Sprint 3 - Agility Design Document

Table of Contents

Table of Contents

1. Executive Summary

1.1 Project Overview

This project tests the capabilities of the Sphero SPRK+ programmable robot.

1.2 Purpose and Scope of this Specification

Purpose of this specification is to examine the ability of the Sphero SPRK+ to run the obstacle course.

In scope

- Robot functions properly on a flat surface
- Supports all devices with Bluetooth
- Waterproof outer shell

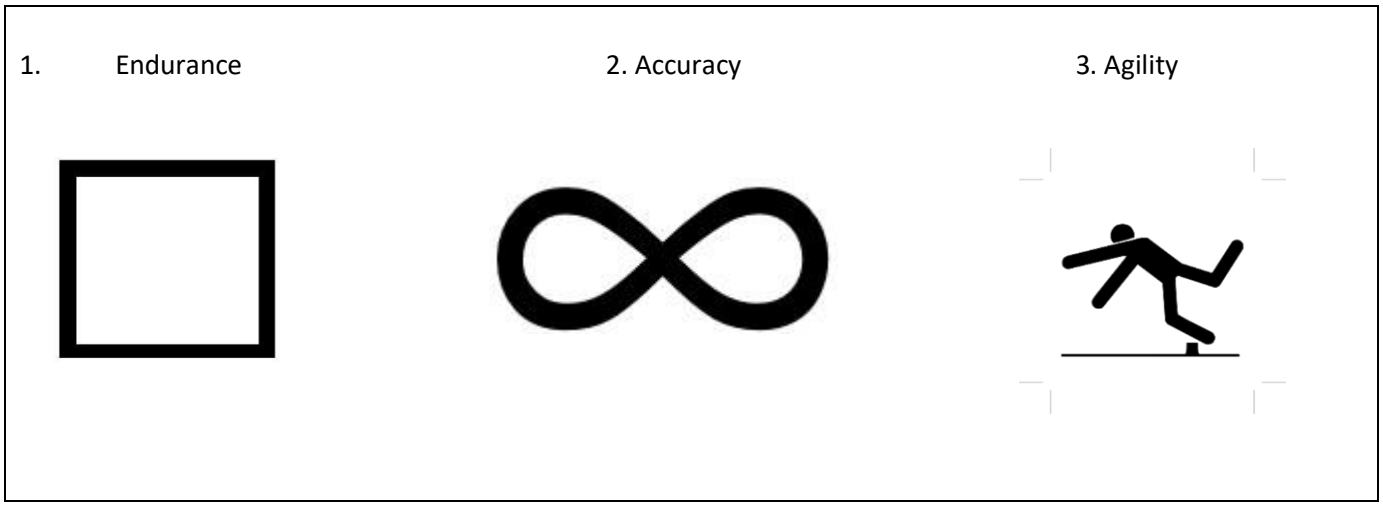
Out of Scope

- Should not be operated outside
- Bluetooth will be disconnected with a range of more than 100 feet.

2. Product/Service Description

2.1 Product Context

This project is a third of the main Robotics Triathlon project which consists of two more sprints testing endurance and accuracy.



2.2 User Characteristics

In order to use the robot, users only need to understand the basic concepts of block code. No knowledge of programming is required to operate it. Users should have access to a device that supports Bluetooth and an open space with a flat surface to meet the requirements.

2.3 Assumptions

- Availability of an indoor flat surface meeting the required measurements
- Equipment will only work on certain operating systems

