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Review on Check Weighing Automatic Guided Vehicle

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REVIEW ON CHECK WEIGHING AUTOMATIC GUIDED VEHICLE

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Abstract

In the current industrial development, Automatic Guided Vehicle (AGV) / Autonomous Mobile Robot serves a major role to improve intralogistics and material handling. However, for system integrators, the choice and effective deployment of improved, suitable and reliable communication and control technologies for these unmanned vehicles remains a very challenging task. Specifics of Check Weighing AGVs depend on the sensitivity of the load cell that has been integrated and the sensitivity of the magnetic tape scanner. In this paper, a review of Check Weighing AGV is presented. The paper consists of the development and fabrication of Check Weighing AGVs which plays a primary role in intralogistics and material handlings in storage facilities of industries. With the help of Check Weighing AGVs, one is able to give weight limit / weight of the product to be moved in intralogistics of storage facilities which improves the trust over the product of the company. The paper also presents a thorough discussion of areas in need of the Check Weighing AGVs and their major purpose in the current automated world.

Index Terms: Automatic Guided Vehicles (AGV), Magnetic Tape, Magnetic Tape sensor, Load cell, Dynamic Weighing, Integration.

Introduction

The first known Automated Guided Vehicle (AGV), was introduced by Barret Electronics of Northbrook, Illinois, USA in 1953 and since then, AGVs have been used extensively to simplify intralogistics and material handling processes in industrial environments. Also, in the past few decades, Autonomous Mobile Robots (AMRs) have continued to be widely integrated and used in industrial environments. AMRs are often taken to indicate material handling vehicles that can autonomously navigate from place-to-place to accomplish specific tasks. They are usually in the form of robots' arms and actuators that are built on top of mobile platforms. AGVs on the other hand are most often used in industrial applications to move materials around the manufacturing floor or in a warehouse. In some instances, an AMR can be constructed with an AGV serving as the mobile base to accomplish set objectives. In most modern applications however, both AMRs and AGVs are often used interchangeably to mean autonomous devices that can accomplish industrial tasks which can include material handling, research activities, collaborative work with humans (cobots), or cooperative activities with another AGV or AMR. In the case of AMRs, the mobile base and the robot arm can be viewed as separate subsystems that collectively form the complex AMR system. The base, which can be an AGV, is often used to cart, dock or park the robot arm to a location where the arm is needed to accomplish a specific task. Thus, in general, AMRs are an advanced form of AGVs; and they can be integrated in a factory environment without any supporting infrastructure, such as wires, optical markers, magnets etc. An AGV often must navigate with the aid of supporting infrastructures while an AMR can autonomously navigate using only onboard intelligence. In view of their wide range of uses and applications for smart manufacturing, AGVs and technologies that support them have been projected to generate close to $7 billion (USD) in revenue by the year 2022. Also, AGV and AMR technologies have been projected to become pivotal for actualizing smart manufacturing. They will also be central to the success of factory of the future (FoF) initiatives in several factories around the world.

Methodology

In order to achieve the above purpose, in this paper the following procedure has been carried out

- Literature review concerning development of AGVs in the current world.
- Literature review concerning AGVs used in intralogistics.
- Literature review concerning Magnetic Tape guidance.
- Literature review concerning weighing mechanism to be used in AGV.
- Literature review concerning variation between static weighing and dynamic weighing

Overview of AGV

[1]The process of selecting an appropriate AGV begins with defining the task at hand. AGV for industry can be divided into the following categories:

- Towing Vehicles
- Unit Load Vehicles
- Pallet Truck
- Fork Lift

AGV NAVIGATION SYSTEMS:

[1]There are four main forms of navigation used by AGVs today. The system chosen is influenced by the layout of the environment and the task required.

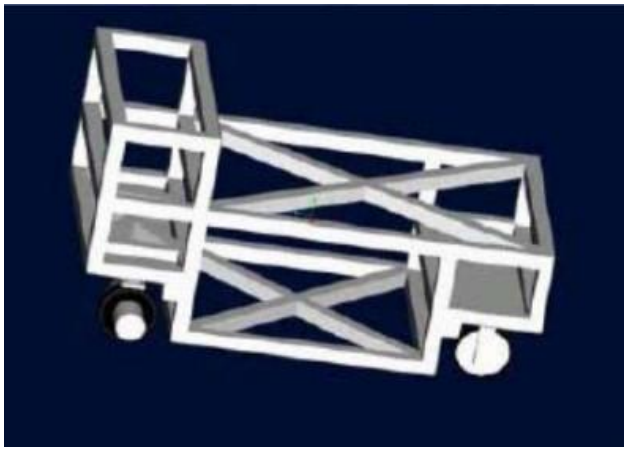
- Laser Guidance
- Line Following Guidance
- Magnetic Spot Guidance
- Barcode Guidance

	Laser Guidance	Magnetic Spot	Line Following	Barcode Guidance
Cost of installation	High	Low	Low	Low
Ease of Installation	High	High	High	High
Complexity	High	Low	Low	Low
Flexibility	High	Medium	Low	Medium
Deviate from routes	Yes	Yes	No	No
Efficiency	High	Medium	Low	Medium
Ease of expansion	High	High	Low	High

Fig.1 Guidance System Comparison Table [1]

AGV Design

[2]The design of the AGV represents a large role in the tasks to be performed. The central elements of the vehicle perform the actual transport task. Other elements are used as input or active signal elements of the AGV. All of these correspond to the central factor and the combination of all factors leads to the actual performance of the AGV missions.



