Autonomous guided vehicle report sample

Business, Industries

Introduction

Autonomous guided vehicles are also referred to as automated guided vehicles or automatic guided vehicle. Its robot which follows wires or marks in a flow or any other surface that it may be guided through. They are commonly used in industries to carry materials around warehouses and other manufacturing facilities. This is useful in area where it could be difficult for human beings to carry loads. Automatic vehicles can also be applied in exploration work or where there is possibility of damage. They are used for electrical installations as well as navigation through hazardous areas especially those suspected to be planted with bombs (Behnlg 2008). Rescue missions can also be carries out by use of these automated vehicles.

Automated guided vehicles reduce costs and increases effectiveness and efficiency in a manufacturing plant or a warehouse. Some of the industries where use of AGVs is applied are, metal industries, pulp industries, newspaper industries, paper industries, food industries and medical industries among many other industrial applications.

Autonomous Guided Vehicle

AGVs are guided by laser beams or magnetic tapes. The lower cost AGVs are guided by magnetic tapes while the expensive ones are guided by laser beams. Varies models of AGVs are used for moving goods in assembling lines, their transportation in a plant and delivery. Due to advancement in technology, most AGVs are Laser navigated. Laser Guided Vehicles have computer systems that are coded to communicate with other vehicles so as to ensure that products are moved safely within a transmission line in plant (Keith 2008).

The following are examples of Automatic Guided Vehicles and their uses.

AGVS Unit Load Vehicles; These made of decks which are used for transportation of unit load. These vehicles use automatic load transfers. The decks can be customized to contain multiple compartments and they can assume the following models; lower type or lift type, belt or chain made and or made of powered or non-powered rollers.

Light Load AGVS; these can carry a load of about five hundred pounds. They are used in the transportation of small load such as baskets and other light loads. These vehicles are mainly used in areas with limited navigation spaces.

AGVS Towing Vehicles; they are among the first type to be introduced and are very popular. They are used for towing vehicles such as trailers. They can pull loads weighing between 9, 000 pounds to 65, 000 pounds.

AGVS Fork Truck; they are mainly used for stacking loads in a rack. This takes place during packaging of already processed products. They can work on goods on the stands as well as those on the floor.

AGVS Assembly Line Vehicles; these are a prototype of the light load Automated Guided Vehicles. They are used in applications involving a series of assembling processes.

AGVS Pallet Trucks; they are used for carrying palletized loads. There use eliminates the use of fixed load stands. The palletized loads are usually carried to and fro the floor level.

Automatic Guided Vehicles performances optimally in applications which have the following characteristics;

- There is standard delivery of secured loads
- Where operations are carried out in two shifts
- There is medium output of products
- There is repetitive material movement over short distances.
- Tracking of material is very important
- On time material delivery is important otherwise lateness would lend to ineffectiveness in operations

Some elements of applications handled by AGVS are;

Raw Material Handling: they are used for transportation of raw materials mainly from the receiving bay to the warehouse and then transport the directly from the warehouse to the production lines. Examples of raw materials are steel, metal, plastic, rubber and paper.

Pallet Handling: movement of pallets is very repetitive especially in distribution and manufacturing plants. AGVS are used for carrying pallets from palletizer to the wrapping stretcher. It is then transported to the storage warehouse and finally to the shipping docks.

Work in the Process Movement: this is one of the common applications of AGVS. This is because of the repetitive nature of material movement in manufacturing process. AGVS carries materials from the warehouse facility to either the production or processing lines or transportation from one process to another.

Finished Product Handling: the movement of the finished products is the last step before the goods are taken to the customers for consumption. This takes place from the manufacturing facility to the shipping facility. These movements are handled with care because they are finished product and can be damaged if handled roughly. The AGVS movements are controlled with high degree of precision in terms of acceleration and deceleration and this reduce the potential of damaging the products.

Roll Handling: they are used for storing and stacking rolls on floors. They can also load paper rolls on a printing press. They are used for transportation of rolls in the following plants; printer pants, steel producers, paper mills, newspapers plants, converters and plastic manufactures among other industrial plants.

