

Sprint 2 - Accuracy Design Document

November 16, 2022

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1. Executive Summary

1.1 Project Overview

In this project we will design a robot that is able to complete a predetermined obstacle course set up inside of HH208. The robot will need to speak at certain intervals, travel to the specified areas, light up the correct color when required, and perform other tasks to the best of its ability. There will be three tests the robot goes through, testing its skills in Endurance, Accuracy and Agility.

1.2 Purpose and Scope of this Specification

In scope

This document addresses the intended audience of the project:

- The intended audience of this project will be Prof. Eckert, who will judge its performance.
- Students in the classroom will also listen to our presentation and are also part of the intended audience.

Out of Scope

The following items address how this project relates to technology outside of its scope:

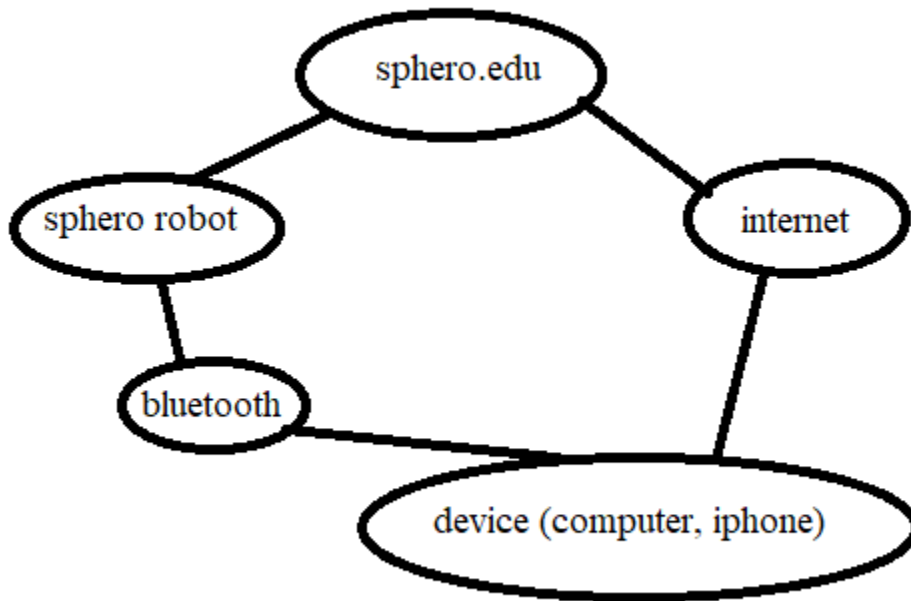
- Controlling a robot is something that is useful and applied in many factories in modern day.
- Products such as self-driving cars also use algorithms to control themselves.

2. Product/Service Description

2.1 Product Context

This product is similar to millions of other autonomous robots that are programmed to perform a specified task multiple times. Modern factories and assembly lines make heavy use of robots to complete certain parts of a process repeatedly. This project is independent and self-contained since it does not have any application outside of the classroom. Perhaps the robot itself could be reprogrammed to complete other tasks, so in that way, it is not self-contained. It does have limitations in that it doesn't have much interaction with a variety of related systems. A web application or database can be used in many ways by many systems, but this robot has a single programming application and a

single way of outputting data and actions.



2.2 User Characteristics

- Student
 - Very experienced with product
 - Above average technical expertise
 - Familiarity with computer science
- Faculty/staff
 - Much experience with product
 - Vast technical Expertise
 - Mastery of computer science
- Non-Comp Sci Student
 - No experience with product
 - Average technical expertise
 - Familiarity with technology
- Non-Comp Sci Faculty/Staff
 - Zero experience with product
 - Little technical expertise
 - Unfamiliarity with technology

2.3 Assumptions

We assume that the robot is performing in ideal conditions - flat ground, indoors with no wind, no outside interference at any point while it is running, and so on. We assume that the robot will do exactly

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what it is told, exactly the same way every time we tell it to do something. There should be a sustained wifi connection to allow the robot to communicate to its controller.

2.4 Constraints

- The project will run on a limited time schedule.
- There is only one programming interface with no alternatives to code the robot.
- We can only work with one robot among three group members.
- The testing room has limited accessibility and tests can only be conducted there during certain times.
- We must use technology that is compatible with the robot. (windows computers cannot be used)
- Limitations within the IDE itself that is used to program the robot.
- External factors such as friction, sliding, and uneven ground may result in unintended results as for the movement of the robot.

2.5 Dependencies

- The robot must be placed properly in the square so that it is facing the correct direction for it to then follow the correct path. Otherwise, it may not follow the correct path and hit objects in the room which is a violation of a requirement.
- In order for the robot to stop in the same place that it started, flash multicolored lights for 5 seconds, and say "I am the winner", it must first complete the figure eight course 5 times.

