

**The Grocobot**

Kent He, Mohammed Miah, Zarif Ahmed, Rafwan Sarker

Department of English, City College of New York

ENGL: 21007, Writing for Engineering

Professor Jacobson

April 21, 2025

Table of Contents

Introduction.....3

Contents.....3

Why Grocobot?.....4-5

Features.....5-8

Contradiction.....8-10

Future of the product.....10-11

Conclusion.....11

References.....12

## **Introduction**

In an era where AI is increasingly integrated into our everyday lives, there have been attempts to incorporate this technology into shopping experiences. The Grocobot is an improvement on existing AI Shopping cart design, prioritizing a healthy diet. Unlike existing designs such as the Caper AI Shopping cart and the Shopic shopping cart attachment, we decided to combine these concepts with a focus on health.

With the Grocobot, users can enter information about themselves, which will be utilized to best help users find food products best suited to them. The built-in AI “coach” function helps the owner maintain and keep track of their diet when shopping for foods, preventing them from overspending and maintaining a healthy lifestyle. For users who want to take it further with improving their lifestyle, they can give Grocobot any personal health concerns they have, and the Grocobot will flag products that will negatively affect their health.

With new and quickly advancing technology, we have transformed your average cart into a super cart with an advanced system. The Grocobot, helping you in ways you never imagined.

## **Contents**

- Why Grocobot?
- Features
- Contradictions
- Future of the product
- Conclusion

## Why Grocobot?

In the United States of America, food is wasted at an alarming rate, and about one third of it is wasted by the consumer. According to phys.org “U.S. consumers waste a lot of food year-round—about one-third of all purchased food. That's equivalent to 1,250 calories per person per day, or US\$1,500 worth of groceries for a four-person household each year, an estimate that doesn't include recent food price inflation.”(figure 1).

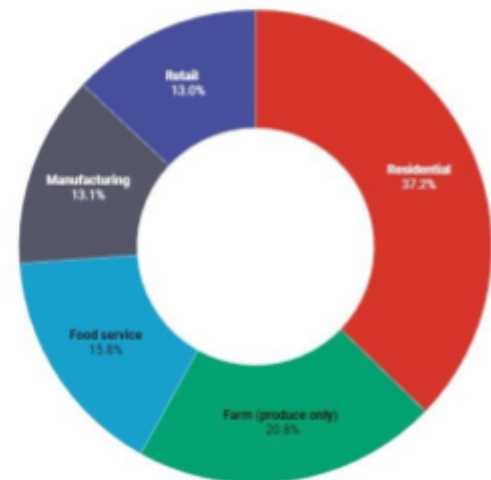
This is where Grocobot comes in, not only can users track the caloric needs of the individuals in their family they can also set their caloric needs. If someone is working out or is an athlete, their caloric needs will vary depending on whether they're cutting, bulking, or maintaining weight. The app will ensure they meet their specific calorie intake needs during the shopping process. That isn't the only purpose, even if an individual has a medical condition, they can be assisted with the Grocobot app. By providing bloodwork and information about the user's medical condition, Grocobot can assist during shopping. For example, if a user is diabetic and they provide their blood work information, the app can set a limit on added sugars, saturated and trans fats that they can purchase. The app works with multiple family members, and can suggest beneficial market products based on nutrients.

Figure 1

### Households account for the largest share of US food waste

In 2019, the U.S. wasted 80.6 million tons of surplus food across all sectors. This represented 35% of total food production. More than one-third of the waste occurred in homes.

Residential 37.2% Farm (produce only) 20.8% Food service 15.8% Manufacturing 13.1% Retail 13.0%



Households on overspending on groceries

users can set a shopping cycle. If they have to shop biweekly, monthly, or bimonthly, the app will use the user's caloric intake and nutritional needs, and suggest proper product quantities to purchase. It can store a history of what products were purchased repeatedly and will add it to an easily accessible suggested grocery list.

### **Features**

This smart shopping cart has several features separating it from other shopping carts, it has mobility assistance, artificial intelligence and a user centric design aimed at making the grocery shopping experience better. At its core, the cart has hardware and software to perform real-time data analysis, nutritional tracking, budgeting, and even personalized health feedback. The system is built for a wide demographic of our shoppers including, elderly, individuals with disability and tech savvy shoppers.

