Sprint 1 - Endurance Design Document

March 28, 2024

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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 the classroom. 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 1 of the Robotics Project:

- Modification of code for robot to travel in the square of the classroom 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 2 and 3 of the robotics project are out of scope:

- Modification of code to travel around an obstacle course.
- Modification of code to travel in a figure 8 motion.

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 perimeter of room HH208	Required for full credit	1	03/26	Approved
ENDUR_02	Robot begins with a green light	Required for full credit	1	03/22	Approved
ENDUR_03	Robot begins saying "Ready, set, go"	Required for full credit	1	03/22	Approved
ENDUR_04	Robot stops with a red light	Required for full credit	1	03/26	Approved
ENDUR_05	Robot stops saying "I'm tired and I need water"	Required for full credit	1	03/26	Approved
ENDUR_06	Robot travels to each of the yellow tiles		1	03/26	Approved
ENDUR_07	Robot turns in the center of each yellow tile		2	03/26	Approved
ENDUR_08	Robot travels to the first corner		2	03/22	Approved
ENDUR_09	Robot turns 90 degrees clockwise after reaching the center of the first set of yellow tiles		2	03/22	Approved
ENDUR_10	Robot travels to the second set of yellow tiles		2	03/22	Approved

Req#	Requirement	Comments	Priority	Date Rvwd	SME Reviewed / Approved
ENDUR_11	Robot turns 90 degrees clockwise after reaching the center of the second set of yellow tiles		2	03/26	Approved
ENDUR_12	Robot travels to the third group of yellow tiles		2	03/26	Approved
ENDUR_13	Robot turns 90 degrees clockwise after reaching the center of the third set of yellow tiles		2	03/26	Approved
ENDUR_14	Robot returns to the starting location		1	03/26	Approved
ENDUR_15	Robot doesn't collide with anything		2	03/26	Approved
ENDUR_16	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	03/26	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

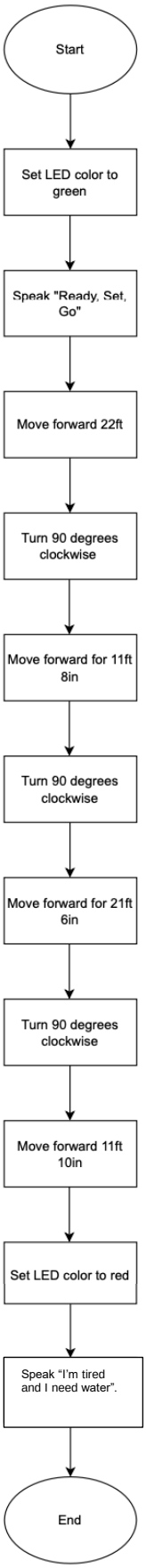
Meeting Date	**Attendees (name and role)**	**Comments**
03/22/2024	Lucy and Callan	Confirmed requirements 02, 03, 08, 09, 10
03/26/2024	Lucy, Callan, and Alexander	Confirmed remaining requirements and tests passed
03/28/2024	Lucy, Callan, and Alexander	Finished SDD

