AUTONOMOUS PACKAGE DELIVERY ROBOT

Electronic hardware and software for efficient pathfinding system

Figure 1 : Complete System

ENGINEERING REQUIREMENTS

1) Ease of Use

Intuitive human-machine interface for setting destination and loading.

2) Edge Detection

Determines pathway bounds to maintain a safe distance from edges.

3) Emergency Shutdown

Implements intuitive emergency stop button and will shutdown if a collision is detected.

4) Lockbox User Safety

Safety feature that disables power under loading operation or unexpected system condition.

5) Object Avoidance

Navigates around stationary objects detected in the path and ensures safe zone operation.

6) Object Collision Prevention

Detects and appropriately responds to unavoidable objects in its path.

7) Pathfinding Software Implementation

Accurately follows a predefined path of at least 20 meters.

8) System Motion Control

Accurate movement control for moving forward, backward, left ,and right.

Oregon State University

INTRODUCTION

The purpose of the Autonomous Package Delivery Robot (APDR) project is to provide Oregon State University campus residents with a safe and autonomous package delivery service. This is the third year this project has been in development. The main design focuses for this project include an improved power management system, a more robust pathfinding software, and user safety. Several sensors, including LiDAR and a deep depth camera are used to track and map the robot's location. The framework for the mapping and navigation algorithms are provided by the Robot Operating System (ROS). The frame, motors, and batteries for this robot were recycled from an old electric wheelchair.

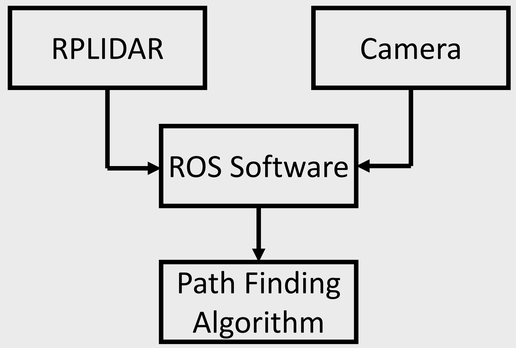

Figure 2 : Pathfinding Block Diagram

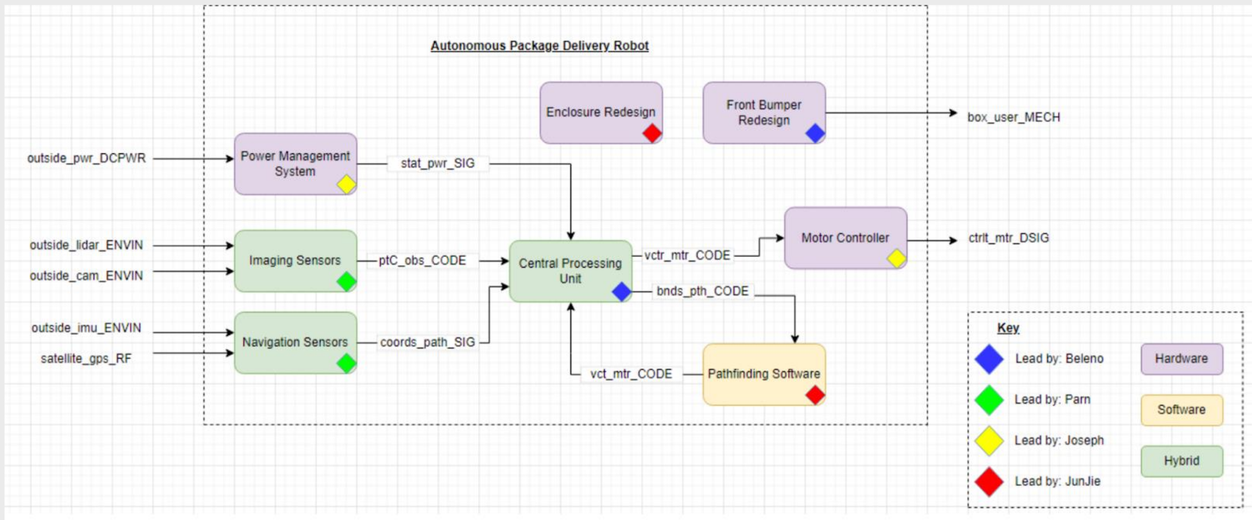

Figure 3 : System Block Diagram

SOFTWARE

Pathfinding

Pathfinding block finds the optimal route while avoiding obstacles. It ensures safe and efficient package delivery by guiding the robot through its environment using sensors, maps, and algorithms.

User interaction

Users input destination via an interface and the robot autonomously navigates to the destination, avoiding obstacles and adhering to constraints. Users can remotely monitor the robot's progress for efficient and convenient package delivery.

HARDWARE

Jetson Nano

Single board computer for the robot that processes all the data received from the sensors. Serves as core computational hardware.

LIDAR

Light detection and ranging. Used to remotely detect solid objects within the surroundings of the robot

Camera

Depth camera used to detect edges and objects in the path of the robot.

HIGHLIGHTED FEATURE

Efficient Pathfinding

Based on sensory input, the Autonomous Package Delivery Robot uses mapping algorithms to create a map of the robot's surroundings, which may include obstacles, boundaries, and target locations. Once the map is generated, the pathfinding block employs an A* algorithm implementation to compute the most efficient and collision-free path from the robot's current location to the destination.

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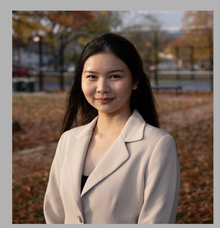

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