Sprint 2 - Accuracy Design Document

November 13, 2024

Table of Contents

Executive Summary

1.1 Project Overview

In this project, we are piloting a mini robot around a figure-8 loop set up. The intended audience is anyone who has an interest in beginner coding and wants to start learning.

1.2 Purpose and Scope of this Specification

The purpose of this specification is to introduce people to beginner programming and physically see the results of some simple work. Our main in-scope goal was to stick to the loop accurately, but as we worked, we developed the out-of-scope goal of ensuring proper axis orientation for the robot in order to make this journey more accurate.

Product/Service Description

General factors that affect the program and its requirements are access to the software, Bluetooth compatibility to connect to the robot, access to a testing space for the program. Without access to the software required, we cannot develop or test this program. We can code on a device without Bluetooth capabilities, but you need a device with these capabilities to connect to the robot. Additionally, you need access to the testing space to ensure that your design accurately reaches all goals.

1.3 Product Context

This project is widely related to a variety of other coding projects. A similar approach can be used for other courses you want your robot to tackle such as circling a room or encountering obstacle course. Every project utilizing the Sphero robots uses the Sphero Edu software and coding inside to connect and control the robots. These projects can be shared with other people for them to enjoy too.

1.4 User Characteristics

People who will be utilizing this project are beginner programmers who are looking to learn more and get comfortable with block code. This could be students or the public. They don’t have any experience but should have some general coding expertise.

1.5 Assumptions

Our robot must be charged and ready to sync up to our devices. We must also be familiar with the coding software that connects to our robot. The Sphero Edu software must be available to use and not have any server issues. Additionally, the testing room must be available for us to conduct testing

1.6 Constraints

You must have access to the Sphero Edu software and a device that is compatible with it. Additionally, you need to have access to a figure-eight course loop. This project isn’t nearly large enough to have any impact on disk space or other hardware limitations. Your device must have Bluetooth capabilities to connect with the robot. This program should be easily accessible by anyone with this software. No data encryption is required.

1.7 Dependencies

Basic coding based on the algorithm as well as proper hardware is required before the accuracy testing, including ACCUR_01 – 04, can be taken. ACCUR_05 – 06 can only be confirmed once the coding software is downloaded and properly connected. In order to for the robot to track and run, it needs its built in sensors so it can properly calibrate to the aim you want. People must understand how to use the software for any of these requirements to be fulfilled

1.8 Functional Requirements

Req#	Requirement	Comments	Priority	Date Rvwd	SME Reviewed / Approved
ACCUR_01	Get back to the starting point	This is the main goal of the program	1	11/11	11/11
ACCUR_02	Don't leave the taped path	The main requirement is to stay on track an on the taped path	1	11/11	11/11
ACCUR_03	Delays are included for accuracy	This will give the robot time to fully stop and prevent it from going off of the loop	2	11/11	11/11
ACCUR_04	Robot is ready	The robot must be charged and connected to our devices to test our code	1	11/11	11/11
ACCUR_05	Sphero Edu software is running correctly	The software must be working properly for us to code, connect to our robot, and test	2	11/13	11/13
ACCUR_06	Properly set the robot's axis of orientation	If the robot is not aimed directly forward in line with the path start, it will veer off course	1	11/13	11/13

1.9 Security

1.9.1 Protection

All progress was logged, and data integrity was checked along the way to ensure that there wasn't any unintended access or modification

1.9.2 Authorization and Authentication

The software used to develop and execute this program doesn't require any authentication, as it isn't very important and can be easily replaced if compromised. It's simply block code inside of a coding app that controls robots, which aren't very useful if hacked.

1.10 Portability

All the code is not very host-dependent due to the block code only working inside of the Sphero Edu software. Block code isn't as portable as most text codes. A specific operating system isn't required, as anything that can run Sphero Edu is all you need to complete this project alongside the robot.

