

Robotics in Logistics

Supplement 2017

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ROBOTICS
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AUTOMATION

Saved by the machines

Urban spaces are battling pollution and overcrowding, while the city's consumers demand impeccable deliveries. Logistics needs a saviour; will robots come to the rescue? **Alexandra Leonards** looks at autonomous robots in and outside of the warehouse.

Plagued by stifling pollutants and growing congestion, the weight of overpopulation and consumer demand falls heavily on global cities. Lorries transporting single-item orders, excreting fumes while they travel to addresses that demand next-day delivery, certainly aren't relieving the problem. Even takeaways delivered to famished customers in gas-guzzling cars, and consumers collecting mid-week perishables are contributing to gridlocked streets and carbon emissions.

"Does it really make sense to drive our two-tonne car two miles to the grocery store to pick up three bags of shopping?" says Henry Harris-Burland of Starship Technologies, a leader in the field of autonomous delivery robots. "Traditional delivery methods are struggling to keep pace with the volume of deliveries, whilst cities are struggling with congestion and pollution as the number of vehicles on the road increases."

The sustainability of the existing delivery model, including the seemingly unsolvable puzzle of the last-mile, has frequently come under fire. But companies developing autonomous delivery robots are offering an alternative, and perhaps a greener, more sustainable way of delivering in urban environments.

Along with the global burden to stamp out toxic fumes, the logistics space faces monumental pressure to transport goods quickly and punctually, but not without delivering these items in undamaged and well-presented boxes, tied with frilly ribbons and fancy bows.

This weighty responsibility inspires Harris-Burland to label autonomous delivery a "necessity", rather than an opportunity: "E-commerce is growing at around ten per cent every year, which means more deliveries, and in turn more cars and vans on the road. Robotics is crucial for the long term sustainable success of delivery as it provides a low



“Each human eye looks differently - the slight difference gives us a depth of field. We do exactly the same thing...”

Jeff Christensen



Magazino's TORU Cube for e-commerce and e-fulfilment.

emission, convenient and cost effective method of delivery."

Robotics as a requisite for the future of delivery is something that Konstantin Lassnig, founder and CEO of Austrian-based Arti Robots, entirely agrees with: "The delivery of goods is a relatively complex task, and will become even more challenging in the near future. As more and more purchases are made online, customers expect deliveries to become faster and cheaper. Robots are the only solution to keep up with this trend."

Robotics companies aren't just aiming for smoother final miles; they're looking to revolutionise the culture of delivery. "We aim to eliminate missed deliveries in the future by creating a cost efficient on-demand delivery service," says Harris-Burland.

Starship's robot, described by the company as a "personal courier", has

Vision Guided Vehicles

American company Seegrid, which specialises in autonomous 3D vision navigation, uses cameras to navigate the warehouse with its "Vision Guided Vehicle."

"We take pictures in stereo – five pairs of cameras to cover the entire dome – with a 360 degree view around it," says Jeff Christensen, vice president of products. "By using two cameras looking in the same direction, like binocular vision.

"Each human eye looks differently - the

slight difference gives us a depth of field. We do exactly the same thing.

"We can deliver that disparity of image, reading three dimensions with just cameras."

The machine, which is used by the likes of Amazon, BMW and Whirlpool, takes photos as it travels through the warehouse – stitches them together into a 3D space, where thousands of points become a digital fingerprint of one point.



been developed for 24/7, on-demand deliveries – only to show up when it has been requested directly by the consumer. It can transport products to locations within a three-mile radius; it maps an area before driving autonomously to the destination and takes 15-30 minutes to deliver. This bot knows exactly where it is to the nearest inch, and could generate delivery costs of just £1 per journey.

Behind the scenes, within the safety four walls, robots are slowly being integrated into the logistics arena. But how realistic is it to expect governments and communities to accept self-governing machines roaming the streets?

French robotics company Effidance has had a working relationship with Deutsche Post DHL for around a year and a half. “DHL is really looking at solutions that will improve its service, internally and also outside for deliveries,” says Eric Ploujoux of Effidance. “We have delivered a couple of robots that are currently in operation in various environments.”

Effidance has already supplied DHL with warehouse robots, which were first trialled in June of last year. But it's in the process of adapting these robots for delivery.