3. Requirements

Requirements:

1. The robot must begin on the designated starting point.
2. The robot must run the figure eight course five times. (for loop)
 - a. robot travels in a complete circle moving counterclockwise above the starting point. (simultaneous use of roll function and spin function)
 - b. robot then travels in another circle moving counterclockwise below the starting point. (simultaneous use of roll function and spin function)
3. The robot must return to the starting point. (stop function)
4. The robot must speak "I am the winner". (speak function)
5. The robot must flash multicolored lights for five seconds. (for loop)
 - a. robot will light up a random color (LED function with "random color" variable)
 - b. the light will remain on for a short amount of time (delay function)

3.1 Functional Requirements

Req#	Requirement	Comments	Priority	Date Rvwd	SME Reviewed / Approved
ACCUR_01	Robot must run the figure eight course 5 times	make sure the robot does not collide with any of the walls	1	11/11/22	Approved

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Req#	Requirement	Comments	Priority	Date Rvwd	SME Reviewed / Approved
ACCUR_02	Robot must stay within the path provided	robot must be aimed precisely when it is placed down to make sure it travels in the correct direction	1	11/11/22	Approved
ACCUR_03	Robot must start and finish in the square provided	robot must be placed within the yellow square, or it will not follow the correct path	1	11/11/22	Approved
ACCUR_04	When the robot finishes the course, robot will speak, "I am the winner" and flash multicolored lights for 5 seconds	use the LED and speak functions to do this, have volume turned up to hear the words	2	11/13/22	Approved
ACCUR_05	Robot must not collide with anything in the room	If the robot does not follow the tape accurately enough, it may run into objects in the room	1	11/14/22	Approved
ACCUR_X X					

3.2 Security

3.2.1 Protection

- The users who are verified by PubCookie are the only ones able to access the system.
- By clicking on expand windows log, the history of the system is stated
- Able to see if changes have been made to the system

3.2.2 Authorization and Authentication

The only people allowed to use this system are the people who are verified by PubCookie and are able to sign on.

4. Requirements Confirmation/Stakeholder sign-off

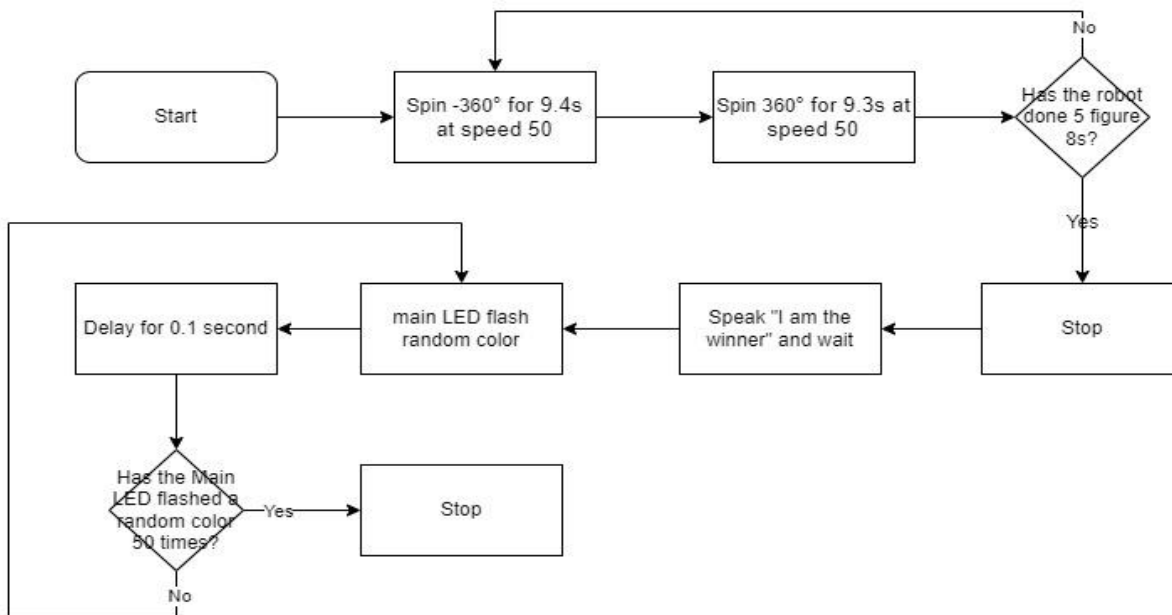
Meeting Date	Attendees (name and role)	Comments
11/14/22	Bryan Kahl	confirmed all
11/14/22	Jason French	confirmed all
11/14/22	Aidan Sacci	confirmed all except ACCUR_04

5. System Design

5.1 Algorithm

- Robot must start in the square provided.
- Robot must run the figure eight course 5 times.
- Robot must stay in the path provided.
- Robot must finish in the square provided.
- Robot must say "I am the winner" and flash multicolored lights for 5 seconds.

