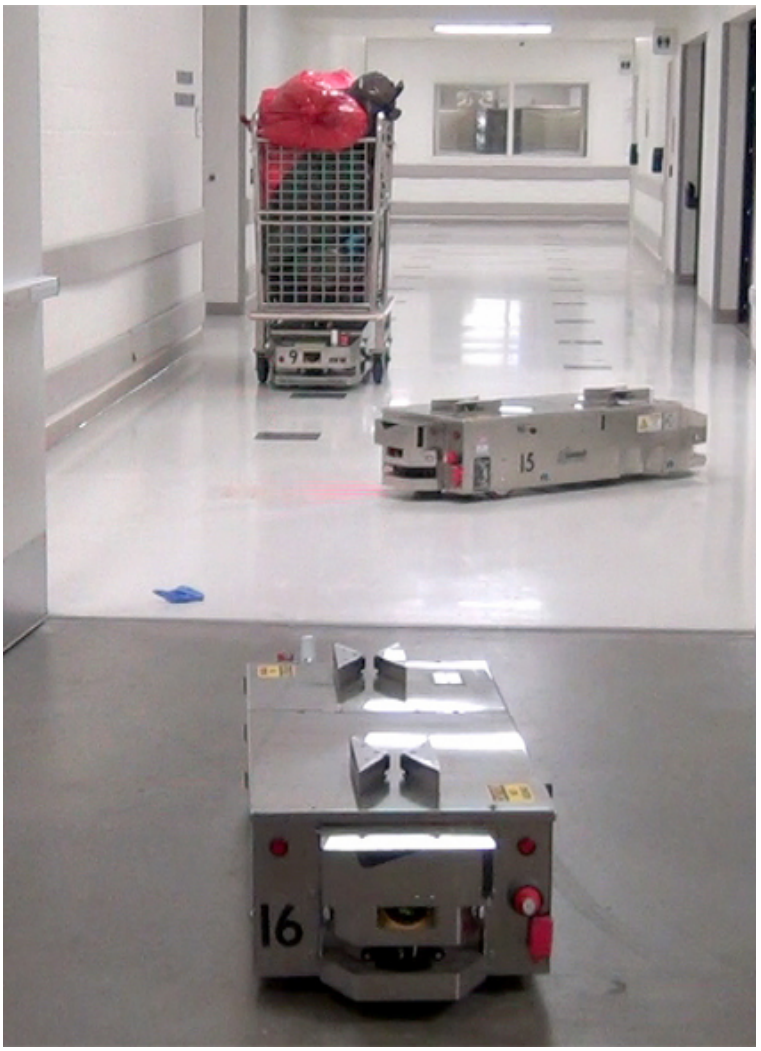

ROBOTS IN DISGUISE

Hospital automated guided carts increase efficiency, reduce operating costs

By Garry A. Koff

Manual cart transportation is not only wasteful and inefficient but also completely avoidable today thanks to mobile robots. These battery-powered machines, commonly referred to as automatic guided vehicles (AGVs), are capable of performing a wide variety of tasks within healthcare facilities.

AGVs drive under carts, automatically taking them to specified destinations. They safely traverse hospital corridors and interface with elevators to move patient meals, linens, medical supplies, trash and other materials as needed.

AGVs have an operational speed of approximately 200 feet per minute, which is the speed of walking pedestrians. They can slowdown automatically in areas as desired, and are equipped with audible devices and flashing lights. Most units are outfitted with a laser bumper sensor to detect objects in their path. Typically, the sensor can be programmed for range and width of coverage. Anything detected in the path of the AGV will slow and stop the unit. The AGV will only resume its travel when the object is clear of the detection range.

AGVs communicate with a central system controller, which provides their 'missions' — for example, where to pick up and deliver a cart — and keeps track of their locations so logistics management know where the units are and what they are doing at all times.

The units can be readily removed or rerouted since no physical 'tracks' are required for pathways. AGVs have a virtual set of coordinates stored in their computer memories, allowing routes and station locations to be changed by simply modifying the CAD (computer-aided design) path drawing. This 'virtual' path navigation means they can be easily installed in both new and existing facilities.

