RoboMapper: An Autonomous Robot Navigator

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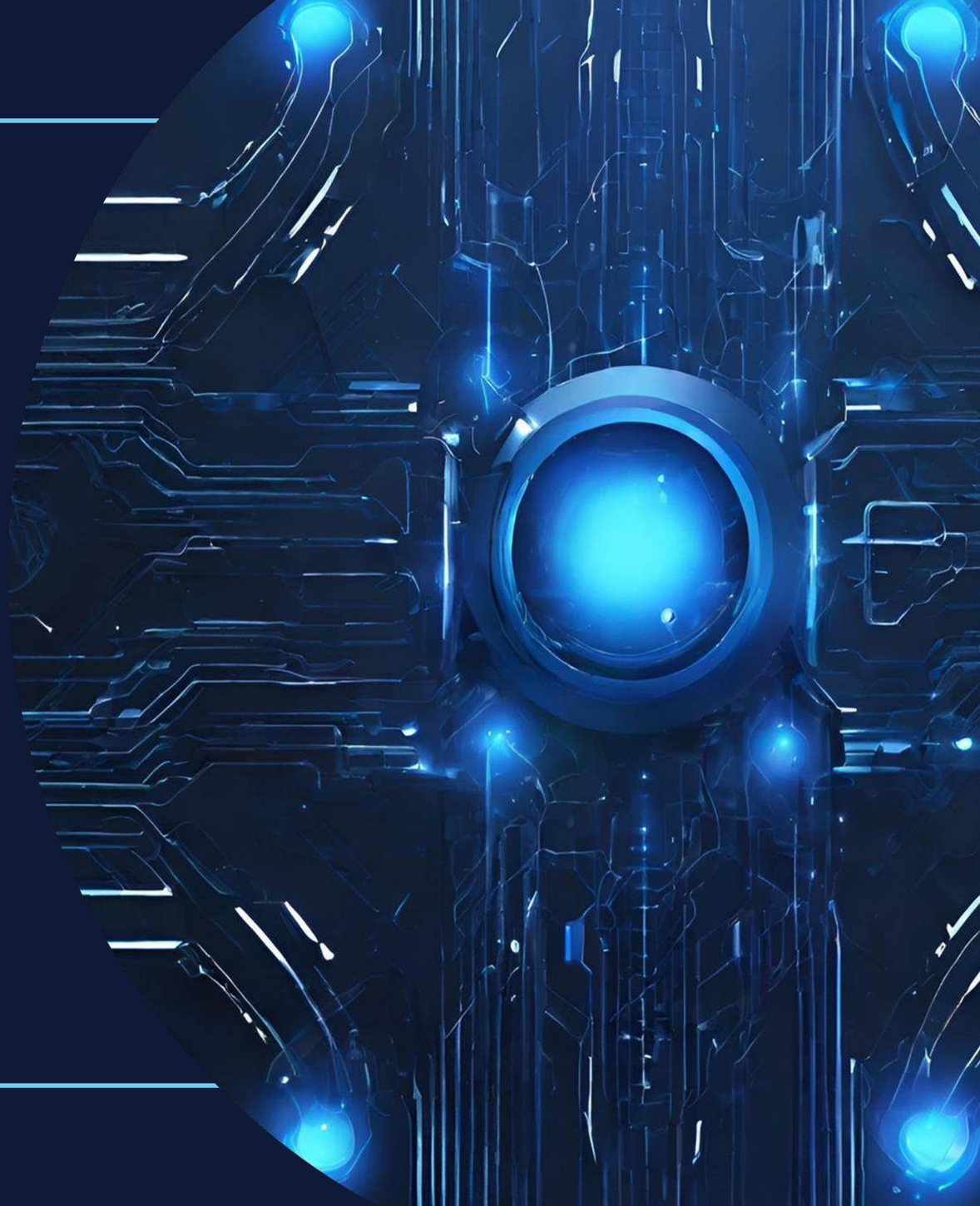
Agenda

- Introduction to the project
- Importance of Autonomous Navigation
- Literature review
- Project Methodology Overview
- Challenges
- Key Concepts and tools
- Results
- Future Enhancement
- Conclusion
- Reference

Introduction

RoboMapper is an autonomous robot capable of navigating and mapping open areas while avoiding obstacles.



