

# **RFID Based Automatic Billing Trolley**

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**Abstract:** *Nowadays the shopping has become a huge trend in urban or metropolitan cities, more at weekends. Due to this the super markets, big bazaar etc., has named very well because of availability of all the things at one place. Trolley is used to make shopping easy and simple. It is problem for consumers to stand in long queue for billing and very difficult to follow covid rules at covid-19 time. To handle the large crowd, we must reduce the process of the billing time. This is done using smart shopping system based on RFID. Items that are put in a smart shopping cart are read one by one and the bill is generated and displayed. After the final bill is generated the customer pays the bill by using their Pre charged cards provided by the shopping mall. The aim is to reduce the time consumption needed for the billing system.*

**Keywords:** Automatic Billing System, RFID Scanner, Shopping Trolley, Controller

## **I. INTRODUCTION**

Humans are constantly trying to invent something new. The main motivation behind this reform or this has been done with the aim of limiting the development of new technology and make daily tasks less demanding, stressful and saving Time, can be accessed independently of different domain. The app helps customers find items in the right stock by giving them new insight, along with a grocery store course guide, as well as data on things on the rundown. It contains information background on the items purchased by the customer. It empowers customers to use the information for the next purchase. The general store can perceive the pattern and then collect stock or advance offers as needed [11]. Nowadays, shopping is one of the most important functions that people invest in an impressive amount of energy and time. In general, the vast majority of the general population shop for an hour or more every day. Customers have a lot of trouble during shopping, one of them is waiting in queue to bill for products and most of the customers are budget shoppers. Most of the time they will know that the bill is more useful than the budget value and there will be problems with removing the products [1].

Sometimes, shoppers are unable to buy all the products they need and lose some. Second, shoppers nowadays are more comfortable buying from home than going to the store. Then, the next difficulty is to locate the products here. Above all, it is a completely time-consuming process. So overcome this problem a smart trolley with an automated billing system is proposed. With these trolleys Customer can do their shopping comfortably and pay close attention to their shopping list without needing to drive around in their shopping cart. This type of advanced system used in various application such as big-bazars, demarts in a shopping center present existing billing system are operated manually. When after the total purchase the person as go to the payment billing center there is a long queue at the billing center. The upcoming days remove the existing billing system to install the RFID based smart trolley with automatic billing system. This smart trolley having number of components such as RFID reader, RFID tags Arduino, LCD, HC-12 wireless module.

**Aim & Objective:**

In the present-day shopping system, one of the difficulties is waiting for long time in a queue for billing of the products which is time consuming. The main aim of this project is to reduce the time for billing in order to avoid huge crowding in the billing area. So that the customer can reduce the time in making payment and can have ease in his shopping.



Another added or extended feature of this project is customer could pay their bill by their pre-charged customer card provided by the shop. Finally, the whole information will be sent to central PC of the shopping mall.

## **II. LITERATURE SURVEY**

For our project we are surveying some reports and references which are helping us to make it easy and simplest and they are as follows

### **1. Smart Shopping Cart with Automated Billing Using Arduino (2023) [1]**

This study presents a smart shopping cart system integrated with RFID technology to automate the billing process, reducing the need for manual barcode scanning and enhancing customer convenience. "Smart Shopping Cart with Automated Billing Using Arduino" by Rutwij Kulkarni, Aditya Kumavat, Aman Jha, Ashutosh Pratap Singh, and Prof. Anuja Chincholkar (2023). The project addresses the common issue of long checkout queues in supermarkets by implementing an automated billing system within the shopping cart itself. The system utilizes RFID tags for each product and an RFID reader mounted on the cart to scan items as they are added. This enables real-time calculation of the total bill, eliminating the need for manual scanning at checkout counters. Due to the seamless integration of RFID technology, the system is easy to implement and requires minimal maintenance. The automated approach enhances efficiency, accuracy, and the overall shopping experience.

### **2. IOT Based Smart Shopping Cart (2023) [2]**

This study presents an IoT-based smart shopping cart system that enhances the shopping experience by integrating automated billing and real-time cart tracking. The system incorporates ZigBee modules to enable communication between shopping carts while also providing an additional layer of security by sending an SMS to the customer after the bill is paid. "IOT Based Smart Shopping Cart" by Anusha K, Gayana G P, Rekha B Honnali, Sahana G B, and Shridevi H (2023). The project aims to revolutionize the traditional shopping experience by utilizing IoT technologies to streamline billing and improve security. Each shopping cart is equipped with a ZigBee module, enabling communication with other carts and the store's central system for real-time tracking. Once the customer completes the payment, an SMS notification is sent to their registered mobile number, ensuring transparency and security in the transaction. The integration of ZigBee allows carts to share shopping information, but it also introduces security risks and increases system costs. Despite these challenges, the system enhances the overall efficiency and convenience of the shopping process.