PLIGHT OF THE NAVIGATOR

Several types of navigation technologies are used to guide AGVs in a facility. Some of the most popular forms of AGV guidance are proximity sensor, laser and inertial navigation.

Proximity sensor navigation uses multiple sensors (sonic, infrared and laser, for example) to determine the vehicle's position relative to walls and other physical objects in order to guide it through an area.

Laser target navigation makes use of fixed reflective targets mounted on walls and columns in the AGV operating area. Equipped with a rotating laser transmitter/receiver, the AGV emits a laser beam that is reflected back by multiple targets along its path. The unit then calculates the beam's angle and distance in relation to the targets to triangulate its position and guide it on its way.

Inertial navigation utilizes an electronic chip, called an inertial sensor, in the AGV. The sensor detects the slightest change in the left-right movement of the vehicle as it travels. With the aid of small reference markers, this information is used to correct the vehicle's position and keep it on the right path.

Both laser and inertial navigation systems are accurate within plus or minus one inch.

▲ Automatic guided vehicles drive under carts, automatically taking them to specified destinations. They safely traverse hospital corridors to move trash and other materials as needed.

CALL OF DUTY

AGV systems typically employ some type of 'call and remote dispatch' operation. Staff can call for an AGV by pressing a button or using a touchscreen, for example, when a cart is ready to be picked up. The central controller stores these calls and then assigns an available AGV to perform the pickup and associated delivery mission. Systems with this capability do not require an operator to be present when the AGV arrives, allowing staff to place a cart for pickup and then resume their regular responsibilities.

Idle AGVs will go to automatic battery charging stations periodically, eliminating the need to change batteries. The vehicles even 'go to sleep' during off shifts or low volume periods to conserve the charge level in their batteries.

There are various ways to alert maintenance when there is a problem or notify staff when a cart is delivered to their area. The central controller can send text messages to designated personnel, for example. Graphic displays of the system path, vehicle locations and system status are also available on monitors networked with the system.

HANDLE WITH CARE

AGVs require periodic maintenance. This typically involves a simple inspection, cleaning, and mechanical and electronic adjustments. Preventive maintenance is generally performed quarterly and requires one to two hours per vehicle. The skill level required to maintain an AGV is similar to that of an electrician/mechanical facility engineer.

AGV uptime is quite high. With proper maintenance vehicles sustain 97 to 99 per cent uptime. Fleet sizing for larger systems includes spare AGVs to allow for planned maintenance and unplanned vehicle downtime. System-wide failure is extremely rare because the central controller normally includes a backup controller.

INVESTING IN THE FUTURE

While AGVs have been widely used in the industrial sector for more than 40 years (where company survival is tightly coupled with operating costs), they have been mostly overlooked in the healthcare industry; that is, until now. Tightening budgets and rising healthcare costs have prompted hospitals to look at new ways to reduce non-value added labour. AGVs not only increase productivity, improve cart delivery response times, eliminate lost/delayed cart deliveries and help cut operating costs, but newer technologies have greatly lowered the investment cost of these systems, making them a viable option for nearly all facilities. Today, the payback period for vehicle automation can often be less than two years.

Hospitals that employ AGV cart transportation systems have seen a positive return on investment of 1.25 to 1.5 full-time equivalents (FTEs) per AGV per shift. Even a system with just a few AGVs can reduce labour by three to five people per shift.

The price of an AGV system can vary widely, depending on its size and vendor. A small system with three vehicles will cost between $300,000 and $400,000 US, while a larger system with approximately 15 vehicles will range from $1.5 million to $2.5 million US. The cost includes the AGVs, system controls, system engineering services, and system installation and startup.

If the initial cost of a small system of three AGVs is approximately $350,000 US, for example, it provides a FTE reduction of three per shift, two shifts per day and a FTE cost of $45,000 per year. A hospital could see a reduction in its operating budget of $270,000 per year. This would result in an investment payback of less than 18 months. More importantly, the savings per year continues every year the system is in operation. ■

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