Fig,2 AGV frame design [2]

Applications of AGV

The main use of AGV is where it requires processing tasks. There are many industries that use AGVs to transport humanless materials from one fixed place to another. The types of industries that can use AGVs are as follows:

- [2]The agricultural industry uses the light load transport AGV to process seeds from small flat pots on the farm. It is very difficult to use the AGV in underground mining industries due to the imprecise GPS system, in which case the laser target AGV is very useful. There are a number of other industries where a fresh idea of transportation and handling needs could facilitate AGV adoption.
- [2]Industries include heavy manufacturing, light manufacturing, food processing industry, petroleum and refining industry. These are the industries that make extensive use of AGVs. The first AGV was developed in the secondary industry. Then, based on the mission requirements and environmental conditions, the researcher proposed and developed an AGV for use in other industries. Today, AGVs are used not only in secondary industries but also in tier 1 and tier 3 industries.
- [2][4]Industries include healthcare such as medical care and hospitals, pharmaceuticals, waste treatment industry, hotels and restaurants. These are industries that are adopting AGVs for multiple purposes. Some of these industries already use AGVs, but there's a change in the environment everywhere, so it needs special-purpose AGVs in most places.
- [3]AGV systems are widely used in logistics systems. Technology development related to the AGV system which includes vehicle systems, vehicle controls, navigation, location and communication with supervisory control. An AGV navigation system may include data collection, decision-making and material control systems. Its Navigation methods can be developed using fuzzy logic based on a neural network where the angle and distance of Obstacles are measured to generate speed and steering angle.

Magnetic Tape Guidance

- [1]The vehicle will follow a track that is detected using a magnetic stripe or a spotlight placed on the ground of the active area. The routes the vehicle will take must be planned in advance as the AGV will not be able to deviate from the routes defined by the magnetic stripe.
- [1]The magnetic guide sensor installed under the AGV detects the magnetic tape as it moves. The sensor can determine the position of the vehicle relative to the range, and it will use input from the sensor to power the appropriate wheels within the predefined tolerances of the track. When the sensor starts to detect that the AGV is out of lane, it adjusts the power supplied to the steering engine and readjusts the vehicle in the lane.
- [3]Magnetic tape is placed on the ground or buried in a 10mm trench; not only provides paths for the AGV to follow, but also provides bands in different combinations of polarization, sequence, and distance placed along the track telling the AGV to change lanes, accelerate, slow down, and stop.

Fig.3 Magnetic Tape and sensor [1]

Obstacle Detection

[1]Obstacle detection and docking AGV will be equipped with a set of sensors to work in conjunction with navigation systems and position sensors such as magnetic field guidance sensors or laser scanners.

Weighing Mechanism

[5][6][7]Demand for digital weighing machines is growing for companies dealing in measuring items as they provide precise and accurate measurements of the weight of objects. Digital scale for accuracy and efficiency in measuring the weight of items, giving satisfaction to producers/sellers and buyers.

Load Cell

[6][7]Force sensors or Load cells, also known as transducers, convert mechanical energy (weight) into an electrical output. The magnitude of the electrical power is proportional to the applied force. Strain gauge in the force sensor deforms when pressure is applied to it. The strain gauge generates an electrical signal during strain because effective resistance changes during deformation.

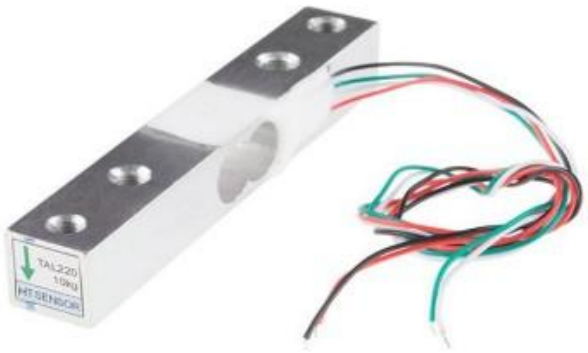


Fig.4 Load Cell [7]

Integration

From the above collected reviews and information, the integration of AGVs and weighing is done. However the main role of the weighing mechanism is to check weights that have been moved from one part of the warehouse (intralogistics) to another, the process is generally known as check weighing. By integrating the check weighing mechanism with AGV, non-defective final products only can reach for outsourcing.

Conclusion

In the current developing world, the quality depends on the accuracy of the consumer products. With the help of Check Weighing AGV, one can assure the quality and quantity of the final product which will reach consumers by next step. By studying this paper, one can relate how to integrate both AGV and Weighing Mechanism.

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