

Sprint 1 - Endurance Design Document

Table of Contents

1. EXECUTIVE SUMMARY	3
1.1 PROJECT OVERVIEW	3
1.2 PURPOSE AND SCOPE OF THIS SPECIFICATION	3
2. PRODUCT/SERVICE DESCRIPTION	3
2.1 PRODUCT CONTEXT	3
2.2 USER CHARACTERISTICS	3
2.3 ASSUMPTIONS	3
2.4 CONSTRAINTS	3
2.5 DEPENDENCIES	4
3. REQUIREMENTS	4
3.1 FUNCTIONAL REQUIREMENTS	5
3.2 SECURITY	5
3.2.1 <i>Protection</i>	5
3.2.2 <i>Authorization and Authentication</i>	6
3.3 PORTABILITY	6
4. REQUIREMENTS CONFIRMATION/STAKEHOLDER SIGN-OFF	6
5. SYSTEM DESIGN	6
5.1 ALGORITHM	6
5.2 SYSTEM FLOW	6
5.3 SOFTWARE	6
5.4 HARDWARE	6
5.5 TEST PLAN	7
5.6 TASK LIST/GANTT CHART	7
5.7 STAFFING PLAN	7

1. Executive Summary

1.1 Project Overview

This project involves the development of an algorithm to control the movement of a Sphero Spark 2 robot to complete an endurance sprint as part of a triathlon. The Sphero Spark 2 robot will be used to navigate a rectangular course made with tape, which is 22 inches in length and 11.8 inches in width. The robot must follow the course and make turns at specific points to complete the endurance sprint.

1.2 Purpose and Scope of this Specification

The purpose of this specification is to outline the requirements and scope of the development of the algorithm for the Sphero Spark 2 robot for the classroom presentation. The intended audience for this specification includes the instructor and students. The scope of this specification includes the following:

In scope

Developing an algorithm to control the Sphero Spark 2 robot to complete an endurance sprint by navigating the rectangular course made with tape.

- The Sphero Spark 2 robot must follow the course and make turns at specific points.
- The algorithm must take into account factors such as degrees, speed, and time.
- The blocks to be used include roll, stop, and heading.

Out of Scope

- Physical construction or modification of the Sphero Spark 2 robot.
- Integration of the algorithm with other systems or devices.
- Testing or validation of the physical movement of the Sphero Spark 2 robot.

2. Product/Service Description

Our product is a Sphero Spark 2 robot that will be used in an endurance sprint as part of a triathlon competition. The Sphero Spark 2 robot will be controlled by an algorithm to complete a full circumnavigation of a rectangular course made with tape. The course is 22 inches in length and 11.8 inches in width. The Sphero Spark 2 robot must follow the course and make turns at specific points to complete the full circumnavigation.

2.1 Product Context

The Sphero Spark 2 robot is an independent and self-contained product. It does not interface with any other related systems.

2.2 User Characteristics

- The users of our product will be students and faculty members who will be participating in the triathlon competition. The general characteristics of our users are:
 - Students/faculty/staff/other: Students and faculty members
 - Experience: Familiarity with Sphero Edu
 - Technical expertise: Basic understanding of how to control the robot using the algorithm provided
 - Other general characteristics that may influence the product: None

2.3 Assumptions

- The Sphero Spark 2 robot is already constructed and does not require any physical modification.
- Users have access to a computer or mobile device to control the robot using the algorithm provided.
- User has basic experience with Sphero Edu

Sprint 1 - Endurance Design Document Arnab and Jason

- User has access to the accurate course based on the measurements of the rectangle, with a functional Sphero Spark 2

2.4 Constraints

- The robot must operate within the specified rectangular course.
- The algorithm must consider the degree, speed, and time required to complete the full circumnavigation.
- The robot must be able to make turns at specific points along the course.
- The robot must complete the full circumnavigation within a specified time limit.

