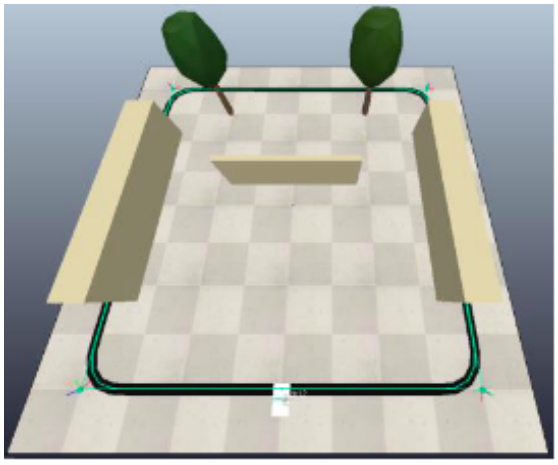
SYSC 4805 Project Proposal

Snow Plow in Coppeliasim



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Group 10 Project: **Fire Opal**

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TA: **Manas Maheshchandra Chamola**

1- About Us

Presented to you by Fire Opal, a team of fourth year engineers at Carleton University. The following is a project proposal that will go over the details of the build process of a snow removal robot made on CoppeliaSim.

1.1- Overall objective

The Objective of this project is to build a robot that efficiently clears snow off of the given highlighted path while tackling multiple challenges faced on the path using Coppeliasim.

1.2 - Overall Deliverables

The deliverables of this term will be as follows:

- A project Proposal: this is a team written report that will explain how a robot clears the snow off an area enclosed by a closed black path and how the robot is required to complete its task without hitting obstacles. This document covers the scope of the project such as list of requirements and list of actual activities that cover all the requirements, timeline or schedule of the project and responsibilities of all team members.
- Project Progress report: this is a team written report that shows progress made by the team towards the objectives of the term projects.
- Final Report: this is a team written report that contains all information about the project how a snow shoveling robot can automate the task of shoveling snow.
- Final Project Demonstration: there will be a team demonstration to the TA.
- Final Project Presentation: the Coppeliasim Model file will be handed in on Brightspace and there will be a team oral presentation by group members.

2- Scope

The scope of the project will go in detail of what work needs to be completed throughout the semester, the approximate timeline for each process, and criteria for testing to make sure it is suitable for our quality check

2.1- Requirements

In order to fulfill the objective of this project the following list of logistical and technical requirements are set up to build a fully functioning and efficiently running robot:

- Research regarding which base robot model to start with on Coppeliasim
- Pick out size/shape of wheels and motors (2 wheel drive(front or back wheel driven) or 4 wheel drive)
- Finding realistic sensors that can be used for the robot
- Choose appropriate location for the sensors
- Incorporate the sensors onto the robot body
- Coding the robot to integrate movement features and sensors
- Choose and work on an efficient extendable plow design
- Build the retraction motors for the plow
- Integrate both the extendable plow mechanisms to work with the sensors
- Coding the robot to make the moveable plow and integrate the sensor/movement features

2.2 - Work Breakdown Structure(WBS)