### **Overview**

- Brushless DC Motor
- Arduino Microcontroller
- Ipad screen/Interface

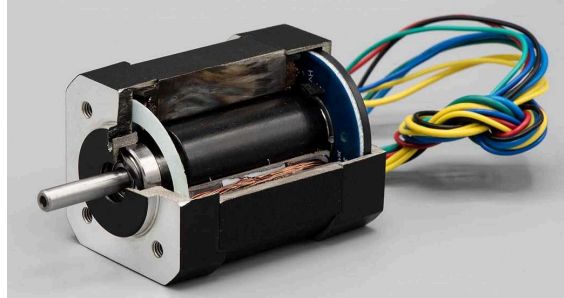


Figure 2

Example Brushless DC Motor. ASSUN <https://assunmotor.com/blog/how-long-do-brushless-motors-last/>

The cart is powered from a brushless DC motor which is sustainable and better longevity, this motor is connected to the omnidirectional wheels that provide smooth directions. It uses a combination of ultrasonic sensors, infrared proximity detectors, and computer vision to detect and avoid obstacles. These sensors allow the cart to autonomously follow a user within a limited range or navigate short distances on its own. It would be beneficial to those who are pregnant, don't want to put attention to the cart or with disability. The cart is also installed with a GPS and RFID which helps the cart to reposition itself in larger supermarkets.

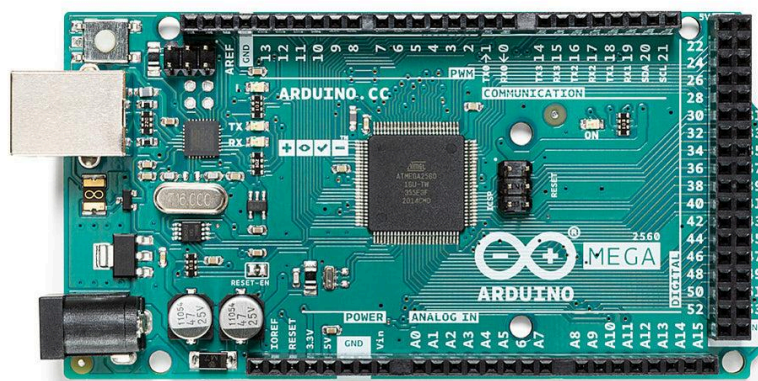


Figure 3

Arduino Mega 2560 Rev3 Board. Arduino. <https://store.arduino.cc/products/arduino-mega-2560-rev3>

An arduino microcontroller, manages motor control, obstacle detection, and route planning. It connects to the tablet, allowing the user to set instructions for the pathing of Grocobot. The user can set the cart to “Follow Mode” or “Stationary Mode” through the app interface, allowing disabled or distracted users to be able to use a shopping cart without manually pushing it.



Figure 4

15-Inch Android POS Tablet. InterpretationShop <https://www.interpretationshop.co.uk/product/15-pos-android-tablet/>

Mounted at the front of the Cart is a 15 inch Android powered tablet. This tablet serves as the main user interface and is preloaded with a multifunctional application developed in Java. The tablet has a high definition camera which has a preinstalled barcode scanner used to scan product labels and retrieve real-time nutritional and pricing information through an internet-connected database.

The application uses RESTful APIs to fetch product data from retailer databases, nutritional info from public and private food databases Upon scanning an item, the app analyzes calories, macronutrients (carbohydrates, proteins, fats), sodium, sugar, and more, then displays warnings or suggestions based on user-specific dietary constraints.

The user of the smart cart can use the attached camera to scan or link medical data such as recent blood work through an app integration with electronic health record systems like MyChart. The app uses machine learning algorithms to analyze patterns and suggest diet changes.

For budgeting, the app uses real-time price tracking and a smart calculator. As items are scanned or placed into the cart, a load-cell based weight sensor and RFID reader verify the addition. Prices are added to a running total and visualized on-screen. Users receive notifications if they're close to or over budget and are offered cheaper or healthier alternatives when available.

The system supports multiple user profiles and biometric logins via facial recognition or fingerprint sensors on the tablet. The UI includes accessibility features like voice assistance, high-contrast text, screen reading, and multilingual support. Users can toggle between different shopping modes such as “Quick List,” “Healthy Mode,” “Allergy Mode,” or “Meal Planner,” each offering personalized suggestions and alerts.

All data processing and storage are encrypted. The cart connects via Wi-Fi or 5G to cloud servers hosted on secure platforms like AWS or Azure, ensuring fast processing and data synchronization. The app follows modern cybersecurity protocols like OAuth 2.0 for user authentication and TLS encryption for data transmission. The cart can also operate in offline mode, storing data locally and syncing once reconnected.

### **Contradiction**

As innovative as the shopping cart there are many concerns to be raised. One major challenge is the balance between privacy and personalization. To offer accurate dietary and

health-based suggestions, the cart must access sensitive data of the user, which would be their medical records leading to raise concerns on their privacy and data. To combat this, future versions could process data locally using edge computing, ensure all data is encrypted, and offer full transparency and user control over what's shared and will be supplied from a reliable health supplier for the user's data to be private. Furthermore, there will also be concerns in convenience and cost, autonomous movement, nutritional tracking, and RFID scanning would make the cart expensive to build and maintain, which will make it upscale to the consumers. This could be mitigated by partnering with other companies such as Zebra technologies, and other healthcare companies and advertising different brands to cover the cost, to promote healthier lifestyles.