Requirements Confirmation/Stakeholder sign-off

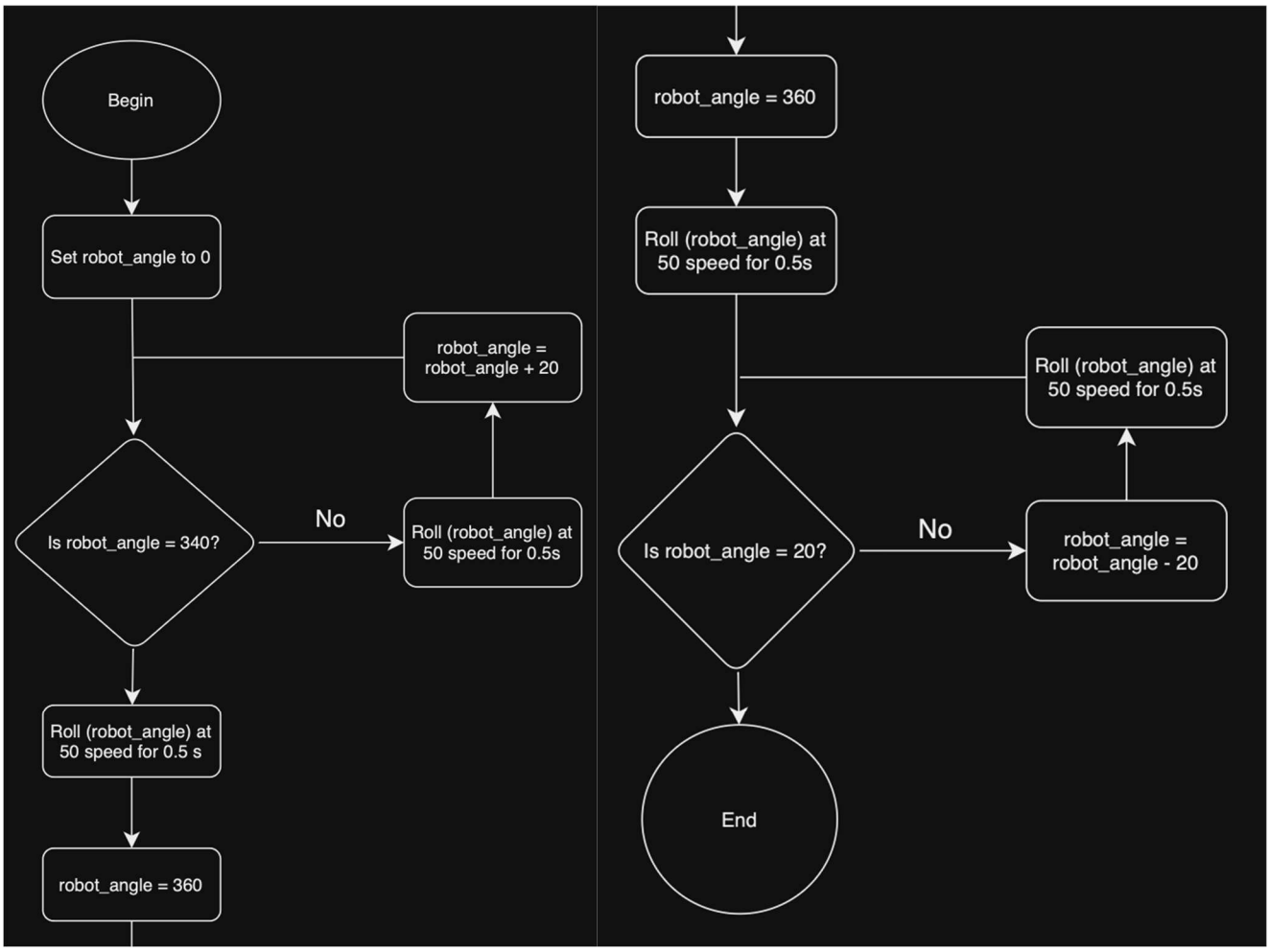
Meeting Date	Attendees (name and role)	Comments
11/11/2024	Sami (documenter), Ethan (coder), Gavin (debugger)	Confirmed all except ACCUR_05 and 06 (not talked about yet)
11/13/2024	Sami (documenter), Ethan (coder), Gavin (debugger)	Everything confirmed

System Design

1.11 Algorithm

- On the start of the program, set robot_angle to 0
- While robot_angle does not equal 340
    - Roll at (robot_angle) at 50 speed for 0.5s
    - Robot_angle = robot_angle + 20
- Roll at (robot_angle) at 50 speed for 0.5s
- Robot_angle = 360
- Roll at (robot_angle) at 50 speed for 0.5s
- While robot_angle does not equal 20
    - Robot_angle = robot_angle – 20
    - Roll at (robot_angle) at 50 speed for 0.5s
- End

1.12 System Flow



1.13 Software

We utilized block coding, the Sphero Edu application platform, and a Sphero Bolt to develop, debug, and deploy this application.

