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Components of Automated Guided Vehicle: A Review

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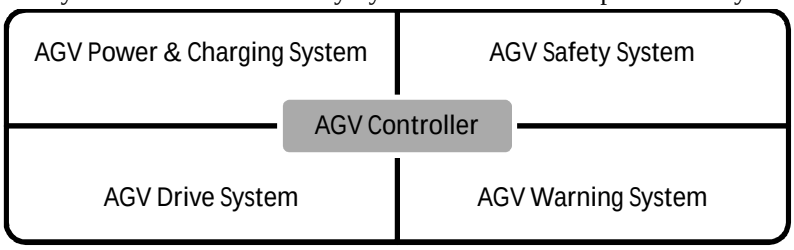
Abstract: ***An automated guided vehicle (AGV) is a portable robot that follows markers or wires in the floor, or uses vision, magnets, or lasers for navigation. They are most often used in industrial applications to move materials around a manufacturing facility or warehouse. Application of the automatic guided vehicle broadened during the late 20th century. 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 first AGV was brought to market in the 1950s, by Barrett Electronics of Northbrook, Illinois, and at the time it was simply a tow truck that followed a wire in the floor instead of a rail. Out of this technology came a new type of AGV, which follows invisible UV markers on the floor instead of being towed by a chain. The first such system was deployed at the Willis Tower (formerly Sears Tower) in Chicago, Illinois to deliver mail throughout its offices. 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.***

Today, the AGV plays an important role in the design of new factories and warehouses, safely moving goods to their rightful destination.

Keywords: AGV, Power system, Charging system, Drive system

I. INTRODUCTION

This paper represent the system functional description and the main subsystems of the AGV, chassis and Structure, the Tow Pin actuator, the AGV control system, the AGV safety system and the power system. In terms of the control of the AGV, the various systems within the AGV that are discussed in next section which include the AGV Drive system, AGV User control Interface & warning system, the AGV power system and the AGV Safety System. The main component of any AGV is shown below:



II. AGV ARCHITECTURE

A. Safety System

The relation between AGV safety system with other AGV equipments is shown in figure. The AGV safety system is composed of multiple E-stops, Collision detection sensor, drive contactors and brakes integrated with a safety controller device. The safety system realization is done in a manner that the required safety standards are achieved. Both the ESTOP Actuators and Range Sensor are wired in dual channel mode. Diagnostic monitoring is done. Power contactor feedback is monitored.

The AGV is equipped with multiple safety devices mounted on its exterior to protect against collisions and to shut down the AGV in situations where the behaviour of the AGV can endanger the integrity of persons and objects in its surroundings. Emergency stop pushbuttons located on each of the four side of the AGV. The E-stops are located for easy accessibility in an emergency situation.

Warning lights are mounted on the AGV. They can shine with a steady light or flash with different frequency to indicate different modes of operation. A beeper is mounted on the AGV for audible warning. It sounds when the AGV is in motion or can be programmed to sound when suitable.

AGVs come standard with a collision avoidance system. When the vehicle is traveling along the guide path, this system will detect an obstacle (such as a person) in front of the vehicle. At a configurable distance from the obstacle, the vehicle will decelerate to a slower speed. If the obstacle is detected within specified distance from the vehicle, the vehicle will apply its brake, stopping before contact is made. The vehicle will resume operation approximately two seconds after the obstacle is removed.

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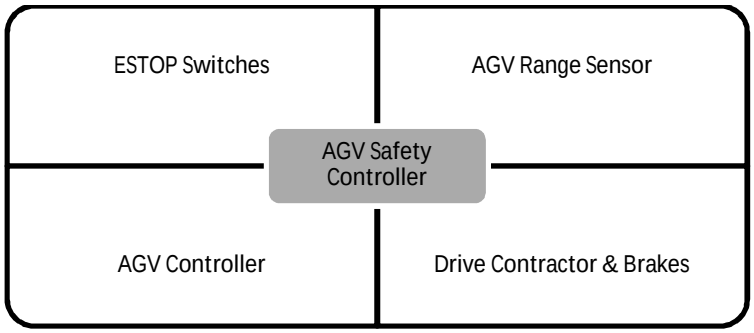
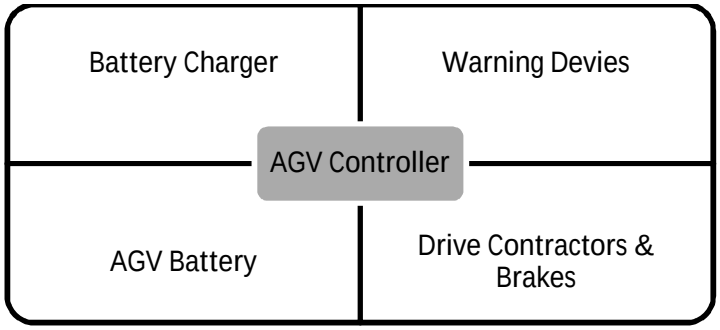


