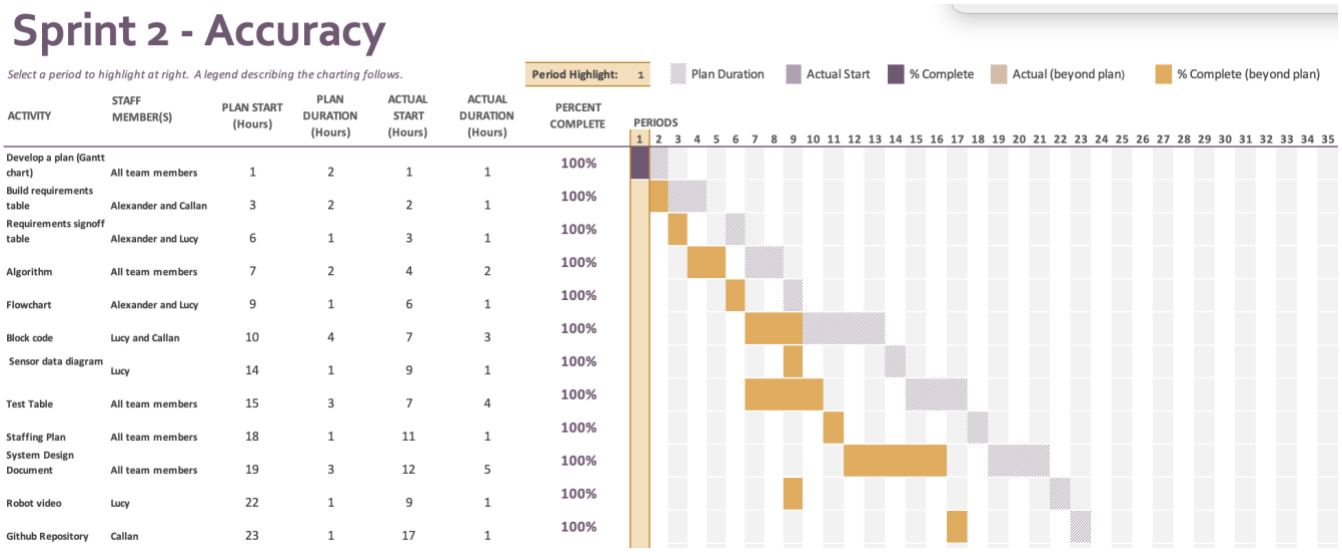
### *5.5 Test Plan*

| Reason for Test Case | Test Date | Expected Output | Observed Output | Staff Name | Pass/Fail |
|---|---|---|---|---|---|
| To make the Robot travel around the first semi-circle | 04/09 | The Robot successfully travels around the taped out semi-circle and returns to the original starting position | The Robot travelled in a straight line | Lucy | Fail |
| To make the Robot travel around the first semi-circle | 04/09 | The Robot successfully travels around the taped out semi-circle and returns to the original starting position | The Robot travelled in a circle, but the it was too small and didn't travel along the tape | Lucy | Fail |
| To make the Robot travel around the first semi-circle | 04/09 | The Robot successfully travels around the taped out semi-circle and returns to the original starting position | The Robot travelled in a circle that was too big | Lucy | Fail |
| To make the Robot travel around the first semi-circle | 04/09 | The Robot successfully travels around the taped out semi-circle and returns to the original starting position | The Robot successfully travels around the taped out semi-circle and returns to the original starting position | Lucy | Pass |
| To make the Robot travel around the second semi-circle | 4/10 | The Robot successfully travels around the taped out semi-circle and returns to the original starting position | The Robot travelled in a circle that was too big | Lucy | Fail |
| To make the Robot travel around the second semi-circle | 4/10 | The Robot successfully travels around the taped out semi-circle and returns to the original starting position | The Robot started following the tape, but then went off to the right | Lucy | Fail |
| To make the Robot travel around the second semi-circle | 4/10 | The Robot successfully travels around the taped out semi-circle and returns to the original starting position | The Robot successfully travels around the taped out semi-circle and returns to the original starting position | Lucy | Pass |