### **3. Smart Shopping Trolley With Automated Billing (2023) [3]**

This study introduces a smart shopping trolley system that automates the billing process and provides multiple payment options, enhancing efficiency for both customers and store owners. The system integrates a Raspberry Pi for processing, allowing customers to complete payments via credit cards or by scanning a QR code. "Smart Shopping Trolley With Automated Billing" by Apeksha Jagtap, Rohit Pagar, and Gopika Nair (2023). The project aims to simplify the shopping experience by reducing the need for manual checkout and enabling digital payment methods. Customers can choose to pay either by swiping a credit card or by scanning a QR code, making the process seamless and user-friendly. The smart trolley system enhances convenience by eliminating long queues and ensuring faster transactions. However, the inclusion of a Raspberry Pi increases the complexity and cost of the system, requiring careful optimization for widespread adoption.

### **4. IOT Based Smart Trolley System For Automated Billing Using RFID (2023) [4]**

This study presents an IoT-based smart trolley system integrated with RFID technology to automate billing while enhancing user convenience and safety. The system is designed to autonomously follow customers while detecting and avoiding obstacles in its path, ensuring a seamless and secure shopping experience. "IOT Based Smart Trolley System For Automated Billing Using RFID" by S. Karthi, K. Sathiya Sri, A. Venimalathy, and T. Sindhu (2023). The project aims to modernize the shopping process by introducing a smart trolley that follows customers automatically, eliminating the need for them to push carts manually. Equipped with RFID technology, the system scans items as they are added, updating the bill in real time. Additionally, the trolley is designed with obstacle detection capabilities,



allowing it to navigate safely within the store environment. While this innovation enhances the overall shopping experience, the system requires regular maintenance and software updates to ensure optimal functionality and reliability.

5. IOT Based Smart Shopping Cart using NODE MCU and RFID (2022) [5]

This study introduces an IoT-based smart shopping cart system that leverages NodeMCU and RFID technology to automate billing while enhancing customer engagement through real-time promotional updates. The system displays current offers as pop-ups on the trolley screen, providing customers with instant access to discounts and deals. "IOT Based Smart Shopping Cart using NODE MCU and RFID" by Saksham Singh, Abhishek Dadhwal, Shashikant Tomar, and Shivi Saxena (2022). The project focuses on improving the shopping experience by integrating automated billing with promotional features. The system uses RFID tags for seamless product identification and a NodeMCU microcontroller to process data and display relevant offers on a digital screen attached to the trolley. By notifying customers about ongoing discounts and promotions in real time, the system not only enhances customer convenience but also benefits supermarkets by increasing sales and customer retention. The ability to provide quick service further strengthens its role in modern retail environments.