2.4 Constraints

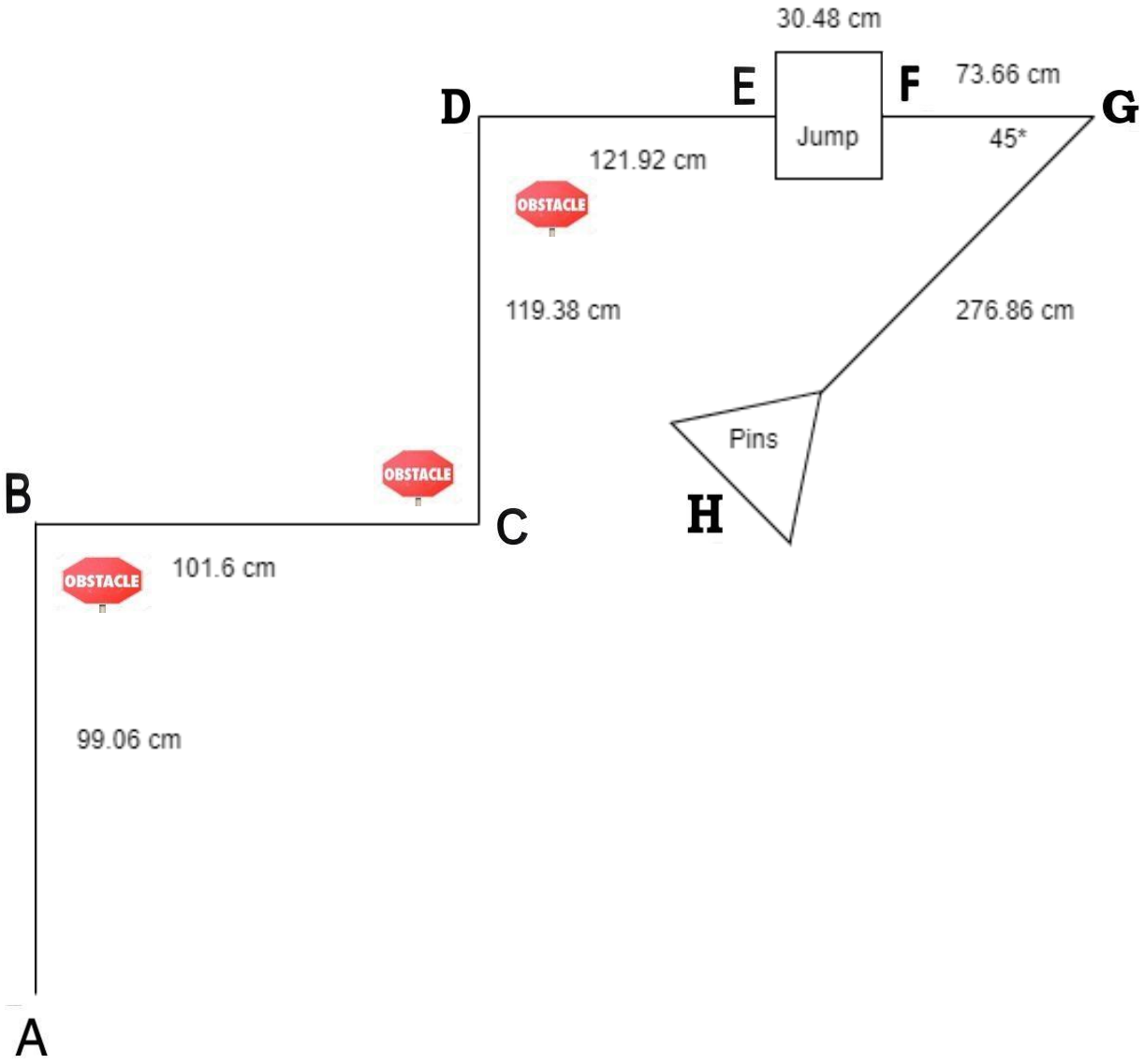
- Use of the officially measured course was not available

- Limited number of robots (one per group)

2.5 Dependencies

- Sphero SPRK+ needs to be charged every 60 minutes
- Check the availability of maximum area of flat surface before working on the block code

