

ABSTRACT

This research aims to develop a mapping and navigation system utilizing the LIDAR A1 sensor integrated with SLAM (Simultaneous Localization and Mapping) and GMAPPING algorithms. The system is designed to operate on the Raspberry Pi 4B platform, Gmapping performed well outdoors but showed minor distortions due to uneven terrain, while indoor mapping exhibited higher accuracy and resolution. Wall detection achieved 90% accuracy indoors and 75% outdoors. Debris detection was 80% accurate indoors and 60% outdoors Human detection remained below 10% in both indoor and outdoor environments, largely due to the LiDAR A1's limitation to 2D scanning, which cannot capture height (Z-axis) information, making it difficult to differentiate humans from other obstacles due to LiDAR A1's 2D limitations. Processing time was faster indoors (100 ms) than outdoors (300 ms).

Keywords: LIDAR, SLAM, GMAPPING, DBSCAN, RANSAC, Raspberry Pi 4B.