Sprint 1 – Endurance

System Design Document

November 1, 2024

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CS-104-01

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1. Executive Summary

1.1 Project Overview

Utilizing a Sphero SPRK robot, the goal of this project is to develop a block code algorithm that will allow the robot to successfully circumnavigate the CS-104-01 classroom without any errors.

1.2 Purpose and Scope of this Specification

The purpose of this project is to test and evaluate the endurance of the Sphero SPRK robot as well as the effectiveness of our block code algorithm. The project's intended audience is the CS-104-01 class and professor.

The following requirements listed are in the scope of this project:

- A GitHub repository must be created and maintained for this project
- A Gantt chart made in Excel must be created and consistently updated to reflect progress made on the project
- A flow chart made in draw.io must be created to effectively display the robot's algorithm in a step-by-step format
- A video of the robot successfully circumnavigating the classroom must be recorded and uploaded to the collaborative GitHub repository

The following items listed are outside the scope of this project:

- The robot will not need to utilize any loop statements for this project, as it is a relatively simple project in terms of block code, and loop statements may overcomplicate the algorithm
- The robot does not need to be as fast as possible because accuracy (i.e. staying on the blue tape) and successfully rotating around corners is of higher importance

2. Product/Service Description

2.1 Product Context

The Sphero SPRK robot is dependent on a computer or laptop to be controlled by the Sphero EDU application's block code.

2.2 User Characteristics

The users of the Sphero SPRK robot and the audience for this project are students and professors of CS-104-01. This audience has a higher technical expertise, as the vast majority of students in the class are computer science or software engineering majors at Monmouth University.

2.3 Assumptions

For this project, it is assumed that the user will be utilizing the Windows operating system on their computer to run the block code. It is also assumed that the user will have all the necessary parts in order to operate the Sphero SPRK robot.

2.4 Constraints

The design of the algorithm for this project may be constrained by some aspects of the Sphero SPRK robot and its application. For example, the robot itself is slightly unstable and has difficulty with moving straight in one direction. It also has difficulty going around sharp corners smoothly due to its spherical design. In terms of the Sphero EDU application, the block code format may constrain how the algorithm is developed.

2.5 Dependencies

This project's algorithm is dependent on a laptop running the Windows 11 operating system. It is also dependent on a charger and charging adapter that will power the robot.

3. Requirements

Top Priority Requirements:

- An algorithm must be designed to make the Sphero SPRK robot circumnavigate a rectangle marked by blue tape on the floor of the CS-104-01 classroom
- The robot must be able to fully circumnavigate the classroom all in one go, meaning it cannot bump into any objects or encounter any errors in the block code
- The robot's sensor data as shown in the Sphero EDU application must accurately reflect the rectangle shape of the blue tape marked on the floor of the classroom

Low Priority Requirements:

- The robot does not need to circumnavigate the classroom as fast as possible, but speed and timing will be of slight importance

3.1 Functional Requirements

Req#	Requirement	Comments	Priority	Date Rvwd	SME Reviewed / Approved
1	Circumnavigate the rectangle around the classroom	Must circumnavigate without bumping into anything	Top Priority	10/30/24	Approved
2	Sensor data must show a rectangle	Must be as exact as possible	Top Priority	10/30/24	Approved

3.2 Security

3.2.1 Protection

There are no major security restrictions or requirements for this project, except for making sure to store the robot in a safe location when it is not in use.

3.2.2 Authorization and Authentication

There are no major authorization or authentication requirements for this project, except for making sure the robot is connected to the correct computer when working on the Sphero EDU application during class time.

3.3 Portability

The block code can be transferred to other computers as a Java code file.

