Sprint 3 - Agility Design Document
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1. Executive Summary

A) Project Overview

This project was intended to make a sphere ball (Sphero) travel along a course, maneuvering itself to avoid collisions while moving through obstacles, and knocking down markers (pins) at the end.

B) Purpose and Scope of this Specification

Purpose, intended users, and in/out of scope concepts of this project are included below.

In scope

This document addresses requirements related to the buildup, preparation, execution, and reflection of the project:

- Planning for Agility Robotics Project
- Development for Agility Robotics Project
- Execution for Agility Robotics Project

Out of Scope

The following items in phase 3 of the Accuracy Sprint are out of scope:

- Planning/Development/Execution directed toward Sprint #1
- Planning/Development/Execution directed toward Sprint #2
- Final Presentation Sprint #4

(Sprint 4 will be considered in the development of the requirements for Sprint 3 (Agility), but Phase 4 requirements will be documented separately in a future assessment)

2. Product/Service Description

This section will include background information for the project. Specific requirements and project assessment/clarifications will be considered in later sections.

A) Product Context

This project relates to other projects as a stepping stone to future complex problems/projects. Its intent was to familiarize us with the interface of this form of block coding, as well as to prepare us what to do in future projects and trials. The group did perform each of these things independently and without help, however the coding system itself had to be implemented by ourselves and was not independent of our workings. When the group faces the troubles and tribulations of future projects, we are fully expected to be prepared for whatever challenges are to come.

B) User Characteristics

Very few different users will be able to or will need to have access to this program. In main there are only a few counted possibilities.

- Student/Workers/Developers
- Professor/Grader/Interpreters

C) Assumptions

The first assumption we had is that the power in the room while we were working is that the power was on and working properly. This is because without it we would not be able to record data, charge our sphere, or develop our algorithm/flowchart during the planning process. We also assumed that each group member was familiar with the equipment necessary for the project, such as the coding environment, planning environments, and the workplace we were developing/working in. We also assumed that the operating system and program we used to code this project, as well as the website we used to develop our flowchart were necessary in aiding our project.

D) Constraints

Describe any items that will constrain the design options, including

- Differing schedules between group members
- Limited time for project
- Access to building only occurred at certain times
- Specificality of project regarding restrictions and requirements
- Other groups doing their projects, taking time on the track away

E) Dependencies

Dependencies that affect the requirements are listed below.

- In the years to come as the programming language used to develop this project will likely change, it may need to be updated in the case that it is expected to stay up to date and work properly
- This project was necessary to build towards future projects in terms of allowing us to understand the requirements of this form of assessment

3. Requirements

- Stay on track
- Avoid object collisions
- Roll over ramp
- Stop at each corner
- Knock down pins
- Collect video evidence

A) Priority Definitions

The following definitions are intended as a guideline to prioritize requirements.

- Priority 1 – Important, 100 percent has to be completed for this project
- Priority 2 – Not necessary for the project/program to run, but is nonetheless important to have
- Priority 3 – Although not as important as the priorities above, it would provide nice functionality

B) Functional Requirements

The table below includes all requirements, comments associated, and the date reviewed. All functional requirements including labor and product requirements are displayed in the chart.

Req#	Requirement	Comments	Priority	Date Rvwd	SME Reviewed / Approved
Agility_01	Stay roughly on blue line	Agree that this is main goal...does not have to be absolutely perfect, but definitely has to follow the same direction and pathway as line	1	11/23/21	Approved
Agility_02	Do not run into obstacles	Agreed that this is important	1	11/23/21	Approved
Agility_03	Stop at each corner (roughly)	Important to stay on approximate track	1	11/23/21	Approved
Agility_04	Roll over ramp and land on line	Not the most important, but robot should land in the approximate right place	2	11/23/21	Approved
Agility_05	Knock down all pins	Although not the most important, would provide very strong functionality	2	11/23/21	Approved
Agility_05	Video evidence	Not necessarily important to functionality, but should take place to prove competency	3	11/23/21	Approved

C) Security

i) Protection

The factors that will protect the system from malicious or accidental access, modification, disclosure, destruction, or misuse are listed below.

- Passwords
- Secure Monmouth Accounts
- Secure Outside Email Accounts
- Not Sharing Information Outside of Our Group

ii) Authorization and Authentication

The project will only be able to be accessed by this group and specifically the members in the group that are working/developing the project. The coding/programming is kept in the account of Alexander DiDomenico, and all the planning documents are under the name of Tennessee Tremain and/or Wilmary Guzman. These documents are secure and inaccessible to anyone other than Tennessee Tremain, Alexander DiDomenico, and Wilmary Guzman.

