International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 06 | June - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Arduino Driven Shopping Trolley with Bluetooth Module

N. Sanjana
UG Student
sanjunasam69@gmail.com

S. Suchithra
UG Student
suchithrasunkari@gmail.com

D. Thrisha
UG Student
thrishadanthuri2003@gmail.com

Dr. Shaik Masthan Basha
Associate Professor
masthanbasha@vmtw.in

Department Of Electronics and Communication Engineering
Vignan's Institute of Management and Technology for Women,
Kondapur(V), Ghatkesar (M), Medchal Dist -501301 Telangana State.

ABSTRACT

In this project, our Smart Shopping Trolley is implemented by integrating Arduino automation, RFID and Bluetooth connection. This system automates product identification and eliminating human efforts at checkout step. The Arduino microcontroller controls the components such as RFID reader, Bluetooth module and an LCD display. Real-time scanning of products with RFID tags, display of billing updates. The actual price of each product and any discounts or offers are shown in LCD for items. With the help of Bluetooth terminal, it allows for real time billing details on shopper's mobile. "Total" tag finalizes the purchase and sends billing details to shopper's mobile. Provides convenience to customer and operational efficiency to retailers.

Keywords: Arduino Nano, RFID, LCD

I. Introduction:

Since traditional shopping practices are tedious because paying in cash is a slow process, long queues and low automation would lead to inefficiencies and unhappy shoppers.

Bar-code scanning and manual payments burn your fingers, traditional checkout never got integrated, so manually updating billing in real-time. The next-generation smart shopping trolley is a solution that automates product identification, payment using contemporary embedded technologies, and billing. The system supplies them with more convenient and precise access during the shopping process by reducing the necessity of a manual scan, counter-based checkouts, etc.

A central controller Arduino Nano, uses an RFID reader for the detection of the product at the time of sale with no need for manual scanning, a Bluetooth module for the wireless UPI transaction, and an LCD for display feedback of correct functionality. The products in product trolleys are equipped with RFID tags which means they can instantly read off items as they are added to the basket as shown in Fig 8. The LCD just shows both the original price and discount amount and bringing you up to date with your total with each new product. Shoppers can complete their purchase with a push-button at any time which is the trigger to billing and resets the system for next user.

Objectives

1. Streamlining product identification and billing processes rapidly by developing an innovative shopping trolley.
2. To combine RFID technology with an Arduino Nano to detect products and update billing in real time.
3. To use a Bluetooth terminal for real-time billing details.
4. To enable real-time user engagement via an LCD display that shows billing information, product specifications, and both regular and discounted prices.

Problem Statement:

In this fast-moving world of today, shopping with its long counters and manual item scanning would be tiring and irritating process. The traditional checkout systems will be delaying, inefficient and billing may go wrong as they heavily rely on human interaction. And consumers remain in the dark about the full cost if there is not a proper up-to-manufacture transparency even at real-time cost recovery. The call for a smarter, more dynamic solution is clearly evident when it comes to the increasing expectation of speed and convenience in retail. Such a system would greatly enhance the customer experience and operational efficiency to instantaneous product recognition, live bill updating and well flowing end-to-end digital payments.

II. Literature Review:

The literature survey on smart shopping trolley systems explores the evolution of technologies aimed at automating the billing process in retail environments. Traditional billing methods, while commonly used, are inefficient due to long queues and reliance on manual operations, leading to customer dissatisfaction and increased labour costs. To address this, RFID-based systems have been introduced, enabling automatic product identification and real-time cost calculation, thereby streamlining the checkout process.

Early implementations featured shopping trolleys equipped with RFID readers capable of scanning product tags and transmitting the data wirelessly to a centralized billing counter. These systems demonstrated improved billing efficiency but required continuous connectivity with a central server, limiting their applicability in offline or low-budget retail setups.

Further advancements included the integration of microcontrollers such as Arduino with RFID systems and LCD displays. These smart trolleys calculated and displayed the total cost of items in real time, offering a cost-effective and compact solution for automated billing. The use of embedded platforms made such systems more accessible for small and medium-sized retail environments.

Arduino-based smart trolley systems gained popularity due to their affordability, flexibility, and ease of programming. These systems can be enhanced with additional features such as barcode scanning, weight measurement, and mobile payment options. However, their overall performance depends on sensor precision and software reliability.

III. System Architecture and Components

Block Diagram:

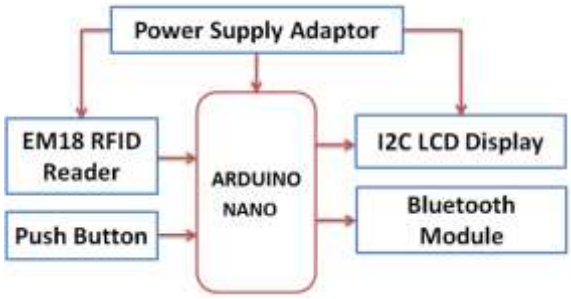

Fig 1. System Block Diagram

Hardware Components:

1. **Arduino Nano**: The Arduino Nano is an open-source microcontroller based on the Microchip Atmega328p microcontroller (MCU) and developed by Arduino.cc and initially released in 2008. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor.

