MEGN540 Project Progress Report: Delivery Rover

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1. Problem Statement

2. Design Concept

We are building a mobile delivery robot. Upon activation, the robot will identify the person nearest to it, drive to that person, and deliver a payload. Many use cases exist for such a robot, including beverage and medication delivery. The robot's capabilities are relevant in industry, so building it will be a good experience for us. The system must have the ability to:

1. Listen for and react to an activation signal.
2. Identify persons in its FOV and target the nearest person to it (if any).
2. Drive to that person in a straight line on a flat, carpeted surface.
3. Stop upon arriving at the person and deliver the payload.

2.1. Sensors and Actuators

2.2. Custom PCB

3. Integration Plan

4. Schedule and Milestones

Initial Plan: We've planned our work/deliverables in two-week increments to keep tabs on progress and enable us to react quickly to any issues. Table 1 shows our milestones and current status. We have completed the first three, and are progressing on the remaining.

Table 1: Project plan and status.

Milestone	Date	Status	Description	Requirements
1	2024-02-07	✓	Material acquisition and planning	• Bill of Materials created • Ordered necessary materials
2	2024-02-21	✓	Software module design	• Project repo instantiated • Module specifications created • ROS framework installed
3	2024-03-06	✓	Prototype build and PCB design	• PCB design finalized • Materials assembled
4	2024-03-20	In Progress	Software implementation	• Visual odometry module implemented • Object detection module implemented
5	2024-04-10	In Progress	Software implementation	• Path planning module implemented • Motion control module implemented
6	2024-04-24	To do	Prototype refinement	• PCB installed/integrated • Path planning and motion control tuned
7	2024-04-30	To do	Deliverables	• Project is demonstrated to the class. • The project report is submitted.

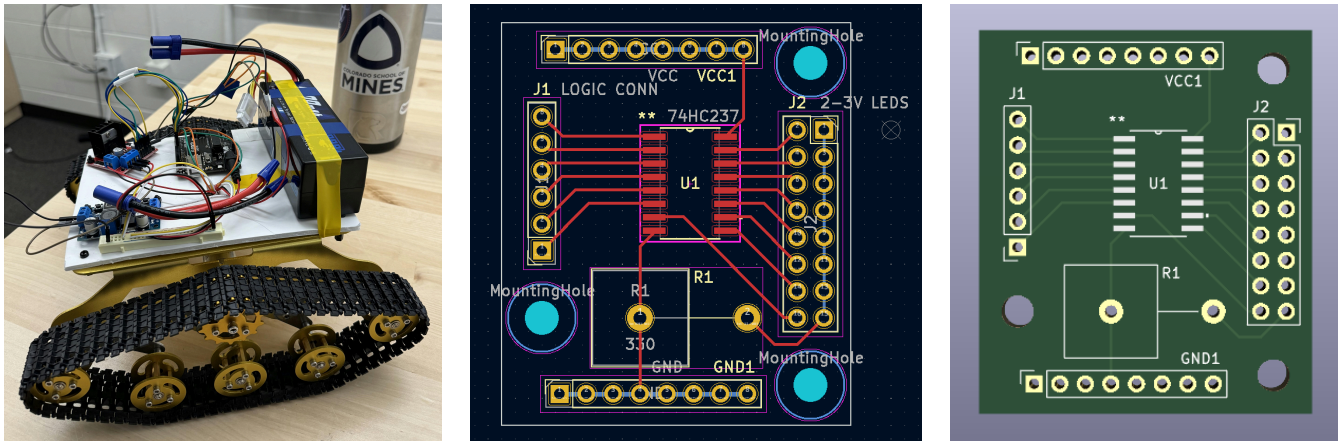

Figure 1: Completed works. (L) Prototype mechatronic system, (R) PCB design.

4.1. Work Split

4.2. Critical Paths

5. Budget Estimate

Budget: $300 ($100 per team member). Our team agreed on this as the upper limit, based upon initial exploration of components we know we need to purchase (chassis, Arduino, motors, and motor controllers) and our purchasing power. We own several more expensive components, including an NVIDIA Jetson Orin Nano and a Stereo RGB-D camera.

6. Risks

6.1. Technical

6.2. Programmatic

7. System Components

7.1. Sensing and Affecting

- **Sensors:** Stereo camera (RGB-D) for visual odometry, depth estimation, and object detection. Wheel encoders for motion control.
- **Affectors:** DC motors to power the robot's drivetrain. Servos to actuate the payload delivery mechanism.

7.2. Software

- Visual odometry module for depth perception and pose estimation.
- Object detection module for person identification.
- Path planning module for trajectory generation.
- Motion control module to power motors and follow the trajectory.

7.3. PCB

We will create a PCB with LEDs to indicate the system's state (powered on, identifying recipients, planning the path, and making the delivery). This PCB will allow us to build something useful for the robot while not greatly exceeding our current abilities.

8. Prototyping

All three team members are in Mechatronics and SLAM, and we have experience with all system components. We view this project as an opportunity to "put it all together" and feel confident in our ability to build a functioning prototype.