Sprint 1 - Endurance Design Document
November 9, 2021

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1. Executive Summary

A) Project Overview

This project was intended to make a sphere ball (Sphero) travel along a path in the shape of a rectangle.

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 Endurance Robotics Project
- Development for Endurance Robotics Project
- Execution for Endurance Robotics Project

Out of Scope

The following items in phase 3 of Project A are out of scope:

- Planning/Development/Execution directed toward Sprint #2
- Planning/Development/Execution directed toward Sprint #3

(Sprints 2 and 3 will be considered in the development of the requirements for Sprint 1 (Endurance), but Phase 3 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

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

- Must travel around the periphery of class (using blue line as a guide)
- Must return to starting location
- Includes speech and color changes when appropriate
- Collisions must be avoided
- Video must be taken to demonstrate the robot's competence

A) Priority Definitions

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

- Priority 1 – Must travel around periphery of class using blue line as a guide, stopping at each corner, and returning to the starting position at the end.
- Priority 2 – Inclusion of speech (at the beginning and end) and color changes (at beginning and end).
- Priority 3 – It would be nice if the robot avoids collisions and proves competence through video evidence during a test run.

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
ENDUR_01	Travel around the periphery of class	Agree that this is main goal	1	11/02/21	Approved
ENDUR_02	Must return to original starting location	Agreed that this is important	1	11/02/21	Approved
ENDUR_03	Inclusion of speech and color change when necessary	Although not main goal, very important	2	11/02/21	Approved
ENDUR_04	Avoiding collisions with objects	Not the most important, but should be completed nonetheless	3	11/02/21	Approved
ENDUR_05	Video evidence	Not necessarily important to functionality, but should take place to prove competency	3	11/02/21	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. These documents are secure and inaccessible to anyone other than Tennessee Tremain and Alexander DiDomenico.

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**
11/02/21	Tennessee Tremain (Design/Planning/Data)	Confirmed
11/02/21	Alexander DiDomenico (Developing/Testing)	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. This is also included in the github repository.

ALGORITHM BLOCK 1

- Start green color
- Speak “Ready, set, go”

ALGORITHM BLOCK 2

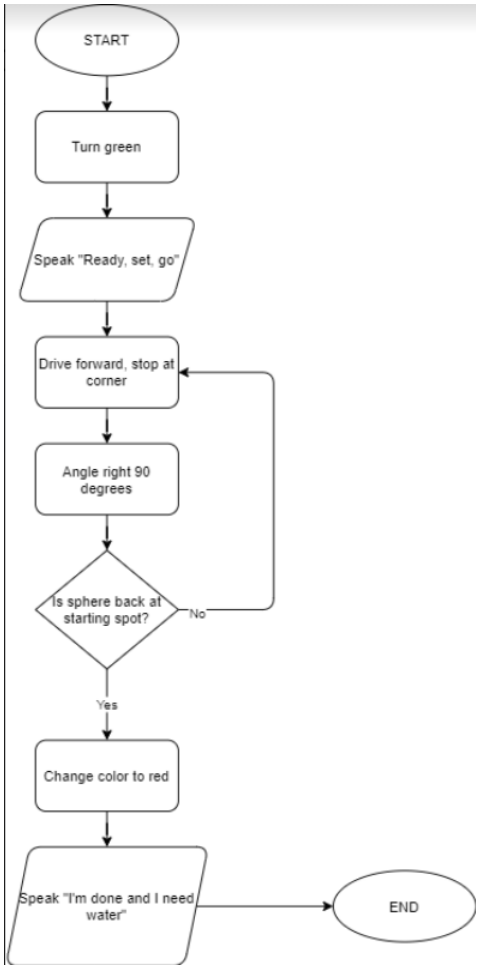
- Drive forward (far)
- Stop (2s)
- Angle right (90 degrees)
- Drive forward (near)
- Stop (2s)
- Angle right (90 degrees)
- ALL OF THE ABOVE GROUP X2

ALGORITHM BLOCK 3

- Turn red color
- “Speak “I’m done and I need water”

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

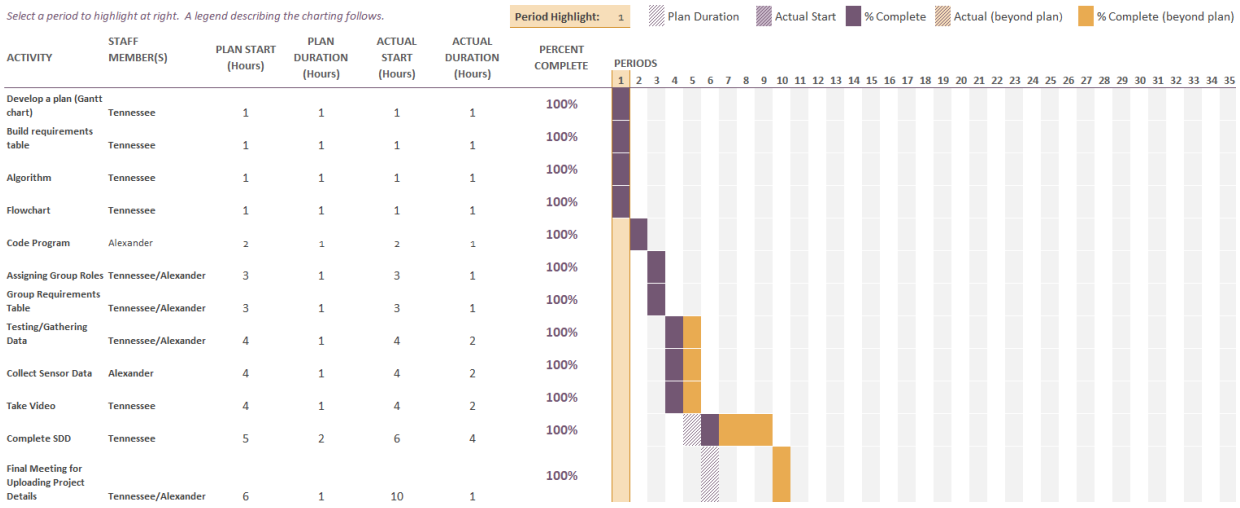
All test cases are included below. This includes all fails, successes, and parts of the testing portion of the project.

