Sprint 1 - Endurance Design Document

November 7, 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

Describe the purpose of this specification and its intended audience. Include a description of what is within the scope what is outside of the scope of these specifications. For example:

In scope

This document addresses the intended audience of the project:

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

Out of Scope

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

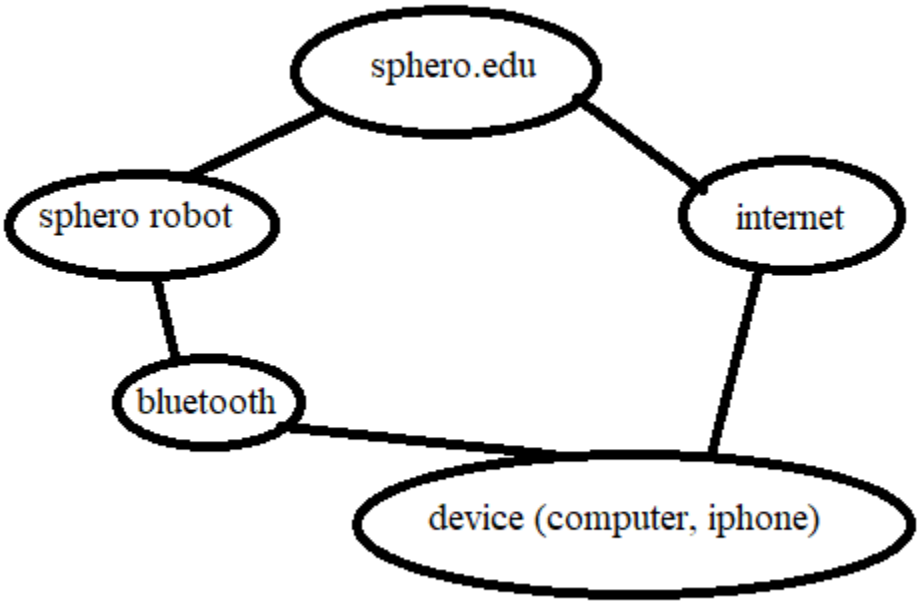
- Controlling a robot is something that is useful and applied in many factories in modern day.
- Products such as self driving cars also use algorithms to control themselves.

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

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.

2.5 Dependencies

- In order for the Robot to stop, turn red, and say “I’m done and I need water,” it must complete its lap around the edge of the room
- The yellow square and the blue tape are guidelines for us to put the robot so it follows its direct path set, otherwise, it may run into other things around the room, since this goes against the requirement that it should not collide with any objects in the room

3. Requirements

Requirements:

1. The robot must benign on the yellow square (will be placed there)
2. The robot must light up green (main LED function)
3. The robot must speak “ready to go” (speak function)
4. The robot must travel around the room on the track laid out
    a. robot moves forward until it reaches the end of the track (roll function)
    b. robot turns right (spin function)
    c. repeat until robot returns to starting square
5. The robot must come back to the square it started in
6. The robot must light up red (main LED function)
7. The robot must speak “i need water” (speak function)

3.1 Functional Requirements

Req#	Requirement	Comments	Priority	Date Rvwd	SME Reviewed / Approved
ENDUR_01	Robot has to travel around the edge of the room	make sure the robot does not collide with any of the walls	1	11/04/22	Approved
ENDUR_02	Robot has to start on the yellow square with blue tape	robot must be aimed precisely when it is placed down to make sure it travels in the correct direction	1	11/04/22	Approved

Req#	Requirement	Comments	Priority	Date Rvwd	SME Reviewed / Approved
ENDUR_03	Robot must start with a green light and say, “ready set go”	use the LED and speak functions to do this, have volume turned up to hear the words	2	11/04/22	Approved
ENDUR_04	Robot must stop with a red light and say, “I’m done and I need water”	Robot stopped within the yellow square, turned red, and said what needed to be said	2	11/04/22	Approved
ENDUR_05	Robot must travel to each corner of the blue tape path and turn right at each corner	The robot followed the tape pretty accurately, not directly on the tape, but close enough	1	11/04/22	Approved
ENDUR_06	Robot must return to its starting location	some room for error here, shouldn’t be an issue if the robot was aimed correctly. It can only get so perfect.	1	11/04/22	Approved
ENDUR_07	Robot should not collide with any objects in the room	No collisions, followed the tape perfectly	1	11/04/22	Approved
ENDUR_XX					

