

# **Requirements Specification: Version 1.0**

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## **Floor Explorer Algorithms Team**



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# CS Capstone Design

## Technical Demo Grading Sheet (100 pts)

**TEAM: Floor Explorer Algorithms Team**

**Overview:**

### **Risky technical challenges**

Based on our requirements acquisition work and current understanding of the problem and envisioned solution, the following are the key technical challenges that we will need to overcome in implementing our solution:

#### **C1: Programming the Robot**

We will use ROS2 to connect to the robot and program it to accomplish our goals. Testing and implementation will come naturally as it is our main method of programming the robot.

#### **C2: Object Avoidance**

Using the various sensors to stop a program once a strong enough return signal is received to avoid obstacles in the robots path. Testing/demoing the sensors responsible for this involves using the feedback from the sensors to stop or continue a program that hinges upon them.

#### **C3: Navigation**

Using the inbuilt coordinate system to navigate a series of directions. ROS2 comes with a coordinate system and using it will help us navigate a digital map in the future. As such being able to test and demo this central feature will involve its use moving about a small path.

#### **C4: Digital Map Creation**

Use the LIDAR sensor to detect surroundings and create a digital map of the area. Creating a proper digital map will take us some time and to demonstrate its use will require partial or full completion of the program.

#### **C5: Wifi Localization**

Get a list of different routers using the wifi capabilities of the robot itself or a Raspberry PI. Connecting to various routers and getting their information and signal strength will allow for the robot to self localize. Using a laptop as an intermediate device while we work on the

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Raspberry PI will allow us to collect and work with data while proper implementation is being completed.

### C6: Wall Follow

Use the IR sensors to identify a wall to the right of the robot and follow it to a location. Essentially using the walls to help navigate will give us an easy way to ensure the robot is following its path to the desired location. Demoing this would require a fully working or near complete system.

### Challenges covered by demos:

In this section, we outline the demonstrations we have prepared, and exactly which of the challenge(s) each one of them proves a solution to.

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#### Demonstration 1: Navigation Demo

Challenges addressed: Challenge 3

Flight Plan:

1. Create a program that is able to take in coordinates
2. Use the navigation system to move a series of coordinates in order autonomously
3. Return to starting position

Evaluation:

- ✓ Convincingly demo'd each of listed challenges?
- ✓ Other evaluative comments:

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#### Demonstration 2: Sensor Distance Demo

Challenges addressed: Challenge 2

Flight Plan:

1. Create a program to take in input from the sensors
2. Once a sensor give a strong enough return move on with the program (or end the program)
3. Collect data from various points in the sensor's usage.

Evaluation:

- ✓ Convincingly demo'd each of listed challenges?

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- ✓ Other evaluative comments:

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### Demonstration 3: ROS2 Demo

Challenges addressed: Challenge 1

Flight Plan:

1. Connect to the robot in real time.
2. Using commands through ROS2 communicate with the robot to control it

Evaluation:

- ✓ Convincingly demo'd each of listed challenges?
- ✓ Other evaluative comments:

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### Demonstration 4: Wifi Strength Demo

Challenges addressed: Challenge 5

Flight Plan:

1. Use a laptop to connect to a router
2. Collect the routers information (such as IP)
3. Measure the strength of the router connection
4. If the router is visible to us compare that to its physical distance

Evaluation:

- ✓ Convincingly demo'd each of listed challenges?
- ✓ Other evaluative comments:

### Other challenges recognized by not addressed by demo:

If there were challenges you listed earlier that were *not* covered by a demo, list here. This will hopefully be a short list...but better to be clear about where you are. If you have items here, you could list (if applicable) any pending plans to reduce these risks.

We currently are not capable of showing off the tech related to challenges 4 and 6 as their implementation will complete them in their entirety. To demo the creation of a digital map would require making a digital map and in doing so would complete that entire section of the project. For the demoing of a wall follow algorithm it would require that algorithm to be complete and as such would no longer be a challenge. The mitigation of these challenges and risks will come from their implementation and completion. As such we will need to dedicate significantly more time to their research and development.