Sprint 1 - Endurance Design Document

November 7, 2023

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# Executive Summary

## *Project Overview*

This project’s goal is to make a Bluetooth Sphero robot run the perimeter of a rectangle in the classroom.

## *Purpose and Scope of this Specification*

**In scope**

This document addresses requirements related to phase 2 of Project A:

* Modification of robot programming
* Measurement of tape on room floor
* Frequent communication via text, virtual, or in person

**Out of Scope**

The following items in phase 3 of Project A are out of scope:

* Managing requirements and time
* Fixing colors and distance

(Phase 3 will be considered in the development of the requirements for Phase 2, but the Phase 3 requirements will be documented separately.)

# Product/Service Description

## *Product Context*

This robot functions similarly to other programs. It’s like a normal computer program, it requires a set of instructions to perform a task. When the robot is hooked up to someone’s computer, they can use the blocks to code the robot to move in a certain direction. When the code is provided to speak, the voice will come out of the computer rather than the robot.

## *User Characteristics*

The professor has worked with the robots before. He is proficient in how they work since he’s used them before. For us, we only had one previous experience with the robots prior to receiving instructions.

## *Assumptions*

The room might not be available to us, so we might not get accurate measurements for how far the robot should move. A Mac computer is also required for the sensor data diagram. There will also be lots of trial and error since we don’t have lots of experience with the Sphero robots and this kind of technology. Also, we might have trouble connecting the Bluetooth to enable the Sphero robots.

## *Constraints*

Describe any items that will constrain the design options, including

* Windows computers won’t work
* One audit trail (test table) and don’t know all of computer’s functions
* Classes and other activities take up access time, need to manage time
* Don’t know how to do professional computer evaluation, only evaluate at a normal level
* Possible limits of storage space
* Computer lag is predictable

## *Dependencies*

* This product requires a computer to function
* The first distance must be measured correctly before the other distances are embedded in

# Requirements

## *Functional Requirements*

| **Req#** | **Requirement** | **Comments** | **Priority** | **Date Rvwd** | **SME Reviewed / Approved** |
| --- | --- | --- | --- | --- | --- |
| ENDUR\_01 | Turn light green |  | 1 |  |  |
| ENDUR\_02 | Speak “ready set go” |  | 1 |  |  |
| ENDUR\_03 | Travel to corner of rectangle | moving in the west direction | 1 |  |  |
| ENDUR\_04 | Turn right |  | 1 |  |  |
| ENDUR\_05 | Travel to corner of rectangle | moving in the south direction | 1 |  |  |
| ENDUR\_06 | Turn right |  | 1 |  |  |
| ENDUR\_07 | Travel to corner of rectangle | moving in the east direction | 1 |  |  |
| ENDUR\_08 | Turn right |  | 1 |  |  |
| ENDUR\_09 | Travel to corner of rectangle | moving in the north direction | 1 |  |  |
| ENDUR\_10 | Turn right |  | 1 |  |  |
| ENDUR\_11 | Turn light red |  | 1 |  |  |
| ENDUR\_XX | Speak “I’m done and I need water” |  | 1 |  |  |

## *Security*

### Protection

* Security and privacy on computer protects data from being stolen
* Activity logging helps keep track of what we’ve done up to that point
* Robot isn’t always with computer, restricting inter module communication
* Data integrity checks when necessary

### Authorization and Authentication

For authorization, Sphero has a privacy policy verifying that the users know how to use the product safety and effectively. For authentication, the computers and logging in to the coding software require usernames and passwords to enter, validating user’s identities.

## *Portability*

* The robot must be connected to the computer the code is being made on
* A Mac is required for the sensor data diagram

# Requirements Confirmation/Stakeholder sign-off

| **Meeting Date** | **Attendees (name and role)** | **Comments** |
| --- | --- | --- |
| 10/25/23 | Andrew | confirmed all |

# System Design

## *Algorithm*

On start

1. Turn the light green on the robot.
2. Have the robot say “Ready set go.”
3. Roll 0° at 80 speed for 12.2 s.
4. Delay for 1 second and rotate 90 degrees.
5. Roll 90° at 80 speed for 6.6 s.
6. Delay for 1 second and rotate 90 degrees.
7. Roll 180° at 79 speed for 12.2 s.
8. Delay for 1 second and rotate 90 degrees.
9. Roll 270° at 86 speed for 6.4 s.
10. Delay for 1 second and rotate 90 degrees.
11. Turn the light red on the robot.
12. Have the robot say “I’m done and I need water.”

## *System Flow*

<https://app.diagrams.net/#G1ezumfYb2AwLoyv-V2qsdGNWlqkcQmz8d>

## *Software*

Made with Sphero.

## 

## *Hardware*

Laptops and the Sphero EDU program were used to code this robotics program.

## *Test Plan*

| **Reason for Test Case** | **Test Date** | **Expected Output** | **Observed Output** | **Staff Name** | **Pass/Fail** |
| --- | --- | --- | --- | --- | --- |
| travel length of rectangle (22 ft.) | **10/25** | robot travel straight | robot went on a slight diagonal and didn’t go the correct distance | Alex | Fail |
| “ ” | **10/25** | “ ” | robot traveled too far | Alex | Fail |
| “ ” | **10/26** | “ ” | robot went off the track and against the wall | Alex | Fail |
| “ ” | **10/26** | “ ” | robot traveled too far | Alex | Fail |
| “ ” | **10/26** | “ ” | robot went off the track and traveled too short | Alex | Fail |
| travel width of rectangle (12 ft.) | **10/26** | robot travel straight | robot was off the track | Alex | Fail |
| travel length of rectangle | **10/26** | robot travel straight | robot followed the path | Alex | Pass |
| travel full rectangle path (22 ft., turn, 12 ft., turn, 22 ft., turn, 12 ft.) | **10/27** | robot stay on the tape on the floor | robot veered off the path to the left, cut a corner, but largely followed the width; it went farther than 22 ft. and I had to stop the program to retrieve the robot | Alex | Fail |
| “ ” | **10/27** | “ ” | robot veered off the path to the left; the robot went past the next 3 paths it was supposed to take | Alex | Fail |
| wanted to see if the robot could travel the whole course | **10/31** | turn in line with the track | turned too early, went too fast | Alex | Fail |
| “ ” | **10/31** | turn in line with the track (Alex added 0.5s to each movement as an adjustment) | went over the bounds | Alex | Fail |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

## *Task List/Gantt Chart*

[Sprint 1 Endurance Gantt project plan Template.xlsx](https://docs.google.com/spreadsheets/d/1T4pNo1ZK35CPqtYn0IvK53v-amchhpSi/edit#gid=1507529980)

## *Staffing Plan*

| Name | Role | Responsibility | Reports To |
| --- | --- | --- | --- |
| Alex | planning, developing, fine-tuning, submitting | SDD, gantt chart developer, creating code, test table, uploading to Github repository | Professor Eckert |
| Andrew | planning, listing requirements, outlining overview of code | SDD, requirements table, flowchart | Professor Eckert |
| Kiumbura | planning, interpreting, documenting | SDD, building algorithm, creating sensor data diagram, creating code, robotics video | Professor Eckert |