Importance of Autonomous Navigation

- Search and Rescue operations in hazardous areas.
- Environmental Monitoring
- Precision Agriculture

Literature Review

- **YOLO v3-Tiny: Object Detection and Recognition using one stage improved model:** This paper introduced an improved model for object detection and recognition, offering valuable insights for implementing the YOLOv3 algorithm in this project. (Link)

- **Autonomous Mobile Robot Navigation in different Environments: Mapping, Localization, and Planning:** This has paper discussed about strategies for autonomous navigation in indoor environments, providing insights into mapping, localization, and planning techniques relevant to this project. (Link)

- **ROBOG: An autonomously navigating vehicle based on road detection for unstructured road:** This paper has explored a vehicle navigation system based on road detection, offering valuable algorithms for obstacle detection and navigation in unstructured environments. (Link)

Project Methodology Overview

YOLOv3 You Only Look Once Algorithm

It is a deep Learning model used for target detection

Mean Average Precision: 96%

Stereo Camera and OpenCV

This enables robot to perceive the environment in 3D for Depth Mapping and Obstacle Avoidance

Autonomous Robot Navigation

The robot is fed information related to latitude and longitude about corners of area for Navigation

Challenges

- Creating Training data for YOLO model
- Calculating depth map is Computationally expensive

Key Concepts and Tools used

- **Pybullet** for creating a simulated environment.
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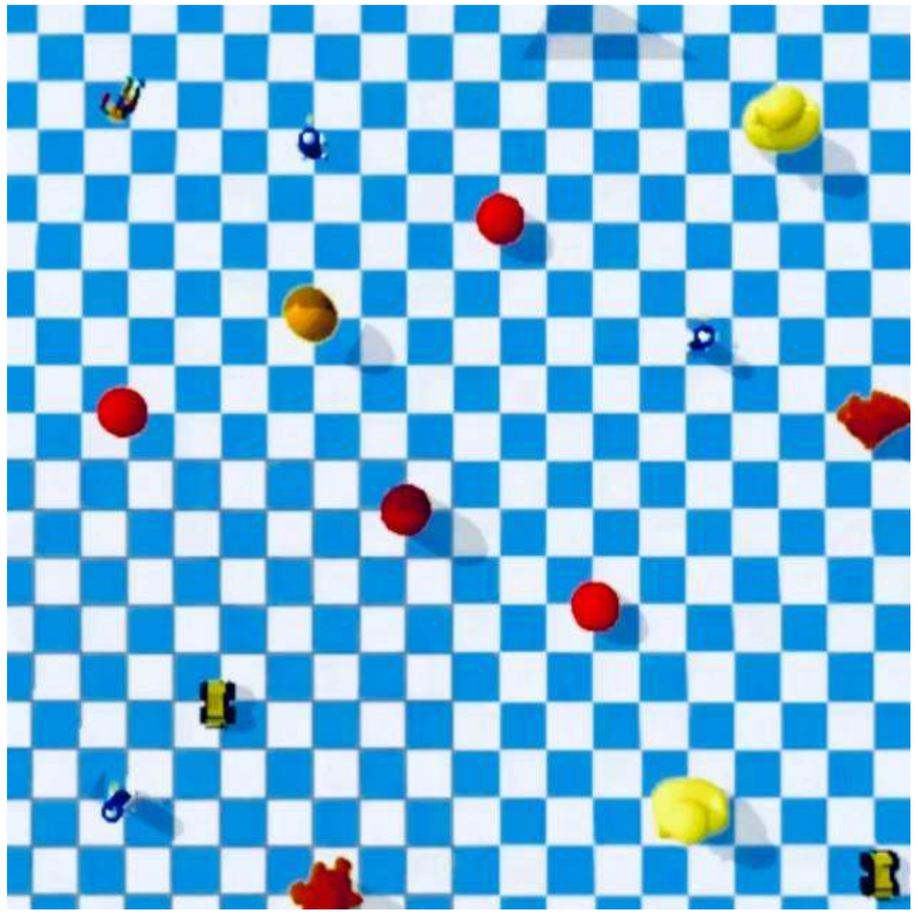
- **OpenCV** for camera calibration and depth map generation.
- **ImageAI library** for implementing the YOLOv3 model.
- **LabelImg tool** for annotating training data.
- **Google Colab** for training the deep learning model.

Results



Future Enhancement

- **Multi-Level Mapping:** Develop multi-level mapping capabilities to handle complex environments with multiple floors or levels.
- **Environmental Sensing:** Enhance the robot's environmental sensing capabilities by integrating additional sensors, such as gas sensors for detecting pollutants or environmental sensors for monitoring temperature and humidity.

Conclusion

RoboMapper has achieved successful simulation overcoming challenges in object detection, obstacle avoidance, and mapping within a virtual environment.

References

- https://pybullet.org/
- https://opencv.org/
- https://github.com/OlafenwaMoses/ImageAI (Image AI library)
- https://github.com/tzutalin/labelImg (LabelImg tool)
- https://arxiv.org/abs/1808.01974

Thank you!