

## **Sprint 3 - Agility Design Document**

**November 30, 2022**

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# 1. Executive Summary

## 1.1 Project Overview

Essentially, The Sprint Agility Robot Project is designed to make the robot navigate through an obstacle course without colliding with any obstacles, and it must go over the ramp and knock down all the bowling pins in the HH208 classroom accurately. The creators of this project, Brian Mohabeer and Anthony Espanol are presenting this project to Professor Gil Eckert of Monmouth University. This is part 3 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 3 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 2 of the Robotics Triathlon:

- Agility of the robot to navigate the obstacle course without hitting obstacles, and the robot must hit down pins on a predefined path

### Out of Scope

The following items in part 1 and 3 of the Robotics Triathlon Project are out of scope and documented separately:

- Measurements of lengths and angles of the path the robot has to navigate.
- Light Colors and required speech of the robot.
- Accuracy of the robot to go around figure 8 shape five times.

# 2. Product/Service Description

## 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 two 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 path laid out for the robot to navigate.
- Part 3 of this project must be completed by November 30th, 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

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- Shero App
- Room with floor plan for the robot to navigate

### 3. Requirements

- The robot must start in the square provided
- Must avoid the three objects it will encounter
- Robot has to go over the ramp
- Robot must knock as many pins possible

#### 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
AGIL_01	Start in square	Confirmed	1	11/21/22	Brian Mohabeer
AGIL_02	Roll robot 3'3" at 0°	Confirmed	1	11/21/22	Anthony Espanol
AGIL_03	Roll robot 3'4" at 92°	Confirmed	1	11/21/22	Anthony Espanol
AGIL_04	Roll robot 3'10" at 0°	Confirmed	1	11/21/22	Anthony Espanol
AGIL_05	Roll robot 7'5" at 91° and robot must go over ramp	Confirmed	1	11/28/22	Brian Mohabeer
AGIL_06	Roll robot 9'1" at 225°	Confirmed	1	11/28/22	Brian Mohabeer
AGIL_07	Robot must knock over bowling pins	Confirmed	1	11/28/22	Anthony Espanol
AGIL_XX					
AGIL_XX					

#### 3.2 Security

##### 3.2.1 Protection

- Prompts for username and password every time you try accessing the Shero 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](http://edu.sphero.com) for details.

## **4. Requirements Confirmation/Stakeholder sign-off**

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

<b>Meeting Date</b>	<b>Attendees (name and role)</b>	<b>Comments</b>
11/21/22	Brian Mohabeer(Manager) and Anthony Espanol(Coder)	confirmed AGIL_01-AGIL_04
11/28/22	Brian Mohabeer(Manager) and Anthony Espanol(Coder)	confirmed AGIL_05-AGIL_07

## **5. System Design**

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

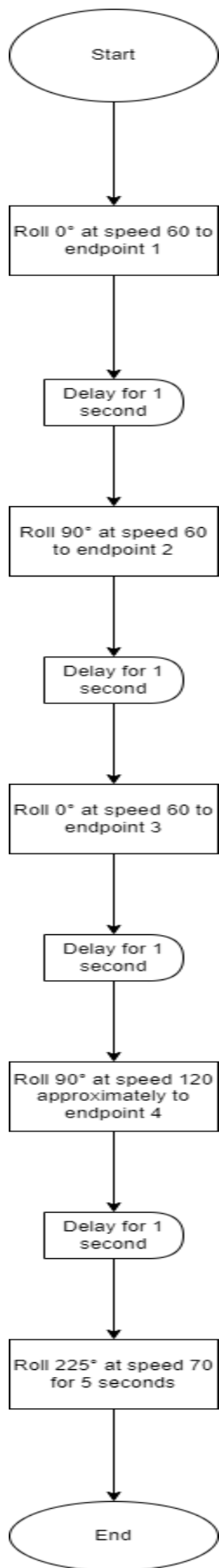
### **5.1 Algorithm**

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

1. Start
2. Roll 0° at 60 speed to endpoint 1
3. Delay for 1 second
4. Roll 90° at 60 speed to endpoint 2
5. Delay for 1 second
6. Roll 0° at 60 speed to endpoint 3
7. Delay for 3 seconds
8. Roll 90° for 120 speed to endpoint 4
9. Delay for 1 second
10. Roll 225° at 70 speed for 5 seconds
11. End