4. Requirements Confirmation/Stakeholder sign-off

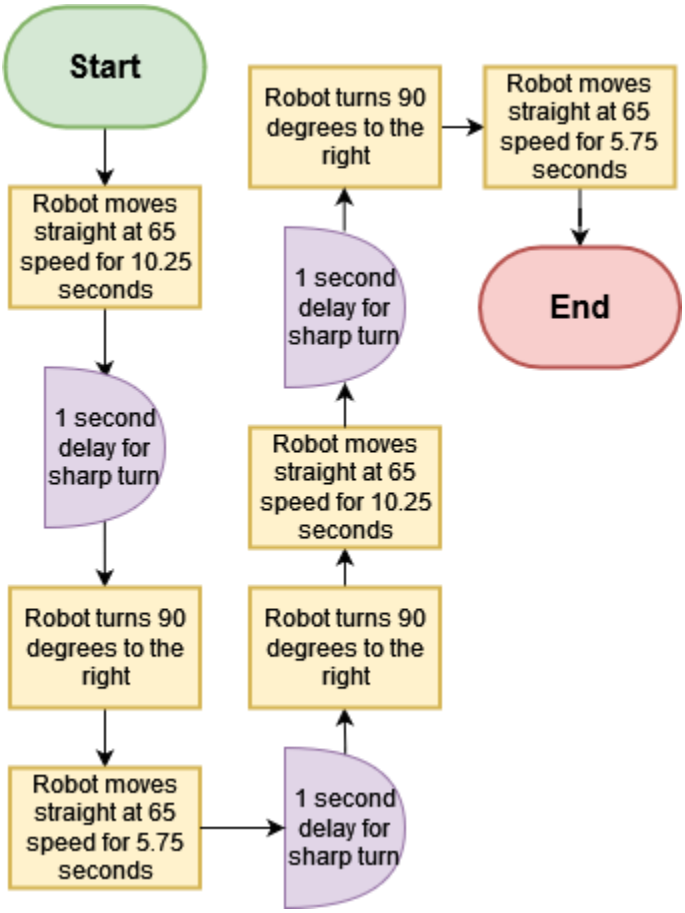
Meeting Date	Attendees (name and role)	Comments
10/29/24	Anna Pitera (Team Leader) Isuhi Acosta (Team Member) Joseph Ventimiglia (Team Member)	Confirmed all requirements

5. System Design

5.1 Algorithm

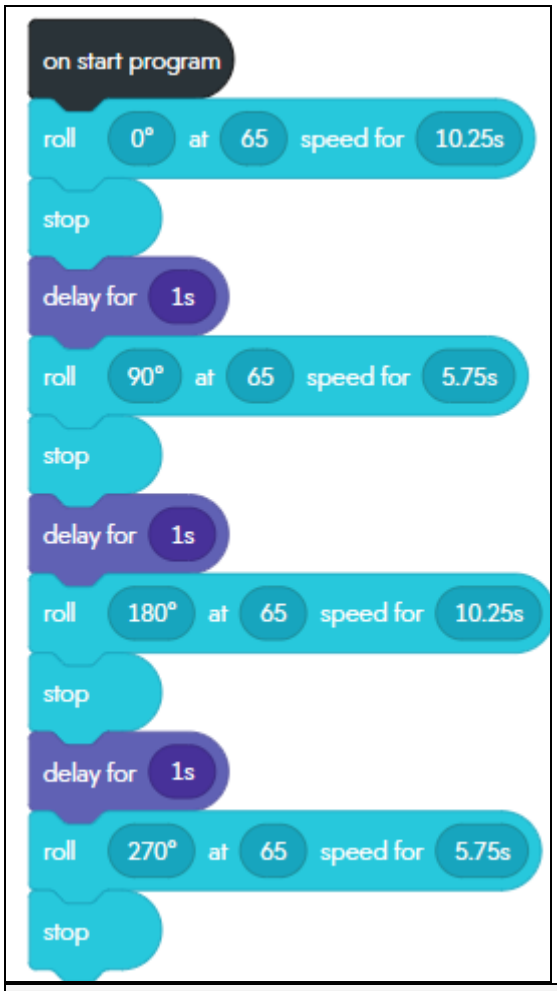
- When the program starts, the robot will move straight to the end of the first blue tape line marked on the floor
- Once it reaches the end, the robot will turn to the right, facing the next blue tape line
- After turning, the robot will move straight to the end of that blue tape line
- Once it reaches the end, the robot will turn to the right, facing the next blue tape line
- After turning, the robot will move straight to the end of that blue tape line
- Once it reaches the end, the robot will turn to the right, facing the next blue tape line
- After turning, the robot will move straight to the end of that blue tape line and complete the program

