

Smart Cart

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Our App: <https://smartcarttauiot.azurewebsites.net/homePage.html>

Summary:

Our project is a web application, to help people navigate in the supermarket and make the navigation efficient.

Big supermarkets are labyrinths to ones who are not familiar with them, finding remote products could be difficult even to experts, and a missing item might cost you a lot of precious time.

Using our application, those problems are solved. The client enters his shopping list and chooses the supermarket he shops at, and if one of his desired products is missing, he will be notified before even starting looking for it. In addition, based on the shopping list and the supermarket structure, a route between the aisles is calculated, a map will be presented on the smartphone with a step by step guide according to his position.

Hardware:

Raspberry Pi 3:

We're using a Raspberry Pi 3 running a Windows 10 IoT Core operating system as the heart of our project, the Raspberry Pi will be connected to a usb camera and will run a UWP app. The Raspberry pi will be connected to the internet via a Wi-Fi dongle, and communicate with the Azure cloud.

Camera:

We're using a Microsoft Webcam: LifeCam Studio (connected to the Raspberry Pi via USB) to take photos of the surrounding and find QR codes, scan them, decode them and send their content (our current location) to the cloud using the Raspberry Pi.

The project in details:

The project consists of 3 parts: the application, the Azure cloud and the Raspberry Pi.

- The user registers into the application (if not registered already), and then logs in. When logged in, the first step is to create the shopping list- choosing the products and their quantities. The user can create a new shopping list and continue, and if that is not the first time he uses the application, he can choose one of his previous shopping lists. If so it is loaded to the app and the user can modify it if needed. If a new list is created or an old one is modified, it is sent to the server and stored there with his other lists. The next step is choosing the supermarket. After selecting the desired one, the list is compared to the supermarket's inventory, and the quantities are validated. The client will be notified if there are missing products or products with not enough items in stock. The last step before starting the navigation is entering the cart number (written on the cart) to the application. The supermarket id and the shopping list are sent to the server, a route is calculated, and a map

of the supermarket appears on the screen. The map includes the supermarket's structure (aisles, entrance, exit), white circles where there are products, and a line representing the route to walk along.

The client should walk according to the route, and whenever he reaches one of the desired products the application will alert that he should pick up that product now. After passing a location, it is marked as "passed".

Eventually, the client is guided to the counters and the exit.

- The navigation is done using QR barcodes and a camera connected to the cart. The camera is powered by the Raspberry Pi. In every aisle there are several QR barcodes. When navigating, the camera on the cart periodically takes pictures, checks whether there is a barcode in it, and one is found, it processes the barcode's value, and sends it to the Azure server to figure out the cart's position.

It was quite a challenge to find a QR code library that would be compatible with the Raspberry Pi's processor. We tried several until we have found one that worked fine. In addition, it took us time to find a suitable application platform that would run on the windows 10 IOT operation system. Eventually, we chose the UWP platform.

- The Azure server holds the database and does computation on the data. The Smart Cart and the client app communicate through the function apps that are on Azure, allowing the app to get information from and to the database and perform computations.

The database tables are:

- shopping_carts- all the carts and their positions.
- users- list of the users uses the application.
- supers- list of the supermarkets.
- items- a record for each product in each supermarket, with its quantity.
- shoppingLists- list of the clients' shopping lists.

We used several Function Apps:

- compute the route.
- send the application the current position of its cart
- handle the users (register, log in)
- manage the shopping list
- change the cart position when the raspberry pi finds a new QR barcode

Some videos:

- The app (part 1) https://www.youtube.com/watch?v=naKRuav_RDI&feature=youtu.be
(part 2) https://www.youtube.com/watch?v=Fre_mkuK568&feature=youtu.be
- Demonstration (part 1) <https://www.youtube.com/watch?v=ckktFpONw74&feature=youtu.be>
- (part 2) <https://www.youtube.com/watch?v=LytA4Nwsbd4&feature=youtu.be>

