Collision Avoidance System For Autonomous Vehicles

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ABSTRACT

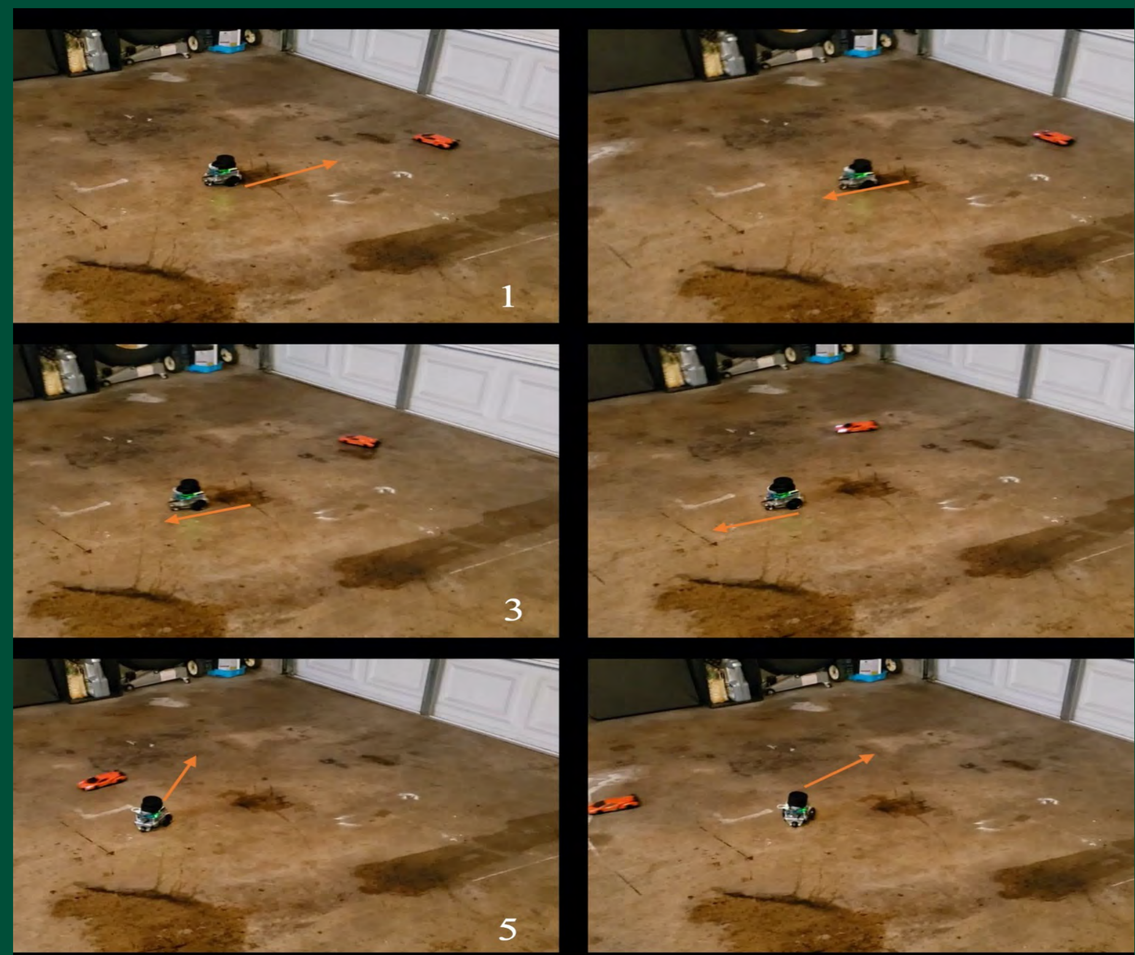
Collision Avoidance System (CAS) for autonomous vehicles is a research of broad and current interest. The purpose of CAS is to safely prevent vehicles from colliding into any obstacle present on their path. This collision avoidance is especially important when an environment is indoor as well as complex and clustered. One of the most important factors for an autonomous air and ground vehicles is safety. The purpose of this thesis is to address the safety aspect of CAS using a sensor that detects non-circular obstacles in a dynamic indoor and unknown environment. The importance of this factor was studied using a lidar sensor, proving its ability to be quick and accurate in avoiding non-circular dynamic obstacles in order to find the safest path possible. Velocity obstacle (VO) method was used for the dynamic environment to test the validity. A 2D lidar obstacle avoidance scanner was mounted on a parallax robot where the robot employed the velocity obstacle method. This method was used for a dynamic environment to assess its validity in safely avoiding obstacles in a real-world scenario. The connection between the robot and a lidar sensor was built through Arduino Uno, the brain of the robot . This approach shows that lidar sensors are able to collaborate with the path planning method in micro robots to function as a micro collision avoidance system which can prevent collisions. The approach presented here is be effective in larger dimensions as well.