There's also tension between healthy guidance and consumer freedom. Some shoppers may feel judged or restricted when the cart flags their unhealthy food choices. This can be resolved by allowing users to adjust the strictness of alerts and framing feedback in a positive and empowering way. Incorporating a sense of earning points for the user could be a valid direction to take instead of criticizing them for their health choices, signing with partners and rewarding them to be healthy. Lastly, the system depends heavily on real-time data and internet connectivity to function smoothly. Any network disruption could impact the experience. To counteract this, the cart would feature offline capabilities with cached data to do seamless shopping.

Moreover, an important contradiction the smart shopping cart may face is data accuracy versus product diversity. For the system to provide correct nutritional information and pricing, it relies heavily on up-to-date databases and accurate product scans. However, with thousands of brands, frequent inventory changes and private-label items, maintaining consistent and accurate

data becomes a challenge. A mislabeled item or outdated nutritional profile could mislead users, especially those managing health conditions like diabetes or hypertension. To address this in the future, developers can implement machine learning algorithms that cross-check multiple data sources, allow stores and brands to update information in real time, and even crowdsource corrections from users. More measures can be taken with store collaborations, to better confirm information and update data as soon as stores push new products.

### **Future of the product**

The future of the smart shopping cart is bright, with the potential to reshape how people shop, eat, and manage their health. As technology continues to evolve, the cart will become even more intelligent, capable of not only tracking individual products but also predicting user preferences, suggesting recipes based on dietary goals, and providing real-time alerts if a user exceeds their daily limits for sugar, sodium, or calories. Integration with wearables like fitness trackers or smartwatches will allow the cart to pull in data like heart rate, activity levels, or glucose levels, further personalizing the shopping experience. In the long term, this could make grocery shopping an essential part of preventative healthcare.

From a social and global perspective, the cart could contribute significantly to public health initiatives. Governments and health agencies may see value in supporting or subsidizing this technology, especially in areas struggling with diet-related illnesses such as obesity, diabetes, or high blood pressure. The smart cart could be deployed in lower-income neighborhoods to help residents make better choices through education and awareness at the point of sale. Partnerships with food manufacturers and local farmers could also provide more transparency about sourcing, promoting sustainable and ethical food options. As the cart collects more anonymized data across

users, it could be used to identify health trends and shape future nutrition campaigns or retail policies.

Technologically, the cart is likely to advance just through AI and automation. The future models may no longer need manual scanning; built in cameras and computers could instantly recognize items as they're placed in the cart. Voice assistants and gesture recognition may allow hands-free interaction, while augmented reality on the tablet could visually guide shoppers to healthier alternatives. Integration with smart home devices will mean that fridges can keep track of the pantry stock, making grocery trips more efficient and less wasteful. As artificial intelligence becomes more advanced, the cart could even help with long-term meal planning, suggest seasonal ingredients, or warn against allergens or food recalls based on a household's profile.

## **Conclusion**

In conclusion the Grocobot is an innovative take on the already invented ai shopping carts. Given all the parts that are in us it shows how effective/efficient an ai shopping cart can be for society. Unlike other ai shopping carts, the cart is significantly beneficial to consumers' health and wellness journeys whether they are active or just looking for a healthier lifestyle. Grocobot isn't just a product but a friend that keeps you on track. Everything is under the control of the buyer, they have the option to not use any of the listed features of Grocobot, with the given security system the user can feel safe giving personal health information as well. With the amount of food going to waste due to consumer overspending, Grocobot helps the users buy proper quantities of food. The consumer gains not only a great lifestyle, but also helps the environment.

## **References**

- *RTS. (2024). Food Waste in America in 2024: Statistics & Facts. Recycle Track Systems.*  
<https://www.rts.com/resources/guides/food-waste-america/>
- *martinekuan. (2022, December 16). Compare AWS and Azure storage services - Azure Architecture Center. Learn.microsoft.com.*  
<https://learn.microsoft.com/en-us/azure/architecture/aws-professional/storage>
- *Caper AI Checkout - Make Shopping Magic. (n.d.). Caper Website. <https://www.caper.ai/>*
- *Home. (n.d.). Shopic. <https://www.shopic.co/home/>*

## **IMAGES**

- *15" POS Android Tablet - InterpretationShop. (2025, January 23). InterpretationShop.*  
<https://www.interpretationshop.co.uk/product/15-pos-android-tablet/>
- *Arduino. (2021). Arduino Mega 2560 Rev3. Arduino Official Store.*  
<https://store.arduino.cc/products/arduino-mega-2560-rev3>
- *(2022, October 10). How Long do DC Brushless Motors Last? | Assun Motor. Assun Motor Pte Ltd. <https://assunmotor.com/blog/how-long-do-brushless-motors-last/>*
-