International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 04, April 2026)

IoT-Based Intelligent Trolley for Automated Billing

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***Abstract*— The SmartCart system is an IoT-based solution designed to enhance and modernize the traditional shopping experience by reducing billing time and eliminating long queues in supermarkets. It integrates technologies such as barcode scanners or RFID readers, microcontrollers, and wireless communication to automatically identify products as customers add them to the trolley. The scanned data is processed and transmitted to a cloud-based server or mobile application, enabling real-time billing and instant display of the total amount, which helps users track their spending while shopping. The system promotes self-checkout, reduces human effort, and minimizes billing errors, thereby improving overall efficiency and customer satisfaction. Additionally, features like product removal detection, real-time updates, and secure digital payment integration make the system more reliable and user-friendly. Overall, SmartCart provides an innovative, efficient, and time-saving solution that transforms conventional retail shopping into a smart and automated experience.**

***Keywords*— Automated billing, RFID, barcode scanning, real-time billing, smart shopping, retail automation.**

I. Introduction

In today's fast-paced retail environment, customers expect a quick, seamless, and hassle-free shopping experience. However, traditional billing systems in supermarkets often lead to long queues, delays, and customer dissatisfaction, especially during peak hours. The need for an efficient and automated solution has become increasingly important to enhance both customer convenience and store productivity.

The SmartCart system is an innovative approach that leverages the power of the Internet of Things (IoT) to transform conventional shopping trolleys into intelligent devices capable of automated billing. By integrating technologies such as RFID or barcode scanning, microcontrollers, and wireless communication, the system allows customers to scan products as they add them to the cart. The billing information is updated in real time and can be displayed on a screen or a connected mobile application.

II. Methodology

The SmartCart system is developed using an IoT-based approach that integrates hardware components, software modules, and wireless communication to enable automated billing.

The methodology follows a structured process involving system design, data acquisition, processing, and real-time communication.

Initially, each product in the store is assigned a unique identification code using either RFID tags or barcodes. The smart trolley is equipped with a scanner (RFID reader or barcode scanner), a microcontroller (such as Arduino or NodeMCU), a display unit, and a wireless communication module.

When a customer places an item in the trolley, the scanner reads the product code. The microcontroller processes this data and retrieves the corresponding product details such as name and price from a local database or cloud server. The item is then added to the cart, and the total bill is updated instantly.

III. Results And Discussion

The implementation of the SmartCart system demonstrated significant improvements in the shopping and billing process. The system was able to successfully scan products using RFID/barcode technology and update the total bill in real time. The integration of the microcontroller and IoT platform ensured smooth communication between the trolley and the central server, allowing accurate and instant data processing.

The results showed a considerable reduction in billing time compared to traditional checkout systems, as customers no longer needed to wait in long queues. The real-time display of the total amount also helped users manage their expenses effectively while shopping. Additionally, the system accurately handled product addition and removal, maintaining correct billing without manual intervention.

From a performance perspective, the system was reliable under normal operating conditions, with minimal delay in data transmission. However, slight latency was observed when network connectivity was weak, indicating dependence on stable internet for optimal functioning. The use of RFID technology improved automation but increased the overall cost, whereas barcode-based implementation proved to be more economical but required user interaction.

IV. CONCLUSION

The SmartCart system successfully demonstrates how IoT technology can transform the traditional shopping experience into a smart, efficient, and automated process. By integrating components such as RFID/barcode scanning, microcontrollers, and wireless communication, the system enables real-time billing and eliminates the need for conventional checkout queues.

The project achieves its primary objective of reducing billing time, minimizing human effort, and improving accuracy in transactions. It enhances customer convenience by providing instant bill updates and supports retailers by increasing operational efficiency and reducing workload on staff.

In conclusion, SmartCart is a practical and innovative solution that contributes to the development of smart retail systems, offering a faster, user-friendly, and technology-driven shopping experience.

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