INTRODUCTION

Collision Avoidance System (CAS) or obstacle detection carries great importance for autonomous vehicles. It uses path planning to generate a series of movements to guide a robot from its starting point to the goal point. Computer vision systems are expensive and powerful at object detection for complex environments. LiDAR (Light Detection and Ranging) is one the major sensor systems that can be used in obstacle detection.

EXPERIMENTAL

Figure 1: (Right) The graphs show the action taken by the robot every time it detects an obstacle



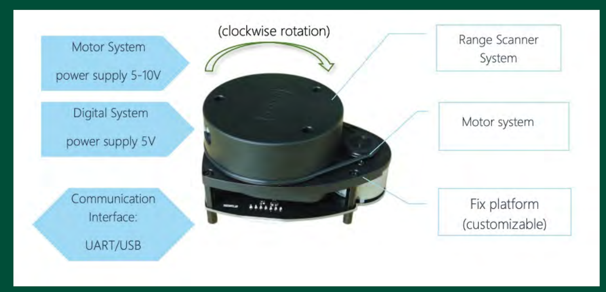


Figure 2: RPLIDAR A1M8

RESULTS & ANALYSIS

RPLIDAR A1 Detection

- Obstacles are detected and avoided by the RPLIDAR sensor
- The environment scans show that the RPLIDAR A1 is creating a collision cone around the obstacles once it detects them .
- The robot takes action when obstacles detected.

