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SMART SHOPPING CART USING IOT

[1*] G. SRIKANTH REDDY, [2*]ORSU VENU, [3*]YADA AKHIL,
[4*]S. SAI PRATHVI, [5*]P. BHAVANI

[1] Assistant Professor, [2,3,4,5] B.Tech FinaL Year
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
NALLA MALLA REDDY ENGINEERING COLLEGE
DIVYANAGAR, HYDERABAD, INDIA.
srikanth.cse@nmrec.edu.in
orsuvenu2001@gmail.com yadaakhil9666@gmail.com
satapathi1710@gmail.com bhavanipuli7@gmali.com

Abstract –- A new smart shopping system has been developed by integrating the Internet of Things (IoT) technology to connect all items in a grocery store. This system involves embedding an inexpensive RFID tag in each product. When a customer places a product into their smart cart, the product details are automatically read by the cart equipped with an RFID reader. As a result, billing is processed from the cart itself, eliminating the need for customers to wait in long queues at checkout. The system also displays the expiration date of each product, and damaged products can be identified by their weight. Expired and damaged products are not considered for billing. Smart shelving has also been introduced in this system, which uses RFID readers to monitor stock levels, potentially updating a central server. This makes inventory management much easier. Finally, checkout points can validate the purchases made by a client. A prototype of this smart shopping system has been developed and tested

KEYWORDS–ARDUINO,RFID, IOT,SMART BILLING,LCD.

I. INTRODUCTION

Over the past two years, there has been a significant increase in the use of RFID technology, particularly in the grocery industry. While earlier applications of RFID technology were limited to Store Keeping Systems (SKU), where products were labelled at the category level due to the high cost of implementation and low profit margins of individual products, advancements in technology have led to the possibility of labelling every product in the store with an RFID tag. With this development, shopping carts could be equipped with RFID readers and pre-programmed computers that can recognize items placed in the cart and display information and promotions from a distance or through a backend system. RFID technology would also allow for quick and efficient checkout processes by scanning all items simultaneously, eliminating long lines that often accompany grocery shopping. A natural progression of this system would be to embed RFID tags in customers' loyalty cards to identify individuals and allow for faster login and payment at the point of sale. This would result in a more seamless and convenient shopping experience for customers, as well as provide retailers with valuable data on individual shopping behaviours.

II. Literature Survey

A study conducted by A.K. ABHILASH in 2017 presented a cost-effective Smart Shopping Cart that uses IoT (Internet of Things) technologies. The system is ideal for supermarkets and retail stores such as Walmart, where it can reduce labor and improve the shopping experience for customers. Rather than having customers wait in long checkout lines, this system automates the billing process, making it easy and convenient.

The shopping process is divided into two categories: predefined lists and random shopping. The proposed system offers the nearest route to pick up listed items from different racks in Walmart. Additionally, the system features Cart-to-Cart communication, allowing customers to share their shopping lists with others to enable parallel shopping using multiple carts. These features save time and make shopping more efficient. The system design is also capable of detecting theft by shoplifters, making it a comprehensive solution for retailers.

A study conducted by Shahoroz highlighted the challenges faced by customers in supermarkets, particularly during peak times such as weekends and discount offers. Long queues due to the barcode-based billing process can be time-consuming and inconvenient. To address this issue, the study proposed an Internet of Things (IoT)-based Smart Shopping Cart that utilizes Radio Frequency Identification (RFID) sensors, an Arduino microcontroller, a Bluetooth module, and a mobile application. The system works by attaching an RFID tag to each product, which is then read by an RFID reader. The product information is then displayed on the mobile application, allowing customers to manage their shopping list according to their preferences. The shopping information is wirelessly transmitted to a server, which automatically generates the bill.The experimental prototype aims to improve the quality of service and eliminate time-consuming shopping processes. The proposed system is competitive and can be easily implemented and tested on a commercial scale in real scenarios.

In a study conducted by Sakorn Mekruksavanich, it was found that the process of buying numerous goods at supermarkets around the world involves a complicated and time-consuming process. Customers are required to bring the items they want to purchase to the check-out area, stand in a long line, and wait for the products to be scanned, the total amount calculated, and the bill paid. To solve this problem, the study proposes the development of a smart basket for shopping.The smart basket includes a barcode reader on a mobile device, and a barcode tag is found on every item in a supermarket. While shopping, customers can scan the products and place them in the basket, and the mobile device will record and display the price and name of each item. In addition, the basket is equipped with a weight sensor system that confirms the accurate pricing of produce during the shopping process.The microcontroller of the smart basket calculates the total cost of the customer's groceries and stores it in its memory. This data is then transmitted from the basket to the main computer's server via a transmitter. With this smart basket, customers can avoid waiting in line and constantly thinking about the amount of money they will need to spend while shopping. Therefore, the proposed smart basket offers a convenient and efficient way for shoppers to purchase their groceries.