2.5 Dependencies

- The algorithm provided must be compatible with the Sphero Spark 2 robot and its capabilities
- The Sphero Spark 2 robot must be fully charged and operational before use
- Device must be compatible with Sphero Spark 2

3. Requirements

Input Requirements:

- The rectangular course layout
- The time limit for completing the course
- The specified turning points along the course
- The starting position of the robot
- The robot's initial speed and direction

Output Requirements:

- The robot must complete the full circumnavigation of the rectangular course within the specified time limit.
- The robot must maintain a stable position and orientation while moving along the course.
- The robot must turn at specific points along the course as specified by the input.

Priority Definitions:

- Priority 1 – The robot must be able to complete the full circumnavigation of the rectangular course within the specified time limit.
- Priority 2 – The algorithm must control the robot's movement within the specified rectangular course.
- Priority 3 – The algorithm must make the robot turn at specific points along the course as specified by the input.

3.1 Functional Requirements

Requirement	Priority	Date Reviewed	Reviewed By

Sprint 1 - Endurance Design Document Arnab and Jason

REQ001 - The robot must turn 90 degrees to the right after completing the second straightaway.	1	3/27/2023	Arnab
REQ002 - The algorithm must control the robot's movement within the specified rectangular course.	2	3/27/2023	Jason
REQ003 - The algorithm must be able to make the robot turn at specific points along the course.	3	3/28/2023	Arnab
REQ004 - The algorithm must ensure the robot maintains a stable roll angle of 0 degrees during the initial movement.	2	3/27/2023	Jason
REQ005 - The robot must roll at a speed of 56 during the initial movement for 11.6 seconds.	2	3/27/2023	Jason
REQ006 - The robot must turn 90 degrees to the right at the end of the initial movement.	1	3/27/2023	Arnab
REQ007 - The robot must roll at a speed of 48 for 7 seconds during the first turn.	2	3/27/2023	Jason

Sprint 1 - Endurance Design Document Arnab and Jason

REQ008 - The robot must turn 90 degrees to the right after completing the first turn.	1	3/27/2023	Arnab
REQ009 - The robot must roll at a speed of 56 for 11.6 seconds during the second straightaway.	2	3/27/2023	Jason
REQ10 - The algorithm must enable the robot to complete the full circumnavigation of the rectangular course within the specified time limit.	1	3/27/2023	Arnab

3.2 Security

3.2.1 Protection

To protect the system from malicious or accidental access, modification, disclosure, destruction, or misuse, the following factors will be implemented:

- Encryption of sensitive data
- Activity logging and historical data sets to monitor system usage and detect any unauthorized access or modification
- Restrictions on intermodule communications to prevent unauthorized data transfer between modules
- Data integrity checks to ensure data has not been tampered with

3.2.2 Authorization and Authentication

To ensure proper authorization and authentication, standard authorization tools will be utilized. This will require users to log in with a username and password, and access to certain system features and data will be restricted based on user roles and permissions.

3.3 Portability

Portability is not a requirement for this system. The product will be designed to run on a specific host machine and operating system, and will not need to be ported to other environments.

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
--------------	---------------------------	----------