B. Power and Charging System

Power charging of the AGV device is shown below with the help of blocks.The AGV is come with the onboard charger that connects to the battery. The AGV can be charged via wall mounting socket. The AGV motion is blocked and brakes are applied when the charging is ON. Appropriate warning or indications are provided on UCI and warning System.



C. AGV Drive System

This is the main subsystem who drives the AGV on the path. The AGV traction and steering is realized with the help a pair of independently controlled Brushed (PMDC) motor drives, arranged on either side of AGV to provide electrically controlled differential steering. The Motors are with the integrated brakes, encoders and a gear box of 1:32 ratio. In addition to this a dual channel high performance Drive Controller designed to convert commands received from AGV Controller into high voltage and high current output for driving AGV Drive motors is used. The power input to the Drive Controller and motor brakes is wired such that the required levels of safety standards are achieved.

D. AGV Chassis and Body Panels

The AGV is constructed in the form of a chassis covered by panels. The chassis is a ladder welded steel structure that is built to carry/ tug the payload as required. The main load is carried by the AGV chassis. The panels protect the components of the AGV and also serve to ensure the security of the operators working in the same space as the AGV

III. AGV USER CONTROL INTERFACE

The AGV is provided with two types of User Control Interfaces. The type 1 user control interface, which is required by an operator every time he wants an access of AGV and allows control of the AGV motion and also an acknowledgement of AGV status. It is fixed to the Front side of the AGV. Type 2 which is relatively less required to be used by operator during normal operations is more or less redundant user control interface is fixed to the Rear side of the AGV.

A. AGV Control and Power Panels

The AGV controller is included within the panels of the AGV to provide protection against elements and also to avoid easy access to the more sensitive component. The access to the controller panels is provided from the front and back of the vehicle. This serves two purposes: access to the controller is provided only in the case of a stationary AGV. The control components including AGV controller, safety controller and relays are installed on one front of AGV and the power components like Motor controllers, contactors, MCBs and fuses can be accessed on the other rear side of AGV.

IV. AGV OPERATING PROCEDURE

A. Prepare AGV before Switching ON

1) AGV is placed on Magnetic path (AGV track)
2) AGV Drive is engaged using clutches.
3) Battery is Fully Charged
4) Connect Battery Connector to AGV battery input Connector
5) Make sure there is no Obstacle in Front of AGV

B. Start AGV

1) Switch ON "Main Switch" on Rear Panel
2) Switch on "On/Off" Switch on Front Panel
3) "Power On" Indicator on front panel will glow.
4) AGV Controller will boot up within 30 Seconds
5) All peripheral devices are powered ON
6) AGV is programmed with default route to follow
7) "Start" button on front panel will start flashing
8) Press "Start" button on front panel to start AGVs auto cycle
9) AGV will move on magnetic track performing desired action based on RFID Tags on Ground.
10) Optional HMI on front panel will show relevant information.

C. Charging of AGV

1) Plug in single phase 110Volts -220Volts 50-60Hz in "Charging Socket" on rear panel. AGV will stop performing normal operation immediately.
2) Tower light will show appropriate status
3) Battery on AGV will start charging.

V. OPERATING AGV

A. AGV System Behavior

The program consists of a bus-route is set for each of the AGVs. The route sets the speed of the AGV depending on the last RFID tag encountered. When the AGV starts it will default to slow speed unless it detects the first RFID Tag on floor. For the straight path, the AGV will select the maximum allowable speed and at curves or before the stations the AGV will slow down its speed.
The following are the specifications for the AGV system of 4 AGVs.

