Sprint 3 - Agility Design Document

December 3, 2020

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1. Executive Summary

1.1 Project Overview

The project is designed to have a robot successfully complete an agility course without colliding with any obstacles and knocking over as many pins as possible. The robot must also adhere to specific distance and turning requirements outlined in the requirements table.

1.2 Purpose and Scope of this Specification

This product and program runs within all legal requirements. No laws are broken in the utilization of this program and robot. All legal mandates are met. Outlines and meets all requirements present in this document.

2. Product/Service Description

2.1 Product Context

This product is more effective than other products due to its simplicity within the code and ease of maneuverability. It interacts with Sphero EDU software, available on mobile devices as well as computers

2.2 User Characteristics

Students and children will use this product to demonstrate a basic version of code that can teach them the ins and outs of coding and program design. This product could be utilized at a place like Code Ninjas, an early coding academy that teaches the basics of code to children. This software can teach the beginning elements of coding and algorithmic design to kids with or without a specific interest in the field. Little technical experience is required due to the lack of actual code needed to create a program. The block coding does not require the user to have previous computer science knowledge, making the market for this market larger than the competition.

2.3 Assumptions

It is assumed that the user has access to a device that can run the Sphero EDU program, a SPRK+, and enough common sense to understand and run the program.

2.4 Constraints

The constraints of this program are the limit of block code on the Sphero EDU app. The robot can do only as many things available on the app block coding software. Another constraint could be the strength of the bluetooth connection to the robot, limiting the range at which the robot can operate while away from the user. The only main constraint with the utilization of the program is that the user must have a SPRK+ robot as well as a bluetooth compatible device with the Sphero EDU software.

2.5 Dependencies

This program requires a SPRK+ Robot and the Sphero EDU app to successfully run the program.

3. Requirements

3.1 Functional Requirements

Req#	Requirement	Comments	Priority
AGIL_01	Robot Must Travel Straight 3’3” From Start		1
AGIL_02	Robot Must Turn Right at the End of the 3’3” Avoiding an Obstacle	Robot Must Not Hit the Obstacle	1
AGIL_03	Robot Must Travel Straight After Turning for 3’4”		1
AGIL_04	Robot Must Turn Left at the End of the 3’4” Avoiding Another Obstacle	Robot Must Not Hit the Obstacle	1
AGIL_05	Robot Must Travel Straight After Turning for 3’10”		1
AGIL_06	Robot Must Turn Right at the end of the 3’10” Avoiding the Final Obstacle	Robot Must Not Hit the Obstacle	1
AGIL_07	Robot Must Travel Straight After Turning for 7’5” and Pick Up Speed to Go Over the Ramp Halfway Through the Distance	Robot Must Make It Over the Ramp and Slow Down After Doing So	1
AGIL_08	Robot Must Make a Hard Right at the End of the 7’5”	Turn is About 225°	1
AGIL_09	Robot Must Travel Straight After Turning for 9’11” Knocking Down as Many Pins as Possible at the End of the Distance	The More Pins the Better	1

3.2 Security

3.2.1 Protection

This program does not have large security protection due to the lack of personal information in this program. There is nothing worth stealing within the program, therefore, highly maintained security is not necessary such as those present on a banking website. The activity of the robot is logged in sensor data but deleted after the program is run again. Data integrity checks are not necessary with this program due to the lack of personal information present.

3.2.2 Authorization and Authentication

A user must authorize their identity by the logging into their Sphero EDU account in order to access their program. Programs can be made public or private depending on the preferences of the user.

3.3 Portability

This program is portable due to the portability of the physical robot as well as the code can be run from any device with bluetooth and the Sphero EDU software.