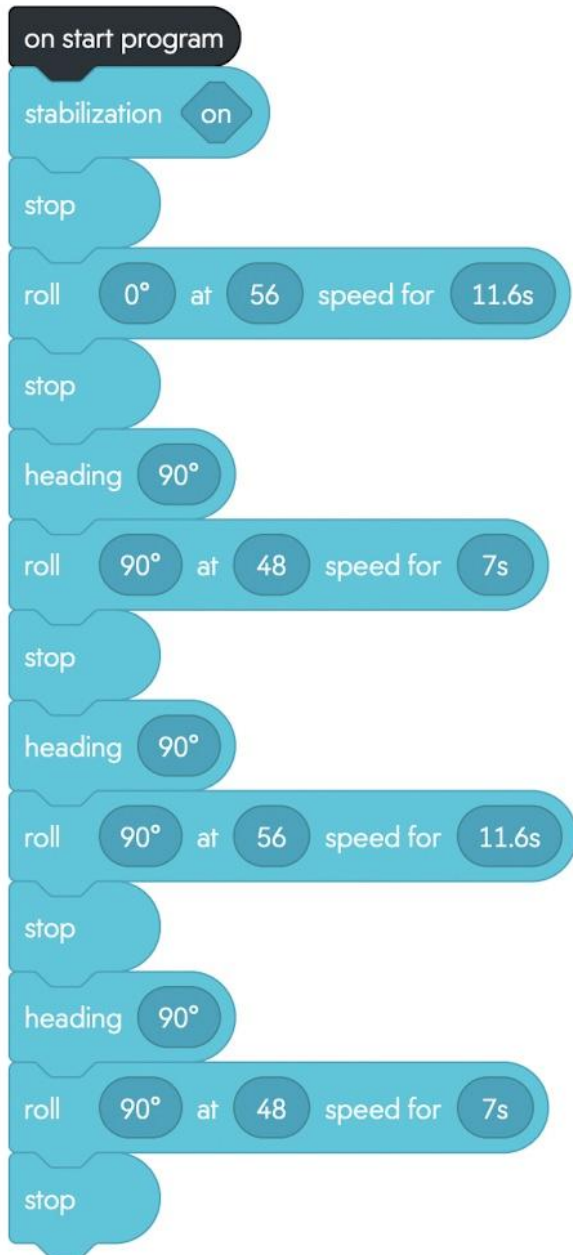
Sprint 1 - Endurance Design Document Arnab and Jason

3/24/2023	Arnab, Jason	Testing out initial sphero spark 2
3/27/2023	Arnab, Jason	Algorithm completed, triathlon was succesful