**III. SYSTEM ARCHITECTURE**

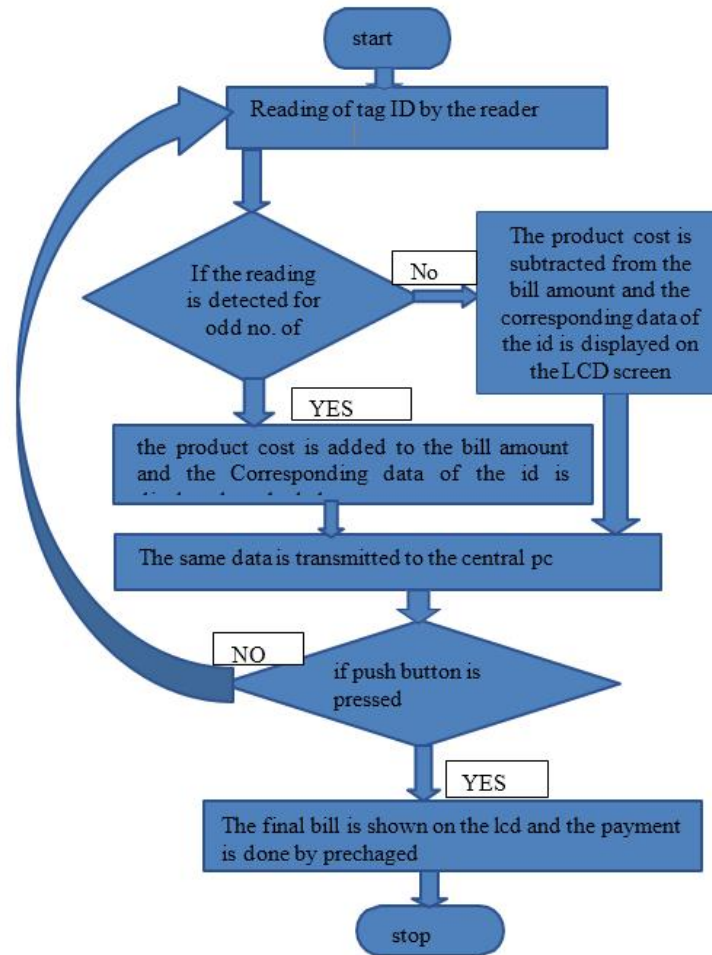


Fig. 2. Flow Chart of Working



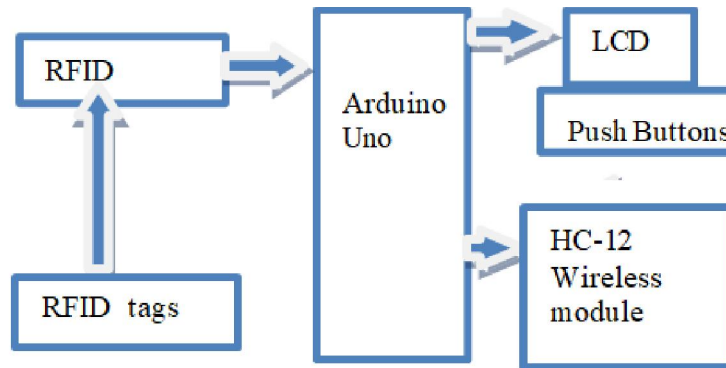


Fig. 1. Block Diagram

An RFID tag (of frequency 125khz) is attached to every product in the mall and the reader (EM-18) is attached to the trolley. At the time of purchase, the tag attached to the product is scanned by the reader. Each tag has a unique EPC. Based on the EPC received by the Arduino, the information of the product is displayed on the LCD along with the updated cost.

This information is also sent to central PC with the help of HC-12 transmitter at the trolley and HC-12 receiver at the PC. If the customer wants to remove the added product, the product should be scanned again. Then the cost of the corresponding product will be deducted from the bill. The push button is provided at the trolley to indicate the end of the shopping. On pressing of push button, the final bill is displayed on the LCD and the payment through precharged card can be done. Recharged cards are unique RFID tags provided for each customer. These cards contain the information such as the customer identification number and the balance available in the card. By scanning precharged cards, payment is done at the trolley itself. Finally, LCD shows the balance available in their card. This whole information is available on the serial monitor of central PC.

#### A. Arduino Uno:

The Uno R3 is an ATmega328P microcontroller-based development board. This is widely popular in Embedded electronics because of the available resources and easy to use by everybody features. With 14 digital input/output pins where 6 can be configured and used as PWM outputs, 6 as analog inputs is a great addition for I/O related operations. Powered with a 16 MHz ceramic resonator, an USB connection, a power jack, an ICSP header, and a reset button. It includes a LED that can be useful in multiple applications or to test the board functionality. A voltage regulator, better to say an LDO, is available inside this development board to make this Arduino compatible for a wide range of input voltages. The application is very easy, just upload the code, and run.

Development board



Fig. 3. Arduino Uno



### B. RFID Tag Reader:

The Radio frequency Identification (RFID) is a wireless identification technology that uses radio waves to identify the presence of RFID tags. We need to bring the RFID tags near to the reader to read the unique identifier number associated with that RFID tag as it has a microchip with radio antenna mounted on a substrate which carries a unique 12-byte identifier. RFID Reader has a transceiver and antenna mounted on it to read the data of the RFID tag and transmit the same to the microcontroller or the PC. It can communicate with your PC with either RS232 or WEIGAND communication protocols. The form of communication is selected by SEL pin. If SEL pin is selected HIGH then form of communication is RS232 and if SEL pin is pulled LOW then form of communication is WEIGAND. Usually, the RS232 is selected because it's popular so SEL pin is pulled HIGH. You can use RFID tags in auto Attendance system, Item Identification system, Automatic payment mechanism, medical tags etc sensor.