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

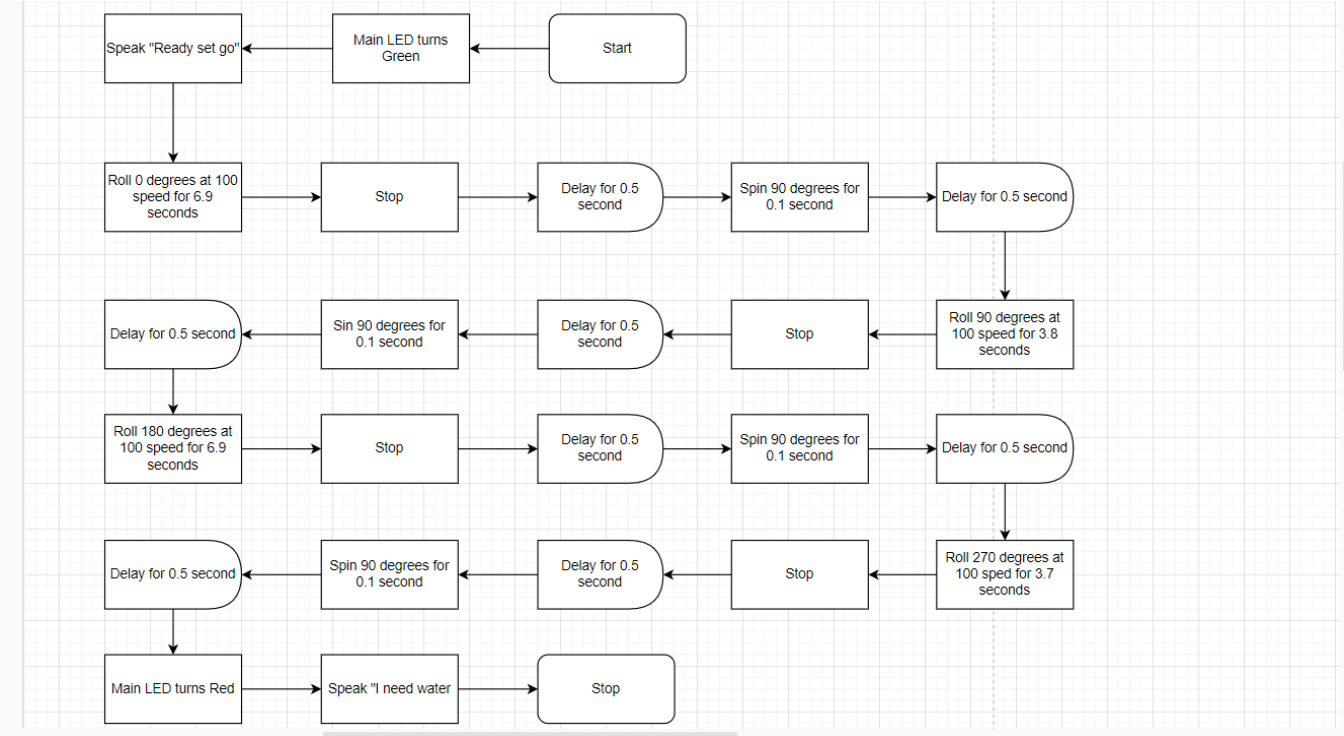
Meeting Date	Attendees (name and role)	Comments
11/04/22	Bryan Kahl	confirmed all except ENDUR_03, ENDUR_04
11/04/22	Jason French	confirmed all except ENDUR_07
11/04/22	Aidan Sacci	confirmed all except ENDUR_01

5. System Design

5.1 Algorithm

- Robot must travel around the edge of the room
- Robot must start on the yellow square with the blue tape
- Robot must start with a green light and say “ready set go”
- Robot must stop with a red light and say “I’m done and I need water”
- Robot must travel to each yellow floor tile and turn right at the center of each tile
- Robot has to return to its starting location
- Robot should not collide with anything in the room

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
testing functionality of robot	11/04/22	Robot starts with green light	robot lit up green	Aidan	Pass
Test the audio of the robot	11/04/22	Robot says “ready set go”	Robot said “Ready set go”	Bryan	Pass
Test ability to complete the track	11/04/22	Robot travels around the room	Robot collided with objects and went too far.	French	Fail
Test ability to complete the track	11/04/22	Robot travels around the room	Robot didn’t come to a full stop at the corners, went off the track	French	Fail
Test ability to complete the track	11/04/22	Robot travels around the room	Robot traveled around the rooms without colliding into anything.	French	Pass
Test the audio of the robot	11/04/22	Robot turns red and says “I’m done and I need water”	Robot said “I’m done and I need water” and turned red	Bryan	Pass
Finalizing performance of the robot.	11/04/22	Robot performs all actions in order	Robot lit up when it was supposed to and completed the track without colliding	Aidan	Pass

5.6 Task List/Gantt Chart

https://docs.google.com/spreadsheets/d/1-FGcDlMh_-gsbu0Lou313cEhh-VNq5Evwp1jo2Qir8w/edit?usp=sharing

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

Name	Role	Responsibility	Reports To
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