Autonomous Snowplow

10.14.2022

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Team: Old Gold

L3-Group4

Wilson Amoussougbo (101119293)

Tyler Mak (101108389)

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1. Project Charter

1.1.Objective

The following document written by the members of Old Gold is a project proposal for the course SYSC4805 and is based on the conception of an Autonomous Snowplow. The goal of the project is to materialize a robot whose task will be to clear off snow in an enclosed area without hitting any fixed or moving obstacles. The project is composed of diverse components and its completion consists of syncing multiple technologies to ensure a functional assembly. The purpose of the following proposal is to put an accent on the scope of the project by listing all the necessary engineering requirements and testing plans as well as specifying the project schedule by setting up the milestones, activities, and contingencies. Finally, a cost baseline figure will be provided followed by a responsibility assignment matrix.

1.2.Milestone and Final deliverables

This section of the proposal covers the project milestones and final deliverables. The following table lists all the major dates for assignments and team meetings.

Date	Event	Date	Event
September 15th, 2022	Lab 1	November 04th, 2022	-Perimeter Detection -Unit Testing
September 23rd, 2022	Lab 2	November 11th, 2022	-Progress Report -Obstacle Detection -Unit Testing
September 30th, 2022	Lab 3	November 18th, 2022	N/A
October 07th, 2022	Lab 4	November 25th, 2022	-System Testing
October 14th, 2022	Project Proposal	December 02nd, 2022	-Integration Testing -Project Demo -Bug Fixing
October 21st, 2022	-Robot Speed -Unit Testing	December 09th, 2022	-Final Report

Table 1: Project Milestone and Final Deliverable Dates

2. Scope

2.1. Project requirements

Specifying requirements is a crucial part of any project. In this section, all the engineering requirements for this project will be listed.

1. The robot shall not exceed a speed of 30 cm/s while moving
2. The robot shall be a maximum size of 216 by 252 by 150 mm
3. The robot shall be able to detect the perimeter of the testing space
4. The robot shall be able to detect any obstacles before collision
5. Design a plow to attach to the robot for clearing the “snow”
6. Design a route the robot shall take for clearing the “snow”
7. The robot shall clear the “snow” in the testing area within 5 minutes

2.2. Project life-cycle

Every project can be broken down into different phases and these phases make the path the project will take to get from the start to the finish. The following image below shows our project’s work breakdown structure.

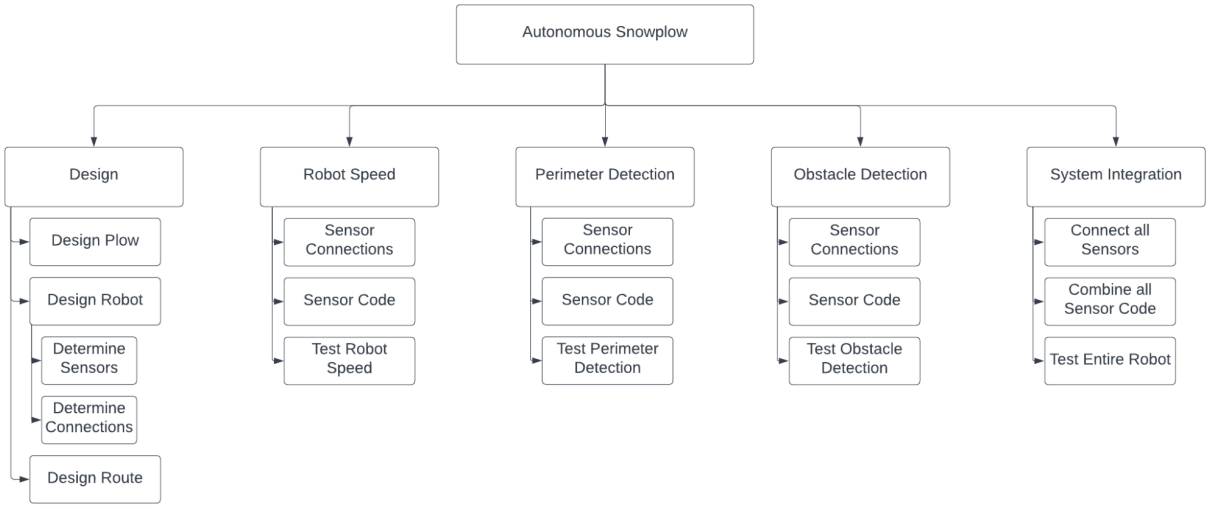

FIgure 1: Project Work Breakdown Structure

2.3. Testing

Testing is a fundamental part of our project and a set of testing that covers all the requirements has been put in place. In this section, we will discuss our plan for the unit testing to verify the successful completion of each activity independently from the rest of the project and the integration testing to validate the functionality of the system as a whole.