| Reason for Test Case | Test Date | Expected Output | Observed Output | Staff Name | Pass/Fail |
|---|---|---|---|---|---|
| To loop the Robot to make it repeat the 2 semi-circles four more times | 4/10 | The Robot successfully travels around the taped figure eight course five times and returns to the original starting position | The Robot successfully travelled around the tape for three loops, but then travelled off right | Lucy | Fail |
| To loop the Robot to make it repeat the 2 semi-circles four more times | 4/10 | The Robot successfully travels around the taped figure eight course five times and returns to the original starting position | The Robot successfully travelled for two loops, but then the loops became too small | Lucy | Fail |
| To loop the Robot to make it repeat the 2 semi-circles four more times | 4/10 | The Robot successfully travels around the taped figure eight course five times and returns to the original starting position | The Robot successfully travelled around for three loops, but travelled to wide on the fourth and crashed | Lucy | Fail |
| To loop the Robot to make it repeat the 2 semi-circles four more times | 4/10 | The Robot successfully travels around the taped figure eight course five times and returns to the original starting position | The Robot successfully travelled all five loops, but didn't stop in the original location | Lucy | Fail |
| To loop the Robot to make it repeat the 2 semi-circles four more times | 4/10 | The Robot successfully travels around the taped figure eight course five times and returns to the original starting position | The Robot successfully travels around the taped figure eight course five times and returns to the original starting position | Lucy | Pass |
| Make the Robot stop and speak "I am the winner" | 04/11 | When the Robot stops it speaks "I am the winner" | The Robot spoke and said "I am the winner" after it had stopped | Callan | Pass |
| Make the Robot flash multi-colored lights for five seconds | 04/11 | The Robots LED light changed color for 5 seconds | The Robots LED light changed color for 7 seconds | Callan | Fail |

| Reason for Test Case | Test Date | Expected Output | Observed Output | Staff Name | Pass/Fail |
|---|---|---|---|---|---|
| Make the Robot flash multi-colored lights for five seconds | 04/11 | The Robots LED light changed color for 5 seconds | The Robots LED light changed color for 7 seconds | Callan | Pass |
| Make the Robot exit the program | 04/11 | The Robot exits the program | The Robot exits the program | Callan | Pass |

## *5.6 Task List/Gantt Chart*




| ACTIVITY | STAFF MEMBER(S) | PLAN START (Hours) | PLAN DURATION (Hours) | ACTUAL START (Hours) | ACTUAL DURATION (Hours) | PERCENT COMPLETE |
|---|---|---|---|---|---|---|
| Develop a plan (Gantt chart) | All team members | 1 | 2 | 1 | 1 | 100% |
| Build requirements table | Alexander and Callan | 3 | 2 | 2 | 1 | 100% |
| Requirements signoff table | Alexander and Lucy | 6 | 1 | 3 | 1 | 100% |
| Algorithm | All team members | 7 | 2 | 4 | 2 | 100% |
| Flowchart | Alexander and Lucy | 9 | 1 | 6 | 1 | 100% |
| Block code | Lucy and Callan | 10 | 4 | 7 | 3 | 100% |
| Sensor data diagram | Lucy | 14 | 1 | 9 | 1 | 100% |
| Test Table | All team members | 15 | 3 | 7 | 4 | 100% |
| Staffing Plan | All team members | 18 | 1 | 11 | 1 | 100% |
| System Design Document | All team members | 19 | 3 | 12 | 5 | 100% |
| Robot video | Lucy | 22 | 1 | 9 | 1 | 100% |
| Github Repository | Callan | 23 | 1 | 17 | 1 | 100% |

## *5.7 Staffing Plan*

| Name | Role | Responsibility | Reports To |
|---|---|---|---|
| Lucy | Problem Solver | Leader for writing the algorithm, checks the SSD, and films the robot | Callan |
| Callan | Recorder | Records the information and fills it out onto the SDD | Lucy |
| Alexander | Coder | Writes the flowchart and the code | Lucy and Callan |