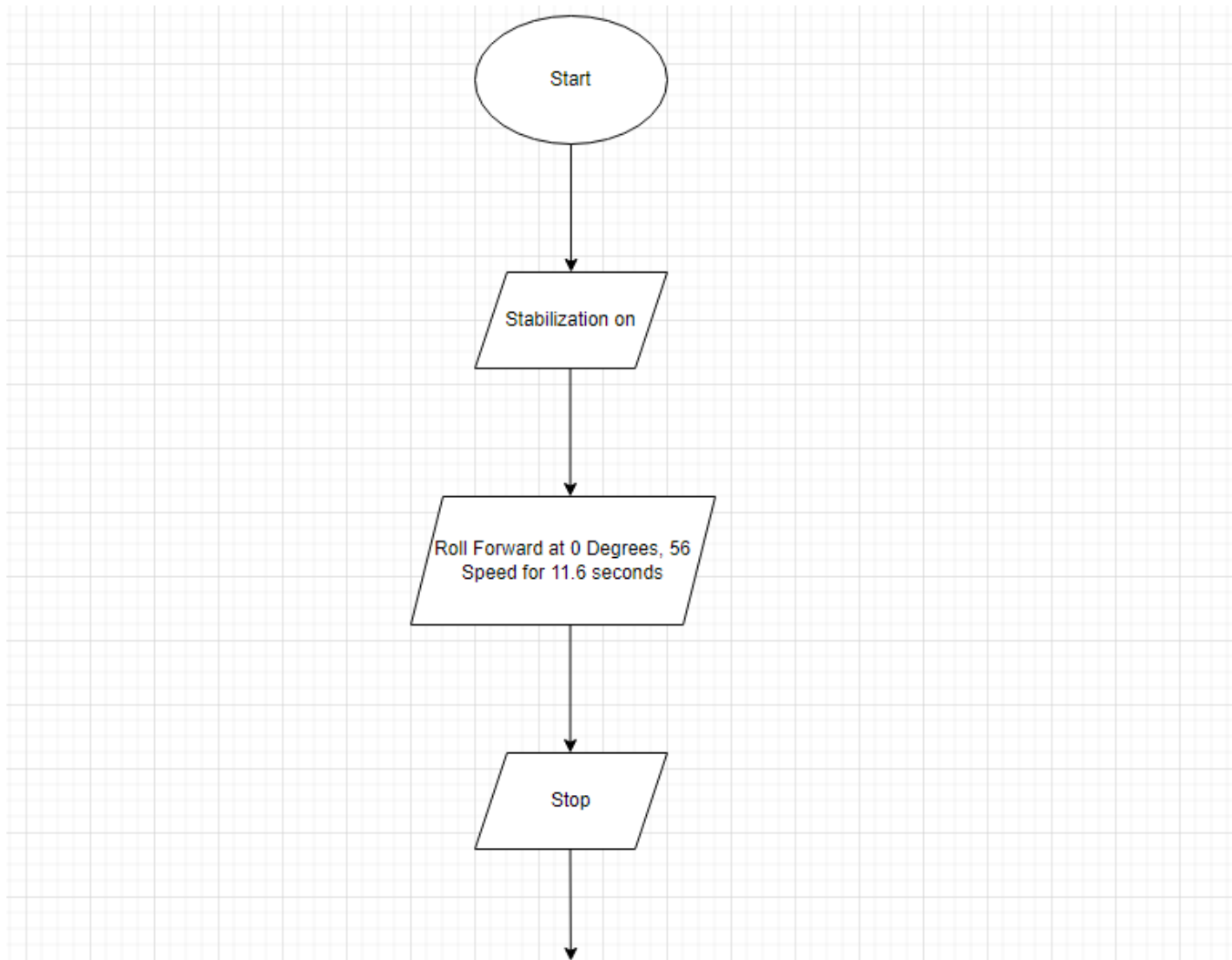
5. System Design

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

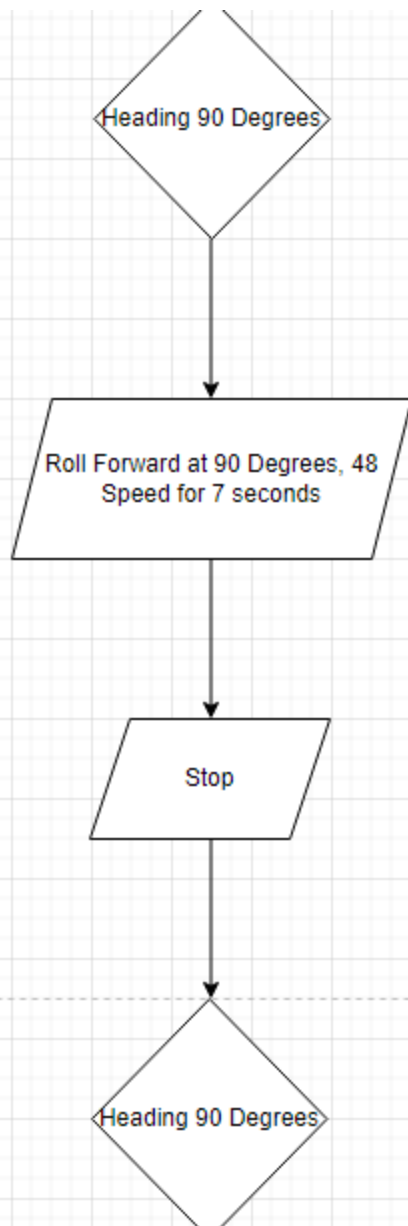
5.1 algorithm



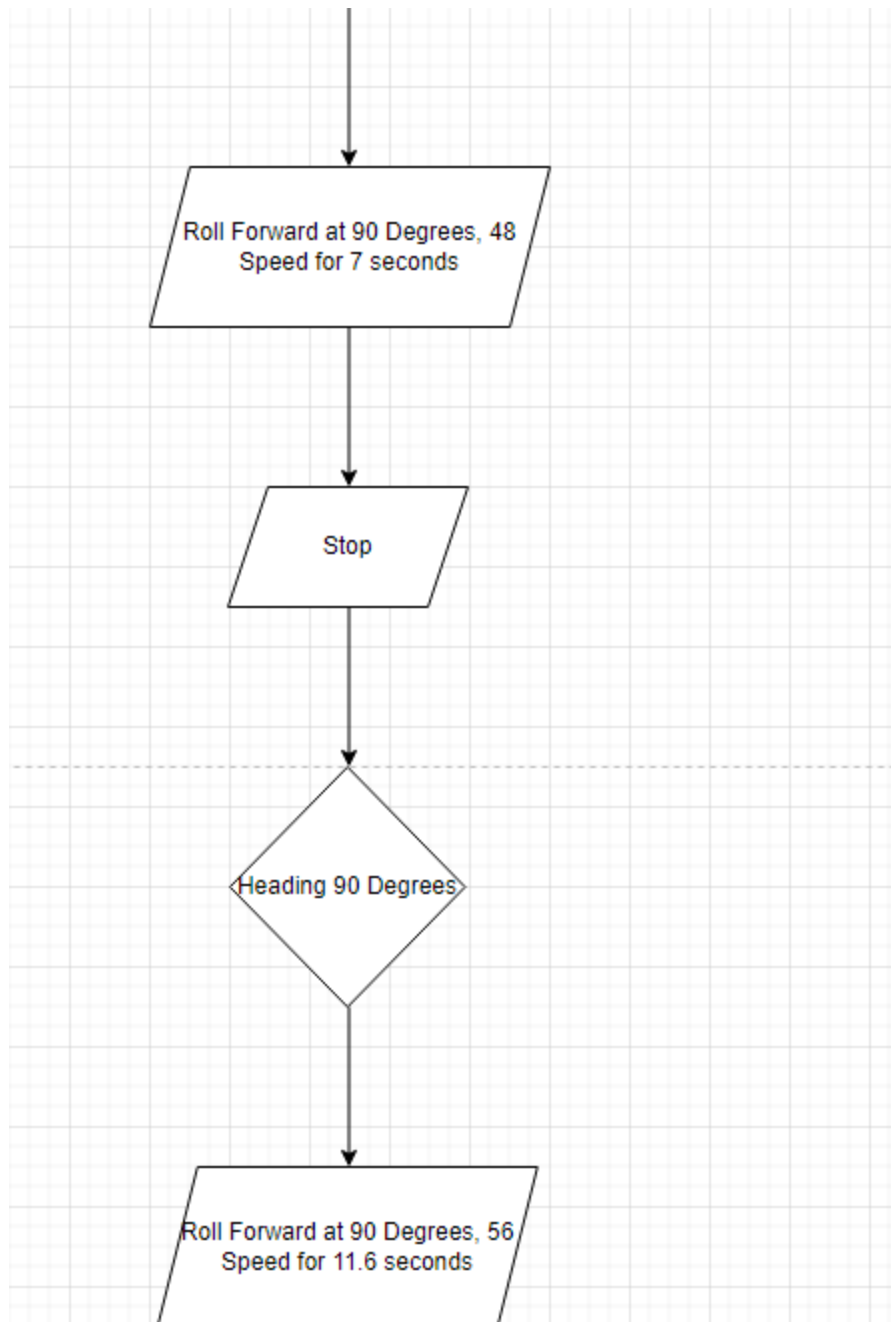
5.2 System Flow



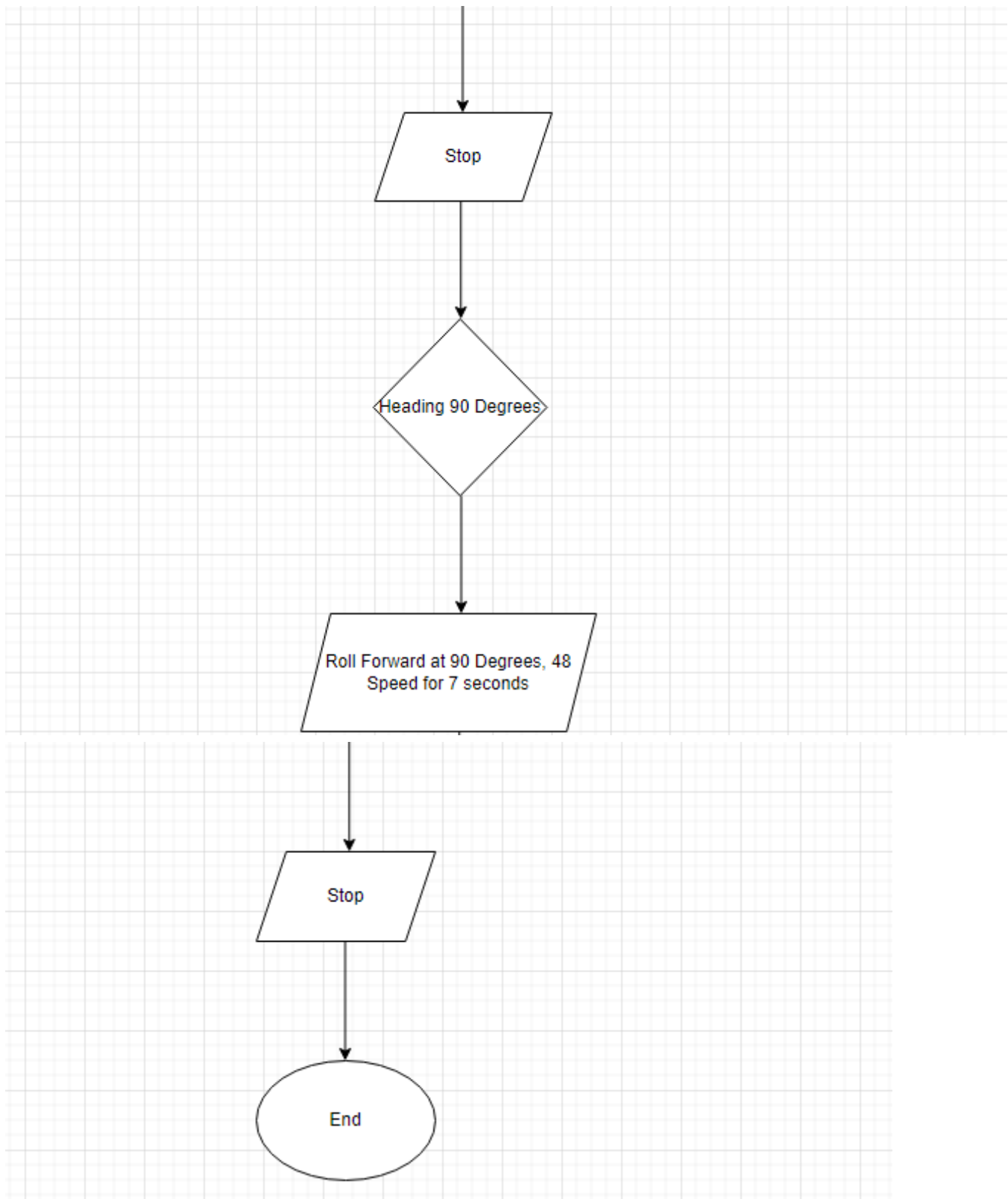
Sprint 1 - Endurance Design Document Arnab and Jason



Sprint 1 - Endurance Design Document Arnab and Jason



Sprint 1 - Endurance Design Document Arnab and Jason



Sprint 1 - Endurance Design Document Arnab and Jason

5.3 Software

- Sphero Edu
- Use of Block Code integrated within Sphero Edu powered by JavaScript

5.4 Hardware

- Sphero Spark 2
- Computer

5.5 Test Plan

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
Test stability of the robot	3/22/2023	The robot should be able to stand upright without wobbling for at least 10 seconds	The robot stands upright without wobbling for 15 seconds	Arnab	Pass
Test basic movement	3/23/2023	The robot should be able to move forward in a straight line for 5 seconds at 50% speed	The robot moves forward in a straight line for 5 seconds at 50% speed	Jason	Pass
Test turning ability	3/24/2023	The robot should be able to turn left 90 degrees and then move forward in a straight line for 5 seconds at 50% speed	The robot turns left 90 degrees and then moves forward in a straight line for 5 seconds at 50% speed	Arnab	Pass