- UNIT TESTING
    - Design
        1. Take measurement of the robot assembly and verify that it does not exceed the following requirement : width, length, height = {216, 252, 150} mm.
        2. Verify that the plow width and length respectively do not exceed 40mm and 20 mm.
    - Robot Speed
        1. Verify that at maximum speed with minimum friction and no obstacle the speed of the assembly does ot exceed 30 cm/s.
        2. Certify that the robot moves at specified speed chosen by the user.
    - Perimeter Detection
        1. Verify that the system generates a signal when sensors detect the closed black path.
        2. Verify that when the signal is generated by the system, the robot changes direction and does not cross the closed black path.
    - Obstacle Detection
        1. Verify that the system generates a signal when sensors detect an obstacle.
        2. Verify that when the signal is generated by the system, the robot changes direction and does not hit obstacles.
- INTEGRATION TESTING
    1. Make sure that the robot is able to adjust (slow down) speed when getting close to the close black path or an obstacle.
    2. Verify that the robot is able to change direction in the testing area without hitting any obstacle.
    3. Make sure that the plow attached to the robot is able to clear off obstacles with a diameter of 42.6 mm.

3. Schedule

3.1. Schedule network diagram

A schedule network diagram is used to determine the relationships between activities. The following image below describes the sequential and logical relationships between our project activities.

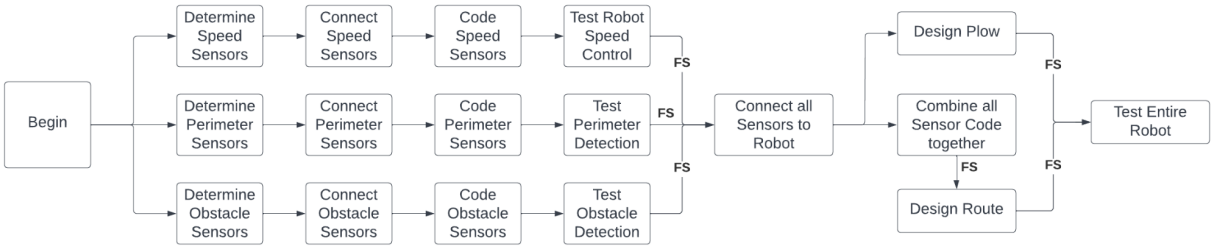

Figure 2: Project Schedule Network Diagram

3.2. Upcoming events

The following weeks, we will need a plan to decide on what tasks we will be working on as well as the amount of time we should spend working on each activity. The following image below is a Gantt chart for the entirety of the project.