K.Lakshmi (2020) suggests that while shopping can be fascinating, standing in long queues for billing and payment can be tiresome. To address this issue, a smart trolley is proposed that can take care of shopping and billing. With the smart trolley, customers can walk straight into the shop, purchase products, and walk out of the shop. The e-bill is sent to the customer's mail, and they can view their purchase details using the shop's website. To implement this system, an Arduino board, Radio-Frequency Identification (RFID) reader, RFID tag, LCD display, ESP8266 Wi-Fi module, database manager, and a website to maintain product and customer details are required. This IoT-based system enables the trolley to interact with the network worldwide, and the admin can access product and customer details from anywhere in the world.

In a paper by H.H. Chiang (2016), the development of a smart shopping cart (SSC) for integration into a smart mall system is presented. The aim is to provide customers with an efficient user interface to effectively promote the shopping service. The SSC includes a function for face recognition on the user interface, which enables the system to recognize the customer and provide relevant assistive shopping information based on

their purchase history. The SSC also uses radio-frequency identification (RFID) tags to automatically detect and display related product information on the user interface as products are added to the cart. The SSC also offers a search function to improve purchasing efficiency and navigation aid within the mall. The SSC is also capable of automatic billing, and the shopping data is stored and transmitted to the cloud server of the shopping mall. Experimental demonstrations show the effectiveness of the SSC in interacting with customers and providing efficient shopping services.

III.EXISTING METHODOLOGY

The current system employs the conventional method of barcode scanning which can be quite slow as each product needs to be scanned individually. Moreover, the billing process is not automatic and customers have to wait in long queues to complete their purchases. This slow barcode-based billing system often leads to long queues and waiting times. To address this issue, the RFID-based billing system has been introduced which allows customers to pay through credit/debit cards or cash. However, even this process can be time-consuming for billing purposes, resulting in longer waiting times. To overcome this challenge, a proposed solution is the RFID-based smart trolley system.

IV.PROPOSED METHODOLOGY:

The primary objective of this project is to enhance customer satisfaction by reducing the time taken for the billing process. Traditionally, customers have to wait in long queues, even for a few products. However, with the introduction of the smart cart, customers can add products to their cart without having to stand in a queue. The smart cart is designed to complete the billing process automatically, and the final bill is displayed on the cart itself, as well as on the customer's mobile application. Additionally, customers can pay their bills using a pre-recharged RFID card, which is a quick and efficient method of payment. The smart cart system also includes a user interface on the customer's smartphone, allowing for easy and convenient shopping. Overall, the primary concept of the smart cart is to develop an automated self-checkout system that is integrated into a shopping cart and can be controlled using a smartphone.

V. FUNCTIONALITIES

- The smart shopping cart using IoT offers a range of features and functionalities that make shopping more convenient for customers. Firstly, the cart is equipped with sensors and RFID technology that allows for automatic product detection. This eliminates the need for manual scanning of each item and saves time and effort for the customer. Additionally, the system displays real-time product information, such as prices, nutritional information, and ingredients, helping customers make informed decisions while shopping.

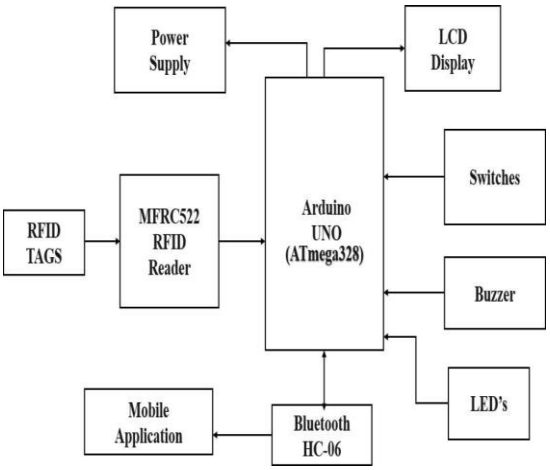
- The smart shopping cart can also provide personalized recommendations based on the customer's purchase history, preferences, and dietary restrictions. This feature is aimed at improving the overall shopping experience for the customer. Furthermore, the system is integrated with a mobile application that allows customers to view their shopping list, track their expenses, and receive discounts and promotions.
- The smart shopping cart is designed to provide a hassle-free checkout experience for customers. The system automatically calculates the total bill based on the products added to the cart and allows customers to make payment through multiple options like RFID card, credit/debit card, or mobile payment. This eliminates the need for customers to stand in long queues for the billing process.