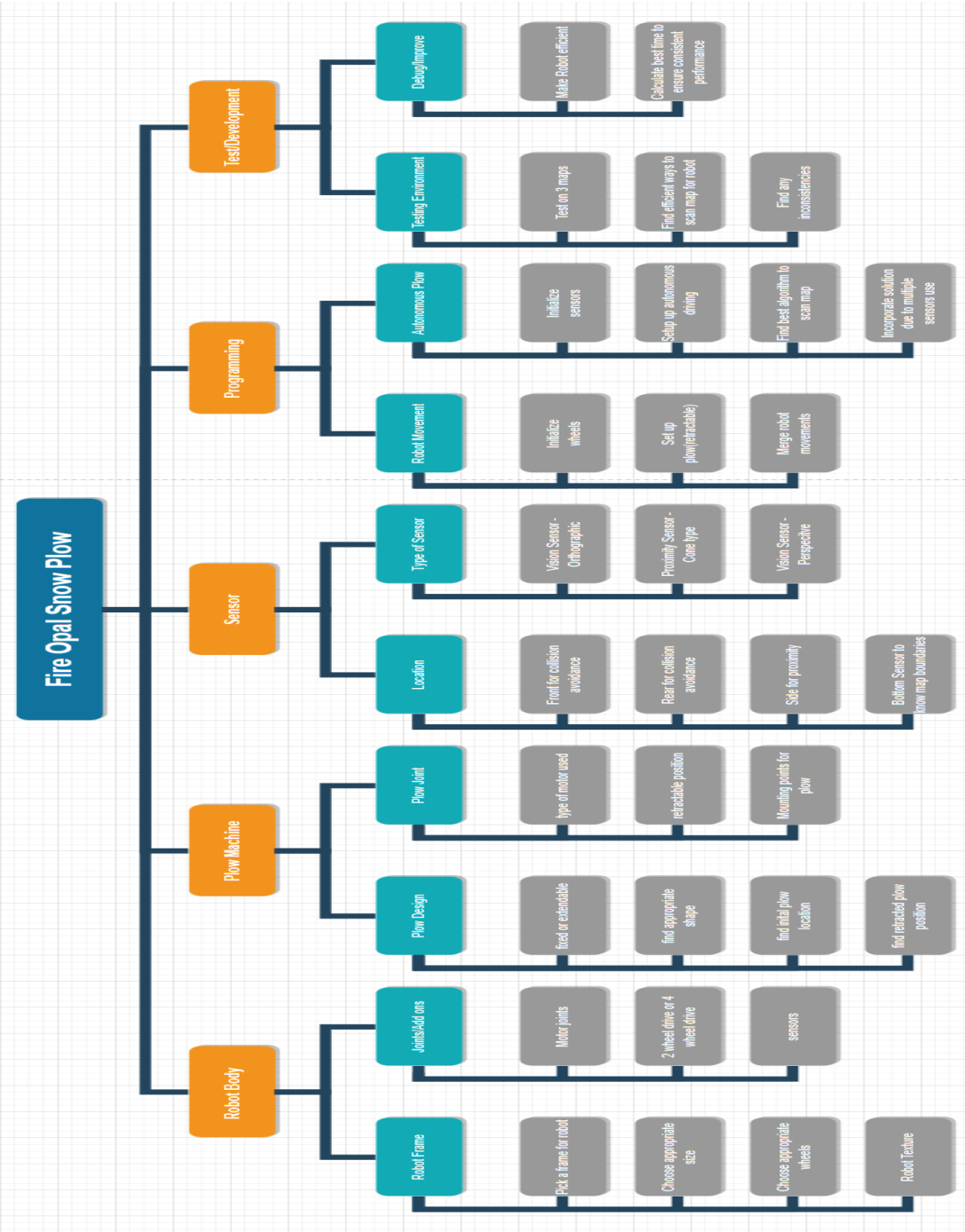

Figure 1: Our project work breakdown structure is split between the 5 members of our team. Each team member is assigned with tasks based on their skills and interests.

2.3 Testing

A number of tests will be conducted to make sure all requirements are covered. All components of the system will be tested in order to make sure that the robot is able to deal with challenges on the path.

Physical Robot: The robot body will be tested to make sure the object properties such as the object being collidable, measurable, detectable and renderable are enabled. The robot size will be measured so that it fits the requirements needed for simulation.

Plow Machine: plow expandability and retraction tests will be performed as well as making sure they work well with the sensors.

Sensor: tests will be carried out on the proximity and infrared sensors to make sure the robot doesn’t go off the cleaning path.

3- Schedule:

3.1- Schedule Network Diagram

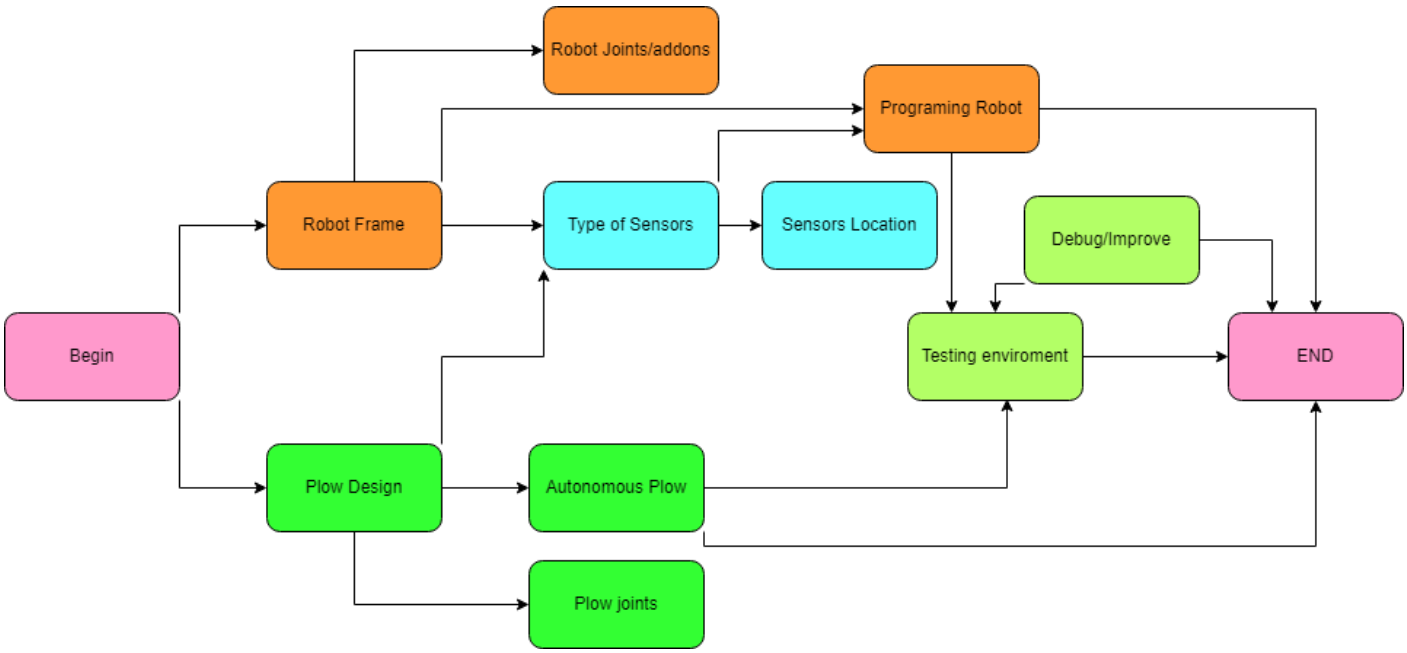

Figure 2: The schedule network diagram shows the flow of events planned to execute in order to design and construct a fully functioning robot.

