Sprint 1 - Endurance Design Document

November 07, 2022

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1. Executive Summary

1.1 Project Overview

Essentially, The Sprint Endurance Robot Project is designed to make the robot go around each corner of the rectangle in the HH208 classroom accurately. The creators of this project, Brian Mohabeer, Anthony Espanol, and Dylan Welsh are presenting this project to Professor Gil Eckert of Monmouth University. This is part 1 of a 3-part group project called Robotics Triathlon.

1.2 Purpose and Scope of this Specification

The purpose of this project is to list the requirements of part 1 of the Robotics Triathlon project to the class and the professor with any constraints and assumptions.

In scope

This document addresses requirements related to part 1 of the Robotics Triathlon:

- Measurements of lengths and angles of the path the robot has to navigate.
- Light Colors and required speech of the robot.

Out of Scope

The following items in part 2 and 3 of the Robotics Triathlon Project are out of scope and documented separately:

- Accuracy of the robot to go around figure 8 shape five times.
- Agility of the robot to navigate the obstacle course without hitting obstacles, and the robot must hit down pins on a predefined path

2. Product/Service Description

In this section, describe the general factors that affect the product and its requirements. This section should contain background information, not state specific requirements (provide the reasons why certain specific requirements are later specified).

2.1 Product Context

This project uses the Sphero App for Windows 10, Android, and Apple devices to program and test the Sphero SPRK+ robot to do specific tasks. At the same time, this project also teaches the project team and the class to learn the fundamentals of software engineering.

2.2 User Characteristics

Our group for accomplishing this project consists of three college freshmen in the CS 104 computer science class who are now learning computer engineering concepts and computer programming.

2.3 Assumptions

We are assuming that our robot does not have any hardware defects and it is capable of executing the instructions from the Sphero App accurately and consistently. We are also assuming the dimensions given for this project are accurate. NOTE: The Sphero App’s sensor data on Windows is not currently available to users.

2.4 Constraints

- Will need another OS besides Windows for any required robot firmware update.
- Access to room HH208 which has the floor paths laid out for the robot to navigate.
- Part 1 of this project must be completed by November 7th, 2022.
- The robot cannot collide with any objects.

2.5 Dependencies

- A robot
- Device with an Operating System which will work with the Sphero App
- Shero App
- Room with floor plan for the robot to navigate

3. Requirements

- The robot will start in the yellow square with the blue tape and navigate around the path laid out with the blue tape which is rectangular in shape.
- At the start, the robot will light blue and speak “Ready set go”
- At the end, the robot will light red and speak “I’m done and I need water”
- Robot has to start and end in the same square
- Robot cannot collide with any objects

Priority Definitions

The following definitions are intended as a guideline to prioritize requirements.

- Priority 1 – The requirement is a “must have” as outlined by policy/law
- Priority 2 – The requirement is needed for improved processing, and the fulfillment of the requirement will create immediate benefits
- Priority 3 – The requirement is a “nice to have” which may include new functionality

It may be helpful to phrase the requirement in terms of its priority, e.g., "The value of the employee status sent to DIS **must be** either A or I" or "It **would be nice** if the application warned the user that the expiration date was 3 business days away". Another approach would be to group requirements by priority category.

3.1 Functional Requirements

Req#	Requirement	Comments	Priority	Date Rvwd	SME Reviewed / Approved
ENDUR_01	From starting Yellow Square, light robot Green	Confirmed	1	10/31/22	Dylan Welsh
ENDUR_02	Speak “Ready set go”	Confirmed	1	10/31/22	Anthony Espanol
ENDUR_03	Roll robot 22’ at 0 deg	Confirmed	1	10/31/22	Brian Mohabeer
ENDUR_04	Roll robot 11’8’’ at 90 deg	Confirmed	1	10/31/22	Brian Mohabeer
ENDUR_05	Roll robot 21’6’’ at 180 deg	Confirmed	1	11/2/22	Brian Mohabeer
ENDUR_06	Roll robot at 11’10’’ at 270 deg which returns robot to starting square	Confirmed	1	11/2/22	Brian Mohabeer
ENDUR_07	Light robot red	Confirmed	1	11/2/22	Dylan Welsh
ENDUR_08	Speak “I’m done and I need water”	Confirmed	1	11/2/22	Anthony Espanol
ENDUR_XX					

3.2 Security

3.2.1 Protection

- Prompts for username and password every time you try accessing the Sphero App.