4. Requirements Confirmation/Stakeholder sign-off

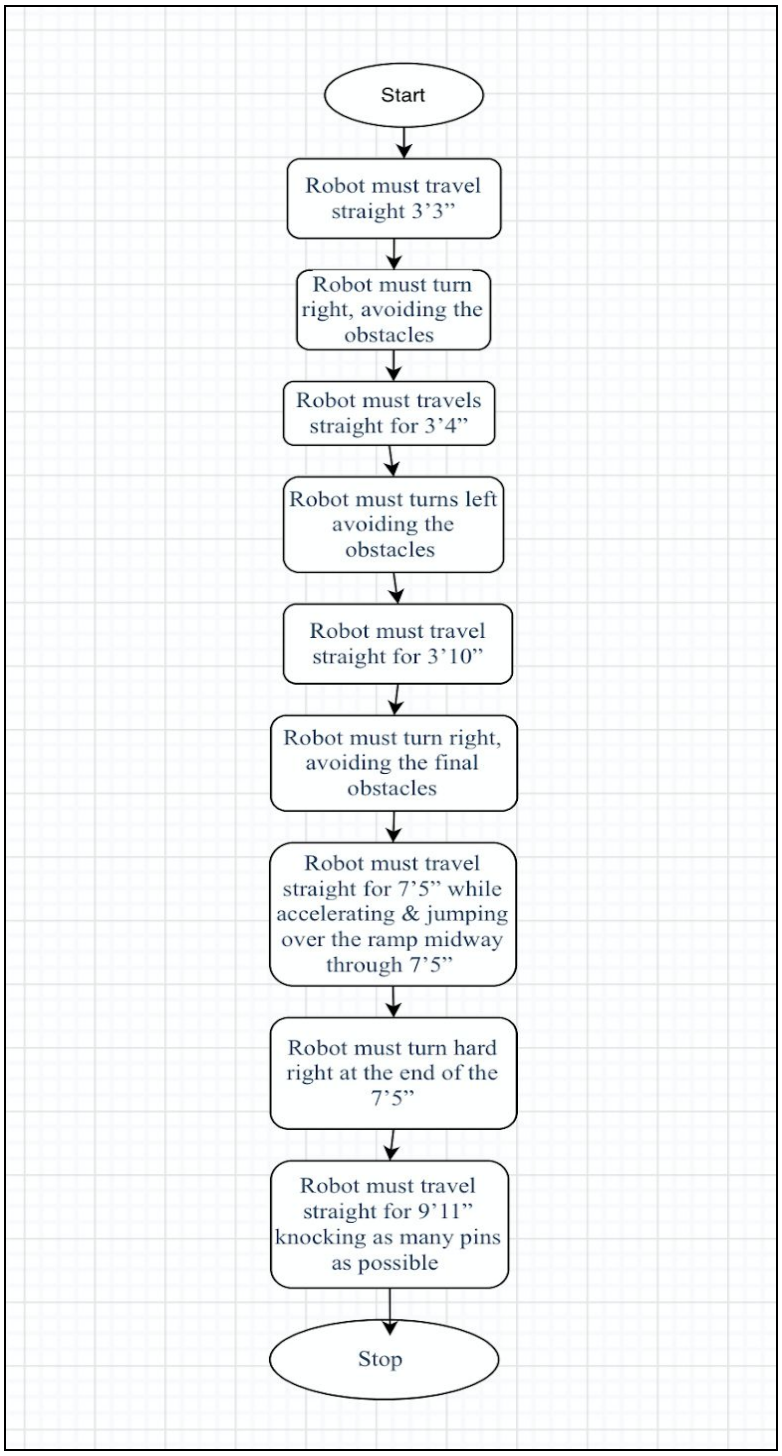
Meeting Date	Attendees (name and role)	Comments
11/29/20	Andrew Catapano, Estania Blanc, & Matthew Emery	Confirmed all Requirements listed in Gantt Chart and Algorithm