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
Drive forward at constant speed, check what time it crosses first turn line	11/02/21	Receive estimate time	6s	Tenn/Alex	Pass
See if first distance is correct with relative time	11/02/21	End at corner	Incorrect angle	Tenn/Alex	Fail
See if first distance is correct with relative time	11/02/21	End at corner	Ended at corner	Tenn/Alex	Pass
Turn 90 degrees and end at next corner after shorter length	11/02/21	End at new corner	Angle off at first length	Tenn/Alex	Fail
Turn 90 degrees and end at next corner after shorter length	11/02/21	End at new corner	Too far	Tenn/Alex	Fail
Turn 90 degrees and end at next corner after shorter length	11/02/21	End at new corner	Too short	Tenn/Alex	Fail
Turn 90 degrees and end at next corner after shorter length	11/02/21	End at new corner	Angle off at first length	Tenn/Alex	Fail
Turn 90 degrees and end at next corner after shorter length	11/02/21	End at new corner	Too far	Tenn/Alex	Fail
Turn 90 degrees and end at next corner after shorter length	11/02/21	End at new corner	Ended at new corner	Tenn/Alex	Pass

See if doubled code works	11/02/21	Complete course	Slightly off distance on third leg	Tenn/Alex	Fail
Run through whole course	11/02/21	Complete course	Angle on first leg off	Tenn/Alex	Fail
Run through whole course	11/02/21	Complete course	Third leg distance incorrect	Tenn/Alex	Fail
Run through whole course	11/02/21	Complete course	Course Completed	Tenn/Alex	Pass

F) Task List/Gantt Chart

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



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

Period Highlight: 1 — Plan Duration — Actual Start — % Complete — Actual (beyond plan) — % Complete (beyond plan)

ACTIVITY	STAFF MEMBER(S)	PLAN START (Hours)	PLAN DURATION (Hours)	ACTUAL START (Hours)	ACTUAL DURATION (Hours)	PERCENT COMPLETE
Develop a plan (Gantt chart)	Tennessee	1	1	1	1	100%
Build requirements table	Tennessee	1	1	1	1	100%
Algorithm	Tennessee	1	1	1	1	100%
Flowchart	Tennessee	1	1	1	1	100%
Code Program	Alexander	2	1	2	1	100%
Assigning Group Roles	Tennessee/Alexander	3	1	3	1	100%
Group Requirements Table	Tennessee/Alexander	3	1	3	1	100%
Testing/Gathering Data	Tennessee/Alexander	4	1	4	2	100%
Collect Sensor Data	Alexander	4	1	4	2	100%
Take Video	Tennessee	4	1	4	2	100%
Complete SDD	Tennessee	5	2	6	4	100%
Final Meeting for Uploading Project Details	Tennessee/Alexander	6	1	10	1	100%

PERIODS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

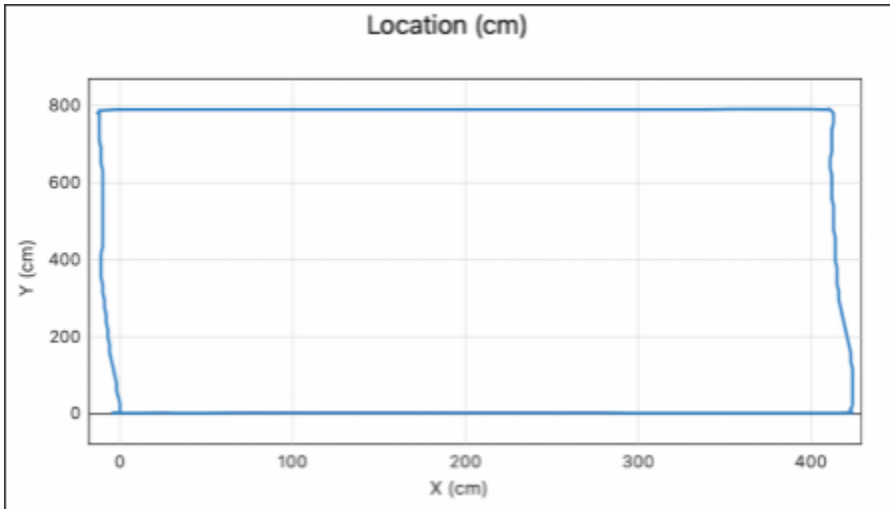
G) Staffing Plan

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	Planning/Recording Data	Plan Project, Evaluate Requirements, Formulate Data, Analyze Data	Alexander DiDomenico
Alexander DiDomenico	Development/Testing	Coding, Development of Project, Control of Program During Testing Cases	Tennessee Tremain

H) Sensor Data

Below is the sensor data for a full, completed run of this project. This is also included in the github repository.



I) Block Code

Below is the block code for a full, completed run of this project. This is also included in the github repository.