

WRO 2019

S-mart

Solutions and Application

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1.Introduction

1.1 Vision and goals

Since this year's WRO theme is "Smart Cities", we decided to create a model of a smart supermarket. Currently, advanced technology and resources are available to build more convenient supermarkets, especially in Vietnam.
Our goal is that this supermarket is an inspiration for businesses to develop smart, technology dependent supermarkets that help simplify everyday tasks. We not only want to inspire innovators to solve problems in our daily life by using technology, but also other teenagers to be creative and explore the endless possibilities.

1.2 Problem

A study shows that an average person goes to the supermarket to do groceries on an average 1.6 times per week. Each shopping trip takes approximately 41 minutes. After doing the math, it can be estimated that a person spends 53 hours in supermarkets in a year.

One reason is because supermarkets can be hard to navigate, especially ones that have large areas and display a vast array of products. Statistics show that an average Amercian supermarket has 42,200 products on display. Even though supermarkets try their best to organize the products into different sections, people still find it hard to find the products that they are looking for because some products don't fit into one category, but two or three. Therefore, looking for specific products can be time-consuming. Even when people eventually remember where different products are, supermarkets still rearrange their products once in a while.

The second reason in that waiting at the check-out station can also be time consuming, especially when the supermarket is at its rush hour. People have to line up and if they're unlucky, the person in front of them purchases 2 or more carts worth of items. Sometimes, people only need to check out one or two items, but have to wait in a long line to purchase the items. Waiting at the check out station is a waste of time, inconvenient and interferes with other plans.

1.3 Solution

Our solution is to create a supermarket system that is convenient, user-friendly and saves time. One feature of the system is that it helps to navigate customers in the supermarket so that products can be easily found and put into the trolley. Another feature of the that it uses a 2-in-1 trolley; a trolley that acts as a navigator as well as a check-out station.

The outdoor supermarket system allows customers to stop buy and buy a few items without entering the supermarket.

1.4 Project components

The project consists of 2 sections

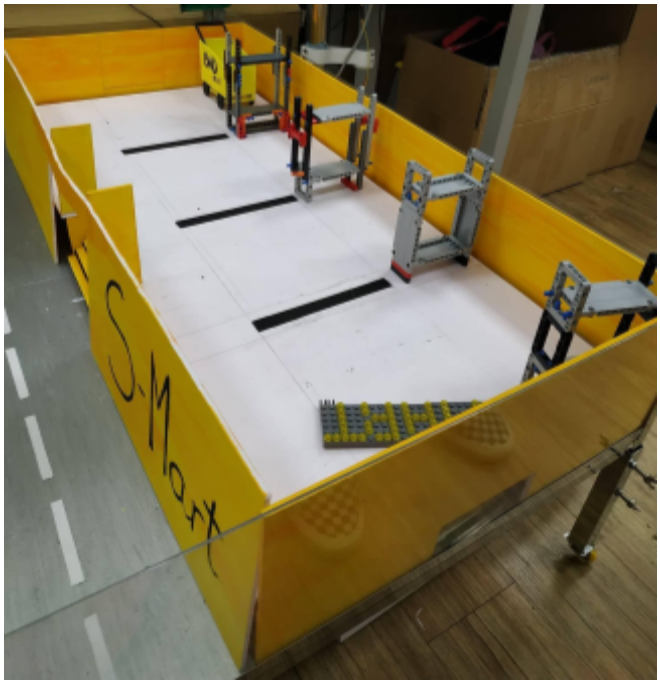
- Indoor supermarket
- Outdoor machines

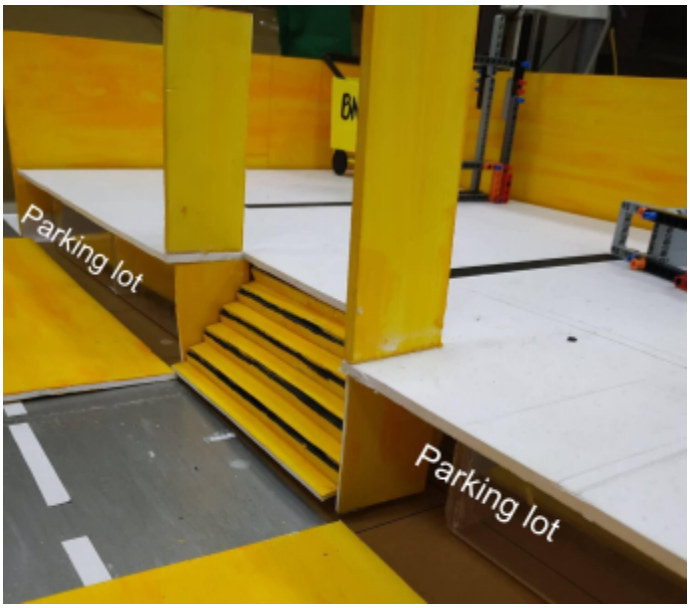
The indoor supermarket has more products on display and takes more time navigating, while the outdoor machines display the most commonly bought products to be purchased quickly.

