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SURVEY ON SMART TROLLEY

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ABSTRACT :

The traditional shopping experience is undergoing a transformation with the advent of innovative technologies. The Smart Shopping Trolley project exemplifies this paradigm shift by integrating cutting-edge technologies such as Raspberry Pi, image processing, database management, and mobile applications to enhance the efficiency and convenience of shopping. This review paper provides an overview of the project's objectives, methodologies, key findings, and implications for the future of retail.

Keywords— Image Processing, Raspberry Pi

INTRODUCTION:

The evolution of technology has continuously reshaped various aspects of our daily lives, and the realm of retail is no exception. Traditional shopping experiences often involve cumbersome processes, including manual scanning of items at checkout counters, leading to inefficiencies and delays. In contrast, the proposed Smart Shopping Trolley system represents a groundbreaking advancement in the retail landscape, seamlessly integrating cutting-edge technologies to redefine the shopping experience.

At the heart of this innovative solution lies the utilization of QR code scanning technology, a feature poised to revolutionize the way consumers interact with shopping carts and products. Unlike conventional shopping carts, which rely on manual input and checkout procedures, the Smart Shopping Trolley system streamlines the entire process through a series of intuitive steps.

1. Users log into the mobile app and scan a QR code on the shopping trolley to activate it.
2. They place products under the trolley's camera.
3. The camera scans QR codes on products, automatically opening the trolley's gate to safely deposit items.
4. Decoded product information is sent to a central database, instantly updating the user's mobile app cart.
5. Users can monitor and manage their selections in real-time through the app.
6. When ready, users can securely pay via the app's integrated e-wallet.

Literature Review

Paper [1] In this setup, a mobile application is pre-installed on the user's device, which is connected to the shopping cart. Communication between the shopping cart and the mobile application is facilitated through Bluetooth technology. The Arduino microcontroller manages the RFID sensors and facilitates the transmission of data to the mobile application.

Through this configuration, the mobile application receives real-time data from the RFID sensors via the Arduino microcontroller. This data exchange enables users to interact with the smart shopping cart interface directly from their mobile devices. Additionally, the mobile application communicates with a central server to further process and store the shared data.

Paper [2] In this setup, when a consumer places an item into the shopping cart, the integrated barcode scanner automatically scans the item's barcode and displays its value on the digital display panel. This real-time feedback allows consumers to keep track of their purchases as they shop. Once the consumer completes their shopping, the accumulated bill is sent to the checkout counter section for payment processing. This seamless integration of IoT technology streamlines the shopping experience, providing consumers with instant feedback on their purchases and simplifying the checkout process

Paper [3] The system is centered around the ARM7 microcontroller, which is equipped with an LCD display and an RFID scanner, as well as Zigbee

wireless technology. The 16x2 LCD display provides real-time information to the consumer by showcasing the scanned product's unique code and price. The RFID scanner seamlessly captures product information, which is then displayed on the LCD screen, providing consumers with immediate access to pricing details as they shop. Once the consumer has completed their shopping, they can proceed to the checkout counter, where the displayed bill on the LCD screen serves as an instant reference for payment.

Paper [4] The implementation incorporates the EM-18 RFID scanner module, which operates at a frequency of 125 kHz, making it a low-frequency RFID reader. The RFID scanner module is capable of detecting RFID tags within its range, allowing for real-time tracking of items placed in the trolley. The system provides a convenient feature where consumers can view the accumulated bill in real-time and selectively remove items by pressing a delete button. To facilitate this functionality, the authors have employed the Arduino Uno microcontroller, known for its affordability and efficiency. The Arduino Uno provides all necessary support for the microcontroller, requiring only a connection to a laptop or power source to begin operation. Upon scanning an item, the system initiates the billing process, with the option for consumers to remove items if desired.

Paper [5] The framework proposed aims to alleviate queues in shopping centers by leveraging RFID modules. In this setup, an RFID reader is employed to scan RFID tags attached to items as they are placed into the shopping trolley. Should a customer wish to remove an item, they simply need to take it out of the trolley. The system's LCD display provides real-time updates on removed items, displaying their name, cost, and the updated total bill. To streamline the checkout process, the system utilizes a Xampp server to send the bill directly to the cashier.

Paper [6] The system's design ensures seamless communication and data exchange between the shopping trolley and other components, thereby enhancing the overall shopping experience for both buyers and sellers. ZigBee technology serves as the backbone of the system, functioning similarly to an Xampp server but with greater reliability and efficiency.

Paper [7] As customers place items into the shopping cart, an RFID reader integrated into the cart detects the RFID tag on the product, subsequently displaying its price on an LCD display. This process continues seamlessly as more items are added to the cart. Additionally, the shopping cart is equipped with a ZigBee transmitter, responsible for transmitting data to the main computer system. The main computer system is equipped with a ZigBee receiver, positioned nearby to receive the transmitted data from the transmitter.

Paper [8] This paper introduces an approach to designing a Smart Shopping Trolley based on Passive UHF RFID technology. Drawing inspiration from Panasonic's development of a smart shopping basket, this system utilizes UHF RFID technology operating within the frequency range of 916-924 MHz. Key components of the system include two Circular Polarized (CP) Patch antennae, strategically positioned to read RFID tags in various orientations. The RFID reader employed in this setup is the CSL 468, boasting 16 ports and a scan speed of 300 tags per second.

Paper [9] This paper facilitates the creation of an automated centralized billing system for shopping malls, streamlining the checkout process for customers. In this system, ZigBee and RFID technologies are integrated to enable seamless communication between the shopping cart and the central billing system. Customers have the convenience of paying their bills using credit or debit cards, adding to the efficiency and convenience of the shopping experience.

