SYSC 4805
Computer Systems Design Lab

Automated Snow Plough
Project Proposal

G6

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1. Project Charter

1.1 Team name & Colour

- Group 6
- Colour: Big Foot Feet

1.2 Project Objective

- The main objective of our project is to configure a robot that has the ability to remove snow (debris) from its immediate path and stay within the borders set by black tape. The robot will need to be able to remove moving and non moving objects from its path and into the restricted area. The machine should also be able to avoid the restricted tape when it is in its vicinity and continue to remain and roam inside of the restricted area. The other main objective of this project is to prevent the robot from doing the penalties that are stated in the requirements of the robot. Some of the penalties include building the robot with a maximum size, not hitting any of the obstacles, and the robot going past the black tape. To summarise, our robot's main goal is to remove snow (debris) from the bounded area without the robot committing any of the given penalties.

1.3 Overall Deliverables

- Project Proposal (October 20th 2023)
- Progress Report (November 14th 2023)
- In-Lecture Presentation (November 23rd 2023)
- Project Lab Demonstration (December 5th 2023)
- Final Report (December 8th 2023)

2. Scope

2.1 List of Requirements

This project includes both Project Requirements and Physical Requirements, as seen below. The Project Requirements describe what requirements that need to be fulfilled, and the physical requirements describe which hardware components that will be used in order to fulfil the Project requirements.

2.1.1 Project Requirements

- Testing area must be roughly 2.5x2.5
- Lightweight wooden cubes with side length of 20mm for snow
- Maximum robot size: 225 x 262 x 150 mm (Width x Length x Height)
- The robot must start from a corner inside the perimeter, aligned with one edge of the perimeter.
- The maximum allowable robot speed is 30 cm/s
- The maximum allowed operation time to clear the snow is 5 minutes

2.1.2 Robot Requirements

- Robot Frame (Including Plough) : Height x Width x Length
- Arduino Due
- Cytron Motor Controller Board
- 4 DC Motors
- 2 x Wheel Encoder
- 1 x Line Follower Sensor
- 1 x VMA330 IR Obstacle Avoidance Sensor Module
- 1 x Ultrasonic Distance Sensor

2.2 Detailed Deliverables

Week by Week Breakdown:

Week 1 (Oct 31)	Sensors testing and configuration Complete construction of robot frame
Week 2 (Nov 7)	Mount sensors on robot frame Test sensors on robot layout
Week 3 (Nov 14)	Program basic motion with obstacle avoidance Program line following functionality (black border path)
Week 4 (Nov 21)	Program plough functionality Finalise Program code
Week 5 (Nov 28)	Test all functionality of robot

	Final pre-demonstration test
Week 6 (Dec 5)	In Lab Demonstration

2.3 Testing Plan

Sensors Test:

- Wheel Encoder: Robot speed is to be manually measured (distance/time) and compared to wheel encoder's speed output
- Line Follower Sensor: Accuracy of sensor to be tested by using a black line path and measuring how far centre of robot is from centre of robot at all times
- VMA330 IR Obstacle Avoidance Sensor Test 1: Robot is to be commanded to move towards obstacle blocking path, time required to identify and avoid obstacle to be measured
- VMA330 IR Obstacle Avoidance Sensor Test 2: Robot is to be commanded to move towards obstacle blocking path, clearance distance from obstacle to be measured
- Ultrasonic Distance Sensor: Distance from obstacle to be manually measured and compared with sensor's distance output

Motors test:

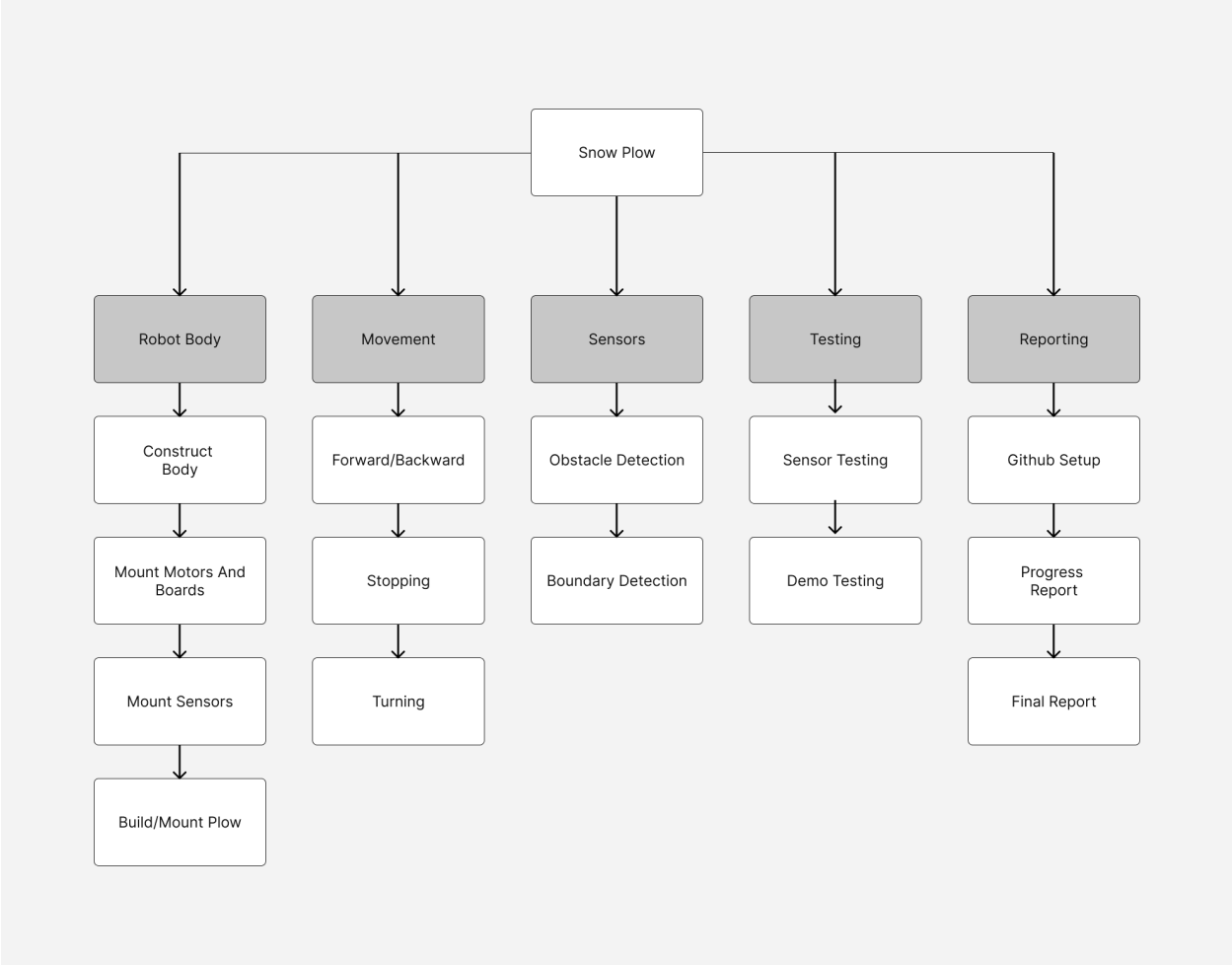
- Forward test: Testing forward movement at the following increments: Max speed, 50% speed, 10% speed
- Backwards test: Testing backward movement at the following increments: Max speed, 50% speed, 10% speed
- Turning test: Turning radius and time to be measured
- Stopping test: Time taken to measure stopping time to be measured

Working Product Test:

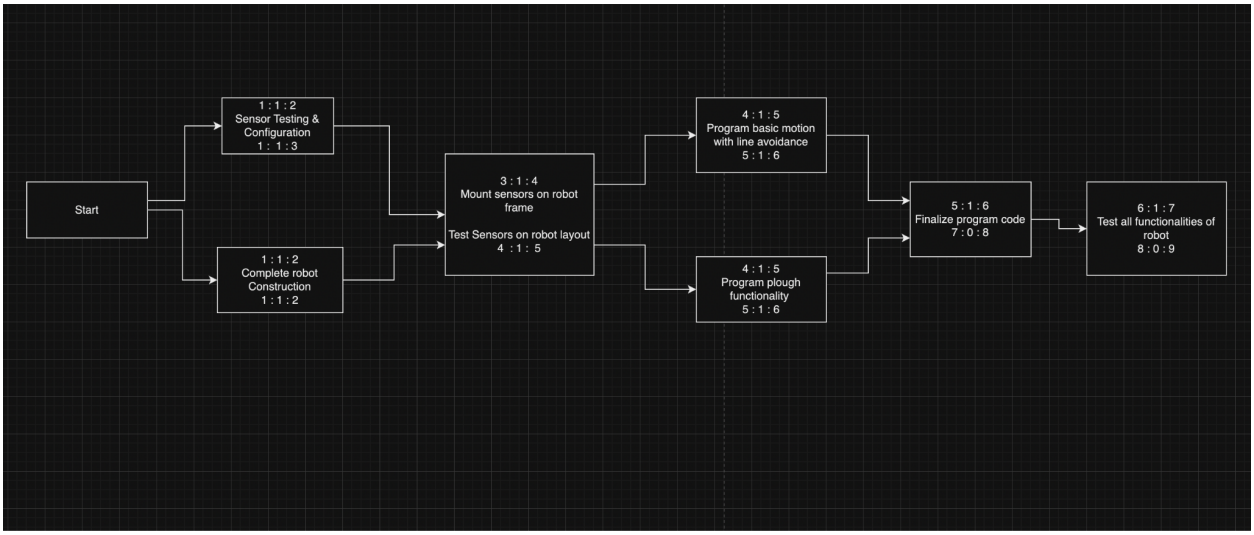
- Testing robot in demo environment (using obstacles, enclosed border path, test cubes)