3. Requirements



3.1 Functional Requirements

Req#	Requirement	Comments	Priority	Date Rvwd	SME Reviewed / Approved
ENDUR_01	Robot moves at 0 degree from point A to point B	Point B is 3’3’’ from point A	1	12/01/20	12/01/20
ENDUR_02	Robot avoids first obstacle	Placed at the inside of the corner	1	12/01/20	12/01/20
ENDUR_03	Robot moves 90 degree from point B to point C	Point C is 3’4’’ from point B	1	12/01/20	12/01/20
ENDUR_04	Robot avoids second obstacle	Placed at the inside of the corner	1	12/02/20	12/01/20
ENDUR_05	Robot moves 0 degree from point C to point D	Point D is 3’11’’ from point C	1	12/01/20	12/01/20
ENDUR_06	Robot avoids third obstacle	Placed at the inside of the corner	1	12/01/20	12/01/20
ENDUR_07	Robot moves 90 degree from point D to point E	This is the ramp which is 4’ from point D	1	12/01/20	12/01/20
ENDUR_08	Robots goes over the ramp	From E to F	1	12/01/20	12/01/20
ENDUR_09	Robot moves from the ramp to point G	Point G is 2’5’’ from the ramp	1	12/01/20	12/01/20
ENDUR_10	Robot goes 225 degree from point G to point H	Point H is 9’1’’ from point G	1	12/01/20	12/01/20
ENDUR_11	Robot knocks over as many pins as possible	At point H	1	12/01/20	12/01/20
ENDUR_12	Robot increases speed from point G to point H	Knocking over pins	2	12/01/20	12/01/20

3.2 Security

3.2.1 Protection

- No personally identifiable information stored in the robot itself
- Water resistant and scratch resistant outer cover
- Works with third-party security experts to audit the Sphero Edu platform
- Data encrypted in transit and at rest where possible

3.2.2 Authorization and Authentication

Users will have to make an account on sphero.edu in order to access the program.

3.3 Portability

- Program robot with the Draw, Block, or JavaScript Canvas
- Compatible with iOS 10+, Android 5+, Windows 10, macOS, Chrome OS

4. Requirements Confirmation/Stakeholder sign-off

Meeting Date	**Attendees (name and role)**	**Comments**
12/01/20	Zainab, Nick, Tyler	Confirmed all requirements