- Finally, the smart shopping cart can provide navigation assistance to customers by guiding them to the locations of the products on their shopping list. This feature is especially helpful for customers who are unfamiliar with the store layout. Overall, the smart shopping cart using IoT offers a range of features and functionalities that are aimed at improving the shopping experience for customers.

VI. LIMITATIONS

- Cost: The implementation of smart shopping cart technology involves a substantial investment in hardware and software, which may not be financially feasible for small retailers.
- Reliance on Technology: The system heavily relies on technology, and any technical malfunction or glitch may cause inconvenience to customers.
- Privacy Concerns: The use of RFID technology raises concerns about privacy as it may track customers' movements and purchases, which may lead to privacy issues.
- Limited Accessibility: The technology may not be accessible to all customers, particularly those who are elderly or have disabilities, which may result in exclusion and inconvenience for some customers.
- Maintenance: The smart shopping cart system requires regular maintenance and software updates to ensure smooth functioning, which can be time-consuming and costly.
- Integration with Existing Systems: Integrating the new technology with existing POS systems and inventory management systems can be a challenge, requiring significant time and effort.

VII. ARCHITECTURE



VIII. MODULES

There are 3 Modules present in our website

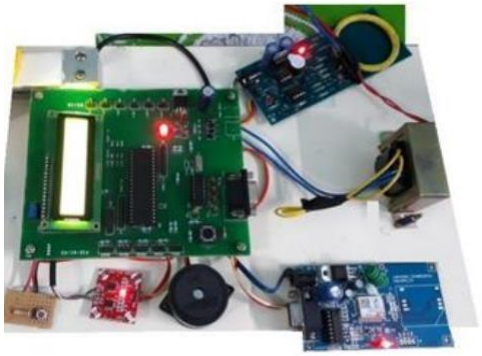
1.Sensing module: This module consists of various sensors that can detect items placed in the shopping cart, weight sensors that can measure the weight of the items, and RFID (Radio Frequency Identification) readers that can detect the RFID tags on products.

2.Communication module: This module enables the shopping cart to communicate with the store's network and other devices in the store. It typically uses wireless technologies such as Bluetooth or Wi-Fi to transmit data to the store's servers or other device.

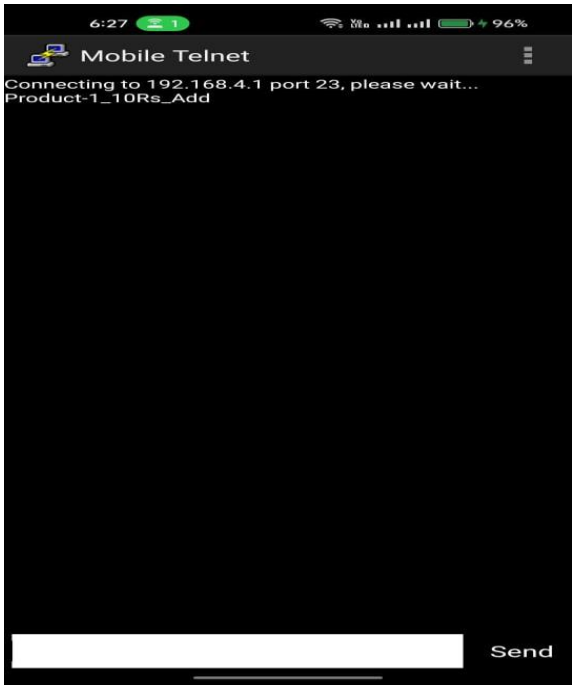
3.Display module: This module consists of a display screen that can show the items in the cart, the total cost of the items, and other information such as product details, nutritional information, and promotional offers. It can also provide directions to customers on where to find products in the store.

