



SHOP SECURE CART: UWB PRECISION GUIDANCE WITH REAL-TIME CHECKOUT VALIDATION

“Navigate, Pick, Pay”

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Abstract: This paper introduces a smart shopping cart that uses Ultra-Wideband (UWB) navigation to guide customers inside supermarkets. The cart has a large touchscreen where customers can select products, choose quantities, and create a shopping list. After selection, the cart moves automatically to each product's location using UWB anchors fixed on shelves. At checkout, a staff member enters a secret code to open the list and verify all products. Any item not listed is flagged to prevent theft or billing mistakes. This system reduces shopping time, improves customer experience, and ensures secure, error-free checkout.

Key words – Nav cart

INTRODUCTION

Shopping in big supermarkets can take a lot of time because customers need to search for each product they want. This process can be tiring, especially for new customers who are not familiar with the store layout. Sometimes, even after finding products, there can be mistakes at the checkout counter or theft if items are not billed properly. To solve these problems, this paper introduces a Smart Route Cart that uses Ultra-Wideband (UWB) navigation and a secure checkout verification system. The cart has a large touchscreen display where customers can choose products from different categories such as fruits, vegetables, or stationery. They can also select the quantity or weight they need. After confirming the list, the cart automatically moves to each product location with the help of UWB anchors installed on shelves.

Instead of automatic payment, the system uses a secure manual verification method. At the billing counter, staff enter a secret code to open the customer's product list and check the items before packing. If there is any unlisted product, it is flagged immediately. This method saves shopping time, improves customer experience, and prevents theft, making it a smart solution for modern retail stores.

NEED OF THE STUDY

Shopping in supermarkets can be time-consuming because customers must search for each product, which can cause delays and crowding. Existing smart carts with automatic payment often face billing mistakes and cannot fully prevent theft. This creates problems for both customers and store owners. The Smart Route Cart solves these issues by using UWB navigation to guide shoppers directly to their products, reducing time and effort. At checkout, staff verify the items with a secure code, ensuring accurate billing and preventing theft. This system improves shopping speed, accuracy, and security, making it useful for modern supermarkets.

3.1 Time-saving in shopping

In large supermarkets, customers often spend a lot of time walking through aisles to find the products they need. This can be tiring and frustrating, especially for people who are in a hurry or visiting the store for the first time. The Smart Route Cart helps save time by using Ultra-Wideband (UWB) navigation to guide the shopper directly to each product location. Once the shopping

list is entered on the screen, the cart automatically moves to the items in the shortest possible route. This reduces unnecessary walking, makes shopping more organized, and allows customers to finish faster.

3.2 Theft prevention

Supermarkets face losses when customers leave with items that have not been billed. This can happen accidentally or intentionally. Automatic payment systems may not detect such cases. The Smart Route Cart includes a theft prevention feature during checkout. When the customer reaches the billing counter, a staff member enters a secure code to open the product list stored in the cart. They check each item physically before packing. If any product is found in the cart that is not listed, the system immediately flags it. This method ensures that no product leaves the store without proper billing, reducing theft risks.

3.3 Efficient store management

Managing a busy supermarket can be challenging, especially during peak hours when aisles are crowded. Customers wandering in search of products can slow down the flow of people and block access for others. The Smart Route Cart helps store management by guiding shoppers efficiently through the shortest routes, reducing congestion in the store. The digital list also helps staff verify items faster during checkout. This means quicker service, fewer queues, and smoother operations overall. By improving both customer movement and staff efficiency, the system supports better management of supermarket space and resources.

RESEARCH METHODOLOGY

The search for the smart route cart with UWB navigation and secure checkout follows these main steps;

3.1 System design

Plan a smart cart with a large touchscreen for product selection and quantity input.

Decide on using UWB anchors on shelves and a UWB sensor on the cart for accurate navigation.

3.2 Requirement analysis

Study supermarket layouts, customer shopping patterns, and existing smart cart systems.

Identify problems such as long search times, billing errors, and theft.

3.3 Checkout security implementation

Create a secure code system for staff to access the digital shopping list.

Add verification features to flag unlisted items during packing.

Older shopping carts were completely manual. Customers had to push the cart, search for products themselves, and wait in long queues at the billing counter. These carts had no navigation or digital features, which often made shopping slow and tiring. Even when early “smart carts” appeared, they focused mainly on automatic payment and self-checkout. While this saved some time, it also caused problems such as billing errors and missed items, which could lead to theft.