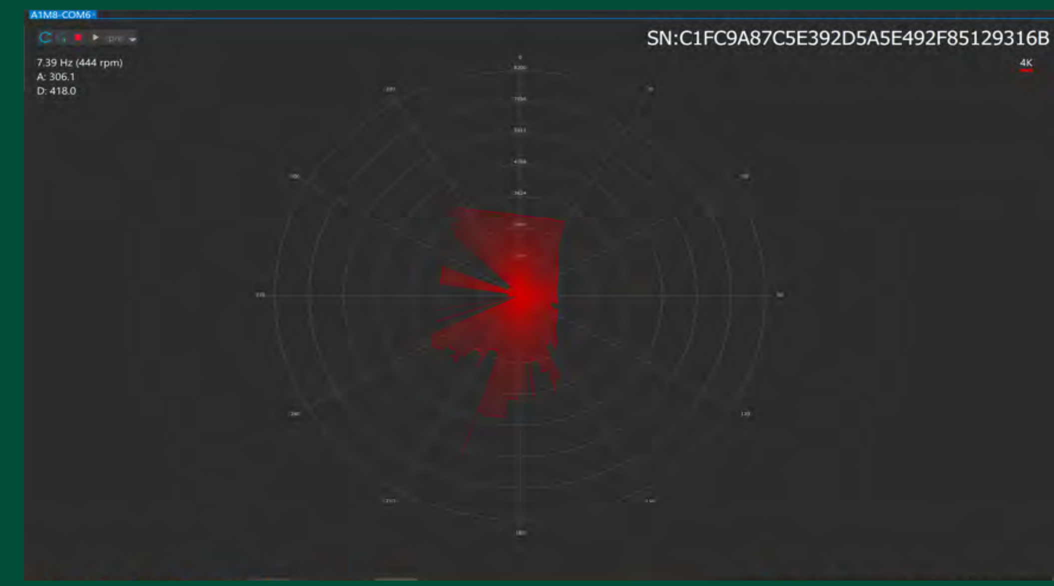
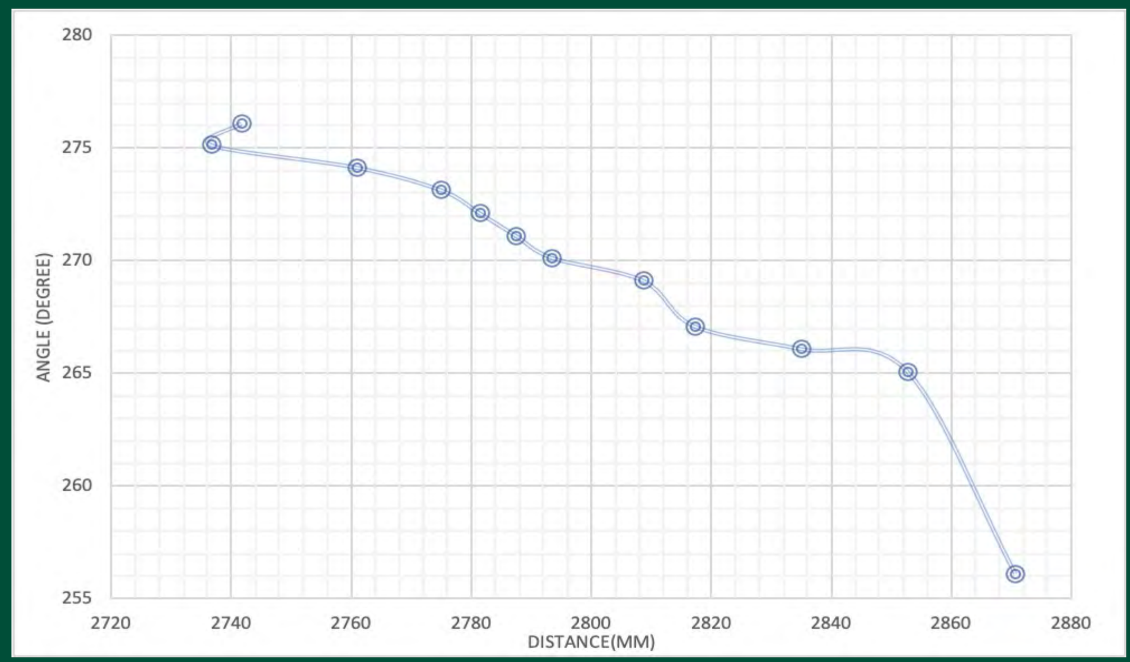


Figure 3: (left) the outline of the environment is scanned by RPLIDAR A1 sensor.



