Robot use ROS to control the delivery and receiving of items in multiple directions.

CONTROL SYSTEMS AND INSTRUMENTATION ENGINEERING PROGRAM
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Introduction

Autonomous transport robots are a type of vehicle capable of moving along predefined routes automatically for transporting goods. This type of vehicle has been widely used in industrial logistics, such as pallet transportation. Therefore, this research aims to create an AMR (Autonomous Mobile Robot) that can move automatically without manual control.

Designed as a Mobile robot, it is intended for transporting goods while moving automatically. This includes developing a navigation system using lidar for mapping and identifying the robot's position on the map. It utilizes Mecanum wheels for movement and considers the load capacity using Load cells to prevent exceeding the robot's carrying capacity.

Its tasks include receiving and delivering goods or office equipment within the engineering school building autonomously. The goal is to assist in the automatic movement of personnel items within the building, have the ability to avoid obstacles, and implement a theft prevention and alert system while performing delivery tasks.

Methods

- The map is created by taking scan values from RPLIDAR S2E and creating Hector slam so that the program can specify the area that the robot can move. It is based on the ACD (Approximate Cell decomposition) Quadtree theory which states that black space is an impassable barrier. White space is open space that can go.

- The robot's locomotion method is omnidirectional using Mecanum wheels to support the movement.

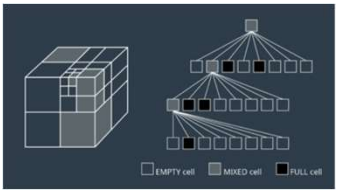


Figure 1: ACD Quadtree

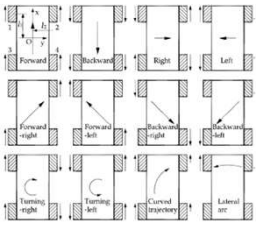


Figure 2: Omnidirectional

System Overview

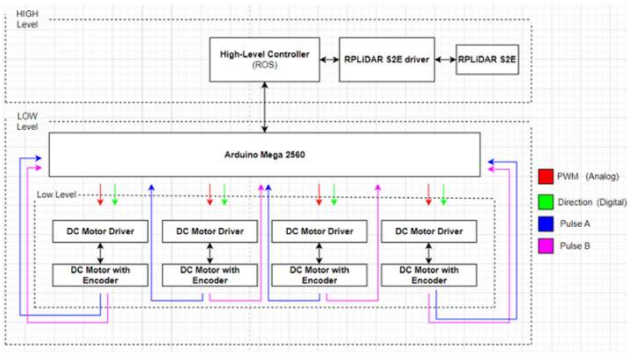


Figure 3: Side and top view of AMR

Results

Navigation: Maps that is 7th floor of CB4 can be created by RPLIDAR S2E and locations of transportation starting points and destinations point by point to point methods.

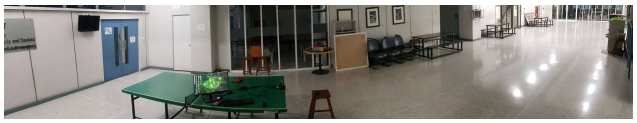


Figure 4: map of open space on the 7th floor.

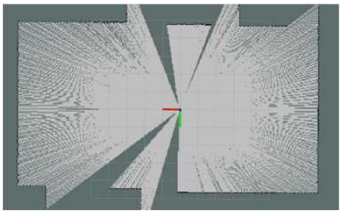


Figure 5: Hector SLAM of open space on the 7th floor.

Control speed and movement: The omni-directional movement experiment is designed to control the rotational direction of motors. The experiment involves designing motor movement synchronized with the motion of the vehicle as it moves in various directions. The results of the experiment conclude that all four motors can operate to move in the desired direction according to the turning pattern.

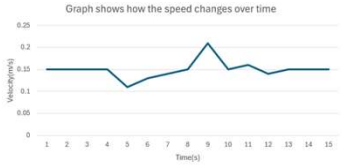


Figure 6: PID controller.

As the motor speed deviates from the setpoint, the PID controller adjusts the speed: it increases speed when it drops below the setpoint and decreases speed when it rises above, effectively maintaining it at the desired level.

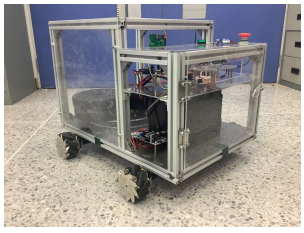
Carry Loads Guidelines:

Case 1: If the weight exceeds 10 kg, the robot will not move the delivery.

Case 2: To verify constant cargo weight during delivery.

Case 3: The robot moves to deliver items weighing more than 100 grams

Conclusion



- The robot can map and move along a specified path, and when sensors detect obstacles in the robot's path, the program will instruct the motors to change the speed of the robot, which will cause the Mecanum wheels to change. A path to avoid obstacles and move on to your destination. When receiving items to load, the weight will be checked before and every time along the way so as not to exceed the weight limit that the robot can carry.

Figure 4: AMR with RPLIDAR & Mecanum wheels

References

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