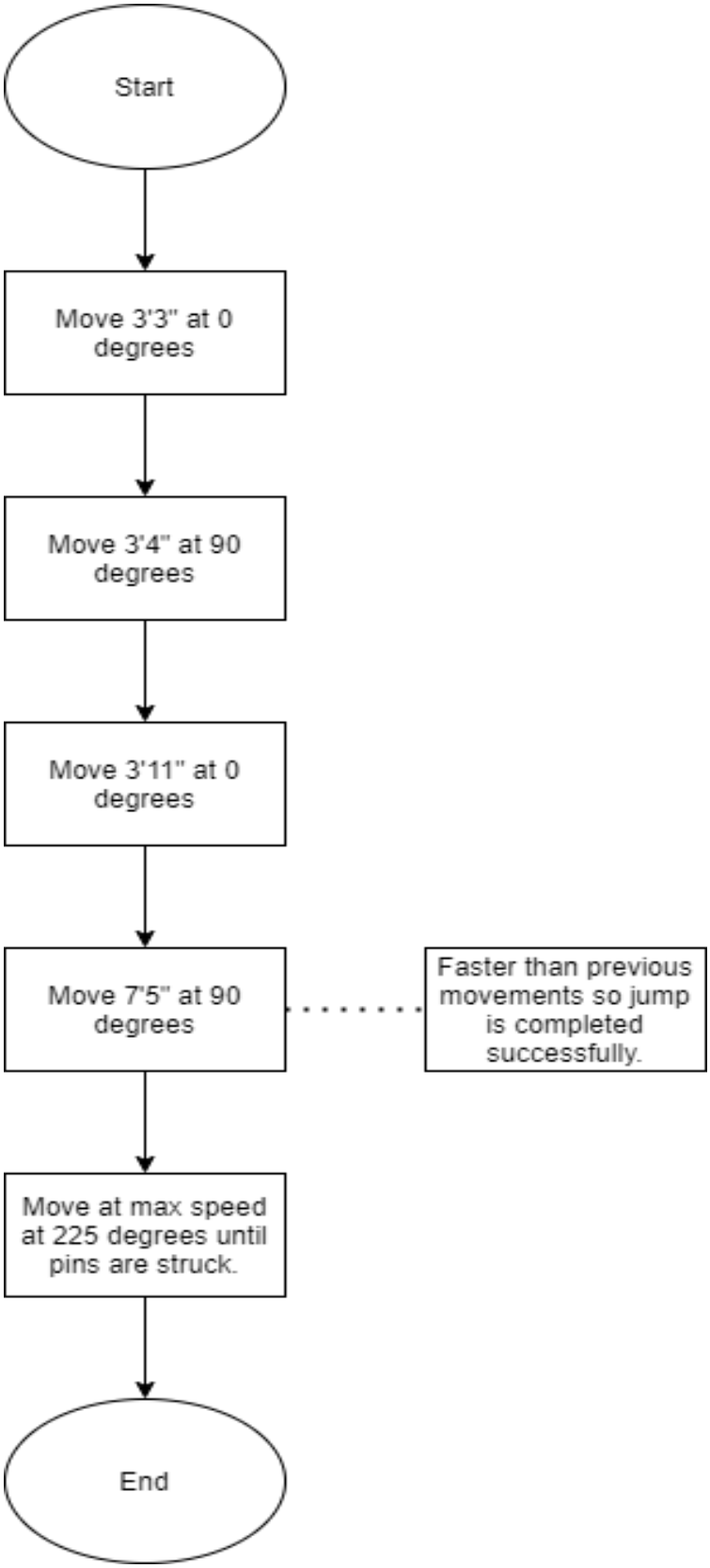
5. System Design

5.1 Algorithm

1. Move 3'3" at 0 degrees.
2. Move 3'4" at 90 degrees.
3. Move 3'11" at 0 degrees.
4. Move 7'5" at 90 degrees faster than before as to complete the jump.
5. Move at max speed at 225 degrees until pins are struck.