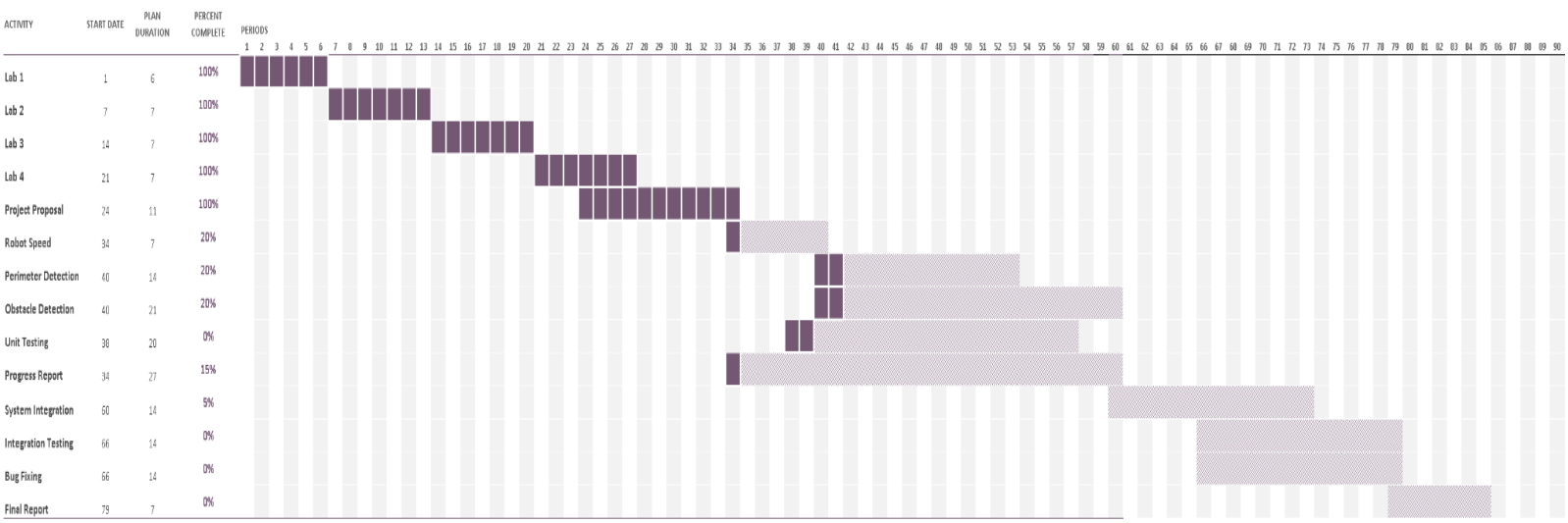

Figure 3: Project Gantt Chart Diagram

4. Cost

The following figure represents a cost baseline diagram of the overall project.

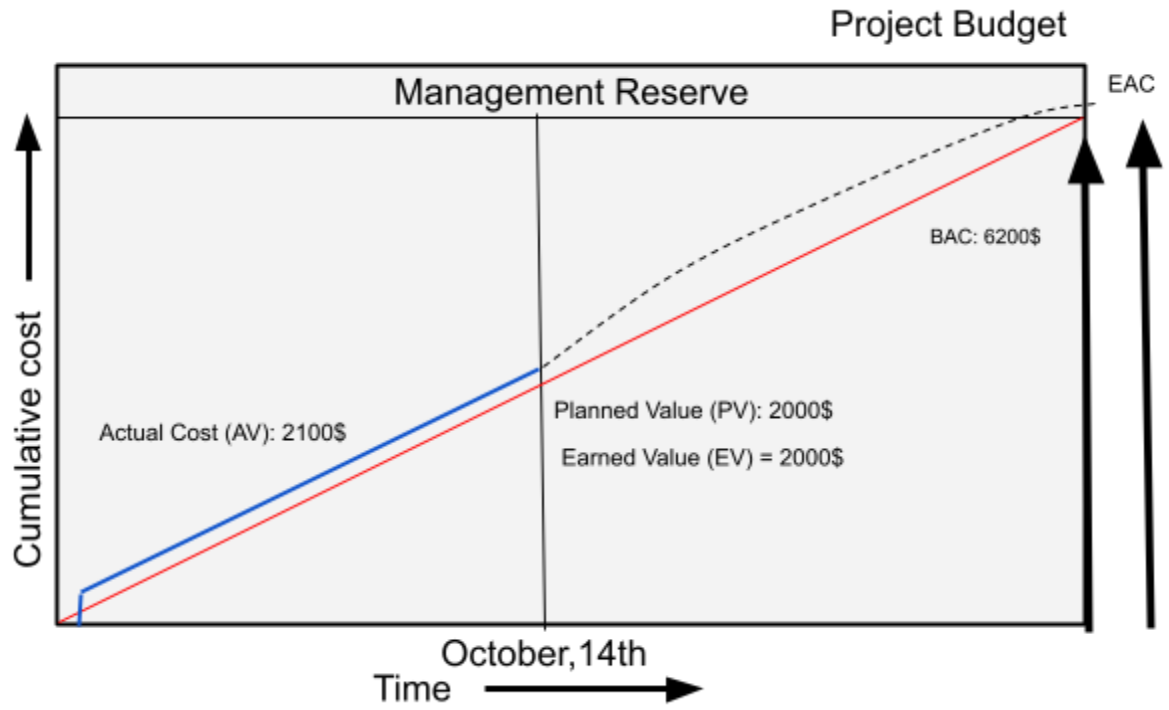

Figure 4: Baseline Cost Diagram

5. Human Resources

This section of the proposal will cover the project human resources and the person responsible and an approver for each activity will be assigned.

Activites	Responsable	Approver
Connect Speed Sensors	Wilson	Tyler
Code Speed Sensors	Tyler	Wilson
Test Robot Speed control	Tyler	Wilson
Connect Perimeter Sensors	Wilson	Tyler
Code Perimeter Sensors	Wilson	Tyler

Test Perimeter Detection	Tyler	Wilson
Connect Obstacle Sensors	Tyler	Wilson
Code Obstacle Sensors	Wilson	Tyler
Test Obstacle Detection	Tyler	Wilson
Combine all Sensors to Robot	Wilson	Tyler
Combine all Sensor Code together	Wilson	Tyler
Design Plow	Tyler	Wilson
Design Route	Wilson	Tyler
Test entire Robot	Wilson	Tyler

Table 2:Responsibility Assignment Matrix