5. System Design

5.1 Algorithm

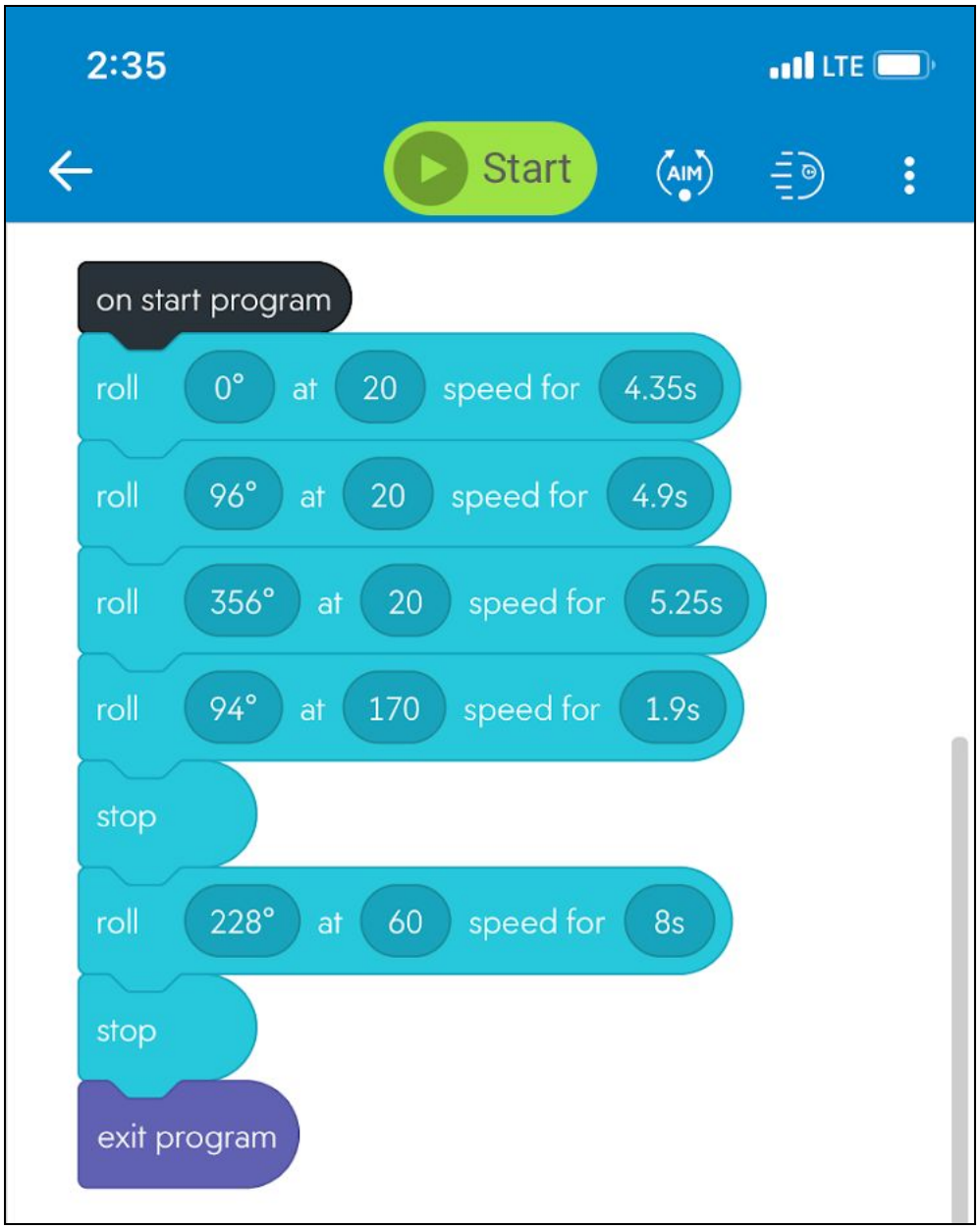
- Start Program
- Robot travels straight for 3’3”
- Robot turns right, avoiding the obstacle
- Robot travels straight for 3’4”
- Robot turns left, avoiding the obstacle
- Robot travels straight for 3’ 10”
- Robot turns right, avoiding final obstacle
- Robot travels straight for 7’ 5” while accelerating and jumping over the ramp midway through the 7’ 5”
- Robot turns hard right at end of the 7’ 5”
- Robot travels straight for 9’ 11” knocking down as many pins as possible
- End Program

