AUTOMATED GUIDED VEHICLE (AGV) & AUTONAMOUS MOBILE ROBOT (AMR)

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History

Automated Guided Vehicle (AGV) & Autonamous Mobile Robot (AMR)

AUTOMATED GUIDED VEHICLE (AGV)

	Explaination
1950s	• AGV technology is first used in the manufacturing industry for transporting heavy loads and materials within a factory or warehouse. • Early AGVs use wired guidance systems, which involve wires embedded in the floor to guide the vehicles along a predetermined path.
1970s	• AGV technology evolves with the introduction of laser guidance systems, which allow AGVs to navigate without the need for wires in the floor. • This makes AGVs more flexible and versatile, and they can be used in a wider range of environments.

AUTOMATED GUIDED VEHICLE (AGV)

	Explaination
1980s	• AGV technology becomes more advanced with the introduction of computerized control systems. • This allows AGVs to operate more efficiently and with greater precision, and they can communicate with other machines and equipment in the manufacturing process.
1990s	• AGV technology continues to improve with the introduction of advanced sensors and navigation systems. • These sensors allow AGVs to detect and avoid obstacles, and to navigate around complex environments with greater accuracy.

AUTOMATED GUIDED VEHICLE (AGV)

	Explaination
2000s	• AGV technology continues to evolve with the integration of artificial intelligence and machine learning algorithms, which enable AGVs to make more informed decisions and operate with greater autonomy. • This makes AGVs even more efficient and productive in the workplace.
Today	• AGVs are used in a wide range of industries, including manufacturing, logistics, and healthcare, to transport goods and materials safely and efficiently. • AGVs continue to evolve and improve, driven by the need for greater efficiency and productivity in the workplace.

AUTONAMOUS MOBILE ROBOT (AMR)

	Explaination
1950s	• Research begins on autonomous mobile robots (AMRs) with the development of the first remotely operated vehicle, which is used to explore the surface of the moon.
1960s	• The first truly autonomous mobile robot is developed, called "Shakey the Robot." Shakey is capable of performing simple tasks like moving objects and navigating around obstacles.
1970s	• Research in AMR technology continues, with the introduction of new sensors and navigation systems. Researchers experiment with different types of sensors, including sonar and infrared, to help robots navigate their environment.

AUTONAMOUS MOBILE ROBOT (AMR)

	Explaination
1980s	• The first commercially available AMRs are introduced, including the Tug robot, which is designed for material handling applications. These early AMRs use simple sensors and algorithms to navigate their environment and perform basic tasks.
1990s	• AMR technology continues to improve, with the introduction of advanced sensors and machine learning algorithms. This enables robots to make more informed decisions and operate with greater autonomy.

AUTONAMOUS MOBILE ROBOT (AMR)

	Explaination
2000s	• AMR technology becomes more sophisticated and versatile, with the introduction of new sensors and advanced algorithms. AMRs can now perform a wide range of tasks, including material handling, inspection, and surveillance.
Today	• AMRs are used in a wide range of industries, including manufacturing, logistics, healthcare, and agriculture, to perform a variety of tasks safely and efficiently. AMRs continue to evolve and improve, with the integration of new technologies like artificial intelligence and computer vision.

02

Differences

Automated Guided Vehicle (AGV) & Autonamous Mobile Robot (AMR)

Key Differences

The key differences between AGVs and AMRs relate to their navigation, flexibility, cost, adaptability, and payload capacity.

Automated Guided Vehicle	Autonamous Mobile Robot
Navigation • AGVs generally use a pre-programmed map or a wired guidance system to navigate their environment	**Navigation** • use advanced sensors and algorithms to autonomously navigate around obstacles and adjust their route in real-time.
Flexibility • designed for specific tasks and are less flexible in terms of their programming and capabilities.	**Flexibility** • more flexible than AGVs, as they can be easily reprogrammed or configured to perform different tasks or operate in different environments.
Cost • simpler and more straightforward in their design and are therefore generally less expensive.	**Cost** • AMRs are generally more expensive than AGVs, as they require more advanced technology

Key Differences

The key differences between AGVs and AMRs relate to their navigation, flexibility, cost, adaptability, and payload capacity.

Automated Guided Vehicle

Adaptability

- AGVs require fixed infrastructure and cannot easily adapt to changes in their environment.

