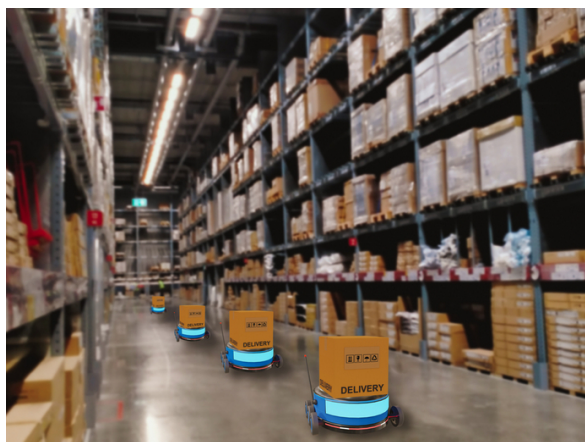




Full circle automation for tidier supermarkets

If they are to keep competing with or even complementing online sales, supermarkets need solutions to handle the logistics problems they face on a daily basis. The REFILLS project has trialled various automation solutions to make these stores all neat and tidy.



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We've all at least occasionally walked into supermarkets during their busy times (or in the early days of the COVID-19 lockdown) only to find messy shelves, devoid of the precious grocery item we've been hunting for. In such scenarios, assistants would be easy targets. Too easy perhaps, as even the most organised assistants will have a hard time ensuring that all supermarket shelves are well sorted and filled at any one time.

For shop owners, sorting goods has never been so costly and time-consuming. But it's not like they have a choice: the sensorial experience is the very thing that enables bricks-and-mortar shops to differentiate themselves from their online competitors.

To help them, REFILLS (Robotics Enabling Fully-Integrated Logistics Lines for Supermarkets) suggests automation solutions that will help sort items, track the ones missing from shelves, retrieve them from storage and even refill empty shelves. Bruno Siciliano, coordinator of REFILLS on behalf of the CREATE Consortium and the University of Naples Federico II, discusses the project's technologies and their benefits for shop owners and supermarket staff alike.

What would you say are the main logistics problems currently faced by supermarkets?

Bruno Siciliano: The main in-store logistics problem is to have all products available at all times for customers, while also keeping the inventory low and having lean just-in-time processes.

Receiving a huge variety of different products each day and restocking them efficiently to refill shelves is complex and comes at a high cost. Besides, searching for the right place in the store, transporting all products within the store and finally having a fast and ergonomic process for restocking the shelves is very time-consuming.

How do you aim to overcome these problems?

Firstly, by reducing the time and cost required to search product locations within a store. We do so by digitalising the store layout and autonomously presorting goods in the backroom according to this layout. Secondly, by autonomously transporting and distributing the pre-sorted products to the correct place in the store. Thirdly, by helping clerks when handling heavy boxes for shelf refilling. We also attempted to solve this problem by using robots to fill the shelves, but this was mainly a challenge for research.

You picked three scenarios for your project. Why this approach?

We looked at all conventional in-store logistics processes and identified repeatable tasks. These include sorting and identification of products, in-store logistics and pick-and-place applications. In the first scenario, mobile robots would inspect shelves and generate semantic environment maps for layout identification and store monitoring. The second scenario employs robots for three tasks: autonomous sorting of cases from mixed-case pallets in the backroom; autonomous transportation of trolleys from the backroom to the shop floor; and assistance provided to clerks. In the third and final scenario, we tried to handle a wide variety of products and refill shelves autonomously.

Can you tell us more about the robotic systems you developed?

We have developed specific hardware using a modular approach. A scanning unit identifies products within the shelves, and stores their position and the way they are showcased. From there on, a pointer unit with a light beam assists clerks in finding the right spot for replenishment.

To enable further automation, we modified and repurposed a robotic arm with extended range and specialised geometry. This enables a SCARA robot to push objects from a trolley to the back of the shelf without colliding with other stored objects.

The last robotic system was developed to transport trolleys filled with products near the shelves, as well as move the mentioned robotic systems within the store. Our logistic software and store management system, which is integrated in the working robots, carriers and scanning units, plays an important role too. It allows communication with the clerks through smartphones or tablets. This can also provide customers with useful information on the products within the store.

Is there any innovation that particularly stands out for you?

Under our first scenario, layout identification and shelf monitoring were intended to be the data basis for all REFILLS' robotic modules. But they turned out to be a very valuable source of data for other processes at retail stores as well.

In the second scenario, we developed a special depalletising cell where a robot equipped with a suitably reconfigurable gripper with sensors is capable of picking boxes of different sizes and dimensions from a mixed-case pallet. This system may have great potential also in warehouses.

Finally, the third scenario enabled us to test and enhance the capabilities of the robots to handle and manipulate a wide variety of products autonomously in various environments including retail stores, using vision and tactile sensing.

How do you see the future of 'bricks-and-mortar' shops, in the face of ever-growing market share for online shops?

Choosing goods in bricks-and-mortar shops is first and foremost a sensorial experience for the customer, and this will remain the differentiating factor from online shops. With that being said, retail stores increase costs related to logistics and service personnel.

That's where automation can make a real difference. Some retail stores already have introduced self-service checkout stations and even automated product billing with chips on the products for self-checkout. Automation may not only reduce the cost of logistics, but also enable retail stores to function as a hub that can be used by online and delivery services thanks to robotic system solutions.

What are your follow-up plans, if any?

DM and the University of Bremen, among others, have started a related project which is all based on semantic shop maps similar to those generated in the first scenario of REFILLS. The project is called Knowledge4Retail (K4R). It is part of Germany's 'AI strategy' and funded by the Federal Ministry for Economic Affairs and Energy. K4R aims to establish a new generation of information systems for retailers and their supply chains, coming together in a digital innovation platform and ecosystem.

Looking further ahead, I think REFILLS was a great opportunity to validate robotic technologies in logistic applications where robots work close to humans. This experience and the knowledge we gathered can be used in fields with similar problems such as hospitals or intelligent factories.

Keywords

REFILLS, supermarkets, automation, robots, logistics

Related projects

	REFILLS Robotics Enabling Fully-Integrated Logistics Lines for Supermarkets 7 August 2020
PROJECT	

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