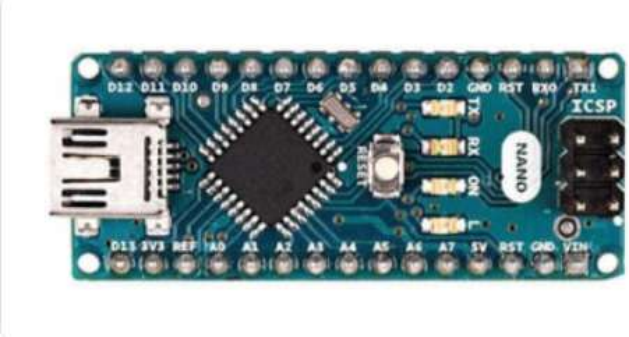

Fig 2. Arduino Nano

It serves as the brain of the system, processing data from the RFID Reader EM 18 and controlling output device, LCD display. The board is programmed using the Arduino IDE with embedded C/C++ language. It operates at 5V and is widely used due to its ease of programming, open-source nature, and extensive library support for interfacing various sensors and modules.

2. **RFID Reader EM 18:** It is used to read unique ID from RFID tags. Whenever RFID tags come in range, RFID reader reads its unique ID and transmits it serially to the microcontroller or PC. RFID reader has transceiver and an antenna mounted on it. It is mostly fixed in stationary position.

Fig 3. RFID Reader

EM-18 is used like any other sensor module. First, we choose the mode of communication between MODULE and CONTROLLER. Next, we will program the controller to receive data from module to display. Next power the system. When a tag is brought near the MODULE it reads the ID and sends the information to controller. The controller receives the information and performs action programmed by us.

3. **I2C LCD Display:** The I2C 16x2 LCD display is used to provide real-time system feedback and status messages to the user. It simplifies wiring by using only two pins (SDA and SCL) for communication, reducing the number of required connections compared to a standard parallel LCD.

Fig 4. I2C LCD Display

The LCD display provides real-time feedback by showing each item's actual price alongside the discounted price, if available. This helps shoppers clearly understand savings applied through offers. It also updates the running total as items are added, giving customers full visibility into their expenses. This enhances shopping transparency and improves decision-making during purchases.

4. **Bluetooth Module:**

The Bluetooth module used in this project is HC-05 which is so familiar and cheap. It is easily available in local Indian markets. You can go either offline or online.

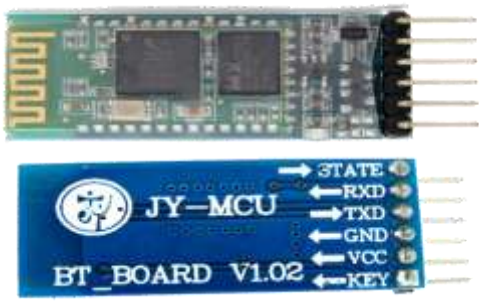

Fig 5. Bluetooth module

5. **Push Button:**

A push is connected to the Arduino as shown in the Fig 7. In this system, it is used along with an RFID scanner to manage item removal. When the button is pressed and an RFID tag is scanned, the system considers the item as removed and deducts its price from the total.

Fig 6. Push Button

Software and Programming

The system is programmed using:

☞ Arduino IDE: Used for writing, compiling, and uploading the firmware to the Arduino Nano microcontroller.

☞ Embedded C/C++ Programming: Implements RFID tag reading, LCD display updates, Bluetooth-based payment request handling, and system logic.

☞ MFRC522 Library: Facilitates communication between the Arduino and the RFID reader module.

☞ Software Serial Library: Enables serial communication with the Bluetooth module for UPI payment processing.

☞ LiquidCrystal_I2C Library: Manages the I2C LCD display to show item details, prices, discounts, and total billing information.

IV. Working Principle

The shopping trolley system operates as follows:

☞ System Initialization: On powering up, the Arduino initializes the RFID reader, Bluetooth module, and LCD display. The LCD displays welcome messages to indicate successful startup as shown in the Fig 7.

☞ Product Detection: As items with RFID tags are placed into the trolley, the RFID reader scans each tag and sends the product data to the Arduino for processing.

☞ Real-Time Billing: The LCD display shows each item's name, actual price, and discounted price (if applicable), along with a running total of all items in the trolley.

☞ Bluetooth terminal display: When the "Total" tag is detected Arduino sends the billing information to the shopper's mobile via Bluetooth as shown in the Fig 11.

☞ Purchase Confirmation: Upon successful payment, the LCD displays "Payment Done" and shows the final bill. The system then reset by workers, ready for the next user.