Paper [10] Smart Shopping Cart system designed for automated billing purposes using wireless sensor networks. This framework finds application in various settings, including supermarkets, with the aim of reducing labor and enhancing the shopping experience for customers. Instead of subjecting customers to long checkout queues, the system automates the billing process, providing a more efficient and seamless experience. Customers can conveniently track details of their purchases and view the current bill amount on the display screen.

CHALLENGES OF PRESENT SYSTEM

It is a time-consuming process to scan details of each n every item.

1. Limited range and accuracy of RFID Readers
2. Customers have to wait for a long time in queues to get the billing process done.
3. Barcode scanners need a clear vision of the barcode to scan with efficiency.
4. To read the barcode the barcode scanner must be rather near to it but its shouldn’t be more than 10ft.
5. Limited connectivity and data transfer.
6. While customers have to wait for some time the barcode scanner retrieves the product information.
7. Scalability and cost

Comparison of research methods and finding

Existing System	Proposed System
Billing is manual leading to inaccuracies	Real time updates on bill total for accurate tracking
Long queues at the checkout due to manual canning and processing	Minimized queues with automated billing process
Barcode requires clear visibility and proximity to	Image processing technologies scans the QR codes,

the barcode.	eliminating the need for manual estimation.
Getting item detail is time consuming and hectic to wait in queues.	Getting item detail is fast and easy and waiting in queues is not required.
Item cost is low however expenditures are much higher.	Item is little expensive but overall expenditure is much low.
Customers get final bill at the billing counter.	After customer add new item bill amount is updated on the app.

Proposed methodology

The primary objective of our proposed system is to automate the product identification process through the utilization of image processing techniques, specifically targeting QR code scanning. By eliminating the need for manual scanning or tagging, the system aims to enhance user experience while ensuring accurate and efficient identification of products. This analysis involves the real-time capture of product images using smart cameras, followed by the extraction and integration of QR code information with the billing system.
In addition to automating the product identification and billing process, our proposed system offers customers an interactive shopping experience with added features such as access to previous shopping history and shopping list management modules integrated into the mobile application.

This experimental prototype is designed to address time-consuming shopping processes and quality of service issues commonly encountered in traditional retail environments. With its ease of implementation and scalability, the proposed system can be seamlessly integrated into commercial operations, offering tangible benefits to both customers and retailers. Future testing under real-world scenarios will further validate its effectiveness and potential for widespread adoption.

Our proposed methodology leverages a combination of hardware components, software algorithms, and mobile application integration to automate the shopping process and enhance user experience.

The process begins with user authentication through the mobile application. Once authenticated, users proceed to activate the smart shopping trolley by scanning a QR code affixed to the trolley.

As the user places products in the trolley, infrared (IR) sensors detect their presence, triggering the Raspberry Pi-equipped camera to capture images of the products. These images are processed using OpenCV for QR code scanning.

Upon successful scanning, the QR code data is decoded and compared with the product database stored on a centralized server. This database contains information such as product name, price, and availability.

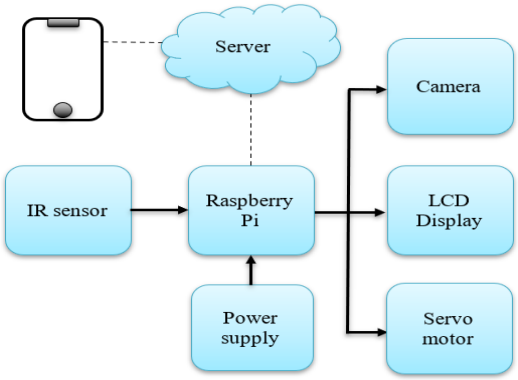
In real-time, a 16x2 LCD screen attached to the trolley displays instructions for the user, guiding them through the scanning process. Simultaneously, the mobile application displays scanned items, their prices, and the total cost.

Once the user has finished shopping, they can view the total cost on the mobile app and proceed to make payments using the integrated e-wallet system. Upon payment completion, the system generates a final bill for the user.

Throughout the process, the security of items inside the trolley is ensured by a servo motor-controlled gate, which remains closed during scanning and payment processes.

The entire system interacts seamlessly with a centralized server, which manages records of products, trolleys, users, and transactions. This centralized approach facilitates efficient management and coordination of the shopping process.

Overall, our proposed methodology aims to eliminate time-consuming shopping processes, enhance security, and improve the quality of service for both customers and shops. It provides a convenient and streamlined shopping experience while leveraging advanced technologies to optimize efficiency and accuracy.



Conclusion

In conclusion, our proposed smart shopping trolley system represents a significant advancement in the retail industry, offering a seamless and efficient shopping experience for both customers and shops. By integrating cutting-edge technologies such as image processing, QR code scanning, and centralized server management, we have created a solution that addresses common challenges in traditional shopping processes.

Through the use of infrared sensors and Raspberry Pi-equipped cameras, we have automated the product identification process, eliminating the need for manual scanning and tagging. This not only saves time for customers but also enhances accuracy and reduces errors in billing.

The integration of real-time display screens and a mobile application provides users with instant access to product information, pricing, and total cost, enabling informed decision-making and a more convenient shopping experience.

Furthermore, the inclusion of an integrated e-wallet system facilitates secure and cashless transactions, improving overall transaction efficiency and customer satisfaction.
The security of items within the trolley is ensured through a servo motor-controlled gate, which remains closed during scanning and payment processes, enhancing the safety and reliability of the system.

Overall, our experimental prototype demonstrates the feasibility and potential of implementing such a system at a commercial scale in the future. By streamlining the shopping process, enhancing user experience, and improving service quality, our proposed system aims to revolutionize the retail landscape and set a new standard for modern shopping experiences.

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