Design of Voice Controlled Automated Guided Vehicle

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Abstract

The Automatic Guided Vehicle refers a type of system that can be used in production as well as in other industries etc. This system includes a battery operated remote sensing locomotive (carrier) on which a small lift is provided, specific path over which it moves, sensors for sensing the obstructions on the path of the carrier. The remote sensing carrier moves using the electric power from the battery. The objective and scope of this work is to create an AGV model that can follow a trail of line on a flat surface horizontally. This AGV model is using microcontroller to control all navigation and lifting functions during its operation. In other words, the microcontroller acts just like the brain for the model that controls all operation of the system. From the remote station we send only information through voice command for moving the carrier, not for steering it. The steering is done by the path. It moves with a low and constant speed on the prescribed path. The path has a specific color. The bottom of the carrier have sensor which is always coupled with the path. The front side of carrier vehicle contains sensors for sensing the obstructions on the path.

Keywords: Voice Controller, Microcontroller, Remote Sensing, Specified Magnetic Path

I. INTRODUCTION

An automated guided vehicle or automatic guided vehicle (AGV) is a mobile robot that follows markers or wires in the floor, or uses vision or lasers. They are most often used in industrial applications to move materials around a manufacturing facility or a warehouse.

Automated guided vehicles increase efficiency and reduce costs by helping to automate a manufacturing facility or warehouse. The AGV can tow objects behind them in trailers to which they can autonomously attach. The trailers can be used to move raw materials or finished product. The AGV can also store objects on a bed. The objects can be placed on a set of conveyor and then pushed off by reversing them. Some AGVs use forklifts to lift objects for storage. AGVs are employed in nearly every industry, including, pulp, paper, metals, newspaper, and general manufacturing. Transporting materials such as food, linen or medicine in hospitals is also done.

An AGV can also be called a laser guided vehicle (LGV) or self-guided vehicle (SGV). Lower cost versions of AGVs are often called Automated Guided Carts (AGCs) and are usually guided by specific lines magnetic tape. AGCs are available in a variety of models and can be used to move products on an assembly line, transport goods throughout a plant or warehouse, and deliver loads to and from stretch wrappers and roller conveyors. AGV applications are seemingly endless as capacities can range from just a few kgs to hundreds of tons.

II. LITERATURE REVIEW

The first AGV system was built and introduced in 1953. It was a modified towing tractor that was used to pull a trailer and follow an overhead wire in a grocery warehouse. The first big development for the AGV industry was the introduction of a unit load vehicle in the mid-1970s. This unit load AGVs gained widespread acceptance in the material handling marketplace because of their ability to serve several functions. Since then, AGVs have evolved into complex material handling transport vehicles ranging from mail handling AGVs to highly automated automatic trailer loading AGVs using laser and natural target navigation technologies. Developed by AM Barrett Jr in 1954 (overhead wire to guide a modified towing truck pulley in a grocery warehouse) 1973, Volvo developed AGV to serve assembly platforms for moving car bodies through its final assembly plants. Today the AGV plays an important role in the design of new factories and warehouses.

Kim et al. proposed a deadlock detection and prevention algorithms for AGVs. It was assumed that vehicles reserve grid blocks in advance to prevent collisions and deadlocks among AGVs. A graphic representation method, called the “reservation graph,” was proposed to express a reservation schedule in such a form that the possibility of a deadlock can be easily detected. A method to detect possible deadlocks by using the reservation graph was suggested.

Afentakis states the advantages of the loop layout as simplicity and efficiency, low initial and expansion costs, and product and processing flexibility. Loop layout has been studied by many researchers including Bartholdi and Platzman, Sharp and Liu,
Kouvelis and Kim, Egbelu, Banerjee and Zhou, Chang and Egbelu. Bozer and Srinivasan initiate the concept of tandem configuration as a set of no overlapping, bidirectional loops, each with a single vehicle.

Mehdi Yahyaei has designed an AGV using fuzzy logic system and a rotational ultra-sonic sensor to steer the AGV to avoid collisions and obstacles. He also employed a programmable logic control (PLC) as the processor which makes the AGV to be ultimately fit to the industrial environments.

In early 1990s Fuzzy logic came through to control and manipulate whole of the material flow in manufacturing floors. The main indication of employing this system on AGVs was the ability of controlling multiple AGV in a same time without collision. However, only simulation results are presented.

Senoo et al used experimental results of a three wheeled mobile robot to discuss the stability of a fuzzy controller. It is also stated that fuzzy control was implemented in order to achieve reduction of steer energy, while maintaining better steer angle when compared with PI control.

### III. DESIGN OF VOICE CONTROLLED AGV

![3D Model of Voice Controlled AGV](image1)

**Fig. 1: 3D Model of Voice Controlled AGV**

![Guidance Path (MGS1600C magnetic Guide sensor path) for AGV](image2)

**Fig. 2: Guidance Path (MGS1600C magnetic Guide sensor path) for AGV**

![Isometric view of Voice Controlled AGV](image3)

**Fig. 3: Isometric view of Voice Controlled AGV**
A. **Working Principle of Voice Controlled AGV**

Our Automated Guided Vehicle is similar to that of pallet truck difference is here it is self-driven. An MGS1600C magnetic guide sensor is provided for sensing the path. In this application, the AGV will follow a track made of an adhesive magnetic tape affixed on the floor. The MGS1600C will measure how far from the center of the tape it is and provide the information to the motor controller which will then adjust the steering so that the vehicle remains at the center of the track. Our AGV is voice controlled by giving voice commands such START & STOP commands. Magnetic tape is the easiest to lay and modify while providing excellent durability and reliability. If any obstacles approaching the vehicle, the vehicles immediately stops by using the signals of various zones as shown in the below figure.

![Image of AGV working principle](image)

**Fig. 5: Working of AGV during various obstacles**

B. **Electronic Circuit for AGV**

![Image of AGV electronic circuit](image)

**Fig. 6: Block diagram of Electronic working of AGV**
C. Applications of voice controlled AGV

Automatic Guided Vehicle can be used in a wide variety of applications to transport many different types of material including pallets, rolls, racks, carts, and containers. AGVs excel in applications with the following characteristics:

- Repetitive movement of material over a distance
- Regular delivery of stable loads
- Medium throughput/volume
- When on time delivery is critical and late deliveries are causing inefficiencies
- Operation with at least two shifts
- Archive Systems
- Cross Docking
- Distribution
- High Density Storage

IV. Conclusion

The AGV is a productivity increasing feature in a factory. During the manufacturing of this AGV we had found many of intelligence that can be given to it. We provide the basic functions like line following and collision avoiding. And the main function, transportation of goods from station to station. The followings are the main features of the prototype which we fabricated.

- Speed of delivery
- Adjustment of vehicle speed
- Flexibility of path
- Adaptive to changes in factory layouts
- Avoid collision with other objects
- Reduction in labor cost
- Reduction in running cost compared to conveyer systems
- Ability to add sensors to detect the payload conditions
- Ability to adjust the lifting time
- Continues cycle of working
- Conditions for line following can be changed easily

References