1) AGV designed for 2-Shift operation
2) AGV guidance method: magnetic guide path
3) AGV Slow Speed: 15 m/min.
4) AGV Fast Speed: 28 m/min.

VI. CONCLUSION

The main components of an AGV are discussed in earlier sections. The system functional description and the main subsystems of the AGV, chassis and Structure, the Tow Pin actuator, the AGV control system, the AGV safety system and the power system are studied. In terms of the control of the AGV, the various systems within the AGV that are discussed.

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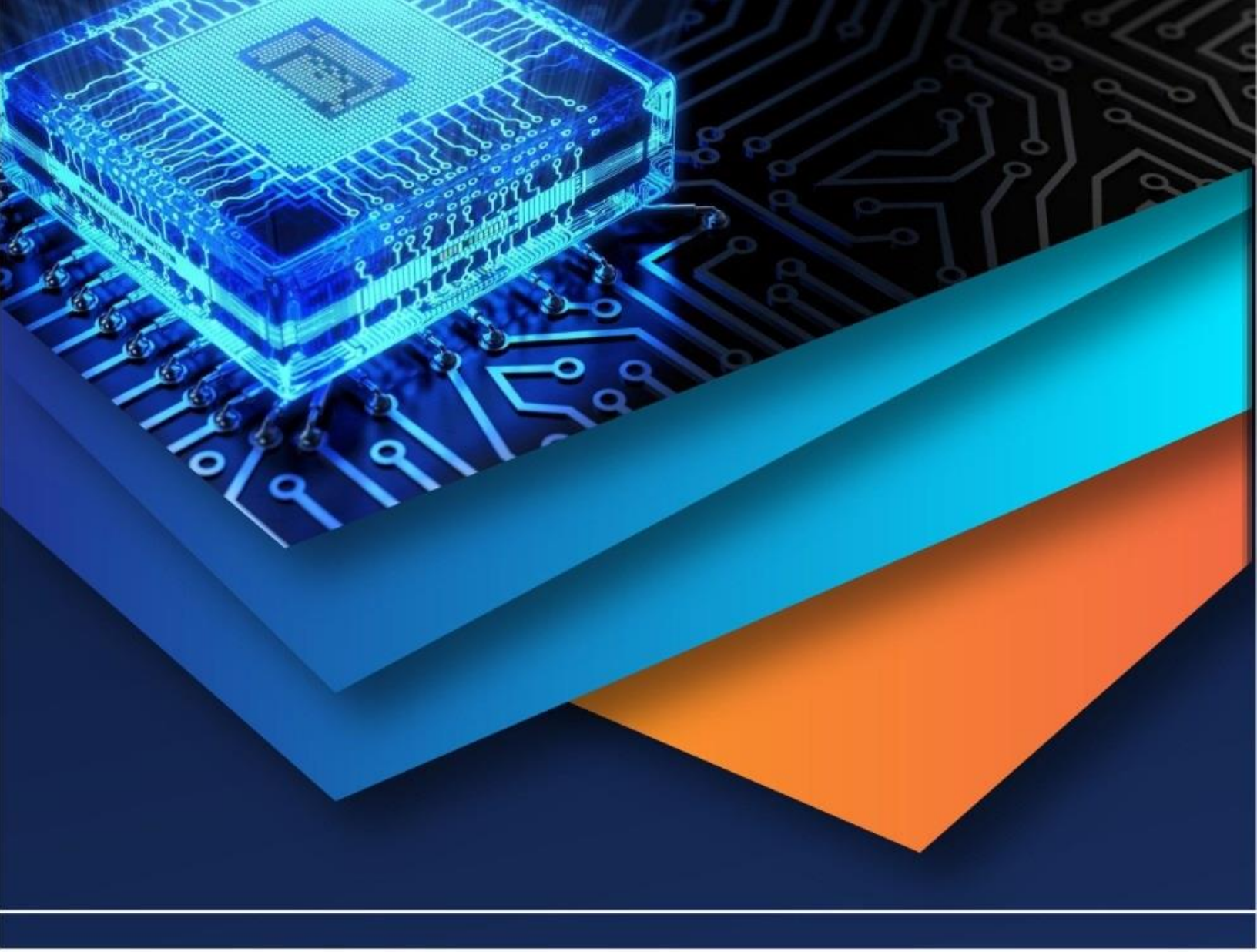

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