Sprint 1 - Endurance Design Document Arnab and Jason

Test circumnavigation course	3/27/2023	The robot should be able to complete the circumnavigation course as described in the algorithm	The robot completes the circumnavigation course within the specified time and speed limits	Jason	Pass
------------------------------	-----------	--	--	-------	------

5.6Task List/Gantt Chart

<i>Activity</i>	Staff Members (Arnab,Jason)	<i>Plan</i> <i>Start</i>	<i>Plan</i> <i>Duration</i>	<i>Actual</i> <i>Start</i>	<i>Actual</i> <i>Duration</i>	<i>Percent Complete</i>
<i>REQ001 - The robot must turn 90 degrees to the right</i>	<i>Arnab</i>	<i>3/22/2023</i>	<i>1 hour</i>	<i>3/22/2023</i>	<i>1 hour</i>	<i>100%</i>
<i>REQ002 - The algorithm must control the robot's movement</i>	<i>Jason</i>	<i>3/22/2023</i>	<i>1 hour</i>	<i>3/22/2023</i>	<i>2 hours</i>	<i>100%</i>
<i>REQ003 - The algorithm must be able to make the robot turn</i>	<i>Arnab</i>	<i>3/23/2023</i>	<i>1 hour</i>	<i>3/23/2023</i>	<i>1 hour</i>	<i>100%</i>

Sprint 1 - Endurance Design Document Arnab and Jason

<i>REQ004 - The algorithm must ensure the robot maintains stability</i>	<i>Jason</i>	<i>3/23/2023</i>	<i>1 hour</i>	<i>3/23/2023</i>	<i>1 hours</i>	<i>100%</i>
<i>REQ005 - The robot must roll at a speed of 56 for 11.6 seconds</i>	<i>Arnab</i>	<i>3/24/2023</i>	<i>1 hour</i>	<i>3/24/2023</i>	<i>1 hour</i>	<i>100%</i>
<i>REQ006 - The robot must turn 90 degrees to the right</i>	<i>Jason</i>	<i>3/24/2023</i>	<i>1 hour</i>	<i>3/24/2023</i>	<i>1 hour</i>	<i>100%</i>
<i>REQ007 - The robot must roll at a speed of 48 for 7 seconds</i>	<i>Arnab</i>	<i>3/27/2023</i>	<i>1 hour</i>	<i>3/27/2023</i>	<i>1 hour</i>	<i>100%</i>
<i>REQ008 - The robot must turn 90 degrees to the right</i>	<i>Jason</i>	<i>3/26/2023</i>	<i>1 hour</i>	<i>3/26/2023</i>	<i>1 hour</i>	<i>100%</i>
<i>REQ009 - The robot must roll at a speed of 56 for 11.6 seconds</i>	<i>Arnab</i>	<i>3/27/2023</i>	<i>1 hour</i>	<i>3/27/2023</i>	<i>1 hour</i>	<i>100%</i>

Sprint 1 - Endurance Design Document Arnab and Jason

<i>REQ10 - The algorithm must enable the robot to complete</i>	<i>Arnab, Jason</i>	<i>3/28/2023</i>	<i>1 hour</i>	<i>3/28/2023</i>	<i>3 hours</i>	<i>100%</i>
--	-------------------------	------------------	---------------	------------------	----------------	-------------

5.7 Staffing Plan

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

Name	Role	Responsibility	Reports To
Arnab	Developer and Tester	Develop and test Sphero Spark 2 Sprint 1 Endurance algorithm	CS104
Jason	Developer and Tester	Develop and test Sphero Spark 2 Sprint 1 Endurance algorithm	CS104