

ROBOTICS DOJO 2025

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Objective

Design and implement a mobile robot with object manipulation mechanism capable of navigating an unknown environment while simultaneously mapping it.

Importance.

robotics research, warehouse automation, rescue operations, and self-driving vehicles.

INTRODUCTION

The robot navigates unknown areas autonomously. It maps the environment in real time using SLAM. The conveyor system handles and moves objects. PiCamera allows machine learning tasks like object recognition. It is useful for warehouses, logistics, and automation.

METHODOLOGY

The robot uses ROS 2 Humble, LIDAR, PiCamera, and Raspberry Pi. Sensors collect data while SLAM builds the map. Machine learning processes camera images for object detection. The robot localizes itself and avoids obstacles. The conveyor transports items efficiently.

ROBOT DESIGN

The robot has four wheels and differential drive. LIDAR scans 360 degrees. PiCamera captures images for object detection. Ultrasonic sensors detect obstacles. The conveyor moves objects. Motors are controlled via L293D driver.

SLAM IMPLEMENTATION

The robot uses GMapping 2D SLAM. LIDAR scans create the map. Odometry tracks the robot's position. RViz displays live mapping. Machine learning identifies objects from camera data.

RESULTS

The robot maps the environment accurately. Obstacles are avoided. The conveyor moves items effectively. Camera and machine learning detect objects successfully. Real-time mapping and navigation work.

CONCLUSION

The robot navigates, maps, and handles objects. It detects items with machine learning. It works in real time for automation tasks. Future work includes 3D mapping and multi-robot SLAM.