“We need to adapt ourselves, because we face different obstacles in and outside of the warehouse,” says Ploujoux. “The brain behind the robot, that which makes it move, is the same, we are just teaching it whether it's in or outside.”

Prototypes

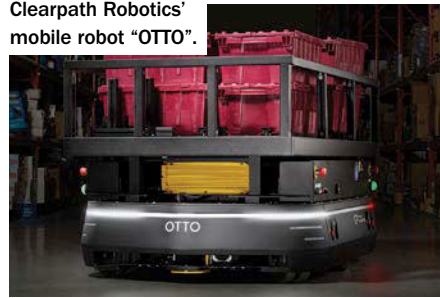
Arti's Konstantin Lassnig agrees that delivery robots aren't quite ready for the market: “We don't believe delivery robots will solve all problems in 2017 already, but we will definitely see many showcases and trials. The successive launch of prototypes with longer test periods of several months in real-life scenarios will push competition towards real products in the next five years.”

According to him, robot technology is still relatively expensive, so design decisions often tend to favour low-capability solutions. “As a result, robots still have problems with complex environments where 3D sensing capabilities are necessary,” says Lassnig. “Indoor environments are mostly solved, whereas outdoor environments feature a very rich and complex challenge for future robot operations.”

Testing is key to the autonomous delivery market. “Current developments include refining the technology to ensure it is safe, and works in most unstructured public spaces,” says Harris-Burland. “The market is still young, with only about six other companies in the autonomous last mile delivery industry.”

According to London-headquartered Starship Technologies, it is the only business in the market to test its robots on real pavements and in real environments. It is currently trialling Just Eat deliveries in London on a daily basis – and it is looking to extend the testing programme to other businesses in the near future. The company also works with Hermes, Swiss Post, German retail giant Metro Group,

Clearpath Robotics' mobile robot “OTTO”.



“...the vast majority of industrial applications do not employ them [AGVs]...”

Bill Torrens



and Wolt (a Nordic takeaway service).

Lassnig says that there are plenty of barriers in terms of legal regulations, but that social acceptance is more important than many might think. “Without a positive attitude or acceptance of the general public, technologies like autonomous robots will just not happen right away,” he says. “Many companies are driving the development in robotics today.”

“The automotive industry is one of the key driving forces, and is transforming the market's belief in robotic solutions – this development is forcing other industries to keep up with state-of-the-art technology.”

All the systems developed by Starship Technologies, Arti and Effidance are being trialled with some kind of human assistance. “We are not at all working on having robots delivering autonomously on the street,” says Ploujoux. “That would require real analysis of the issue of safety. If you leave the robot alone there needs to be 100 per cent confidence that it will be road safe.”

Ploujoux says that with collaborative robots, i.e. machines that work alongside humans, there aren't many obstacles. “But as soon as I have a stand alone robot, I'm facing issues and regulations,” he says. “In that case you have to ask: who is responsible?”

“Technically speaking we are able to do it – but to improve logistics operations today, we focus on the co-operative activity with machines.”

According to Harris-Burland, it really depends on where you are in the world. In March, Virginia passed legislation for autonomous delivery which is valid from 1st July. Washington DC adopted the “personal delivery device act 2016” last year to accommodate Starships' robots.

“The ultimate aim is to have the robots operating at 99 per cent autonomous driving,” says Harris-Burland. “We never want 100 per cent autonomous driving – this is important. Over time, we will obviously scale back the robot handlers so the robots drive without humans near them.”

Autonomous warehouse robots

Machines could not only save delivery from the outside, but also from the inside of the warehouse. And the introduction of self-driving warehouse robots is much more tangible than the outdoor prototypes in the test-stage.

“We are positive that self-driving warehouse robots will play a central role in warehouse improvements,” says Markus Kueckelhaus, DHL's vice president innovation & trend research. DHL started testing Effidance's autonomous “EffiBOT” last June, and estimates that robots will be the norm for logistics in less than five years.

Ford's Autolivery

Ford has unveiled “Autolivery” – a self-driving van concept that works in tandem with drones to pick up and collect goods and packages in urban areas.

Ford reckons that self-driving vans could quickly and efficiently transport everything from groceries to urgently needed medical supplies on the ground, with drones potentially able to take to the air for the

final leg of the journey to reach destinations inaccessible by car, such as high up in a tower block – or where parking would be difficult, impractical, or unsafe.