a

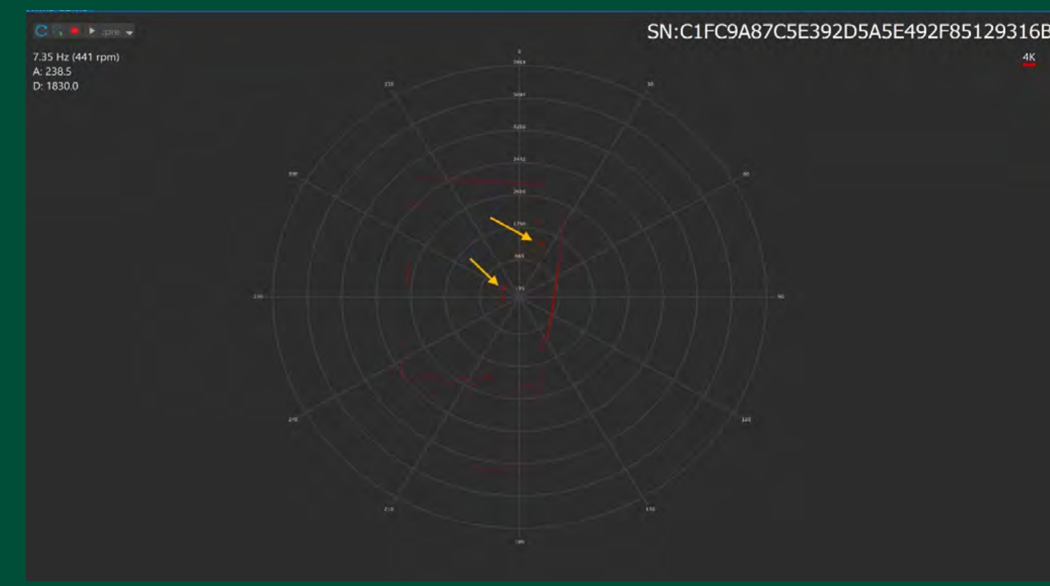


Figure 4: Obstacles are pointed out with yellow arrows. RPLIDAR obstacle detection graph from Robostudio.

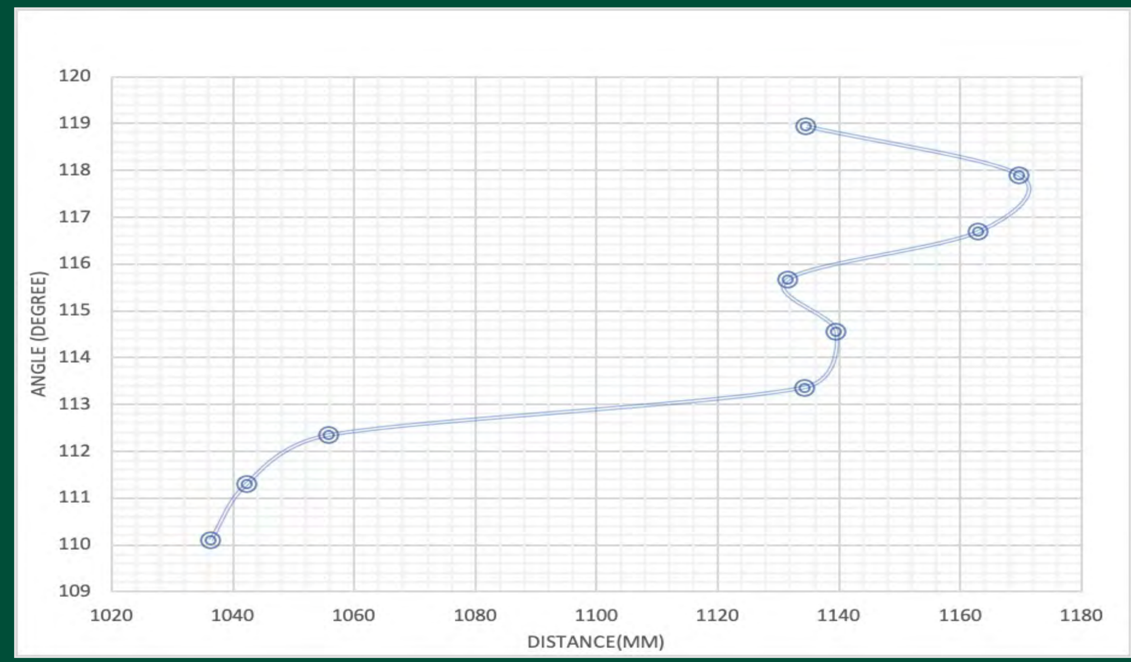


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Figure 5a 5b: (Above) Robot's path while avoiding obstacles.

CONCLUSION

The experience with this research shows:

- **Laser rays from the LiDAR sensor can be used with the velocity obstacle method to find the distance of the objects.**
- **The LiDAR method used in this research shows accuracy of the LiDAR sensors in detecting obstacles for collision Avoidance systems CAS.**
- **Since real life environments are oftentimes very complex and clustered, to solve this, the laser sensors are very accurate in sending and receiving data.**
- **It is very important to receive accurate data in order to achieve safety in real life vehicles.**
- **LiDAR sensors can operate successfully in unknown and unpredictable environments.**

REFERENCES

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