Payload Capacity

- AGVs are typically designed for carrying heavy loads and materials

Autonamous Mobile Robot

Adaptability

- AMRs can adapt to their environment and make decisions on the fly

Payload Capacity

- AMRs are more versatile in their payload capacity, with some models capable of carrying smaller loads or items.

03

Main Components

Automated Guided Vehicle (AGV) & Autonamous Mobile Robot (AMR)

Body Design (AGV)

Compact

These AGVs have a small and compact design, allowing them to move through tight spaces and narrow aisles.

They are often used in applications where space is limited.

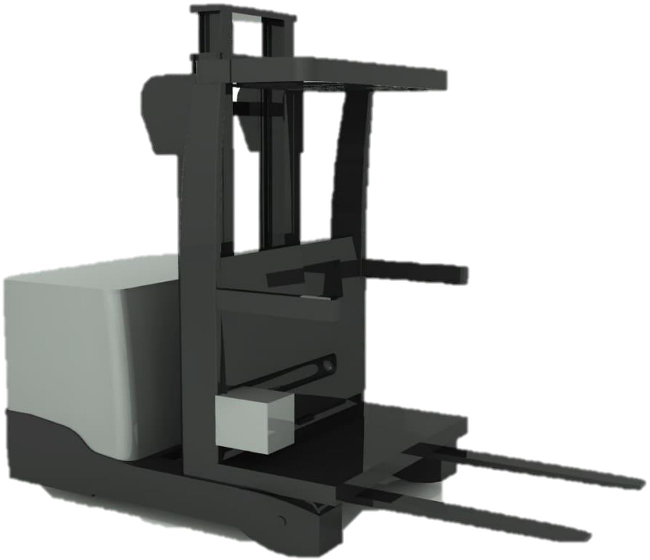
Body Design (AGV)

Low Profile

These AGVs have a low-profile design, allowing them to move under equipment or machines to transport materials.

They are often used in manufacturing or assembly line applications.

Body Design (AGV)



Standard

These AGVs have a more traditional design, with a larger body and more robust frame.

They are often used in larger facilities or applications where heavier loads need to be transported.

Body Design (AGV)

Custom

Some AGVs can be customized with different body designs to meet specific application needs.

For example, an AGV used in a cleanroom environment may have a stainless-steel body to meet cleanliness requirements.

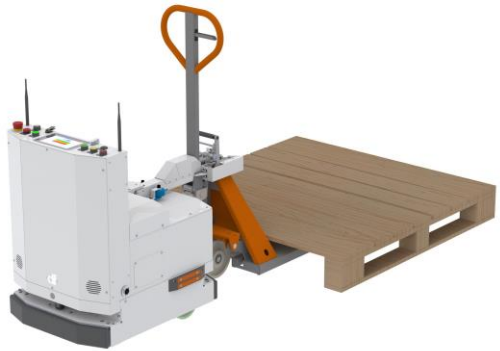
Body Design (AMR)

Compact

These AMRs have a small and compact design, allowing them to move through tight spaces and narrow aisles.

They are often used in applications where space is limited.

Body Design (AMR)



U-Shaped

These AMRs have a U-shaped design, with the payload located in the center.

This design allows the AMR to turn around in tight spaces and navigate through narrow aisles.

Body Design (AMR)

Box-Shaped

These AMRs have a box-shaped design, with the payload located on top.

This design allows the AMR to carry larger payloads and move over uneven surfaces.

Body Design (AMR)

Custom

Some AMRs can be customized with different body designs to meet specific application needs.

For example, an AMR used in restaurant to help the waiters to serve foods to the customers.

Locomotion (Wheeled-AGV)

These AGVs use wheels to move along a pre-determined path or navigate to a specific location

They can have either two or four wheels, and some models have omnidirectional wheels for increased maneuverability.

Locomotion (Guide-AGV)

These AGVs use guidance systems, such as magnetic tape, laser reflectors, or cameras

to follow a pre-determined path or navigate to a specific location.

Locomotion (Tracks-AGV)

These AGVs use tracks or conveyor belts to move along a pre-determined path or transport materials.

Locomotion (Wheeled-AMR)

These AMRs use wheels to move around a facility or workspace.

They can have either two or four wheels, and some models have omnidirectional wheels for increased maneuverability.

Locomotion (Legged-AMR)

These AMRs use legs, similar to those found on robots, to move around a facility or workspace

They can navigate over uneven terrain or obstacles and are often used in outdoor applications.