2. Indoor supermarket

2.1 Overall structure

The indoor supermarket is located on the first floor, just about the ground floor. The ground floor is for the car park. There is a set of stairs leading from the ground floor to the supermarket on the first floor. There are also openings on the ground floor for cars to enter and leave the parking lot. Robotic trolleys, shelves and products are all located on the first floor, in the supermarket.









2.2 Trolley

The trolley is not a typical trolley that is found in supermarkets today. It is a robot that can help people find their way in the supermarket, whether they are new to the supermarket, or whether they are a regular customer. The user inputs voice into the robot and it turns it into text and search the database for the product. Then, the robot draws the path to take to get to the product. Every time the supermarket changes the positions of products, the database has to be updated in order for the path to be drawn accurately. The trolley is not designed to move by itself like a robot, because in that case the satisfaction of pushing the trolley and shopping is not achieved by the customer.

The trolley is also equipped with a checkout system that consists of a screen, scanner, printer and card swipe machine. All of these appliances enable the customer to check out their own items wherever they are in the supermarket, eliminating the need to wait in line at the cashier.

2.3 Shelves and trolley arrangement

The shelves are arranged so that the trolley can easily fit in through the aisles without human intervention. There is a space for trolleys.

2.4 Operation

1. The customer drives the car into the supermarket car park and parks it on the ground floor.
2. The customer uses the stairs to walk up to the indoor supermarket

3. At the automatic doors, customer grabs a trolley and uses the software to create an order with their name on it

4. Using the search feature, they can search for the product and the robot draws a path to the product. The customer just has to follow the trolley's mapped out path and manually take the product from the shelf and place it into the trolley.

5. When enough items are picked, the customer can check out by themselves by scanning the barcodes and placing the items into their shopping bags. If they wish to cancel any items, they can do so on the screen.

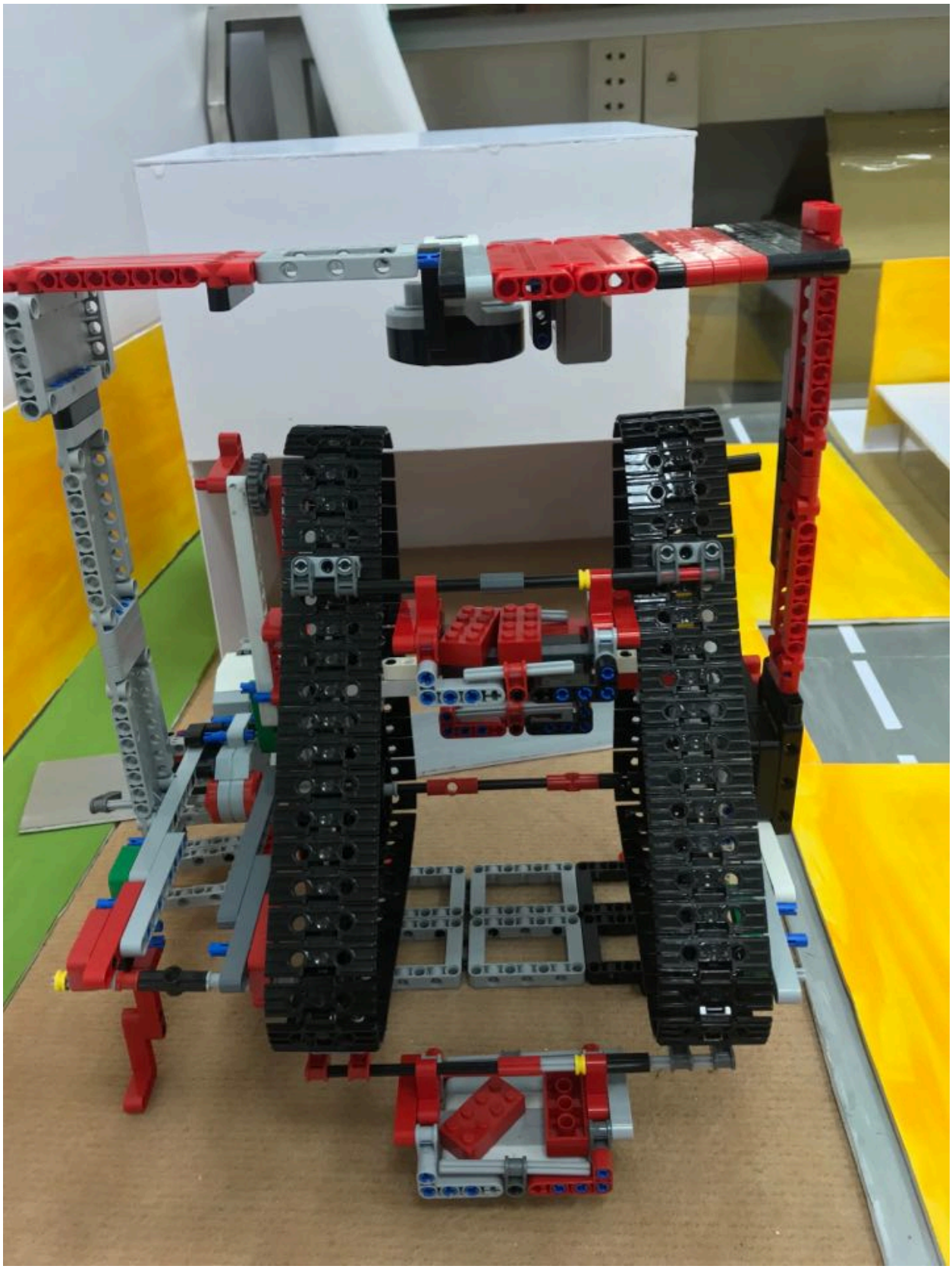
6. Customer scans their credit or debit card to purchase the products. The trolley is then returned to the trolley station and customers can make their way down the stairs, into the parking lot and drive home.