3.2.2 Authorization and Authentication

- Login id and password to Sphero App.

3.3 Portability

- The Sphero App is portable to all OS, but not all the features of Sphero are in all the OS. See edu.sphero.com for details.

4. Requirements Confirmation/Stakeholder sign-off

Include documentation of the approval or confirmation of the requirements here. For example:

Meeting Date	Attendees (name and role)	Comments
10/31/22	Brian Mohabeer(Manager),Anthony Espanol(Coder),and Dylan Welsh(tester/planner)	confirmed ENDUR_01-ENDUR_04
11/2/22	Brian Mohabeer(Manager), Anthony Espanol(Coder), and Dylan Welsh(tester/planner)	confirmed ENDUR_05-ENDUR_08

5. System Design

This section will provide all details concerning the technical design, staffing, coding, and testing the system

5.1 Algorithm

Develop and describe here the algorithm that will be used to provide the required performance of your software

1. Start
2. Set light color green
3. Speak “Ready set go.”
4. Roll 0° to endpoint 1
5. Delay for 1 second
6. Roll 90° to endpoint 2
7. Delay for 1 second
8. Roll 180° to endpoint 3
9. Delay for 1 second
10. Roll 270° to starting point
11. Set light color red
12. Speak “I’m done and I need water.”
13. End

5.2 System Flow

Flowchart:
Endurance Robot Algorithm.drawio.pdf

5.3 Software

Sphero App which uses a GUI interface with Java code. Here is a picture of the block code:
Sensor data: Robot Endurance Sprint Sensor Data.PNG

Code: Robot Endurance Code.png

5.4 Hardware

Dell Laptop with Windows 10 OS and Sphero Robot SPRK+.

5.5 Test Plan

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
Test start and end lights	10/31/22	Comply with specifications	Went as expected	Dylan Welsh	Pass
Test start and end speech	10/31/22	Comply with specifications	Went as expected	Dylan Welsh	Pass
Test initial settings for speed, angle and duration for each side of the rectangular path to be transverse to check what tweaks need to be done for the actual length of roll and direction to be exact with dimensions given.	10/31/22	Not to be accurate, but a general sense in the rectangular shape	The result was much worse than expected, it did not reach the four corners.	Brian Mohabeer, Anthony Espanol, and Dylan Welsh	Fail
Retest roll tweaks done previously. Increase speed and time duration to make the robot reach all four corners.	10/31/22	To be more accurate than the last test	The result was better than the first, and we made the speed a little quicker and increased the time so that it would reach all four corners.	Brian Mohabeer, Anthony Espanol, and Dylan Welsh	Fail
Adjust the speed and time so the robot is more accurate around the corners.	11/2	Robot to meet all the requirements	The result was perfect and met all the requirements.	Brian Mohaber, Anthony Espanol, and Dylan Welsh	Pass
Make slight adjustments to the angles and time duration so the robot is 100% accurate.	11/4	Robot to meet all the requirements	Best outcome possible.	Brian Mohabeer, Anthony Espanol, Dylan Welsh	Pass

5.6 Task List/Gantt Chart

CS 104 Sprint 1 Gant Chart.png

5.7 Staffing Plan

Name	Role	Responsibility	Reports To
Brian Mohabeer	Manager	Manage the project	Team and Professor
Anthony Espanol	Coder	Algorithm, flowchart, and Code	Brian Mohabeer
Dylan Welsh	Tester and Planner	Gant Chart and required to be there for all testing purposes	Brian Mohabeer