### **5.2 System Flow**

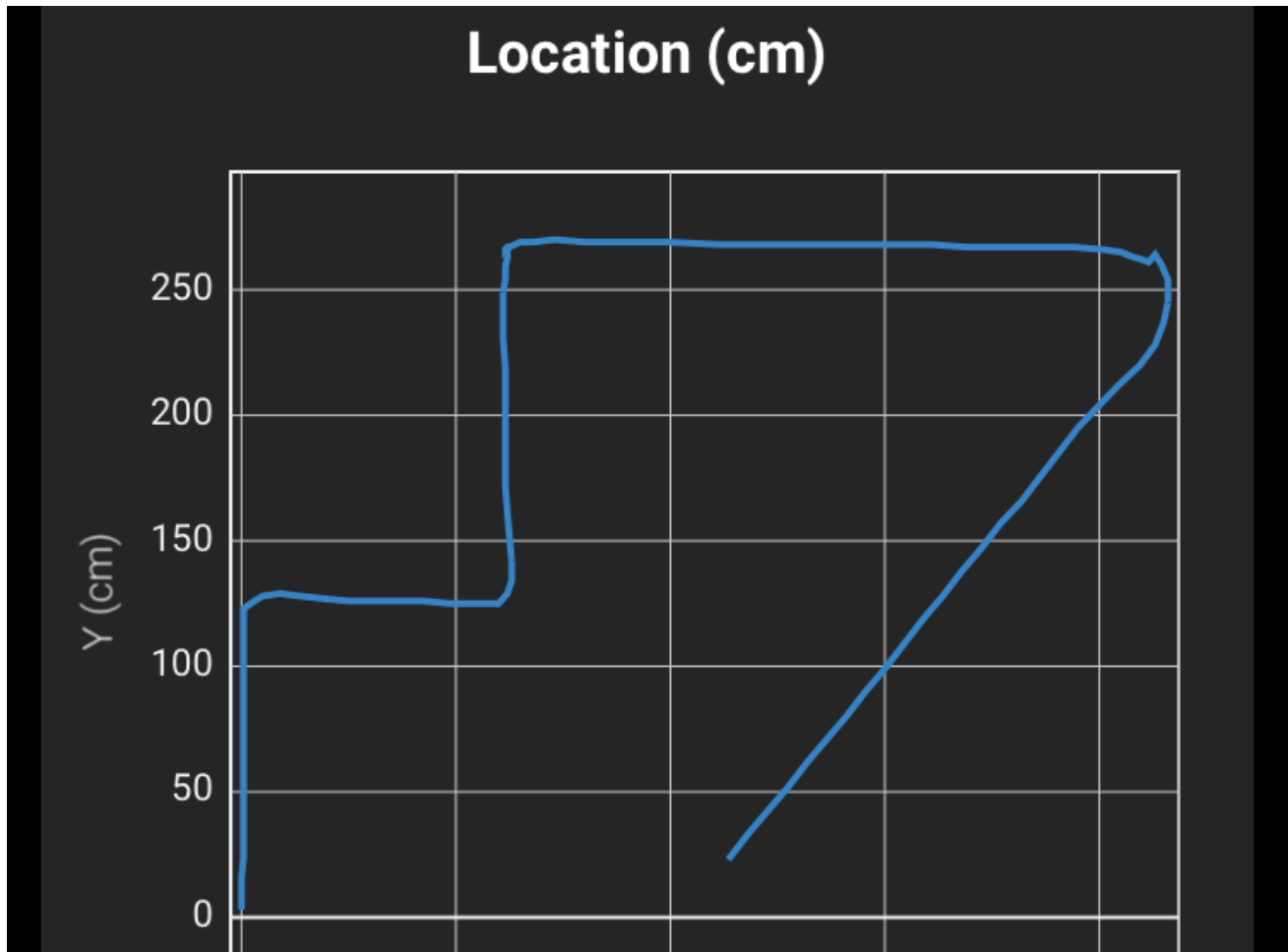
