Team 10 – GNA (Grocery Navigation Assistant)

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Introduction

GNA (Grocery Navigation Assistant) is a senior project designed to solve the problem of inefficient and disorganized grocery shopping by developing a system that maps out the most efficient route around a grocery store.

Our product locates the items in a customer’s grocery list in a store to minimize unnecessary wandering and backtracking. Customers can generate a grocery list on our mobile application, which can then be transferred into the GNA to be sorted and displayed.

The interface also shows the layout image of the grocery store, with the location of the items highlighted for ease of navigation. The cart-mounted system is easily detachable for recharging and maintenance.

Data Transfer Process

Mobile Phone
User generates the grocery list on the app

Scan QR Code
Connects the app to the MQTT topic to send the list

MQTT Server
Receives data from the publisher and sends it to all subscribers

Raspberry Pi
Subscribed to the MQTT topic and receives the list, then sorts the list in an optimized order

Display
Show store layout, sorted grocery list, item details in the GUI

Figure 2: Flowchart describing the data transfer of the grocery list from a user’s personal mobile device to the GNA device.

Mobile Application & Data Transfer

We used React Native to build our application on Expo, and the app is compatible with iOS and Android devices. We also utilized an application layer protocol called MQTT (Message Queuing Telemetry Transport) to establish communication between the GNA and the mobile application. Eclipse Mosquitto, which is a lightweight open-source implementation of the MQTT protocol, works well with our hardware and software components. The MQTT protocol works by “publishing” and “subscribing” to “topics.” Thus, by scanning the QR code, the user can send their list to the same topic that GNA is subscribed to and sends the list to GNA for it to sort.

Housing & Mounting Mechanism

The mounting mechanism design was inspired by the vise grip commonly seen throughout workshops, where a screw and a guide rod allow for clamping between two vertical surfaces.

We applied silicon tape to reduce slippage along the handlebar and the main body of the shopping cart.

We designed the internal component housing with two primary pieces: the base and the back cover. The back cover is attached to the base with seven screws, where the base holds the internal components, keeping them safe from the outside environment.

Graphical User Interface

The application was created using Python’s built-in ‘guizero’ library to keep it simple and lightweight. D&W had already made a handout with the store’s layout, as well as some common items and their corresponding locations. This information was used for the GUI and to build the database of the items into a CSV file format.

The user will see the layout of the store, with the current item’s location highlighted in a green box. The estimated time is calculated given the assumption that finding each item will take two minutes on average. Using the two buttons located in the bottom right corner, the user can navigate through their sorted list.

Hardware Components

- Raspberry Pi 3 Model B
- HMTECH 10.1-inch Touchscreen Display
- Anker 20000mAh Portable Charger
- HB15CK Power Button
- 3D-Printed Mounting Bracket (PLA)