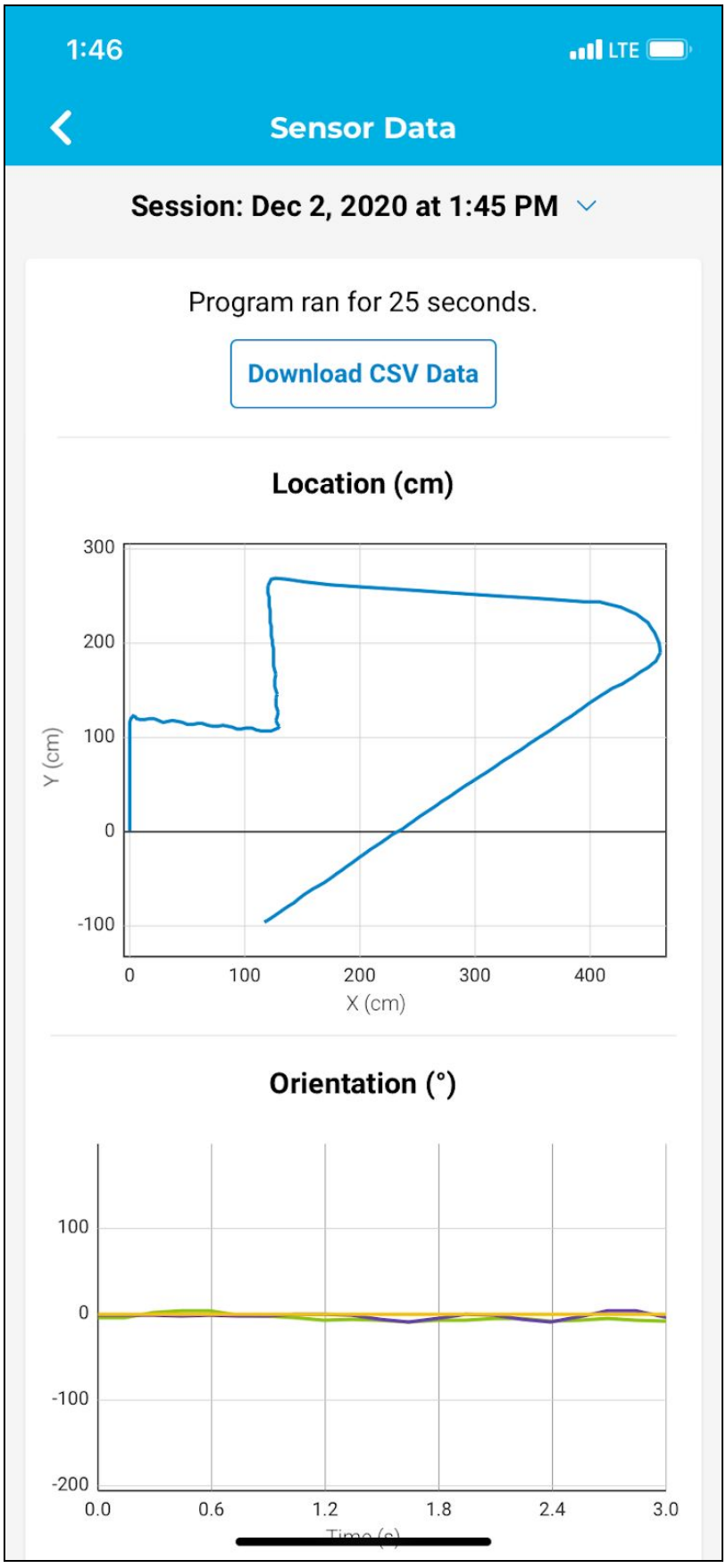
5.2 System Flow



5.3 Software

The software for this program was developed in the Sphero EDU coding platform using block code. It is required for the program required successfully.


2:35
LTE
Start
AIM
on start program
roll 0° at 20 speed for 4.35s
roll 96° at 20 speed for 4.9s
roll 356° at 20 speed for 5.25s
roll 94° at 170 speed for 1.9s
stop
roll 228° at 60 speed for 8s
stop
exit program


1:46
LTE
Sensor Data
Session: Dec 2, 2020 at 1:45 PM
Program ran for 25 seconds.
Download CSV Data
Location (cm)
300
200
100
0
-100
Y (cm)
0
100
200
300
400
X (cm)
Orientation (°)
100
0
-100
-200
0.0
0.6
1.2
1.8
2.4
3.0

5.4 Hardware

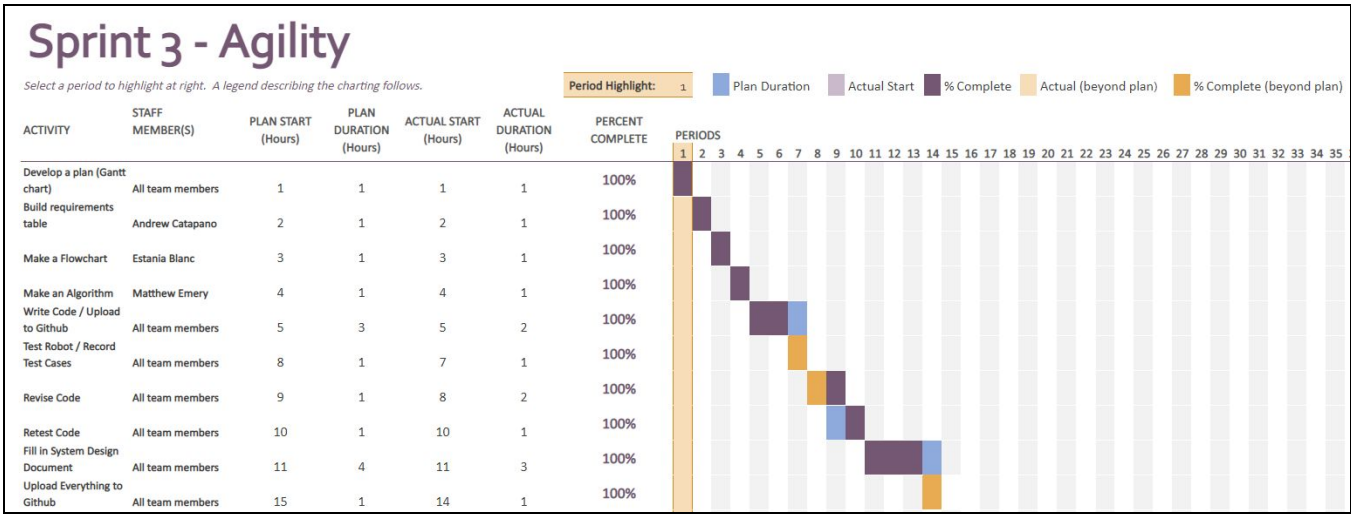
The hardware for this program includes the SPRK+ Robot, computers and phones used to create and test code, as well as the course in the classroom at Monmouth University.