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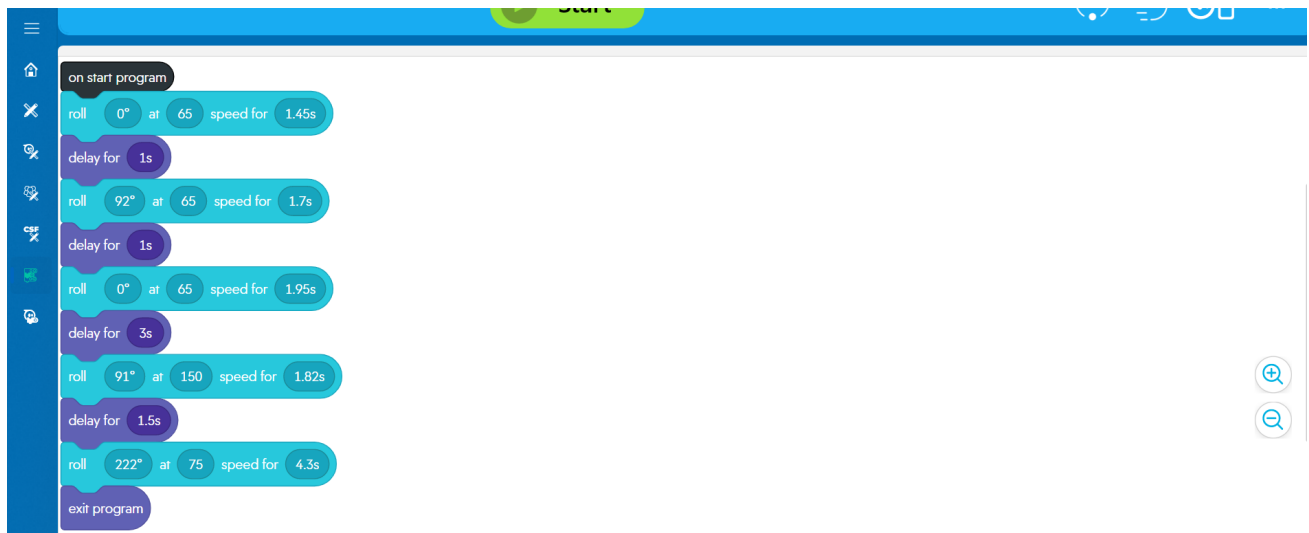
### 5.3 Software

