

Sprint 2 - Accuracy Design Document

November 16, 2022

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1. Executive Summary

1.1 Project Overview

Essentially, The Sprint Accuracy Robot Project is designed to make the robot go around a “figure 8” 5 times 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 2 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 2 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:

- Accuracy of the robot to go around figure 8 shape five times.
- Light Colors and required speech of the robot.

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.
- 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

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 2 of this project must be completed by November 16th, 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
- Sphero App

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- Room with floor plan for the robot to navigate

3. Requirements

- The robot will start in the square provided and it must go around the figure 8 five times.
- Upon finishing, the robot will flash multicolored lights for 5 seconds and speak "I am the winner"
- Robot has to start and end in the same location
- 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
ACCUR_01	Set speed to 50	Confirmed	2	11/11/22	Anthony Espanol
ACCUR_02	Spin 360 deg for 9.4 sec	Confirmed	1	11/11/22	Anthony Espanol
ACCUR_03	Spin -360 deg for 9.4 sec	Confirmed	1	11/11/22	Brian Mohabeer
ACCUR_04	Loop the above requirements to repeat 5 times	Confirmed	1	11/11/22	Anthony Espanol
ACCUR_05	Stop	Confirmed	1	11/14/22	Brian Mohabeer
ACCUR_06	Speak "I am the winner"	Confirmed	1	11/14/22	Brian Mohabeer
ACCUR_07	Flash multicolored lights for 5 seconds	Confirmed	1	11/14/22	Anthony Espanol
ACCUR_XX					
ACCUR_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
11/11/22	Brian Mohabeer(Manager) and Anthony Espanol(Coder)	confirmed ACCUR_01-ACCUR_04
11/14/22	Brian Mohabeer(Manager) and Anthony Espanol(Coder)	confirmed ACCUR_05-ACCUR_08

5. System Design

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

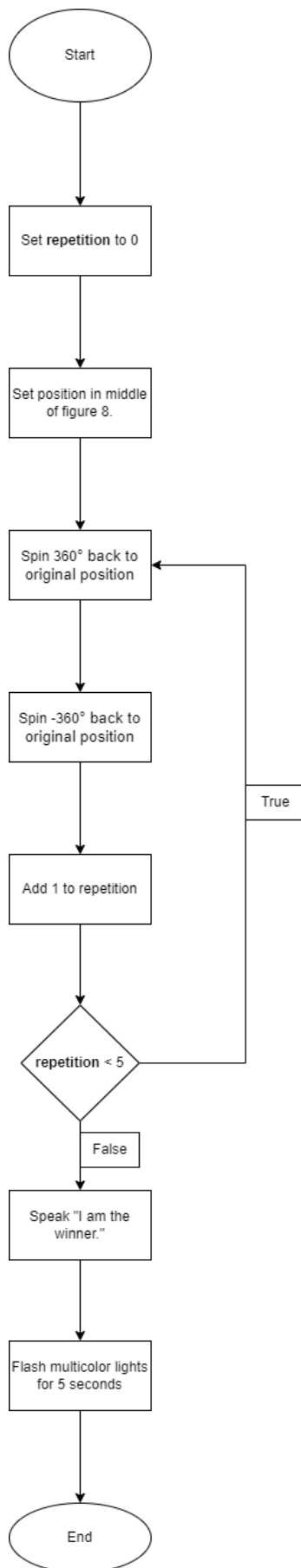
5.1 Algorithm

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

1. Start
2. Set **repetition** to 0
3. Set position in the middle of the figure 8
4. Spin 360° back to original position.
5. Spin -360° back to original position.
6. Add 1 to repetition
7. If **repetition** < 5, repeat steps 3-6.
8. Speak "I am the winner."
9. Flash multicolor lights for 5 seconds.
10. End