5. System Design

5.1 Algorithm

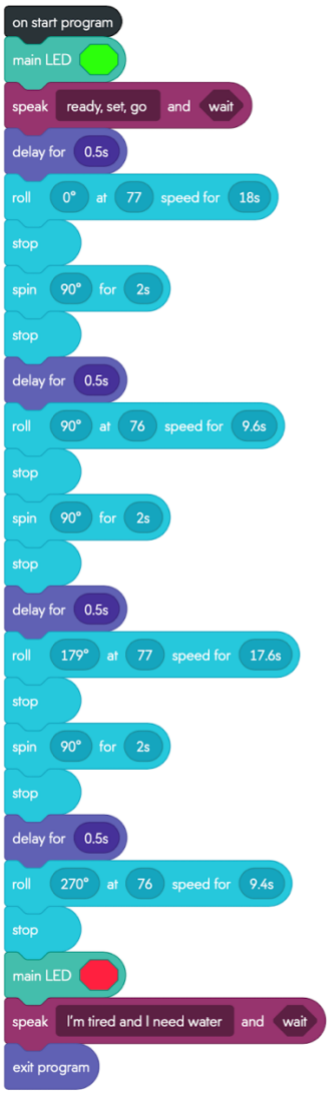
1. Set Robot color to green
2. Set the Robot to speak “Ready, Set, Go”
3. Set the Robot to travel for 22ft/ 18 seconds in the direction of 0 degrees to reach the first corner/ first set of yellow tiles
4. When the Robot reaches the centre of the yellow tiles, it stops
5. Set the Robot to turn 90 degrees clockwise
6. Set the Robot to travel for 11ft 8in/ 9.6 seconds to reach the second corner/ second set of yellow tiles
7. When the Robot reaches the centre of the yellow tiles, it stops
8. Set the Robot to turn 90 degrees clockwise
9. Set the Robot to travel 21ft 6in/ 17.6 seconds to reach the third corner/ third set of yellow tiles
10. When the Robot reaches the centre of the yellow tiles, it stops
11. Set the Robot to turn 90 degrees clockwise
12. Set the Robot to travel 11ft 10in/9.4 seconds to the start and end corner/ last set of yellow tiles
13. Stop the Robot when it reaches the centre of the final set of yellow tiles
14. Set the Robot color to red
15. Set the Robot to say “I’m tired and I need water”

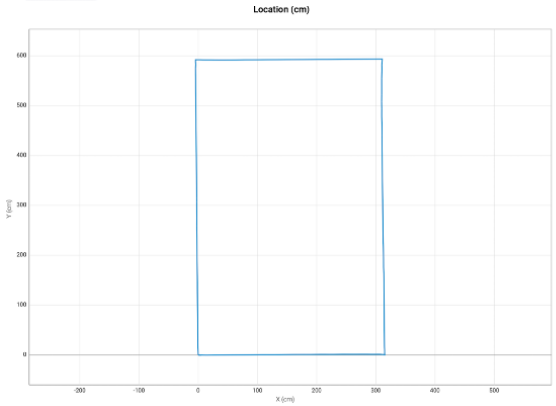
5.2 System Flow



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.