Literature review of Autonomous Guided Vehicles

Autonomous Guided Vehicles are robotic in nature. Its navigation is the most critical component for optimal performance and usability. The integration of various subsystems of an AGVS makes it an art of its kind. Traffic control, path decision and sensing units need well designed integration in order for an AGVS to coordinate its movements and operations.

There has been great advancement of AGVS in the following area; communication, control, intelligence, reliability and efficiency

Communication:

Technology advancement has greatly improved the communication system of AGVS vehicles. The system can communicate effectively by use of integrated computer chips or microprocessors. Multimillion microprocessors are fitted in an AGVS for purposes of sending signals between the operator and the robot. The operator may communicate to an Automated Guided Vehicle which is a thousand miles away by sending signals using remote control. The control system is fitted with receivers and transmitters and so is the robot, they are then given addresses so that they are able to receive the correct messages. Satellite navigation systems have also greatly improved the communication of an AGVS; the Global Positioning system facilitates communication in remote areas. A GPS receiver is fitted in the Autonomous vehicle in order to receive communication data from the remote control centre.

Control:

The control of automatic Guided Vehicles has been greatly improved with the systems being fitted with motion guidance systems. The motion guidance systems are made of sensors which are capable of detecting different types of objects. The sensors are important because they prevent the vehicles from collision with each other or other objects. The systems can be easily controlled through any surfaces or even sharp bends. Wireless remote controls can effectively monitor the movement of the vehicle until it navigates safely to its intended destination. Very high frequency light sensors have made the traffic control of an autonomous guided vehicle precise and time conscious. Handheld remotes have also made movement control of AGVS easy. The operator can guide its movement by point to the direction and stopping it when it approaches an obstacle. A traffic control system is fitted in an Autonomous Guided Vehicles to ensure that they do not collide with one another. Some of the methods used in AGVS traffic control are; forward control, zonal control and combined control. The zonal control method transmits signals to a specific area by use of a wireless transmitter. The forward control method makes use of optical and sonic sensors to prevent the vehicles from colliding with each other. The combined control uses both the forward and zonal control methods to avoid AGVs from colliding with each other. When one control system is down or has failed, the other system can be used to prevent collision

Reliability and Efficiency:

Autonomous guided vehicles are highly automated and can make them work for long hours. They do not get tired like human beings hence they are more reliable. They can also carry out dangerous activities which can be considered extremely dangerous to human beings. The vehicles can adopt different climatic conditions and operate without failure. AGVS can carry out a particular task within a short period of time and more so they can do it accurately. Besides they can undertake tasks continuously without getting tired, these properties make them more efficient, effective and reliable than other non automated machines. The use of 3D maps in it the computer system of the robot enables it to navigate smoothly without losing track of direction. The steering control enables the AGVS to negotiate sharp corners without toppling. This feature makes AGVS more stable hence it can operate on almost all surfaces.

Wired navigation; the sensor is wired and fixed at the bottom of AGVS. It is positioned such that it faces the ground. The wire is located approximately 2 inches above the ground. The sensor perceives the frequency transmitted by the wire and then follows it.

Guide Tape navigation; tapes are used to guide the vehicle through a path. The tapes can be magnetic or colored. They are fitted with magnetic tapes sensor which they follow. The advantage of using a tape is that it can be relocated or completely removed should there arise a need to change the course (Nasir 2007). The colored tape is cheap but it less used because it cannot be used in high traffic and the can get dirty or get damaged. A magnetic bar can be fitted on the bottom of the robot the same way a wire is fixed but it remains passive.

Laser Target Navigation; tapes are fitted on the walls of the Autonomous Guided Vehicles. A laser receiver and transmitter are carried onboard the AGVS. During navigation, a laser beam is sent and received, the time of movement between the times the laser is sent and when it is received is used to calculate the distance. A computer program within the laser system uses the frequency, speed and wavelength to calculate the distance travelled. The results are then recorded in internal memory of the AGVS. A map is stored in memory and it enables the vehicle to correct it location based on the received distance measurements. It then uses it to navigate to a particular destination by regularly updating its location and position using the measurements received.