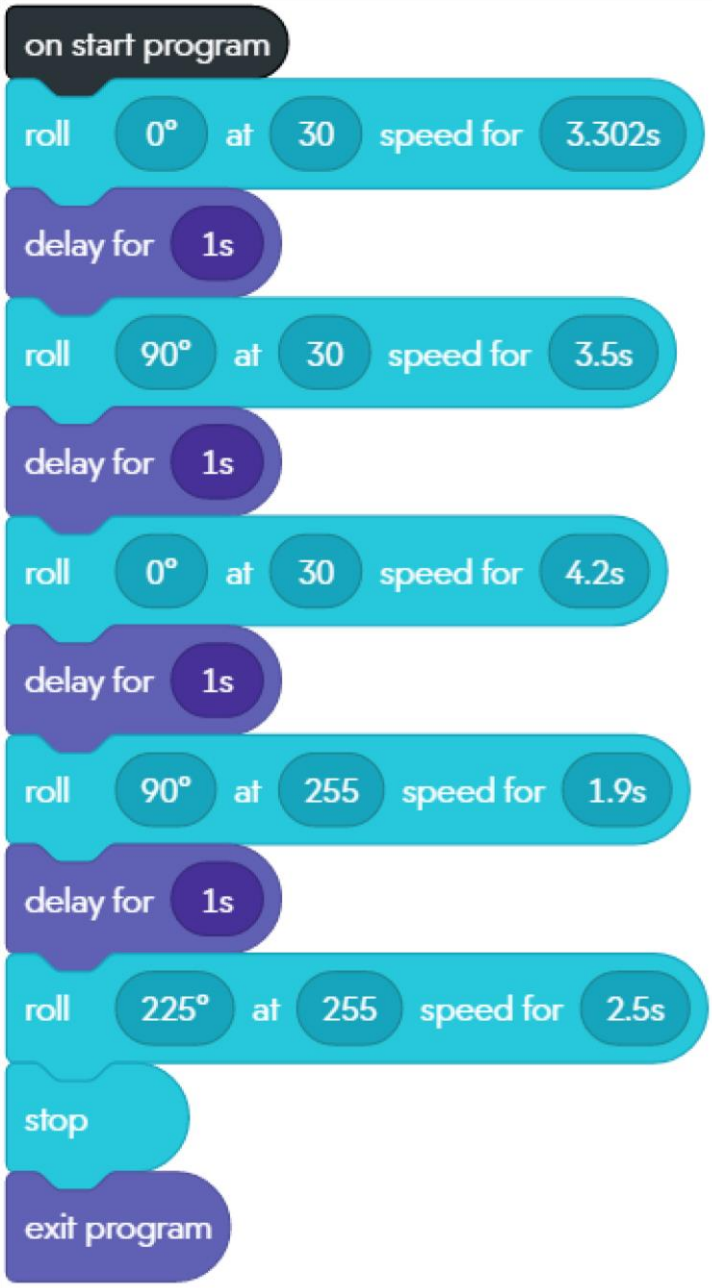
5.2 System flow

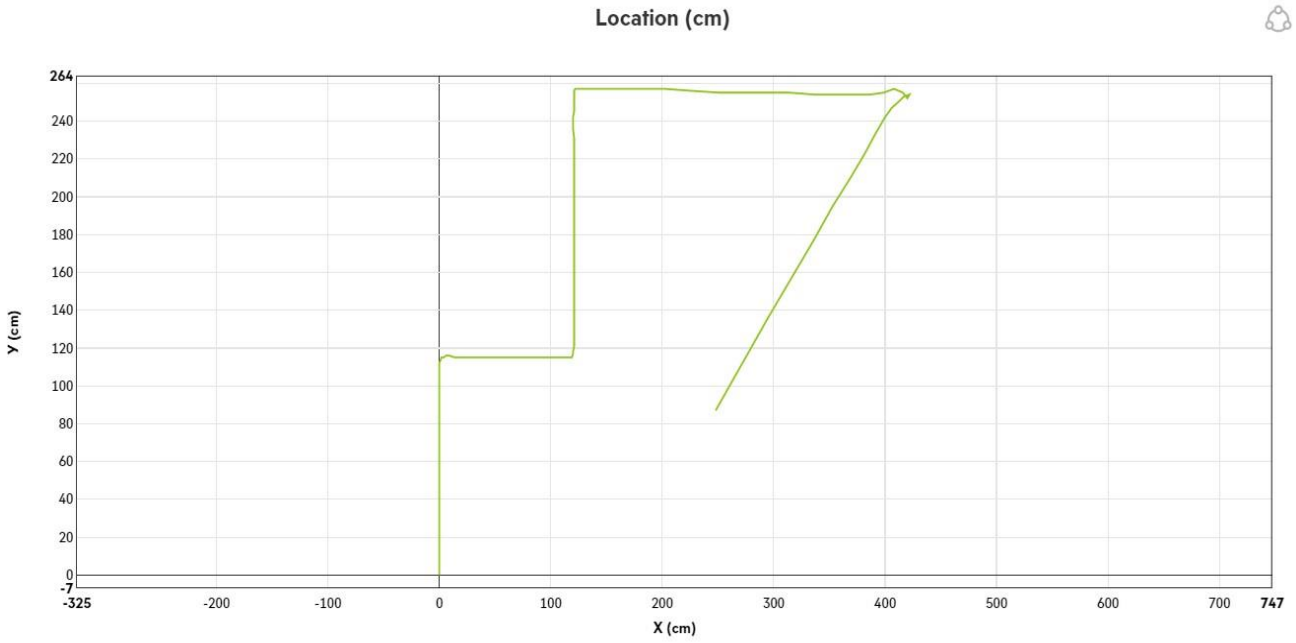
Flowchart:


Start
Move 3'3" at 0 degrees
Move 3'4" at 90 degrees
Move 3'11" at 0 degrees
Move 7'5" at 90 degrees
Faster than previous movements so jump is completed successfully.
Move at max speed at 225 degrees until pins are struck.
End

5.3 Software

Sphero Edu mobile application was downloaded in order to program the robot through block code. Sphero Edu also allows users to see sensor data and write their own code in JavaScript. Windows 10 was used to document and record the test results.