5.2 System Flow



5.3 Software

To develop and deploy this application, SpheroBlock Code was used.

5.4 Hardware

The hardware platforms used to develop, test and demonstrate this application were a laptop and the robot. An iphone was used to program and control the robot, as well as collect some sensor data.

5.5 Test Plan

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
Test the blockcode to see if robot follows the course once	11/11/22	Robot runs the figure 8 once	the robot wasn't turning wide enough, wasn't following the correct path.	Aidan	Fail

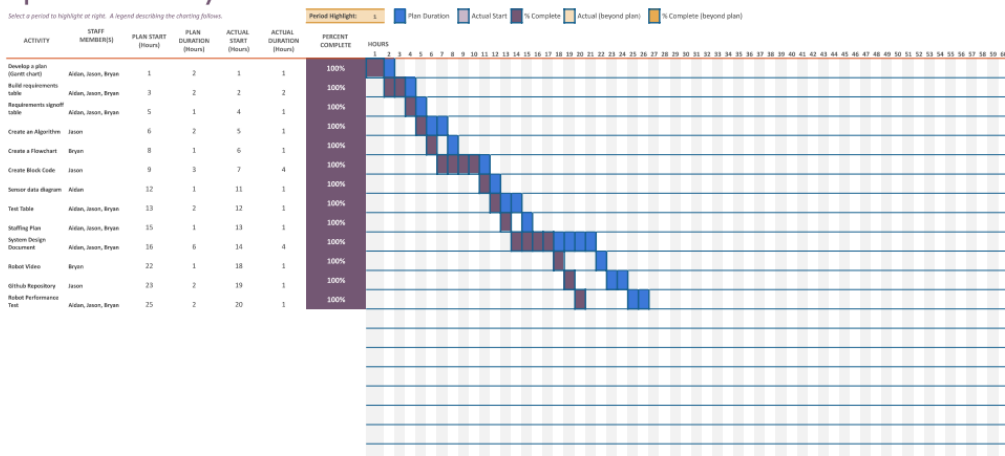
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Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
Test the blockcode to see if robot follows the course once	11/12/22	Robot runs the figure 8 once	robot drifted from its path	Bryan	Fail
Test the blockcode to see if robot follows the course once	11/12/22	Robot runs the figure 8 once	Robot followed the desired path	Bryan	Pass
Test ability to complete the track	11/13/22	Robot runs the figure 8 5 times	Robot followed the path 5 times correctly	French	Pass
Test ability to flash multicolored lights for 5 seconds	11/14/22	Robot flashes multicolored lights for 5 seconds	Robot did not light up at the end	French	Fail
Test ability to flash multicolored lights for 5 seconds	11/14/22	Robot flashes multicolored lights for 5 seconds	Robot kept changing color for an infinite amount of time	French	Fail
Test the audio of the robot	11/14/22	Robot flashes multicolored lights for 5 seconds	Robot flashed multicolored lights for 5 seconds and then stopped.	Bryan	Pass
Test the all of the requirements of the robot for Accuracy Sprint	11/14/22	Robots successfully completes 5 figure 8s while staying on the correct path, speaks after finishing and flashes lights for 5 seconds	Robot was successful in completing the course and all requirements	Bryan	Pass

5.6 Task List/Gantt Chart

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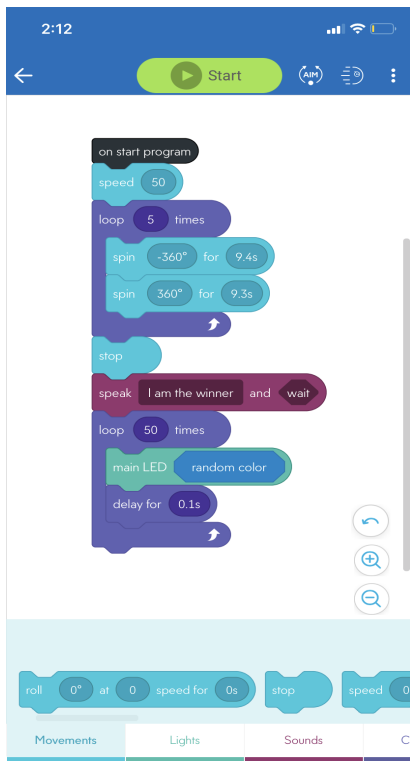
Select a period to highlight at right. A legend describing the charting follows.



5.7 Staffing Plan

Name	Role	Responsibility	Reports To
French	Programmer	Code the logic to make the robot go around the track, light up, speak and generally follow the requirements specified.	Group
Bryan	Flowchart, robot video	Shows how the robot program works in a flowchart, and explains what the robot will do in a video	Group
Aidan	Sensor Data Diagram, System design documenter	Collects data, and fills out all the requirements for the system design document. States all the parts involved with the project	Group

Block Code and Sensor Data Diagram



Block Code:



Sensor Data Diagram: