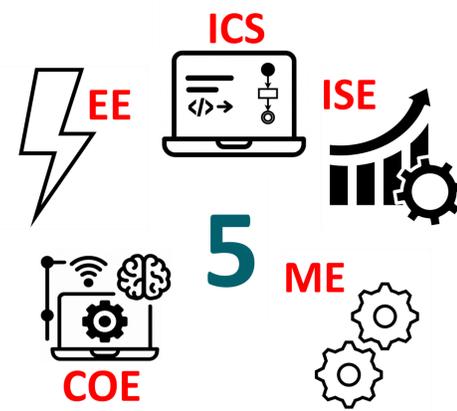# Library Bookshelf Managing Robot

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Coach: Dr. Mohammad Al-Yagoub

Introduction

Our Library Bookshelf Managing Robot solves the issues of customer frustration when locating books in libraries by automatically retrieving books from anywhere. User-friendly, it's ideal for libraries and stores like Jarir. As automation demand grows, our solution enhances user experience. The future of bookstores and libraries starts here.

Problem Statement

Manual book retrieval in libraries and bookstores causes delays, errors, and staff overload. There is a need for an automated solution that improves accuracy, efficiency, and user experience.

Specifications

- Lifts books ≤ 750g (weight), ≤ 3cm (thickness)
- Application: ≤ 2 platforms
- LiDAR localization error ≤ 30cm
- LLM-processed OCR reading accuracy ≥ 85%
- Battery ≥ 6 hours
- Simulation to cut workflow time 10%

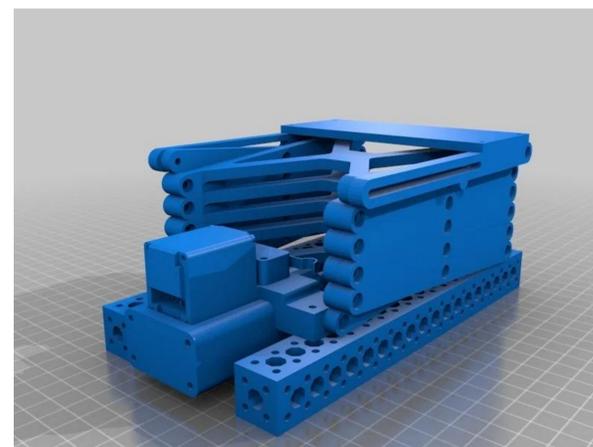## Constraints

- Obstacle detection ≤ 30 cm
- Material sustain temperatures of 10 C to 40 C
- Shelf ≥ 30 cm & ≤ 150cm
- 90% of computation to be done locally (microcontroller)
- Fits aisles 1 – 2.5 m

Integrated Specifications

- Design structure ≤ 30 KG
- Average book retrieval time ≤ 5 mins
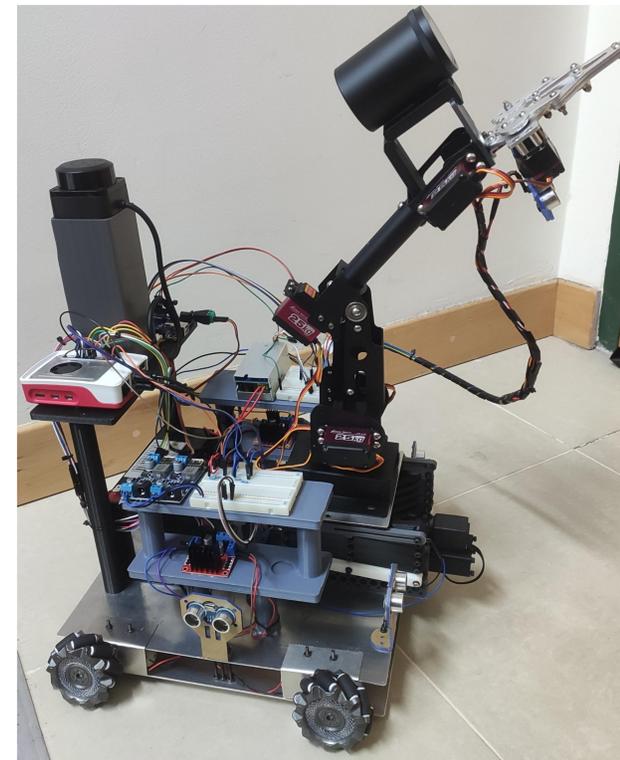- Book recognition accuracy ≥ 90%
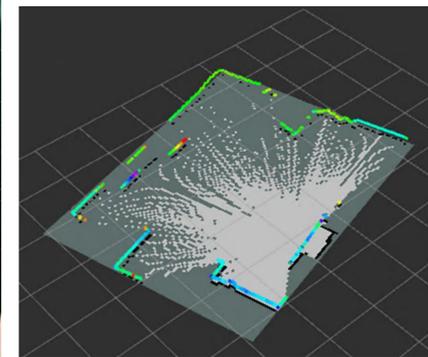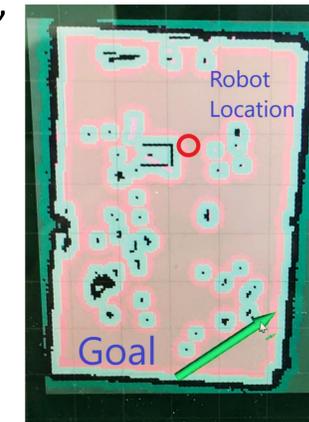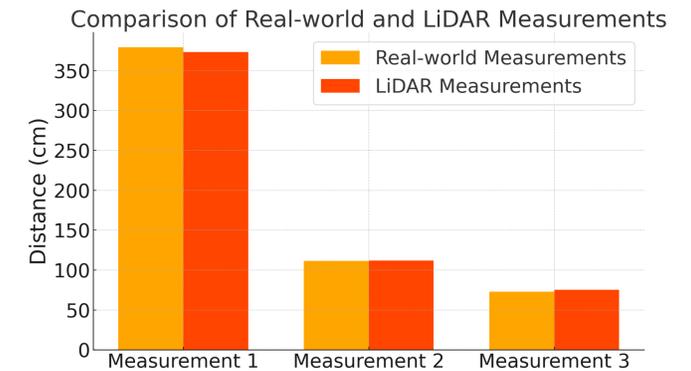- Noise level ≤ 5

Custom Scissor Lift

Prototype Design

Consists of:
- Custom scissor lift, aluminum base
- Sufficient motors, lead acid battery
- Raspberry Pi 5, Arduino Uno
- Application software
- LiDAR: floor mapping (SLAM), localization, and navigation
- Computer vision, OCR

Testing/Validation

Comparison of Real-world and LiDAR Measurements

Conclusion

Reliable computer vision and OCR for identifying book, accurate localization and navigation using LiDAR, with an application and strong performance in testing (having met almost all specifications), the robot accurately and quickly retrieves books.