Locomotion (Hybrid-AMR)

Some AMRs combine both wheeled and legged locomotion systems to provide increased mobility and flexibility in different environments.

Navigation System & Control (AGV)

Magnetic Tape

- Magnetic tape is one of the earliest navigation systems used by AGVs.
- The tape is placed on the floor and contains magnetic signals that are detected by sensors on the robot.
- The signals help the AGV to follow a pre-determined path.

Vision System

- A vision system uses cameras to detect visual cues in the environment.
- The AGV uses image recognition software to identify markers or objects and navigate accordingly.

NAVIGATION SYSTEM

Laser Reflectors

- Laser reflectors are reflective markers that are placed around the environment.
- The AGV uses a laser sensor to detect the markers and navigate to specific locations.

Navigation System & Control (AGV)

Onboard Computer

- The onboard computer is the brain of the AGV.
- It receives inputs from the sensors and software and uses algorithms to control the movement and actions of the robot.

CONTROL SYSTEM

Safety Systems

- Safety systems ensure that the AGV operates safely in its environment.
- For example, sensors can detect obstacles and halt the AGV's movement to prevent collisions.

Motor Controller

- The motor controller controls the speed and direction of the AGV's motors.
- It receives commands from the onboard computer and adjusts the motor output accordingly.

Navigation System & Control (AMR)

Lidar Sensors

- Lidar sensors use lasers to scan the environment and create a 3D map of the surroundings.
- The AMR uses the map to navigate and avoid obstacles.

Cameras

- Cameras can be used to detect visual cues in the environment and help the AMR to navigate.
- They can also be used for tasks such as inventory management.

NAVIGATION SYSTEM

Ultrasonic Sensors

- Ultrasonic sensors use sound waves to detect objects and distances.
- They are often used in combination with other sensors to help the AMR navigate in complex environments.

Inertial Navigation Systems

- Inertial navigation systems use accelerometers and gyroscopes to measure changes in speed and direction.

Navigation System & Control (AMR)

Robot Operating System (ROS)

- ROS is an open-source framework for building robot software.
- It provides a common platform for developers to write software for various components of the robot, such as navigation and control.

Programmable Logic Controller (PLC)

- The PLC is a digital computer that controls the AMR's hardware components.
- It receives commands from the onboard computer and uses algorithms to control the movement and actions of the robot.

CONTROL SYSTEM

Wireless Connectivity

- AMRs often require wireless connectivity to communicate with the onboard computer and other systems.
- This can include Wi-Fi, Bluetooth, or other wireless protocols.

Safety Systems

- Similar to AGVs, safety systems ensure that the AMR operates safely in its environment.
- This can include sensors for obstacle detection and emergency stop buttons.

Data Collection (AGV)

Sensors

- Sensors are used to detect and measure various properties of the environment, such as distance, light, sound, and temperature.
- For example, proximity sensors can detect obstacles and trigger the AGV to stop or change direction.

Barcode Scanners

- Barcode scanners can be used to read barcodes or QR codes on items, enabling the AGV to identify and locate specific objects.

RFID Readers

- RFID readers can read radio-frequency identification (RFID) tags on items, which can provide additional information about the item's location, status, and other properties.

Data Collection (AMR)

Cameras

- Cameras are used to capture visual information about the environment.
- This can include images or videos of the workspace, which can be used for navigation and object recognition.

Lidar Sensors

- Lidar sensors use lasers to create a 3D map of the environment, which can be used for navigation and obstacle avoidance.

Ultrasonic Sensors

- Ultrasonic sensors emit high-frequency sound waves and measure the time it takes for the sound to bounce back.
- This can be used to detect the distance to objects in the environment.

Data Transmission (AGV)

Wired Communication

Wireless Communication

AGVs may use wired communication, such as Ethernet or serial communication, to transmit data to and from the control system.

AGVs may also use wireless communication, such as Wi-Fi or Bluetooth, to transmit data. This can include sensor data, location information, and status updates.

Data Transmission (AMR)

Wireless Communication

Cloud Connectivity

AMRs often rely on wireless communication to transmit data between the robot and the control system. This can include sensor data, location information, and status updates.

Some AMRs may use cloud connectivity to transmit data to a remote server or application. This can provide real-time data insights and enable remote monitoring and control of the robot.