The path outside the indoor supermarket is designed so that customers do not have to go directly into the car park, but can be picked up and dropped off at the stairs leading to the supermarket.

3. Outdoor quick cart machines

3.1 Structure

The outdoor quick cart machines are placed on the outside, next to roads that run through the area. These are placed in those positions so that they are easily accessible for people who want to buy only a few products without leaving their cars and spending too much time.



The machine is similar to a vending machine, but instead of pushing products that are selected by the customer, the shelves rotate depending on the products that customers choose. It consists of 2 conveyor belts that are placed vertically instead of horizontally, connected by shelves hung on axes. The belts are connected to a motor that rotates them, causing the shelves to move to the front and then the back continuously. Since the shelves are hung on axes and not stuck to a stick, they are kept upright when the belts move and products do not fall out.

3.2 Operation

Step 1: Customer drives through the entrance gate and takes a turn at the outdoor quick shopping lane.

Step 2: Customer stops at one of the machines lined up along the lane.

Step 3: Customer presses buttons on a touch sensor to move the conveyor belts so that the shelf containing the product is brought to the front.

Step 4: Customer manually takes the product from the shelf.

Step 5: customers scan the barcode of the products on the scanner

Step 6: Customer manually takes it from the shelf.

4. Conclusion

4.1 Advantages

Just like any other system, this supermarket system has advantages as well as disadvantages. Advantages of indoor supermarket:

- It assists the customers in buying groceries in less time as the shortest route to the searched product is displayed on the screen.
- Customers don't require as much effort because they don't need to walk around looking for groceries.
- It's time-saving because the customers don't have to queue up in long lines just for the check-out.
- By enabling the customers to check out their stuff by themselves, it allows them to take control over their expense, change their decision any time they want before their final payment, and examine the items they want to purchase more carefully.

- Reduces the pressure on the cashiers, especially at high time as the customers take responsibility and initiative for their check-out.

Disadvantages:

- The customers can make mistakes when they scan the items for check out and accidentally take the items out scanning it.
- This quick cart is only suitable for the customers who pay by credit card.
- The system cannot detect the traffic in the supermarket, so the shortest route might be the busiest.

4.3 Application

The indoor supermarket system is most effective if it is used in big supermarkets, like MegaMarket in Vietnam, or Tesco Metro in the United Kingdom. This is possible due to the large space that the supermarkets are spread over and the number of items that are on display. There is also space for trolley storage and without being in the shoppers' path. An intricate navigation system is not necessary in a small supermarket.

The outdoor supermarket system, on the other hand, can be applied in many places because the system doesn't take up too much space and display a large number of produces. Some examples are the gas station, on the side of a road, anywhere convenient for customers to stop by and buy in only a few minutes.

Overall, advanced technology today should be applied to current supermarkets and transform them into a smart supermarket, with the system described above to change people's everyday habits in a positive way.

5. References

- https://www.creditdonkey.com/grocery-shopping-statistics.html