Steering of AGVS;

An AGVS uses differential system for speed control. It has two sets; each set is connected to a drive component. These drives control the speeds of an AGVS and determine the direction of movements such as backwards movement or forwards movements (Zuria 2006). Use of differential enables AGVS to move easily in smaller places, tight places or when operating near other machines. Another system for steering an AGVS is the steered wheel control. This system uses similar principals of operation to those of car and is more accurate than the differential system because turns AGVS smoothly.

Vision Guidance; this system uses cameras for recording objects along routes of navigation. This feature is very useful for exploration whereby recorded features can be relayed for further analysis. The technology used incorporates a grid system and volumetric sensing capabilities. The grid adopts occupancy probability for compensating any inconsistency results from the sensor cameras. A 3d map is used to guide the AGVS through a guided route with any help from human beings.

Geo guidance; this system uses spatially referenced data to determine the route followed by the vehicle. The vehicle uses this technology to identify 3D special location of wall, paths and columns within a warehouse facility. Features in a facility are geo coded and this information is incorporated in the computer system of the AGVS.

Light Sensing Unit

Light sensing unit improve accuracy and prevent errors in AGV vehicle. They assist in preventing collisions, ensure safe monitoring and facilitate transmission of infrared data.

AGVS sensors are designed and constructed by inertia motion detectors. Infrared and ultrasonic electromagnetic waves are used for designing the orientation and position units (Siegal 2009). The design of a light sensing unit depends on the application of AGVS. Examples of applications that need light sensing units are; stabilization of antenna, real-time navigation, aerospace positioning, robotics and human tracking and motion positioning. The surface of the light sensing unit is made of ultra sensitive photoelectric sensors. The photoelectric sensors are sensitive to different parts of the electromagnetic spectrum. Different objects in space exhibit different response towards the electromagnetic spectrum. The unit makes use of this property to automatically detect the feature around it there by enabling it to navigate without the guidance of a human being. The sensor unit is integrated with a computer system to the mechanic components of the AGVS especially the ones involved with its movement. When it approaches an obstacle, the photoelectric sensors identify the wavelength properties and sends signal to the computer system, the computer then analyses this information to identify the type of object. This information is then used to invoke action on the motion of the vehicle. The program may then instruct the AGV vehicle to change the course if there is an obstacle in front of it or may give it a command to follow the route. Before the vehicle is put into use, it is important to input all information of the area of operation in database.

The light sensing unit uses this information for coordination with the mechanical elements of the robots for taking motions.

There are several types of photoelectric sensors that can be used to make a light sensing unit. These are; rectangular sensors, miniature rectangle sensors and pedestal sensors. The modes used for design are the through beam mode, the polarized retro reflective mode, background suppression mode and the proximity diffuse modes. Other types of sensors that may be utilized in the development of light sensing unit are; inertial sensors, wireless sensors, displacement sensors and energy hybrid sensors. They all use the same principles in guiding the AGVS.

Infrared Data Transmission Collision protection

I2C Communication system

An AGVS i2c communication system is composed of an integrated circuit that controls its operations. It is composed of 8-bit control systems fixed with microprocessors and peripheral devices. The devices communicate with each other by sending signals via serial buses. Serial buses are coded hence they do not require a lot of wiring. Serial buses are made of IC connecting pins and they follow all standards and procedures needed for communication of AGVs. The I2C communication system of AGVS is made of the following components:

The transmitter; this is the device that sends information to the bus.

The receiver; this device receives data from the bus.

Master; this device is responsible for initiating a transfer, generating clock signals and terminating transfers within AGVS system.

Master Slave; this device is usually addressed by a master.

Multi- master; this master is used for controlling the bus without changing the message in it.

Synchronization and Arbitration; these are terms used in the communication system in reference to procedures used in the clock signal synchronization of devices. Arbitration means that many masters can be used simultaneously without corrupting the messages.

Conclusions

The design of an Autonomous Guided vehicle requires careful design for optimal performance. For hazardous explorer, the mechanical component and the light sensing unit design and construction forms greatly influences it performance. The data of the area to be explored should be logged into the integrated computer system. The I2C communication system of the robot enables coordinated control of the robot. The design of the Vehicle will also depend on the area of application but most of them have the same elements and design features.

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