D) Portability

As portability was certainly part of the requirements for finishing the project, some of the issues we had to resolve are listed below.

- Sphere had to be portable to test/execute program
- Portability of smartphones/laptops
- Use of a proven portable language
- Operating system portability
- Environment dependence was also essential to this project (WIFI, power, connection to cloud for storing data)

4. Requirements Confirmation/Stakeholder Sign-Off

Approval/Confirmation of the requirements are labelled here:

Meeting Date	**Attendees (name and role)**	**Comments**
11/23/21	Tennessee Tremain (Design/Recording Data Results)	Confirmed
11/23/21	Alexander DiDomenico (Developing/Testing)	Confirmed
11/23/21	Wilmary Guzman (Planning/Organizing)	Confirmed

5. System Design

This section will provide all details concerning the technical design, staffing, coding, and testing the system. These are the steps that were taken in developing the program, and understanding each step was essential to the execution of the final product.

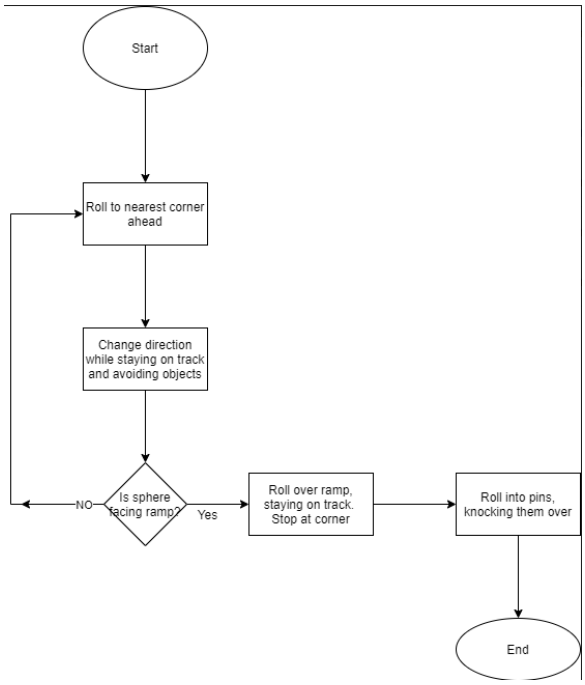
A) Algorithm

The algorithm utilized for our project is listed below.

1. Drive forward until it reaches the corner
2. Turn right, staying on track (avoid object)
3. Drive forward until it reaches the new corner
4. Turn left, staying on track (avoid object)
5. Drive forward until it reaches the new corner
6. Turn right, staying on track (avoid object)
7. Drive forward, roll over ramp, and stop at corner (all while staying on track)
8. Turn towards pins
9. Roll forward into pins, knocking them down

B) System Flow

The flowchart for the project is shown below. This is also included in the github repository.



C) Software

For this project, multiple software programs were used...all of them are listed below.

- Diagrams.net
- Google Drive
- Microsoft Office Apps
- Android
- Apple
- Sphero EDU

D) Hardware

For this project, multiple pieces of hardware were used...all of them are listed below.

- Lenovo laptop
- MacBook
- Personal Built PC
- Sphere with built in computer/communications

E) Test Plan

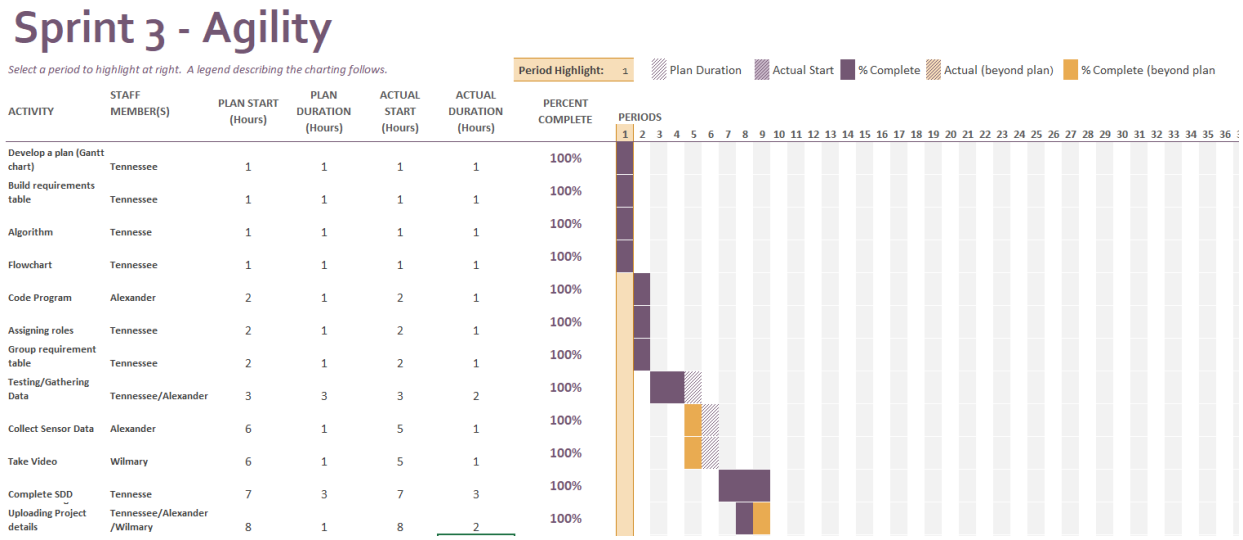
All test cases are included below. This includes all fails, successes, and parts of the testing portion of the project.