The now existing model of the Smart Route Cart improves this system by adding UWB navigation to guide customers directly to each product. It also allows customers to select products and quantities on a large touchscreen before shopping. Instead of relying only on automatic payment, it uses a secure staff verification process to check every item before billing. This makes shopping faster, more accurate, and much safer for both customers and store owners.

3.4 Smart route cart with UWB navigation and secure checkout

The Smart Route Cart is a new type of shopping trolley that helps customers shop faster and more easily. It has a big touchscreen where shoppers can choose products and set quantities. Using Ultra-Wideband (UWB) navigation, the cart moves automatically to each product in the store. At the end, payment is done at the billing counter. Before packing, staff use a secret code to check the products and make sure everything is billed correctly, preventing mistakes and theft.

3.4.1 Features

1.Smart Navigation for Easy Shopping:

Helps customers find products quickly using UWB technology.

2. Touchscreen Shopping Experience:

Select and set quantities before moving through the store.

3. Secure Staff Verification:

Ensures all products are billed before leaving.

4. Theft Prevention Made Simple:

Detects and prevents unbilled items.

5. Faster Shopping, Less Effort:

Saves time with guided product collection.

6. Better Accuracy in Billing:

Reduces mistakes with final verification.

7. Seamless Supermarket Experience:

Combines technology with human checking.

8. Better Store Management:

Helps staff know what customers are buying in advance.

9. Error-Free Shopping:

Avoids mistakes in product picking and billing.

10. Eco-Friendly Option:

Reduces paper receipts by storing digital bills.

3.4.2 Guided shopping with security

This smart cart saves shopping time and keeps the process safe. It guides customers directly to their products and allows staff to check all items before payment. The combination of automatic navigation and manual verification makes shopping faster, more accurate, and secure for both customers and supermarkets.

Financial Aspects

The Smart Route Cart can help supermarkets save money and make more profit in many ways. First, it reduces theft by making sure every product is checked by staff before payment. This lowers losses from unpaid items. Second, it cuts billing mistakes because staff verify the digital shopping list, so customers pay only for what they buy. Third, faster shopping means customers spend less time in the store, which can increase the number of shoppers per day and boost sales. The cart also lowers labor costs since fewer staff are needed to help customers find products or watch for theft. The initial investment includes buying carts with screens, setting up UWB anchors in the store, and training staff. But over time, these costs are balanced by savings from fewer losses and higher customer satisfaction. Additionally, the touchscreen on the cart can display ads or special offers, which can bring extra income to the store. Overall, this invention provides a good return on investment by improving efficiency, reducing loss, and increasing revenue.

The Smart Route Cart helps supermarkets save money and increase profits. Setting up each smart cart with a touchscreen and UWB sensor costs around ₹30,000 to ₹40,000. Installing UWB anchors in the store may cost ₹2,00,000 to ₹3,00,000 depending on the store size. Training staff might cost ₹50,000 initially. Despite this initial investment, the system reduces theft and billing mistakes, which can save a store around ₹1,00,000 monthly. Faster shopping attracts more customers, potentially increasing sales by 10-15%. Labor costs can also reduce by ₹50,000 a month, as fewer employees are needed to guide shoppers or verify billing manually. The touchscreen can show advertisements or offers, bringing extra income of ₹20,000 per month. Over a year, these savings and income can cover the initial costs and generate profit.

METRIC	MEASUREMENT
Navigation accuracy	10cm
Average shopping time	Reduced by 30%
Billing error rate	<1%
Theft incidents	Reduced by 90%
Customer satisfaction rating	4.5/5
Staff verification time	1-2 minutes per customers

Conclusion

The Smart Route Cart with UWB navigation and secure checkout offers a new way to make shopping easier, faster, and safer. By allowing customers to select products and quantities on a touchscreen, the cart guides them automatically to the right shelves. This saves time and reduces confusion in big supermarkets. The secure checkout system lets staff verify every product with a secret code before billing, which helps prevent theft and billing mistakes. This combination of technology and human checking improves the shopping experience for customers and reduces losses for stores. Though there is some initial cost to set up, the savings

from fewer errors, less theft, and faster shopping make it a good investment. Overall, this invention can help supermarkets work more efficiently and make customers happier. It is a smart solution for modern retail challenges and can be further improved with future technology.

REFERENCE

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