3.2 - A Gantt Chart

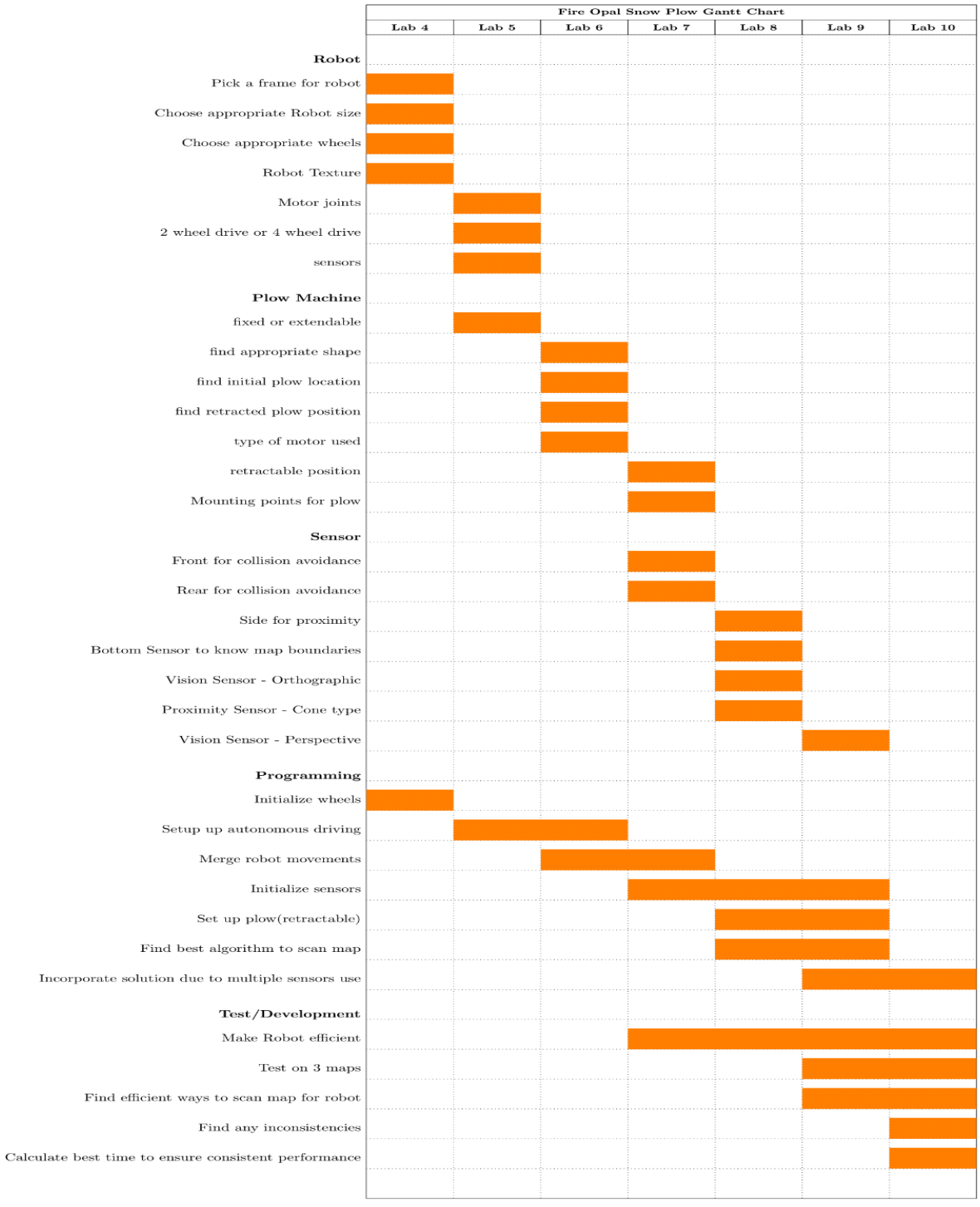

Figure 3: Above Gantt chart designed for the project shows the timeline assigned for tasks in each component of the system.

4 - Human Resources

Table 1: The table below represents the responsibility assignment matrix for each task in the project. The 4 roles assigned are:
R = Responsible, A = Approver, C = Consulte, I = Informed

Itinerary	Chase	Sunjeevani	Israel	Yunas
Robot Frame: Pick a frame for robot	R	A	C	I
Robot Frame: Choose appropriate size	I	R	A	C
Robot Frame: Choose appropriate wheels	C	I	R	A
Robot Frame: Robot Texture	A	C	I	R
Joints/Add ons: Motor joints	I	R	A	C
Joints/Add ons: 2 wheel drive or 4 wheel drive	R	A	C	I
Joints/Add ons: Find ideal sensors	C	I	R	A
Plow Design: fixed or extendable	A	C	I	R
Plow Design: find appropriate shape	I	R	A	C
Plow Design: find initial plow location	A	C	I	R
Plow Design: find retracted plow position	R	A	C	I
Plow Joint: type of motor used	I	R	A	C
Plow Joint: retractable position	C	I	R	A
Plow Joint: Mounting points for plow	I	R	A	C
Sensor Location: Front for collision avoidance	C	I	R	A
Sensor Location: Rear for collision avoidance	R	A	C	I
Sensor Location: Side for proximity	A	C	I	R
Sensor Location: Bottom Sensor to know map boundaries	A	C	I	R
Type of Sensor: Vision Sensor - Orthographic	I	R	A	C
Type of Sensor: Proximity Sensor - Cone type	R	A	C	I
Type of Sensor: Vision Sensor - Perspective	C	I	R	A
Robot Movement: Initialize wheels	I	R	A	C

Robot Movement: Set up plow(retractable)	R	A	C	I
Robot Movement: Merge robot movements	A	C	I	R
Autonomous Plow: Initialize sensors	C	I	R	A
Autonomous Plow: Setup up autonomous driving	A	C	I	R
Autonomous Plow: Find best algorithm to scan map	C	I	R	A
Autonomous Plow: Incorporate solution due to multiple sensors use	A	C	I	R
Testing Environment: Test on 3 maps	R	A	C	I
Testing Environment: Find efficient ways to scan map for robot	C	I	R	A
Testing Environment: Find any inconsistencies	I	R	A	C
Debug/Improve: Make Robot efficient	R	A	C	I
Debug/Improve: Calculate best time to ensure consistent performance	A	C	I	R