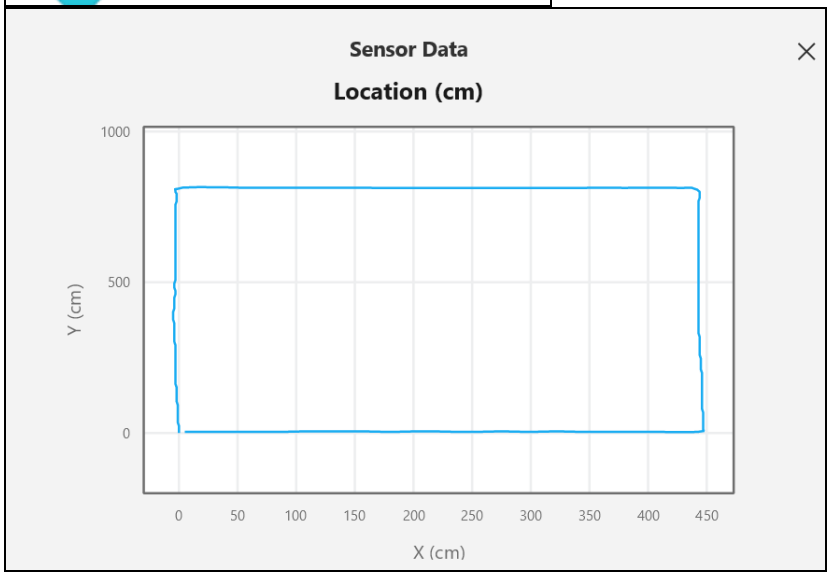
5.2 System Flow



5.3 Software

The Sphero EDU application was used to develop the block code for this project.





5.4 Hardware

A laptop running the Windows 11 operating system was used to run the Sphero EDU application in order to control the Sphero SPRK robot. A charging wire, an adapter, and a Sphero charging pad were also used to power the robot.

5.5 Test Plan

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
Testing block code	10/29/24	Robot will successfully circumnavigate classroom	Robot was not aimed properly and bumped into chair	All team members	Fail
Testing block code	10/29/24	Robot will successfully circumnavigate classroom	Robot was aimed properly, but lost aim before first turn	All team members	Fail
Testing block code	10/29/24	Robot will successfully circumnavigate classroom	Robot got to first turn and attempted to turn, but went in a curve instead and lost aim	All team members	Fail
Testing block code	10/29/24	Robot will successfully circumnavigate classroom	Robot got past first turn, but went too far past the second turn and missed it	All team members	Fail
Testing block code	10/29/24	Robot will successfully circumnavigate classroom	Robot got past first and second turn, but went too far past the third turn and missed it	All team members	Fail
Testing block code	10/29/24	Robot will successfully circumnavigate classroom	Robot successfully circumnavigated classroom by making all 3 turns without bumping into anything	All team members	Pass

5.6 Task List/Gantt Chart

ROBOT PROJECT (CS-104-01)

► Watch How to Make a Gantt Chart in Excel

Anna Pitera
Isuhi Acosta
Joseph Ventimiglia

Project Start: Mon, 10/14/2024
Today: Fri, 11/1/2024
Display Week: 1

TASK	ASSIGNED TO	PROGRESS	START	END
First Robot Program		100%	10/14/24	10/16/24
Create repo & share	Anna	100%	10/14/24	10/14/24
Robot/Sphero EDU computer setup	All	100%	10/14/24	10/15/24
Meet up for block code testing	All	100%	10/15/24	10/15/24
Upload files & submit	All	100%	10/16/24	10/16/24
Triathlon: Endurance		100%	10/23/24	11/1/24
Reserve room for robot testing (Tuesday 10/29)	Anna	100%	10/23/24	10/23/24
Create repo & share	Anna	100%	10/28/24	10/28/24
Design basic block code to test on Tuesday	Isuhi & Joseph	100%	10/27/24	10/29/24
Format Gantt chart	Anna	100%	10/28/24	10/28/24
Format flow chart in draw.io	Anna & Isuhi	100%	10/28/24	10/28/24
Complete System Design Document (SDD)	Anna	100%	10/28/24	11/1/24
Finish block code in reserved room (3:00-4:00 PM)	All	100%	10/29/24	10/29/24
Upload files & submit	All	100%	11/1/24	11/1/24

5.7 Staffing Plan

Name	Role	Responsibility	Reports To
Anna Pitera	Team Leader	- Maintaining Gantt chart - Room reservations - Block code - Robot storage/charging - Writing SDD	Prof Qu
Isuhi Acosta	Team Member	- Flow charts - Block code - Updating GitHub repository - Record videos	Prof Qu
Joseph Ventimiglia	Team Member	- Block code - Updating GitHub repository - Calibrating robot aim during testing	Prof Qu