



Automated Guided Vehicle for Inventory Management

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ABSTRACT

The initiative centers on the development and production of an Automated Guided Vehicle (AGV), designed to transform logistics across multiple industries, such as manufacturing, healthcare, and hospitality. As businesses increasingly aim to enhance their operational efficiency, automating transportation becomes vital for lowering labor expenses and minimizing the time delays associated with human involvement. The AGV presents considerable benefits in material handling, facilitating the effective and dependable movement of goods.

Fitted with cutting-edge sensors, the AGV can navigate autonomously within its surroundings, identifying and circumventing obstacles in real time. This feature guarantees safe functionality in dynamic environments, making it applicable in a variety of sectors. For example, in healthcare settings, the AGV can deliver medical supplies and equipment, reducing wait times and improving patient outcomes. In educational facilities, it can transport documents between offices, optimizing administrative workflows. The AGV's adaptability also extends to shopping centers, hotels, banks, and corporate offices, where it can efficiently distribute items, thereby enhancing service delivery. Powered by a battery-operated remote sensing system, the vehicle is designed to follow designated routes indicated by QR codes. This approach ensures precise navigation and simplifies the complexities often associated with traditional routing methods. By incorporating advanced technology, the AGV not only boosts operational effectiveness but also fosters a more organized and systematic logistics framework.

In summary, this project is set to significantly influence various sectors by meeting the urgent demand for automation in material transport. As industries continue to progress and adopt technological innovations, the deployment of AGVs will be essential in optimizing operations, ensuring prompt deliveries, and ultimately enhancing overall productivity.

Keywords: Logistics Optimization, Material Handling, Real-Time Navigation, Automation.

1 Introduction

The growing need for enhanced efficiency and cost savings across various sectors has spurred remarkable progress in automation technologies. Automated Guided Vehicles (AGVs) have surfaced as a revolutionary approach to improving logistics and material handling operations. Equipped with sophisticated sensors and navigation systems, AGVs can independently transport goods, leading to a decrease in labor expenses and processing durations linked to manual handling



(Baker et al., 2020). These vehicles possess the ability to identify and circumvent obstacles while following designated routes through technologies like QR code recognition (Wang & Chen, 2021). As industries from manufacturing to healthcare increasingly implement AGVs, the opportunity to boost operational efficiency becomes more evident. This paper intends to examine the design, functionality, and applications of AGVs, underscoring their importance in contemporary logistics

2 Recent Works

Numerous research efforts have emphasized the role of Automated Guided Vehicles (AGVs) in the realm of industrial automation. For example, Kim et al. introduced a deadlock prevention algorithm specifically for AGVs to ensure uninterrupted workflow, while Hasdak et al. developed autonomous vehicles focused on minimizing road congestion and accidents. Although these earlier studies offered essential insights into AGV design, they necessitated additional advancements for practical commercial use.

3 Proposed Work Explanation

The AGV employs a line-following technique combined with RF control, enabling it to navigate established routes or be directed from a distance. It features essential mechanical elements, including the chassis and a differential steering mechanism, alongside electronic components like an Arduino Nano controller, ultrasonic sensors, and RF transceivers. Designed for durability and user-friendliness, the AGV can support a payload of up to 120 kg, making it a robust and scalable solution for commercial applications.

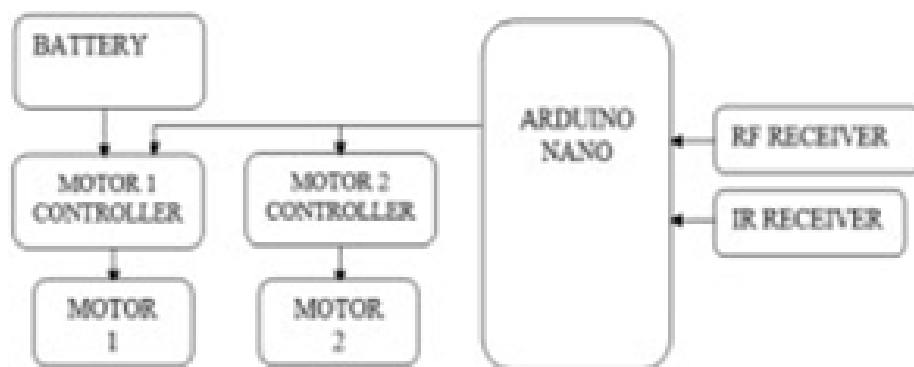


Figure 1: Proposed block diagram

4 Mathematical Expressions and Symbols

Energy requirement (E): $E = P \times T$

Battery capacity (C) in Ampere-hours (Ah): $C = E/V \times \eta b C$

Torque Requirement for the Motor: $\tau = F \times r$



5 Results and Discussion

Initial tests demonstrated the AGV's ability to navigate autonomously, detect obstacles, and adjust its path accordingly. The system's line-following capability was tested on a designated track, where it maintained accurate path-following with minimal deviation. Results show that the AGV's line-following sensors and RF controls effectively managed the vehicle's route and speed. Future improvements could focus on increasing the range and accuracy of obstacle detection, enhancing reliability in dynamic environments

Preparation of Figures and Tables

Authors are supposed to embed all figures and tables at appropriate place within manuscript. Figures and tables should neither be submitted in separate files nor add at the end of manuscript. Figures and Tables should be numbered properly with descriptive title. Each Figure/Table must be explained within the text by referring to corresponding figure/table number. Any unexplained or unnumbered Figure/Table may cause rejection of the paper without being reviewed.

6 Conclusions

This AGV design successfully addresses the need for an automated material handling solution, combining effective navigation, payload capacity, and user-friendly operation. By implementing line-following and RF control, the AGV is suited for a range of industrial applications, enhancing productivity and reducing human intervention. Future developments could include integrating advanced sensors and refining software algorithms to extend its capabilities.

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