Ira A. Fulton Schools of Engineering
Arizona State University

LiDAR Stock Solutions:

Automated Inventory Sensing Robot

Mentor: John Lewis

Team 39: Colton Ard, Jacob Kaplan, Jesse Kinkead, Navdeep Singh, Anthony Velasquez

INTRODUCTION

Despite technological advances, nearly 80% of warehouses still rely on labor-intensive processes that result in inventory errors and operational costs that collectively exceed $1.77 trillion annually across the industry [1,2].

Project Objective:

Design, develop, and pilot-test an autonomous LiDAR-sensing mobile robot that accurately categorizes a variety of products.

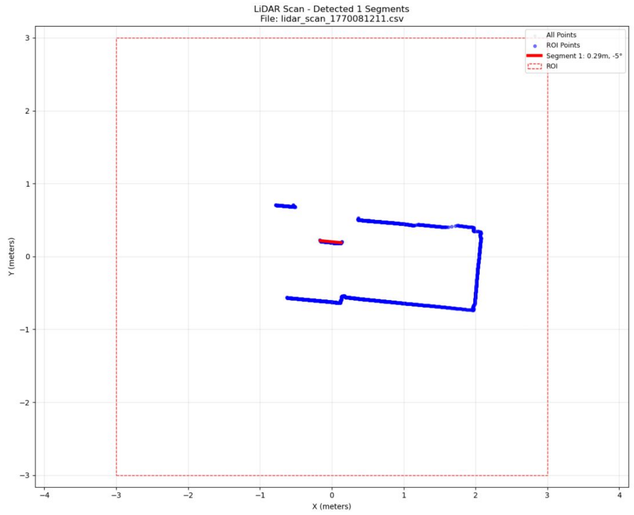
Autonomous Robot
Safely navigates a warehouse environment.
Performs real-time LiDAR scans

Data Processing & Alerts
Identifies low/misplaced inventory
Sends real-time alerts

Web-Based User Interface
Clean, browser-based dashboard
Simple access to inventory data

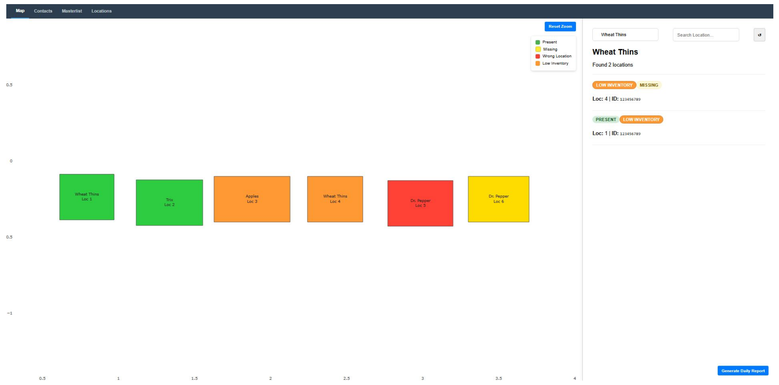
SYSTEM DESIGN

The system utilizes a ROS2 network on a Raspberry Pi 5, employing SLAM Toolbox and a PicoScan 150 Pro to create a 5 cm resolution occupancy grid. When a barcode is detected by the evdev integrated scanner, a custom algorithm isolates lidar clusters in a 90° field and identifies boxes on the map, transforming local coordinates into global warehouse coordinates using the TF2 library. Inventory data is logged to a CSV and displayed through a FastAPI web interface. For real-time monitoring, RViz overlays persistent markers, barcode labels, and measured dimensions onto the live SLAM map.



RESULTS

A robot capable of scanning and mapping boxes, and a web-based interface have successfully been created. misplaced and missing inventory is properly recorded and alerts sent.



CONCLUSION

- Affordable, scalable automated inventory system
- Robot scans locations, identifies products, logs to CSV, updates UI
- Finds low, missing, and misplaced items

References:

[1] IHL Group, "Inventory distortion: The good, the bad and the ugly," Jul. 2023. [Online]. Available: https://www.ihlservices.com/news/analyst-corner/2023/07/inventory-distortion-out-of-stocks/. [Accessed: Oct. 10, 2025].

[2] K. Wolfenstein, "Warehouse retrofit and warehouse automation in the USA – Over 80% of warehouses today have no automation whatsoever," Xpert.Digital, Jan. 5, 2025. [Online]. Available: https://xpert.digital/en/warehouse-automation-usa/. [Accessed: Oct. 10, 2025].