3. Schedule

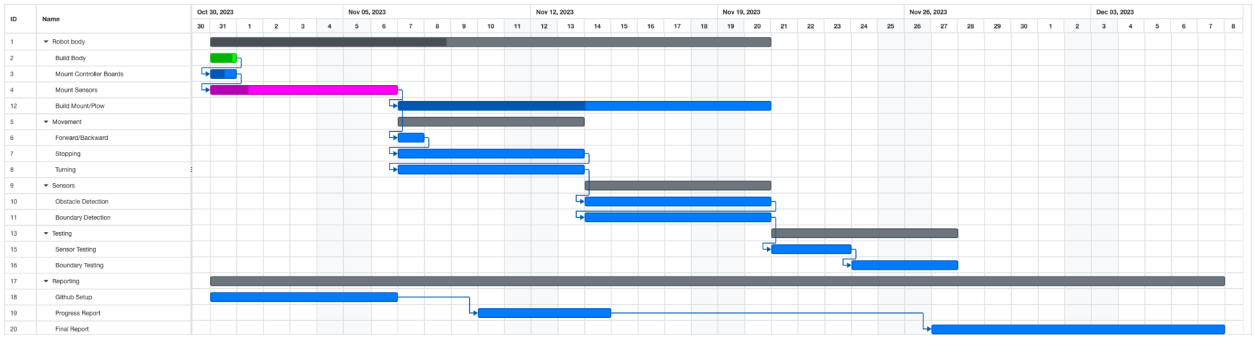
3.1 List of activities covered in the WBS



3.2 Schedule Network Diagram



3.3 Gantt Chart



4. Cost

- The length of our project will be from October 20th to December 8th. That roughly breaks down to 6 weeks of work on the project. Throughout each week of the project's development, the group will work together for 4 hours in the lab and 2-3 hours outside of the lab. The breakdown of the cost of our work is located in the chart below

Week	Hours of work (h)	Total cost
Oct 20 - Oct 27	Lab time: 0 (Reading week) Independant time: 2 hours X 3 member = 6 hours	6 hours * $50 = $300
Oct 28 - Nov 3	Lab time: 4 hours X 3 members = 12 hours Independant time: 2 hours X 3 member = 6 hours	18 hours * $50 = $900
Nov 4 - Nov 10	Lab time: 4 hours X 3 members = 12 hours Independant time: 3 hours X 3 member = 9 hours	21 hours * $50 = $1050
Nov 11 - Nov 17	Lab time: 4 hours X 3 members = 12 hours Independant time: 2 hours X 3 member = 6 hours	18 hours * $50 = $900

Nov 18 - Nov 24	Lab time: 4 hours X 3 members = 12 hours Independant time: 2 hours X 3 member = 6 hours	18 hours * $50 = $900
Nov 25 - Dec 1	Lab time: 4 hours X 3 members = 12 hours Independant time: 3 hours X 3 member = 9 hours	21 hours * $50 = $1050
Dec 2 - Dec 8	Lab time: 0 (Last week of school) Independant time: 2 hours X 3 member = 6 hours	6 hours * $50 = 300
Total	108 hours	108 hours * $50 = $5400

- Therefore, with our group's contribution to the project plus the cost of the kit, the overall cost of this project will be $5,900.00 (work + course kit cost).

5. Human Resources

- Responsibility Assignment Matrix
- Team Members: Ryan Burry, Sundar Vengadeswaran, Ismael Mfumu

Tasks	Responsibility	Approval
Construct body of robot	Ryan, Sundar, Ismael	N/A
Mount Motors and Arduino + Driver Board	Ryan	Sundar, Ismael
Mount Sensors	Ismael	Ryan, Sundar
Forward/Backward (Motor)	Sundar	Ryan, Ismael
Robot Turning (Motor)	Ryan	Sundar, Ismael
Robot Stopping (Motor)	Ismael	Ryan, Sundar
Obstacle Detection (Sensor)	Sundar	Ismael, Ryan
Boundary Detection (Sensor)	Ismael	Ryan, Sundar
Sensor Testing (Testing)	Ryan	Sundar, Ismael
Demo Testing (Testing)	Ryan, Sundar, Ismael	N/A
Github setup (Reporting)	Sundar	Ryan, Ismael
Progress report (Reporting)	Ryan, Sundar, Ismael	N/A
Final report (Reporting)	Ryan, Sundar, Ismael	N/A