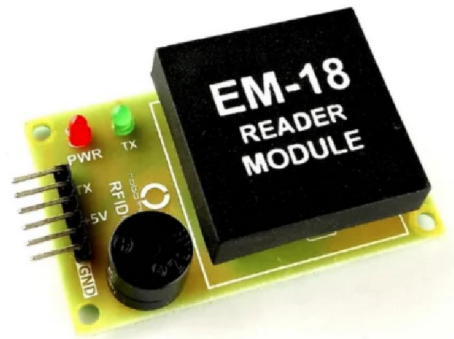


Fig. 4. RFID Tag Reader

### C. RFID Tag:

The RFID Card / RFID Tag (125KHz) is a contactless passive transponder used in access control, attendance systems, and identification applications. Operating at a low frequency of 125KHz, this tag offers reliable short-range communication and is compatible with a wide range of RFID readers. Its durable construction ensures long-term usability in both indoor and outdoor environments, making it ideal for secure and convenient identification.

Features of RFID Card / RFID Tag (125KHz):

1. Operates at 125KHz for short-range RFID systems.
2. Passive design with no internal power source.
3. Compatible with standard 125KHz RFID readers.
4. Durable and lightweight for long-term use.
5. Suitable for access control and identification purposes.



Fig. 5. RFID Tag



#### D. LCD Display:

The 16x2 LCD Display with IIC/I2C interface featuring a green backlight and black characters is an efficient and user-friendly display module for embedded systems. It is widely used in electronics projects due to its compatibility with I2C communication, which minimizes the number of GPIO pins required for interfacing.

This display is ideal for various applications like robotics, IoT devices, home automation systems, and educational projects. Its green backlight ensures excellent readability, while the adjustable contrast allows users to fine-tune the display for optimal performance in different environments



Fig.6. 16x2 LCD Display

#### E. HC12 Wireless Module:

This HC12 SI4463 Wireless Serial Port Communication Module 433Mhz offers reliable, long-range wireless communication in an ultra-compact package. With its 900mW power output and 4-layer PCB, this advanced module allows for reliable, secure data transfer over long distances, with up to 500m+ of coverage. Built-in features such as enhanced frequency hopping, data rate of 250kbps, and CRC error checking help ensure stable, reliable transmission.

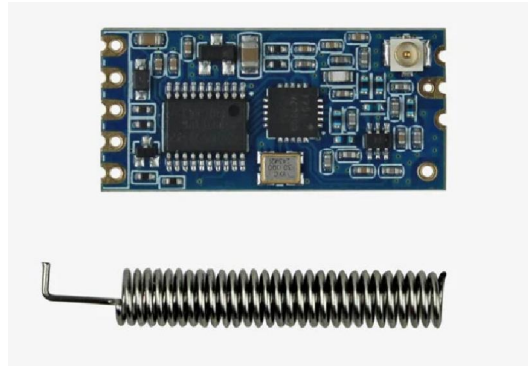


Fig.6. HC12 Wireless Module

#### IV. CONCLUSION

The Work is done with the help of RFID technology, EM-18 reader, RFID tags and Arduino. It's aim is to reduce the time of billing for the customers and to ease the process of shopping so that the customers gets benefited. It can be implemented in shopping malls where there is a large crowd and huge rush into malls. In the world of Automation, This technology will replace the present barcode system which is present being followed. Hence this technology can help people to make their shopping easy and time saving too without any much human intervention. This also reduces manpower and shopping mall maintenance.



This paper represents on RFID System it is good replacement of the barcode scanning system they have many disadvantage in the barcode system like the barcode scanning system can be read data certain distance. The RFID technology very easier to use for old customers and there is no put extra effort this system also called as human friendly smart trolley with automated billing system. This technology provides many benefits. Nowadays all the people depend on digital money transaction like as UPI Payments and this method used in our system it is very easy and faster. If buy a any product, show the name of product, cost of the product, total bill in the LCD. Program dump in the cart it is save time of the client and reduce the labour work. In future ten years, develop the trolley with using dynamic motor that can be connected to the wheel. The expected goals of the project are safe to use, minimize the human efforts.

#### **V. FUTURE SCOPE**

The future scope of an RFID-based billing trolley is highly promising as it can transform traditional shopping into a fast, automated, and user-friendly experience. In the coming years, these systems can be integrated with mobile payment platforms such as Google Pay and PhonePe, allowing customers to complete transactions directly from the trolley without waiting in billing queues. With the addition of IoT and cloud technology, real-time data can be used for inventory management, sales tracking, and demand forecasting, improving store efficiency. Artificial intelligence can further enhance the system by providing personalized product recommendations and offers based on customer preferences. Advanced security features like RFID-based anti-theft systems and weight verification can reduce fraud and improve reliability. Moreover, future developments may include indoor navigation systems to guide customers within stores and integration with fully automated smart retail environments, making shopping more convenient, efficient, and technologically advanced.

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