5.2 System Flow

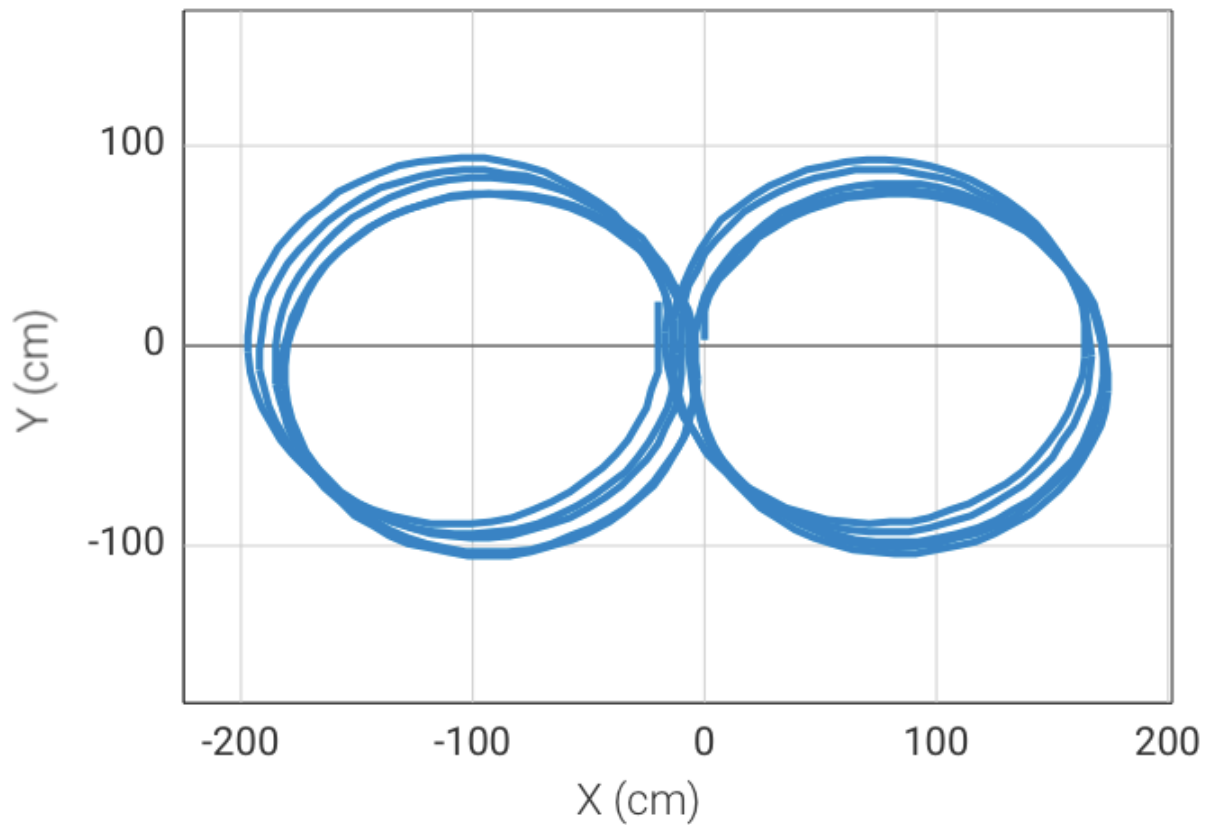
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5.3 Software

Sphero App which uses a GUI interface with Java code.

Sensor data:



Total Distance: 5.677.3 cm

Code:



5.4 Hardware

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

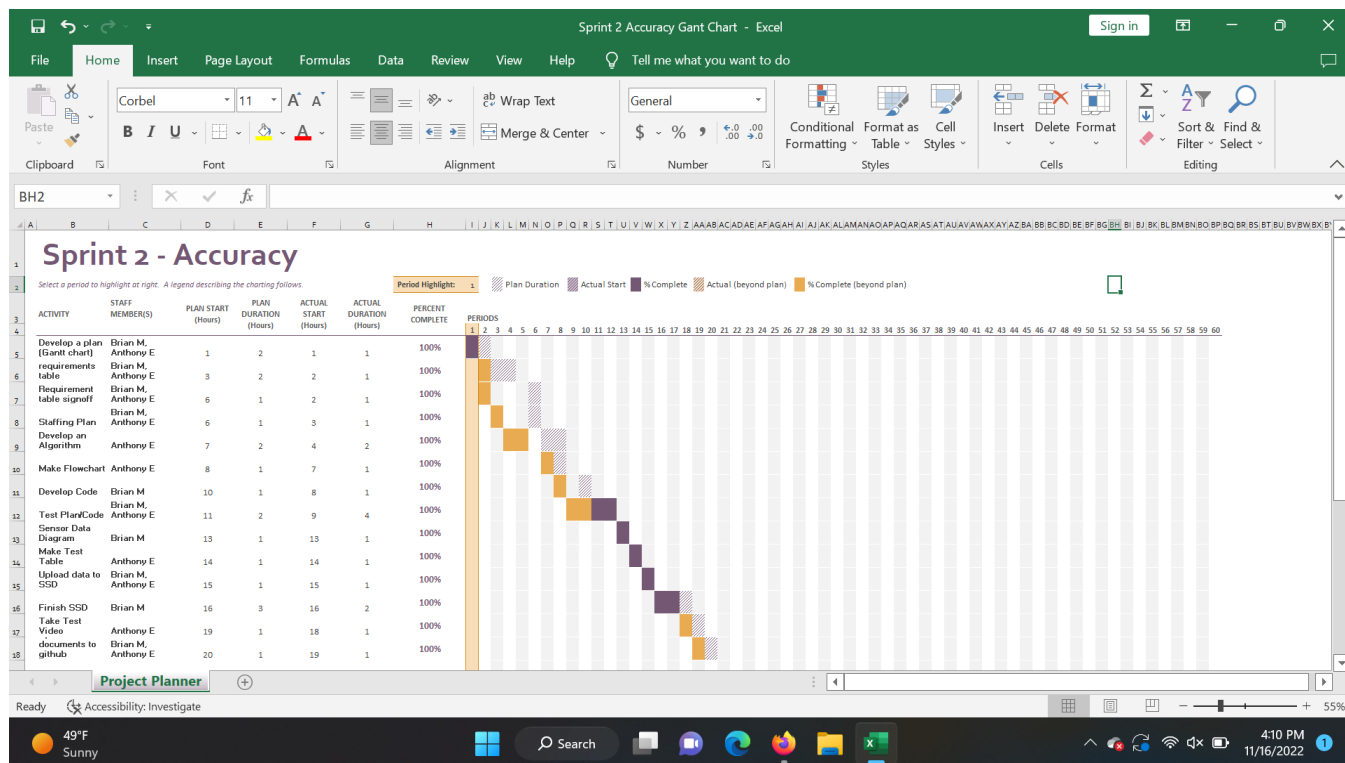
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5.5 Test Plan

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
Robot spins 360 deg around the figure 8 and stops in the same position in which it started.	11/11/22	Robot is not accurate, but it does generally move in the shape of a circle.	Aiming the robot could have possibly affected the output and the robot could be spinning for too much time.	Brian Mohabeer, Anthony Espanol	Fail
Practice aiming the robot and tweak the time of the spin to make the robot stay on course.	11/11/22	Comply with specifications	Went as expected.	Brian Mohabeer, Anthony Espanol	Pass
Robot runs the full course of the figure 8 using the same speed and time for the second circle.	11/11/22	Robot to be accurate during the first circle, but to be off during the second circle because it looks as if the second circle is larger.	The result went as expected so we need to increase the duration of the spin of the second circle.	Brian Mohabeer, Anthony Espanol	Pass
Increase the duration of the time of the second circle so that the robot can accurately navigate the path.	11/11/22	Robot to be very precise.	The robot accurately navigated the figure 8.	Brian Mohabeer, Anthony Espanol,	Pass
Loop the code for the figure 8 so the robot can run the path 5 times.	11/14/22	Robot runs the course five times.	Best outcome possible	Brian Mohaber, Anthony Espanol	Pass
Robot speaks "I am the winner" at the end of the course.	11/14/22	Robot speaks "I am the winner"	Went as expected	Brian Mohabeer, Anthony Espanol	Pass
Robot flashes lights for 5 seconds at the end of the course.	11/14/22	Robot flashes lights	Went as expected	Brian Mohabeer, Anthony Espanol	Pass
Test Course one final time	11/15/22	Everything runs as expected	Project is complete	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