5.4 Hardware

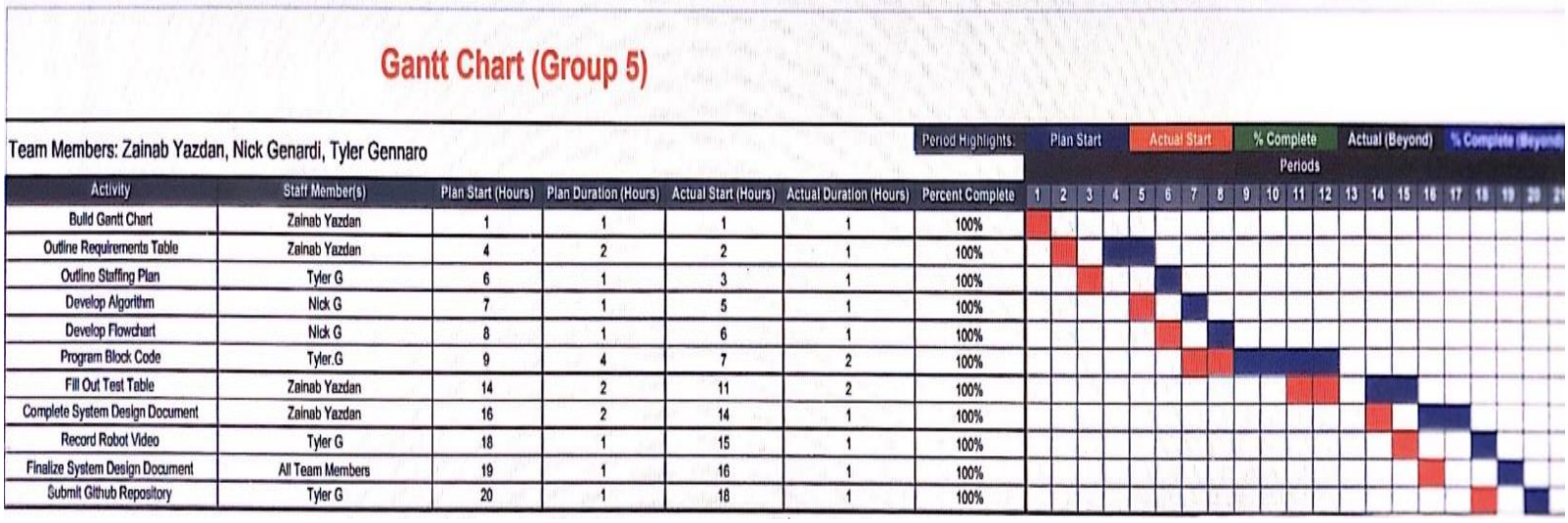
Code was developed on iPhone (iOS 10+) and tested on a Windows 10 Laptop.

5.5 Test Plan

Reason for Test Case	Test Date	Expected Output	Observed Output	Staff Name	Pass/Fail
Check if the robot avoids first obstacle	12/01/20	Robot avoids first obstacle	Robot bumps slightly into the first obstacle	Tyler.G	Fail
Check if the robot avoids first obstacle	12/01/20	Robot avoids first obstacle	Robot avoids first obstacle	Tyler.G	Pass
Check if the robot avoids second obstacle	12/01/20	Robot avoids second obstacle	Robot avoids second obstacle	Tyler.G	Pass
Check if the robot avoids third obstacle	12/01/20	Robot avoids third obstacle	Robot bumps into third obstacle	Tyler.G	Fail
Check if the robot avoids third obstacle	12/01/20	Robot avoids third obstacle	Robot avoids third obstacle	Tyler.G	Pass
Check if robot goes over the ramp	12/01/20	Robot goes over the ramp	Robot stops at ramp	Tyler.G	Fail
Check if robot goes over the ramp	12/01/20	Robot goes over the ramp	Robot goes over the ramp	Tyler.G	Pass

Check if robot goes 225 degree from point G	12/01/20	Robot goes 225 degree from point G	Robot goes 45 degree from point G	Tyler G	Pass
Check if robot knocks over maximum pins	12/01/20	Robot knocks over maximum pins	Robot knocks few pins	Tyler.G	Fail
Check if robot knocks over maximum pins	12/01/20	Robot knocks over maximum pins	Robot knocks over maximum pins	Tyler.G	Pass

5.6 Task List/Gantt Chart



5.7 Staffing Plan

Name	Role	Responsibility	Reports To
Nick Genardi	Project Lead	Coordinate group and activities	Instructor
Tyler Gennaro	Developer	Develop code	Nick Genardi
Zainab Yazdan	Documenter	Document observations for use in this document	Nick Genardi