

ABSTRACT

The utilization of Light Detection and Ranging (LiDAR) technology has made significant progress in various sectors, especially in improving navigation, perception, and safety. This research develops a flexible 3D LiDAR system integrated with an Edge Tracking Algorithm (ETA) to improve the efficiency of scanning and data processing. Unlike commercial 2D LiDAR systems that scan the entire environment, this approach focuses on relevant objects, reducing unnecessary data collection and processing. The ETA algorithm dynamically manages the LiDAR motion, focusing the scan on object edges and adjusting the scanning region based on significant distance changes. Experimental results show a reduction in data processing time of up to 85.57% over the full scan method, with accuracy remaining above 82.59% on objects with complex geometry. This efficiency makes the proposed system highly suitable for real-time applications in robotics and other fields that require fast and precise environment mapping.

Keywords: 3D LiDAR, Edge Tracking Algorithm, Region of Interest(ROI), Object Scanning, Data Processing Efficiency.