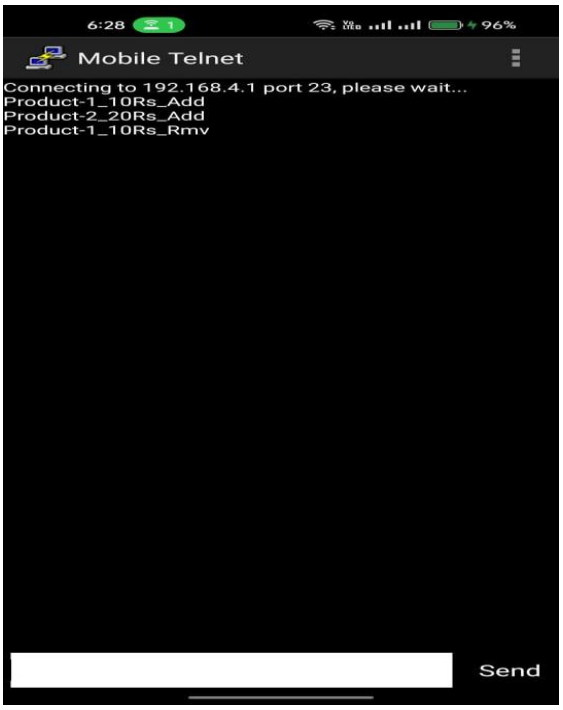
IX. RESULT AND CONCLUSION

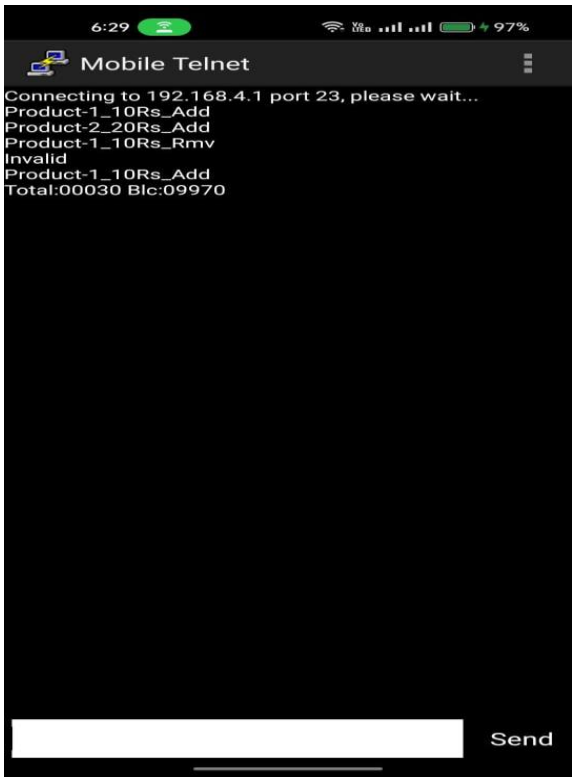
The smart cart, equipped with RFID sensors,

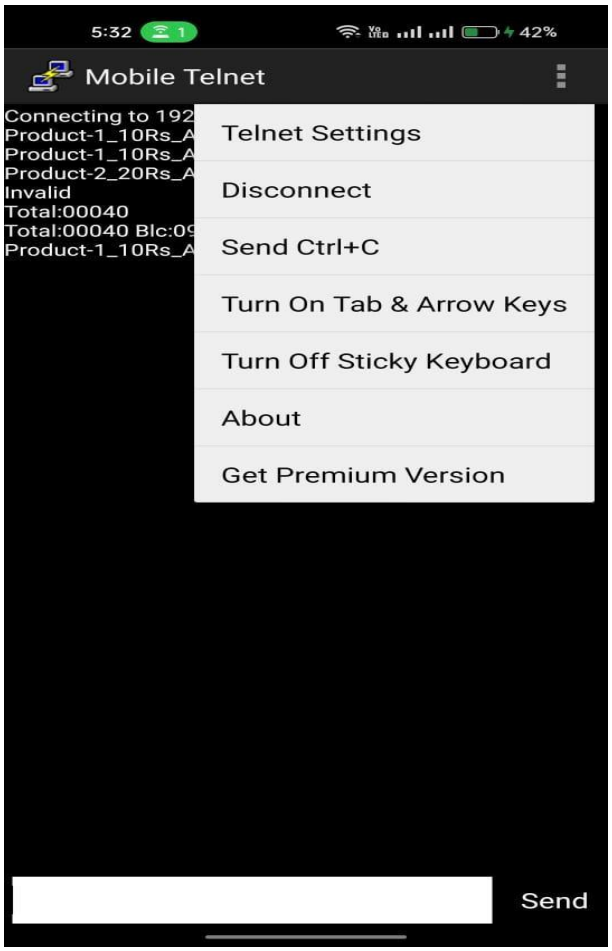


automates shopping, and speeds up billing and checkout. The mobile app acts as a shopping guide, displaying a current shopping list and product information. This technology helps customers maintain their shopping needs and reminds them of remaining products to purchase. It eliminates the need for standing in line during checkout. The system facilitates product searching in large supermarkets. This innovation is suitable for shopping malls, which often have large crowds and rush hours.









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