Mobile robots solve the customisation conundrum for manufacturers

While stationary robots are well-established and important parts of many factories and production plants, mobile platforms and manipulators will become an integral part of the factory of the future. Bruno Adam, Omron’s Mobile Projects Director Europe answers how the manufacturing process is evolving and why factories, driven by greater product customisation, will move from traditional linear models of conveyors and autonomous guided vehicles (AGVs) to more intelligent types of mobile robots.

What do you see as the most important trends in the industry at the moment?

There is a definite trend towards increased automation, with a view to implementing an Industry 4.0 strategy. Most manufacturers wish to boost productivity through closer process and machine monitoring. The improvements that automation brings help manufacturers, who are under a lot of pressure, from customers and even some governments, to increase productivity.

Another interesting trend is the personalisation and customisation of products. Manufacturers have seen and learned from the success of Coca-Cola’s “Share a Coke” marketing campaign. The campaign allowed the customer to buy cans of the soft drink with their name on the outside. This example was followed successfully by other brands, such as Nutella and Marmite. Outside the FMCG space, manufacturers know that if they could offer the customer more choices, it would result in higher sales – to accomplish that, they need to rethink the way that they operate. Luckily, automation is key to enabling them to move closer to that goal.

In what ways does the new methodology differ from now?

The current manufacturing philosophy is based around a linear production line. This works well when you have demand for a high volume of identical goods. If you want to deliver the same volume of goods, but offer a wider variety of choices, the production line isn’t the most efficient way to accomplish that. Some forward looking manufacturers are moving to a cell based approach to increase variety in their offering, but that in itself brings challenges. Conveyors are ideal for a standard production line, but don’t work well in a non-linear environment. The only real alternative to conveyors for more complex production flows is manual handling. The cell-based approach has actually led an increase in people being employed to take part-finished goods between cells using hand carts, trolleys or fork lifts. Of course, this negates the efficiency and cost benefits from the initial automation rationale.
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How can these challenges be overcome?
Mobile robots look to be the answer. The first wave of mobile robots operated by reacting to physical objects. They usually followed a line of paint or magnets, or other types navigated by special markings on walls. Yet, they had a similar drawback to conveyors, in that they are only useful for taking product between two set points. If a point changes, then the environment has to be changed for them to operate, which is time consuming and expensive.

To enable the cell based factory to work efficiently requires an intelligent mobile robot that knows the environment in which it operates, and can calculate the best route between a variety of points. Such a vehicle has been impossible until now for two reasons – there has not been the raw processing power available to process the complex AI algorithms required for autonomous operation, at least one that operates from a small enough battery for the robot’s desired form factor. Also, the technology behind the LIDAR sensors was not yet mature enough to allow the robot to navigate safely. With the technological advancement of the past few years, these barriers to progress have now been removed.

For some time now, Omron has been working on autonomous mobile robots, and recently launched the Omron LD range of AIVs (Autonomous Intelligent Vehicles).

How does the Omron AIV navigate?
Initially, the robot is taken round the factory and allowed to scan the surrounding area with its main LIDAR sensor. It then "stitches" that information together to form a complete static map of the workplace at a height of 200mm. This map contains information on shelves, machinery, walls and doors. The robot uses the map to calculate the best route between any two points.

If more than one vehicle is necessary to accomplish the tasks, the AIVs don’t work completely alone. Fleet management software acts as a scheduler for the AIVs. It is crucial to the operation, calculating where the nearest mobile robot is to the machine needing attendance, dispatching it to the position. The fleet management software can also inform the AIV of any busy areas, so it has the information it needs for its calculations. The software has to communicate with both the AIVs and the machines, while keeping track of the location of every AIV.

While in operation, the LIDAR sensor gives the AIV a 220-degree field of vision that allows it to safely avoid any objects in its path and adapt its speed in real time based on the environment. A vertical LiDAR sensor at either side of the AIV supports the main LiDAR. These two sensors check the path is clear for obstacles and spillages on the floor that may impede the AIV, as well as higher overhanging objects, such as a forklift’s forks or open drawers.
There’s no one size fits all for industrial applications, can the AIV be customised?

This is true. Taking the Omron LD AIVs as an example, the AIVs can be set up a number of different ways. The base of the AIV stays the same, but the upper part can be changed to suit the application. There are three basic configurations, which are flat-top, conveyor and cart transporter.

The flat-top AIVs operate semi-autonomously and have to be loaded and unloaded by hand. They can also be customised. One medical application uses a locked box on the AIV to carry restricted substances around a facility. The conveyors and cart transporter AIVs operate autonomously. For example, an AIV with a conveyor top will communicate to the machine using Wi-Fi or optical data transponder to confirm it is in position and the matching conveyor will load or unload the totes.

Beyond this, integrators are developing variations, such as front or side loading conveyors, dual conveyors, rollers or belts, and many more.

What’s next for mobile robots?

There are still a few challenges left to solve for the next generation of AIVs. To operate in complex and narrow environments, AIVs have to be able to compute complex trajectories taking into consideration the total shape of the vehicle including its load. This enables it to avoid a blockage in narrow curve transitions, for example. Small advancements in the trajectory generator may result in significant throughput improvements because the entire fleet of vehicles is more agile.

Another area for improvement is the AIV’s weight capacity. Currently, the largest Omron LD AIV can carry 130kg, which is enough for most applications. However, some customers, such as those in the beverage or automotive markets, would need AIVs with larger payloads. Larger AIVs are subject to more regulation, and bigger robots have more hurdles to overcome in terms of safety. In time this will come.
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Future generations of fleet management software will also allow more complex production flows. Currently, the software is reactive to the status of the production line – the robot has to wait for a call from the scheduling software that there is a load to pick up. In the next generation of software, this process will be more intelligent. The scheduler software will calculate steps ahead for the AIV, or position them ready for a job to finish. This will provide an even larger boost to productivity, while prolonging the operating time of the AIV.

Additional features will also open up the AIVs up to different applications. For instance, RFID and barcode readers would add to the intelligence of the AIV and allow them to perform more tasks in warehouses.

For more information: industrial.omron.eu

About Omron
Omron Corporation is a leading industrial automation company that leverages its core sensing & control technologies to expand into businesses, such as control components, electronic components, automotive electronic components, social infrastructure, healthcare, and the environment. Omron was established in 1933, and has around 38,000 global employees, offering products and services in over 110 nations and regions. In the industrial automation business, Omron is contributing to making an affluent society by offering automation technologies which drive innovation in manufacturing as well as products and customer support. For more detail, www.industrial.omron.eu

Note for the editor
For media enquiries please contact:
Omron Europe B.V., Wegalaan 67-69, 2132 JD Hoofddorp, the Netherlands.
Marion Beekhuizen, Tel: +31 (0)6 1133 7151
Email: marion.beekhuizen@eu.omron.com
Diane van der Sanden, Tel: +31 (0)6 2943 6751
Email: diane.van.der.sanden@eu.omron.com