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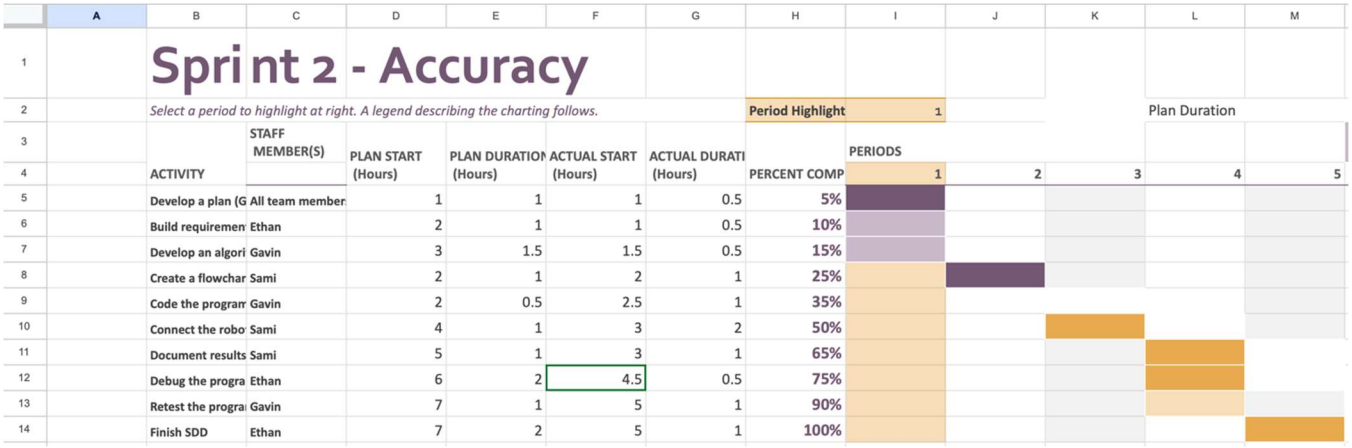
1.14 Hardware

The hardware platforms we used to develop this project were our laptops, which contain hardware components such as CPUs, motherboards, power supplies, SSDs, and memory

1.15 Test Plan

Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
11/13	Slight overshot on each leg of the loop	Slight overshot on each leg of the loop	Sami	Fail
11/13	Slight undershot on each leg of the loop	Slight overshot on each leg of the loop	Ethan	Fail
11/3	Accurate length achieved for each leg of the loops	The robot undershot the length of each leg	Ethan	Fail
11/3	Accurate length achieved	The robot hit the correct length of each loop, but was inaccurate	Sami	Fail
11/3	Accurate path achieved	The robot rolled the proper distance on course after an adjustment of the delay time	Gavin	Pass

1.16 Task List/Gantt Chart



Sprint 2 - Accuracy

Select a period to highlight at right. A legend describing the charting follows.

Period Highlight: 1 — Plan Duration

ACTIVITY	STAFF MEMBER(S)	PLAN START (Hours)	PLAN DURATION (Hours)	ACTUAL START (Hours)	ACTUAL DURATION (Hours)	PERCENT COMP	PERIODS 1	2	3	4	5
Develop a plan (G	All team member	1	1	1	0.5	5%					
Build requiremen	Ethan	2	1	1	0.5	10%					
Develop an algori	Gavin	3	1.5	1.5	0.5	15%					
Create a flowchar	Sami	2	1	2	1	25%					
Code the program	Gavin	2	0.5	2.5	1	35%					
Connect the robo	Sami	4	1	3	2	50%					
Document results	Sami	5	1	3	1	65%					
Debug the progra	Ethan	6	2	4.5	0.5	75%					
Retest the progra	Gavin	7	1	5	1	90%					
Finish SDD	Ethan	7	2	5	1	100%					

1.17 Staffing Plan

Name	Role	Responsibility	Reports To
Ethan Willard	Coder / Tester	Use the algorithm to develop the code and test it	Himself (Group Leader)
Sami Shah	Tester / Logger	Debug any issues with the code and assist with testing again	Ethan
Gavin Rossi	Algorithm Writer / Debugger / Tester	Develop the algorithm, log results of tests	Ethan