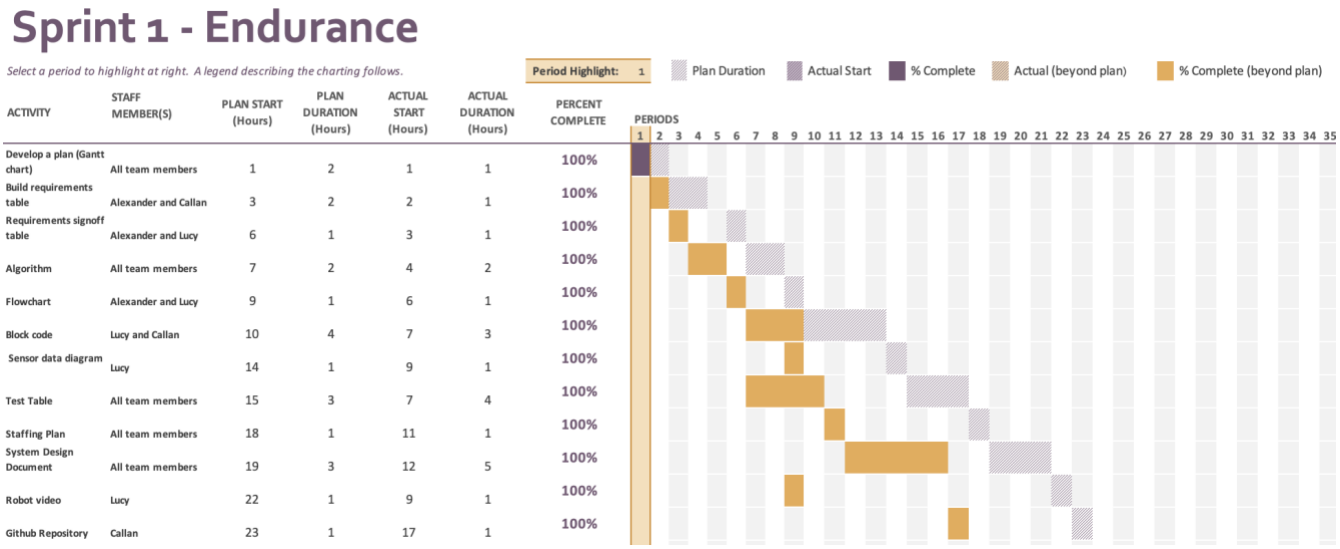
5.5 Test Plan

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
To make the robot color green	03/22	Robot LED light turns green	Robot LED light turns green	Lucy	Pass
Make the robot say "Ready, Set, Go"	03/22	The Robot says "Ready, Set, Go"	The Robot says "Ready, Set, Go"	Lucy	Pass
To figure out how fast the Robot should move	03/22	The Robot drives in a straight line at an appropriate speed	The Robot drives in a straight line at an appropriate speed	Lucy	Pass
Make the Robot move to the first corner	03/22	The Robot reaches the first corner and stops in the centre of the yellow tiles	The Robot drove off on an angle and stopped 7ft away from the corner	Lucy	Fail
Make the Robot move to the first corner	03/22	The Robot reaches the first corner and stops in the centre of the yellow tiles	The Robot was straight however drove past the corner	Lucy	Fail
Make the Robot move to the first corner	03/22	The Robot reaches the first corner and stops in the centre of the yellow tiles	The Robot reaches the first corner in 18 seconds	Lucy	Pass
Make the Robot turn 90 degrees clockwise	03/22	The Robot makes a 90 degree turn clockwise	The Robot made a 90 degree turn clockwise	Lucy	Pass
Make the Robot move to the second corner	03/22	The Robot reaches the second corner and stops in the centre of the yellow tiles	The Robot moved for 11 seconds which was too long, it crashed into the chair	Lucy	Fail
Make the Robot move to the second corner	03/22	The Robot reaches the second corner and stops in the centre of the yellow tiles	The Robot drove off on an angle and therefore, stopped early	Lucy	Fail

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
Make the Robot move to the second corner	03/22	The Robot reaches the second corner and stops in the centre of the yellow tiles	The Robot drove for 9.6 seconds, made it to the second corner, and stopped in the centre.	Lucy	Pass
Make the Robot turn 90 degrees clockwise	03/26	The Robot turns 90 degrees clockwise	The Robot turns 90 degrees clockwise	Callan	Pass
Make the Robot move to the third corner	03/26	The Robot reaches the third corner and stops in the centre of the yellow tiles	The Robot moved on a slight angle and crashed into the chairs on the back wall	Callan	Fail
Make the Robot move to the third corner	03/26	The Robot reaches the third corner and stops in the centre of the yellow tiles	We adjusted the degrees of travel so it didn't crash, however this time it didn't reach the centre of the yellow tiles as it only travelled for 15 seconds	Callan	Fail
Make the Robot move to the third corner	03/26	The Robot reaches the third corner and stops in the centre of the yellow tiles	The Robot moved for 18 seconds and moved past the centre of the yellow tiles	Callan	Fail
Make the Robot move to the third corner	03/26	The Robot reaches the third corner and stops in the centre of the yellow tiles	The Robot travels for 17.6 seconds and reaches the third corner and stops in the centre of the yellow tiles	Callan	Pass
Make the Robot turn 90 degrees clockwise	03/26	The Robot turns 90 degrees clockwise	The Robot turns 90 degrees clockwise	Callan	Pass
Make the Robot move to the final corner	03/26	The Robot reaches the final corner and stops in the centre of the yellow tiles	The Robot travelled for 10 seconds and moved past the yellow tiles	Callan	Fail
Make the Robot move to the final corner	03/26	The Robot reaches the final corner and stops in the centre of the yellow tiles	The Robot travelled for 9.6 seconds and moved past the yellow tiles	Callan	Fail

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
Make the Robot move to the final corner	03/26	The Robot reaches the final corner and stops in the centre of the yellow tiles	The Robot travels for 9.4 seconds and reaches the final corner and stops in the centre of the yellow tiles	Callan	Pass
Make the LED of the Robot turn red	03/26	The LED light of the Robot turns red	The LED light of the Robot turns red	Callan	Pass
Make the Robot speak “I’m tired and I need water”	03/26	The Robot says “I’m tired and I need water”	The Robot says “I’m tired and I need water”	Callan	Pass

5.6 Task List/Gantt Chart



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

Name	Role	Responsibility	Reports To
Alexander	Coder	Writes the flowchart and the code	Lucy and Callan