Sphero App which uses a GUI interface with Java code.

Sensor data:



Code:



### 5.4 Hardware

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

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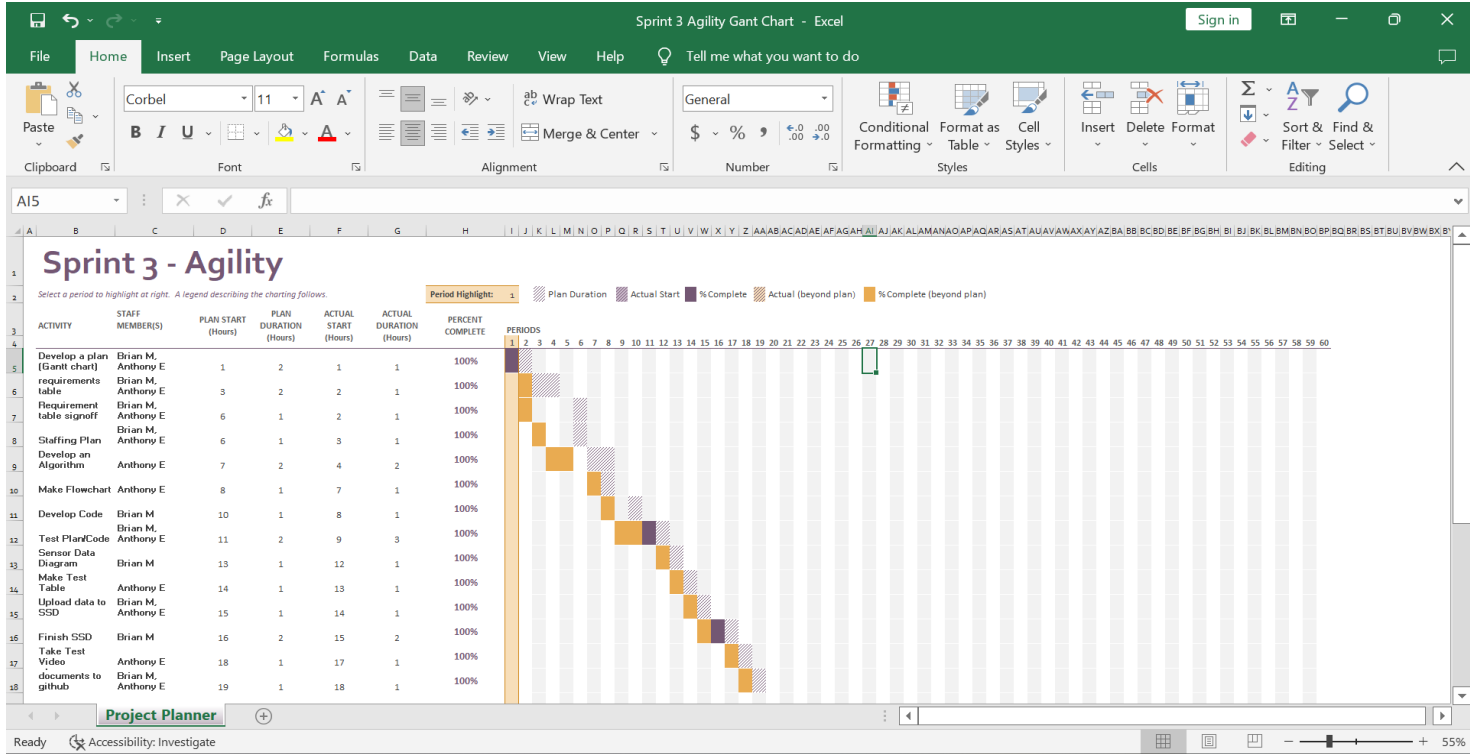
### 5.5 Test Plan

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
Robot rolls 0° until it reaches the end of the first side of the course.	11/21/22	Robot stops a bit short, but it follows the path.	Expected outcome so we must increase the duration	Brian Mohabeer, Anthony Espanol	Fail
Practice aiming the robot and increase the time of the roll to ensure the robot reaches the end.	11/21/22	Robot reaches the end of the first side	Went as expected	Brian Mohabeer, Anthony Espanol	Pass
Robot rolls 92° until it reaches the end of the second side of the course	11/21/22	Robot to be accurate, but stops a slightly short	The result went as expected	Brian Mohabeer, Anthony Espanol	Pass
Robot rolls 0° until it reaches the end of the third side of the course	11/21/22	Robot reaches the end of the third side	The robot stops slightly short just like the previous test case	Brian Mohabeer, Anthony Espanol,	Fail
Increase the times of the two previous sides to ensure the robot reaches the ends of the sides.	11/21/22	Robot reaches the ends of the two previous sides	Robot meets all the requirements up to this point	Brian Mohaber, Anthony Espanol	Pass
Robot roll 91° and goes over ramp fairly accurately	11/28/22	Robot stops short because of the ramp	Went as expected	Brian Mohabeer, Anthony Espanol	Fail
Increase the speed of the robot to ensure it can go over the ramp and not stop short of this side of the course.	11/28/22	Robot goes over the ramp accurately and it does not stop short	Went as planned	Brian Mohabeer, Anthony Espanol	Pass
Robot roll 225° and knocks down bowling pins	11/28/22	The robot knocks over all bowling pins	Robot does not knock over all the bowling pins	Brian Mohabeer, Anthony Espanol	Fail
Increase the duration of the last side to make the robot knock over bowling pins.	11/28/22	The robot knocks over all bowling pins	Went as expected	Brian Mohabeer, Anthony Espanol	Pass
Test the course one final time to make sure the robot meets all the requirements	11/28/22	All requirements were met	All requirements were met	Brian Mohabeer Anthony Espanol	Pass



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### 5.6 Task List/Gantt Chart



### 5.7 Staffing Plan

Name	Role	Responsibility	Reports To
Brian Mohabeer	Manager	Manage the project and update Gant Chart. Required to be present for all testing.	Team and Professor
Anthony Espanol	Coder	Algorithm, flowchart, and Code. Required to be present for all testing.	Brian Mohabeer