V. RESULTS

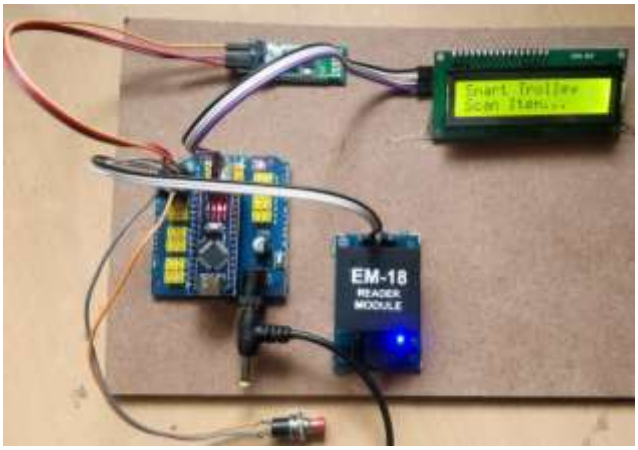

Fig 7. System waiting for Item detection

Fig 8. RFID Tag Scanning

Fig 9. LCD displaying price

Fig 10. LCD displaying Item

Fig 11. Bill details being displayed on Shopper's Mobile.

VI. FUTURE ENHANCEMENTS

Although the system improves the shopping experience significantly, it can be further enhanced by incorporating additional features such as: ☞ Weight Sensor Integration: Verifying that the scanned items match the actual weight in the trolley to prevent theft or mismatches. ☞ Wi-Fi/IoT Connectivity: Allowing real-time data syncing with the store's backend for live inventory updates and customer billing history. ☞ Mobile App Integration: Providing users with a companion app to track expenses, receive personalized offers, and view past purchases. ☞ Voice Assistance: Guiding customers through the shopping process and providing verbal price or offer information via a smart assistant. ☞ Navigation System: Helping customers locate items within the store using an interactive map displayed on a screen or mobile app.

VII. CONCLUSION:

This paper presents an Arduino-driven Shopping Trolley with Bluetooth module presents a significant innovation in the retail shopping sector. It automates the tedious process of billing by enabling real-time item detection, display, and mobile-based bill generation using RFID and Bluetooth technologies. The system offers a cost-effective, flexible, and user-friendly alternative to traditional billing methods and barcode systems. While there are some limitations in terms of cost, range, and security, these can be addressed with future enhancements such as advanced sensors, mobile integration, and encrypted communication. As shopping trends move toward self-service and smart automation, this project stands out as a practical and scalable solution to streamline operations and improve customer satisfaction.

VIII. REFERENCES:

[1]. N. Vidhya Lakshmi and M. Subha, "Smart Trolley for Automated Billing using Wireless Technology," *International Journal of Computer Applications*, vol. 69, no. 9, pp. 1–4, May 2013.

[2]. R. A. Fernandes, T. N. Naik, A. M. Faleiro, and A. Mascarenhas, "Smart Shopping Trolley using RFID," *International Research Journal of Engineering and Technology (IRJET)*, vol. 6, no. 4, pp. 1984–1987, Apr. 2019.

[3]. M. Sivakumar, D. S. Kumar, and S. K. Pavithra, "Smart Shopping Trolley Using RFID," *International Journal of Engineering Research and General Science*, vol. 3, no. 2, pp. 275–278, Mar.–Apr. 2015.

[4]. K. Sankar and V. Vijayalakshmi, "Bluetooth Technology and Its Applications in IoT," *International Journal of Advanced Research in Computer and Communication Engineering*, vol. 7, no. 1, pp. 51–55, Jan. 2018.

[5]. L. Atzori, A. Iera, and G. Morabito, "The Internet of Things: A Survey," *Computer Networks*, vol. 54, no. 15, pp. 2787–2805, Oct. 2010.

[6]. A. Roy, P. Mitra, and S. Mukherjee, "Smart Shopping Cart for Automated Billing Purpose using Wireless Sensor Networks," *International Journal of Advanced Research in Computer and Communication Engineering*, vol. 3, no. 3, pp. 227–231, Mar. 2014.

[7]. K. Shanmugasundaram and R. Ashok Kumar, "Arduino-Based Smart Trolley System Using RFID," *International Journal of Recent Technology and Engineering (IJRTE)*, vol. 8, no. 2, pp. 1560–1563, July 2019.

[8]. D. Kumar and V. Gupta, "Role of Arduino in the Development of IoT Applications: A Survey," *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, vol. 5, no. 1, pp. 47–52, Jan.–Feb. 2019.

[9]. P. S. Sindhu and V. Bhuvaneswari, "Wireless Shopping Trolley for Supermarket Billing System," *International Journal of Science and Research (IJSR)*, vol. 5, no. 3, pp. 49–52, Mar. 2016.

[10]. M. Patel, H. Bhatt, and A. Mistry, "Smart Trolley with Advanced Billing System," (IJCSMC), vol. 6, pp. 105-112, June 2017.