5.5 Test Plan

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
To confirm first step in alorightm	12/2	Robot travels straight fo 3’ 3”	Robot traveled straight for 3’ 3”	All Members	Pass
To confirm second step in alorightm	12/2	Robot turns right at the end of traveling the 3’ 3”	Robot turned right successfully after traveling 3’ 3”	All Members	Pass
To confirm third step in alorightm	12/2	Robot travels straight for 3’ 4”	Robot traveled too short a distance	All Members	Fail
To confirm fourth step in alorightm	12/2	Robot turns left at the end of traveling the 3’ 4”	Robot turned left successfully	All Members	Pass
To confirm fifth step in alorightm	12/2	Robot travels straight for 3’ 10”	Robot traveled straight successfully, but the distance was too long	All Members	Fail
To confirm sixth step in alorightm	12/2	Robot turns right at the end of traveling the 3’ 10”	Robot turned right successfully	All Members	Pass
To confirm seventh step in alorightm	12/2	Robot travels straight for 7’ 5” and picks up speed to go over a ramp located halfway through the 7’ 5” distance	Robot did not successfully go over the ramp	All Members	Fail
To confirm eighth step in alorightm	12/2	Robot turns hard right at the end of traveling the 7’ 5” and successfully completing the ramp	Robot successfully turned hard right	All Members	Pass
To confirm ninth step in alorightm	12/2	Robot travels straight for 9’ 11” and knocks down as many picks as possible at the end of the distance	Robot successfully traveled 9’ 11” and but missed the pins	All Members	Fail
To retest third step in alorightm	12/2	Robot travels straight for 3’ 4”	Robot traveled 3’ 4” successfully	All Members	Pass
To retest fifth step in alorightm	12/2	Robot travels straight for 3’ 10”	Robot traveled straight successfully for 3’ 10”	All Members	Pass
To retest seventh step in alorightm	12/2	Robot travels straight for 7’ 5” and picks up speed to go over a ramp located halfway through the 7’ 5” distance	Robot successfully travelled the 7’ 5” and made it over the ramp	All Members	Pass

To retest ninth step in alorightm	12/2	Robot travels straight for 9’ 11” and knocks down as many pins as possible at the end of the distance	Robot successfully traveled 9’ 11” and knocked over 1 pin	All Members	Pass

5.6 Task List/Gantt Chart



ACTIVITY	STAFF MEMBER(S)	PLAN START (Hours)	PLAN DURATION (Hours)	ACTUAL START (Hours)	ACTUAL DURATION (Hours)	PERCENT COMPLETE
Develop a plan (Gantt chart)	All team members	1	1	1	1	100%
Build requirements table	Andrew Catapano	2	1	2	1	100%
Make a Flowchart	Estania Blanc	3	1	3	1	100%
Make an Algorithm	Matthew Emery	4	1	4	1	100%
Write Code / Upload to Github	All team members	5	3	5	2	100%
Test Robot / Record Test Cases	All team members	8	1	7	1	100%
Revise Code	All team members	9	1	8	2	100%
Retest Code	All team members	10	1	10	1	100%
Fill in System Design Document	All team members	11	4	11	3	100%
Upload Everything to Github	All team members	15	1	14	1	100%

5.7 Staffing Plan

Name	Role	Responsibility	Reports To
Matthew Emery	Programmer/Testers/ Documenters/Technical Writer	● Algorithm ● Test/Build Code ● Complete SDD ● Collaborate with other members	All Team Members
Andrew Catapano	Project Manager/ Programmer/Testers/ Documenters/Technical Writer	● Requirements ● Test/Build Code ● Complete SDD ● Collaborate with other members	All Team Members
Estania Blanc Doblas	Programmer/Testers/ Documenters/Technical Writer	● Flow Chart ● Test/Build Code ● Complete SDD ● Collaborate with other members	All Team Members