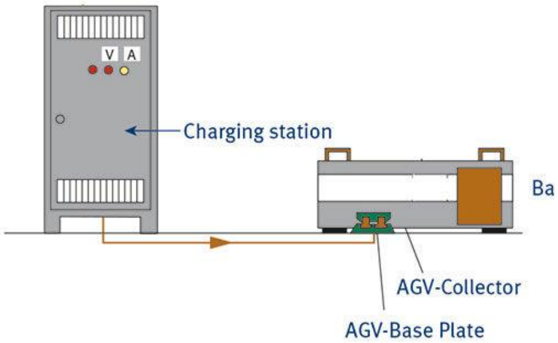
Power Management (AGV)

Batteries

AGVs may use rechargeable batteries to provide power to the robot.

The batteries may be replaced or recharged as needed to ensure the AGV can continue to operate.

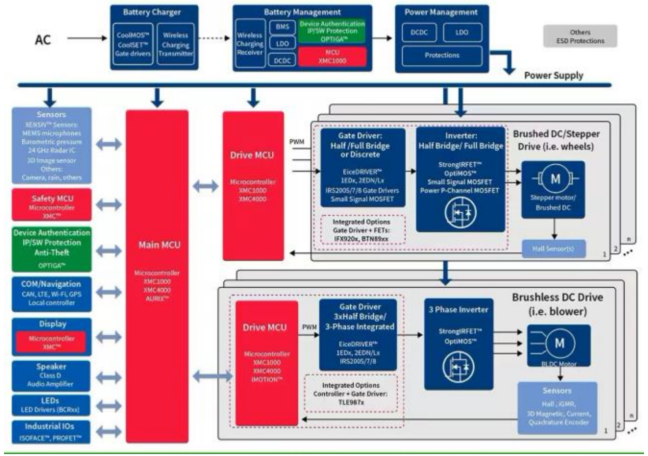
Chargers



Chargers may be used to recharge the AGV's batteries when they are running low on power.

Power Management (AGV)

Power Management Software



Power management software can be used to monitor the battery life of the AGV and optimize the robot's power usage.

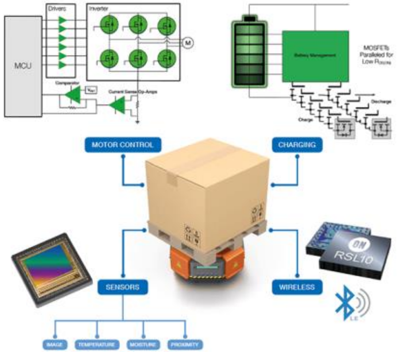
Power Management (AMR)

Batteries

AMRs also typically use rechargeable batteries to power the robot.

The batteries may be replaced or recharged as needed to ensure the AMR can continue to operate.

Battery Management System



A battery management system can be used to monitor the battery life of the AMR and optimize the robot's power usage.

Power Management (AMR)

Docking Stations

Some AMRs may use docking stations to recharge the robot's batteries when they are running low on power.

04

Applications

Automated Guided Vehicle (AGV) & Autonamous Mobile Robot (AMR)

Applications (AGV)

—Material Handling

AGVs are commonly used for material handling tasks, such as transporting raw materials, finished goods, and components in manufacturing and distribution facilities.

—Warehousing

AGVs can be used for picking, packing, and shipping in warehouses and distribution centers. They can also transport products between different areas of the warehouse.

Applications (AGV)

—Healthcare

AGVs are used in hospitals and healthcare facilities for tasks such as moving medical equipment and supplies between different areas of the facility.

Applications (AMR)

—Logistics

AMRs are used for transporting goods in warehouses, distribution centers, and other logistics environments. They can also be used for picking and packing tasks.

—Manufacturing

AMRs are used in manufacturing facilities for tasks such as assembly line work, material transport, and product handling.

Applications (AMR)

—Restaurant

AMRs are used in the restaurants to help waiters to deliver foods to the customers

—Healthcare

AMRs are used in healthcare facilities for tasks such as delivering medication and supplies to patient rooms, as well as moving lab samples and equipment.

CONCLUSIONS

In conclusion, AGVs and AMRs are two types of autonomous robots that are used in a variety of industries and applications. While both types of robots are designed to operate autonomously, they have some key differences in terms of their design, locomotion, navigation systems, and control systems. Both types of robots have important applications in industries such as manufacturing, logistics, warehousing, and healthcare, where they can improve efficiency, productivity, and safety. We can expect to see even more widespread adoption of AGVs and AMRs in the coming years.

Thank You