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
See if robot stops at first corner, and turns at correct angle	11/23/21	Drive forward and turn staying on path and avoiding object	First distance too long	Tenn/Alex	Fail
See if robot stops at first corner, and turns at correct angle	11/23/21	Drive in full circle counter-clockwise (top circle)	First distance too short	Tenn/Alex	Fail
See if robot stops at first corner, and turns at correct angle	11/23/21	Drive in full circle counter-clockwise (top circle)	Drove forward and turned correctly	Tenn/Alex	Pass
Complete first part of course with second distance and turn	11/23/21	Complete first two distances and turns	Angle off on first distance	Tenn/Alex	Fail
Complete first part of course with second distance and turn	11/23/21	Complete first two distances and turns	Distance 2 too short	Tenn/Alex	Fail
See if loops from one to another can be completed consecutively	11/23/21	Complete full run of one of each circle (no stopping)	Distance 2 distance and turn completed	Tenn/Alex	Pass
See if ramp can be included in run	11/30/21	Complete beginning of course and run over ramp, landing in correct spot	Right of ramp	Tenn/Alex/ Wilmary	Fail
See if ramp can be included in run	11/30/21	Complete beginning of course and run over ramp, landing in correct spot	Left of ramp	Tenn/Alex/ Wilmary	Fail
See if ramp can be included in run	11/30/21	Complete beginning of course and run over ramp, landing in correct spot	Angled too far right off start	Tenn/Alex/ Wilmary	Fail
See if ramp can be included in run	11/30/21	Complete beginning of course and run over	Angled too far right off start	Tenn/Alex/ Wilmary	Fail

		ramp, landing in correct spot			
See if ramp can be included in run	11/30/21	Complete beginning of course and run over ramp, landing in correct spot	Completed section	Tenn/Alex/ Wilmary	Pass
Take video of completed course	11/30/21	Complete course, knocking down all pins	Missed pins to the left	Tenn/Alex/ Wilmary	Fail
Take video of completed course	11/30/21	Complete course, knocking down all pins	Course completed, with all pins knocked down	Tenn/Alex/ Wilmary	Pass

F) Task List/Gantt Chart

The Gantt Chart for our project is shown below. This is also included in the github repository.



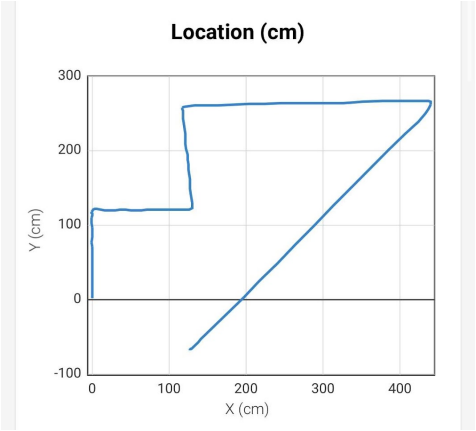
G) Staffing Plan

Below is a chart/table that depicts the roles and responsibilities of each team member that worked on this project.

Name	Role	Responsibility	Reports To
Tennessee Tremain	Design/Recording Data	Evaluate Requirements, Formulate Data, Analyze Data	Alexander DiDomenico and Wilmary Guzman
Alexander DiDomenico	Development/Testing	Coding, Development of Project, Control of Program During Testing Cases	Tennessee Tremain and Wilmary Guzman
Wilmary Guzman	Video	Take Video	Tennessee Tremain and Alexander DiDomenico

H) Sensor Data

Below is the sensor data for a full, completed run of this project.



I) Block Code

Below is the block code for a full, completed run of this project.