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Topic of the Research: Design and Development of IoT Based Hybrid Navigation System for Automated Guided Vehicles (AGV's)

Keywords: Automated Guided Vehicles (AGVs), Internet of Things, Hybrid Navigation System, Obstacle Avoidance, Path Planning Algorithms, Multi-Sensor Fusion

FINDING

This research focuses on developing intelligent IoT-based hybrid navigation systems for Automated Guided Vehicles (AGVs) operating in static and dynamic environments. The study emphasizes key challenges of path planning, localization, mapping, and obstacle avoidance to improve autonomous navigation. An omnidirectional AGV equipped with specially designed mecanum wheels was developed, supported by kinematic and dynamic modelling, sensor integration, and real-time controller implementation.

Several path planning algorithms, including A*, PRM, RRT, Bi-RRT, and the proposed Hybrid Modified A* (HMA*), were implemented for static environments, while D*, APF, DWA, and the proposed A*-DWA Hybrid Optimization (ADWA-HO) algorithm were applied in dynamic scenarios. Results show that HMA* and ADWA-HO significantly outperform existing algorithms in path length and motion time, closely approximating real-world conditions.

The study also introduces Hybrid Fuzzy and Cascade Neuro-Fuzzy architectures, where the proposed Cascade Neuro-Fuzzy demonstrates superior navigation accuracy and efficiency in unknown, indoor, and complex environments. Further, multi-sensor fusion integrating vision,

LiDAR, IMU, and ultrasonic sensors enhances mapping precision, localization accuracy, and robustness compared to individual sensing methods.

Simulation and real-time validation using MATLAB, ROS, and AGV hardware confirm the effectiveness of the proposed hybrid navigation framework for intelligent autonomous AGV applications.