Ford intends to have a fully autonomous vehicle for commercial application in mobility services such as ride sharing, ride hailing or package delivery fleets in 2021.



Starship Technologies' delivery robot is being tested by Just Eat, Hermes, Swiss Post, Metro Group and Wolt.

"There's more of a consumer expectation for rapid delivery, fulfilment – ordering anything on a smart phone – requiring people to do more and more of the work to fulfil those things frequently and faster," says Tom Galluzzo, CEO of US robotics company IAM Robotics. "Of course, people can't keep up with this demand, as a result, businesses are looking to see how they can change the model."

Bill Torrens of US-based Clearpath Robotics, manufacturer of self-driving robot "OTTO", says something that is obvious but ignored is that automated guide vehicles (AGVs) have been around since the fifties. "Yet the vast majority of industrial applications do not employ them," says Torrens. "When they do, it's in a limited way."

One of the most significant reasons behind this is that AGVs, and this goes for automation in general too, has always got stuck for being inflexible. "Humans, despite their foibles, provide adaptability," adds Torrens. With robotics companies generating increasingly flexible models, suited to a wider range of operations, this is beginning to change. "The genesis was about three years ago," says Torrens. "We started to design a more industrial purpose build robot to provide utility and robustness."

Fredrik Brantner, CEO and co-founder of German robot manufacturer Magazino, says that free and flexible navigation without any markers or QR codes is becoming a reality. "While completely autonomous vehicles conquer the first warehouses, other components like forklifts are also retrofitted with additional systems for semi – or completely – autonomous navigation in a certain environment," he says.

Magazino's robot "TORU Cube" is able to understand the environment it is operating in via sensors. "With laser scanners at the front and the rear he can detect obstacles in his way and at the same time he uses the feedback from these sensors to locate himself within the warehouse," says Brantner.

Torrens says that the picture of robotics started to get painted around five years ago. "But there were massive holes," he says. "The puzzle pieces weren't in place – self-driving is one of those pieces."

Torrens predicts that in the next two years robotics will burst the dam and hit the logistics industry like a crashing wave.

"Nowadays, 80 per cent of warehouses all over the world are still being operated manually," says DHL's Kueckelhaus. "Within the past three years, the amount of sold robotics systems for logistics has doubled to approximately 3,000 units per year and will, according to the International Federation of Robotics, continuously increase to more than 14,500 units by 2018."

Rob Keij, commercial director at Barcelona-headquartered Kivnon, says that better costs and understanding will pave the way to a stronger robotics presence. "It's about presenting the technology,

DHL robotics challenge

EffiBOT, the autonomous robot created by French robotics company Effidence, won the DHL Robotics Challenge at the logistics company's Innovation Day in November last year.

The challenge required contestants to design the prototype of a self-driving delivery cart which was able to autonomously accompany DHL's staff during a last-mile delivery re-enactment. The robot had to "traverse typical urban and rural landscapes at walking speed while carrying parcels".

The contest, which involved an obstacle course and three finalists, took place at the DHL Innovation Centre in Troisdorf in front of more than 180 senior supply chain professionals.

At the Innovation Day, Frank Appel, CEO of Deutsche Post DHL, said: "Robotics is a great opportunity. The western world

is lacking productivity progress – our industry is still working similarly to how it was 20, 50, 100 years ago. It [robotics] hasn't hit our market really yet – but robotics will create lots of improvement in the industry."

The DHL Robotics Challenge involved three self-driving delivery robots from different companies and institutions. The first to hit the obstacle course was robotics business Arti, a University of Graz (Austria) company.

The second parcel delivery robot was a Bremer Institut für Produktion und Logistik (BIBA) creation. The robot is an omni-directional, multi-purpose platform. Although the robot was successful on most of the obstacles, it struggled to make its way over a bridge in the rain. But the clear winner was EffiBOT, which completed the obstacles quickly and smoothly.



opening the customer's eyes," says Keij. "A lot of businesses don't know much about robotics or they don't think they're ready for it."

Many companies are trialling one or two robots on a small scale to see how they work and how people will react. "This is what is happening at the moment – but many companies did this in the past, and now they are ordering in the numbers," adds Keij.

Autonomous warehouse technology is set to change the way e-commerce logistics is run, perhaps far sooner than delivery robots. But the two in tandem could really create a force to be reckoned with. ■