Sprint 1- Endurance Design Document

March 23, 2020

# Executive Summary

### 1.1 Project Overview

The Endurance sprint is intended for use in CS 104-01. The project calls for a program written in block code in the Sphero Edu app. The intended function of the program is to guide a robot to complete a circuit around the classroom. **Specific requirements from Prof. Eckert:**

Your robot must successfully travel around the periphery of HH208 (circumnavigate). A clear path will be provided from each outside wall. Robot will start from the yellow square with blue tape. Robot should start with a green light and speak ‘ready set go’ and stop with a red light and speak ‘I’m done and I need water’. Robot must travel to each of the yellow floor tiles and turn right at the center of each tile. Robot must return to it’s starting location. Robot should not collide with any objects as it goes around the room. Points deducted if robot does not light and speak at start and finish, if it collides with anything, or if it does not

finish in the square where it started.

### 1.2 Purpose and Scope of this Specification

**In scope**

This module includes the following:

* A program for the SPRK robot provided for classroom use
* Block code compatible with the Sphero Edu app
* Completion of the Endurance sprint from the overarching Robotics Project

**Out of Scope**

This module excludes the following:

* Code compatible with non-Sphero robots
* Specifications listed outside of the Endurance sprint

# Product/Service Description

### 2.1 Product Context

The project relates to other products because a SPRK robot is required to run the program. A Bluetooth connection is also necessary for the robot to communicate with the device running the program.

### 2.2 User Characteristics

* CS 104-01 students or Prof. Eckert
* Basic understanding of the Sphero Edu app and block code
* No technical expertise required

### 2.3 Assumptions

The equipment necessary to run the program is available, including: Sphero Edu app, SPRK robot, HH208. The user has a general understanding of how to use the Sphero Edu app and the SPRK robot.

### 2.4 Constraints

* Block code is only compatible with the Sphero products
* The program cannot be used for robots not affiliated with the Sphero brand
* Specifically written for use in HH208, cannot adjust to different room sizes

### 2.5 Dependencies

The functionality of the program depends on access to the SPRK robot. Without the robot, the program cannot have the desired output. The program also depends on the Bluetooth connection between the computer and the robot so that the computer can communicate with the robot.

# Requirements

1. Priority 1
   1. Robot must circumnavigate HH208.
   2. Robot must not collide with anything during the circuit.
2. Priority 2
   1. Robot must return to its starting point after completing the circuit.
3. Priority 3
   1. Robot must speak at the beginning and end of the program.
   2. Robot must start with green light and end with red light.

### 3.1 Functional Requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Requirement Number** | **Requirement** | **Comments** | **Priority** | **Date Reviewed** | **Reviewed/Approved** |
| 1a | Robot must circumnavigate HH208. | We do not have access to HH208 to test the program properly, so a different room will be used. | 1 | 3/29/2020 | AN |
| 1b | Robot must not collide with anything during the circuit. | Slower speeds ensure that the robot executes the program with more precision. | 1 | 3/29/2020 | AN |
| 2a | Robot must return to its starting point after completing the circuit. | Since HH208 is unavailable, a different start/end point must be used to test the program. | 2 | 3/29/2020 | AN |
| 3a | Robot must speak at the beginning and end of the program. | Robot has no speakers, so the device running the program must have sound turned on to hear the robot speak. | 3 | 3/29/2020 | AN |
| 3b | Robot must start with green light and end with red light. | It’ll start the program with the green light already on. | 3 | 3/29/2020 | AN |

### 3.2 Security

#### 3.2.1 Protection

Protection is not a concern with this project because our program cannot be misused or cause harm to anything. Malicious access is highly unlikely and the program will be made private on the Sphero Edu app so that it is protected against plagiarism by other students.

#### 3.2.2 Authorization and Authentication

The program is only accessible through our GitHub repository and one of our accounts on Sphero Edu. There is no authorization or authentication required to access our repository, but there is authentication required to access the program on Sphero Edu because only the owner can access it.

### 3.3 Portability

The program is only portable across Sphero’s line of robots as it is written in block code only compatible with Sphero robots. Any operating system can be used to access the Sphero website. The robot can only operate properly in the environment it was developed to circumnavigate, so portability is difficult in the physical world.

# Requirements Confirmation/Stakeholder sign-off

|  |  |  |
| --- | --- | --- |
| Meeting Date | Attendees | Comments |
| 3/29/2020 | Anna Nardelli  Neil Swagger  Connor Vidnansky | Approved all requirements |

1. System Design

### 5.1 Algorithm

1. The robot speaks and says “Ready set go!”
2. Changes to the color green and waits a second.
3. The robot then rolls 10 feet and stops.
4. The robot moves to the left for 10 feet and then stops.
5. The robot turns 180 degrees and rolls for 10 feet and then stops.
6. The robot again rolls left for 10 feet and then stops.
7. The robot’s light changes to the color red.
8. The robot says “I'm done and I need water.”

### 5.2 System Flow

<https://app.diagrams.net/#G1ycYx7o3dxAvmsHpnlD_CHIUPmsFCl1Rc>

### 5.3 Software

The software used to develop the program was the Sphero Edu app and Mac OS.

### 5.4 Hardware

The hardware used to develop the program was a personal computer and a SPRK robot.

### 5.5 Test Plan

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Reason for Test Case** | **Test Date** | **Expected Output** | **Observed Output** | **Staff Name** | **Pass/Fail** |
| Distance | 3/29/20 | Stop without hitting the wall | Didn't hit the wall but overshot the stop by a little | Neil | fail |
| Distance after turn | 3/29/20 | Not go the wrong direction | Went the right way | Neil | pass |
| Second turn | 3/29/20 | Not over shoot the stop | Under shot the stop by a little | Neil | pass |
| Third turn | 3/29/20 | Turn right way and not hit anything | Turned the right direction but was off the line by a little | Neil | fail |
| Back to start | 3/29/20 | Don't hit anything | Stopped close to the start | Neil | pass |

### 5.6 Task List/Gantt Chart

[Gantt Chart](https://drive.google.com/file/d/1Id60vqRKUGoQwoSic-LhK3fhjCeQWdHV/view?usp=sharing)

### 5.7 Staffing Plan

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Role** | **Responsibility** | **Reports To** |
| Anna Nardelli | Leader | Sections 1-4 of Design Document, Gantt Chart, making sure everyone else contributes | Everyone else |
| Neil Swagger | Owner of robot | Type the program for the robot | Everybody |
| Connor Vidnansky | Design Document | Create the flowchart, approve of changes to code/Design Document | Everyone |
| Andrew Welde | Design Document | Write algorithm | Everyone |