International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 07 | July - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

Personalized Shopping Cart Assisted with Recommendations and Real Time Cart Updates

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Abstract **- This paper presents a smart shopping system that benefits users to alleviate the challenges of long queues and providing personalized recommendations based on their purchase history. The system begins by identifying customers through a secure registration and login process. By analyzing their previous purchase history, the system identifies frequently bought items to generate personalized recommendations. These recommendation along with corresponding offers, are presented to the customers through an intuitive user interface. It also integrates with Telegram to send real-time notifications about the user's shopping cart and total bill. Thus enhancing the shopping experience facilitating easy cart management, ultimately saving users time and effort.**

Key Words**: Personalized shopping, Identification of users, Recommendations/suggestions, Discounts, User interface, Telegram**.

I. Introduction

The increasing popularity of online shopping has revolutionized the retail industry, offering convenience and accessibility to customers. To bridge the gap between online and offline shopping, we present a smart shopping system that leverages customer identification, purchase history analysis, personalized recommendations, and integrated Telegram notifications. The primary objective of this project is to enhance the in-store shopping experience by providing customers with personalized recommendations based on their previous purchase history. By identifying customers through a secure registration and login process, the system retrieves their purchase history data and analyzes it to determine frequently bought items. These insights enable the system to generate tailored recommendations, showcasing relevant products and exclusive offers to the customers. To facilitate the shopping process, the system offers an intuitive user interface where customers can browse recommended products, view detailed information, and easily add or remove items from their shopping cart. The cart management functionality ensures seamless updates of the total bill, allowing customers to keep track of their expenses effortlessly. Additionally, the system integrates with Telegram, a popular messaging platform, to provide real-time notifications to customers. It sends updates about the list of items added to their shopping cart and the corresponding total bill, ensuring that they stay informed even when they are not actively using the user interface. This smart shopping system aims to address common challenges faced by customers, such as decision-making.

II. Literature Survey

Viswanadha V Pavan Kumar P Chiranjeevi Reddy S in 'Smart Shopping Cart',[1] 2018 proposed research paper which aims to reduce shopping time at supermarkets by introducing a smart shopping cart system. The proposed solution includes a shopping cart equipped with a barcode scanner and a touchscreen display. Customers can scan products, view product information, cost, and the total bill on the display. The system also allows customers to make online payments using options like Paytm, UPI, or PhonePay, enhancing the consumer experience and reducing shopping time.

Prof. Roopa, Nivas Chandra Reddy in "Research on Smart Shopping Cart" [2] Volume 6, Issue 4 in July-August-2020 Proposed research paper which utilizes various technologies, including RFID (Radio Frequency Identification) tags on products, an RFID reader integrated into the shopping cart, a digital display screen on the cart for item details, and a ZigBee module for transmitting data to the central billing unit. These technologies work together to enable automatic item detection, real-time display of item information, and seamless billing within the cart, enhancing the overall shopping experience.

Mr. P. Chandrasekar in "Smart Shopping Cart with Automatic billing System through RFID and ZigBee" [3] proposed to develop a shopping cart with a Product Identification Device (PID) which will contain a microcontroller, a LCD, an RFID reader, EEPROM, and ZigBee module. Purchasing product information will be read through a RFID reader on shopping cart, meanwhile product information will be stored into EEPROM attached to it and this EEPROM data will be send to Central Billing System through ZigBee module. The central billing system gets the cart information and EEPROM data, it access the product database and calculates the total amount of purchasing for that particular cart.

III. Requirements For Solution

The smart shopping cart system incorporates various hardware components to enable its functionality. It utilizes RFID (Radio Frequency Identification) technology, consisting of RFID tags and an RFID reader. RFID tags are attached to individual items, cases, or pallets and contain a microchip with identifying information. The RFID reader, equipped with a radio frequency module, control unit, and antenna, wirelessly communicates with the RFID tags and reads their data. To provide a user-friendly interface, the system includes an LCD display. The display shows essential product information such as name, price, expiration date, and the total amount. This visual interface allows customers to conveniently view the items they have scanned and their corresponding prices. To provide

feedback during the scanning process, the system incorporates a buzzer. The buzzer serves as an audio signaling device that emits a sound each time a product is scanned by the RFID reader. This audible feedback informs the customer that the scanning process is successful and provides an additional confirmation. At the heart of the smart shopping cart system is the Arduino Uno microcontroller board. The Arduino Uno acts as the central processing unit, receiving data from the RFID reader, processing it, and controlling other components such as the LCD display and buzzer. It utilizes its built-in memory, including Flash memory, SRAM, and EEPROM, to store and retrieve data during operation. To power the system, a power supply is used, providing the necessary electrical energy to the Arduino Uno and other components within the smart shopping cart system. Together, these hardware components work in harmony to create an efficient and user-friendly smart shopping cart system that simplifies the shopping experience for customers and streamlines the checkout process.

The software components of the smart shopping cart system encompass various technologies that work together to enable its functionality. The Arduino IDE (Integrated Development Environment) serves as the programming environment for the Arduino Uno microcontroller board. It allows developers to write, compile, and upload code to the microcontroller, enabling its control and coordination with other hardware components. Embedded C is the programming language utilized for the RFID receiver and transmitter, which include the RFID reader and tags. It enables the mapping of scanned data to corresponding products and prices, facilitating accurate tracking and calculation of the total purchase amount. Python is employed on the front-end side of the system to display the final billed amount to the customer. It interacts with the Arduino Uno, receiving the scanned data and calculating the total price based on predefined product information and prices. Web technologies such as HTML, CSS, and JavaScript are utilized to create a user-friendly interface for displaying the final billed amount. HTML provides the structure of the webpage, CSS handles the styling and visual presentation, while JavaScript adds interactivity and dynamic updates to the displayed information. To manage and store product-related data, a database system like SQLite3 is employed. The database allows efficient storage, retrieval, and management of large volumes of data, including product information, prices, and other relevant details. In some implementations, the system may utilize instant messaging applications like Telegram to send messages to individual customers. This can be utilized to send the final billed amount or any other relevant notifications directly to the customer's device. Overall, the combination of these software components forms the backbone of the smart shopping cart system, enabling seamless communication, data processing, calculation, and user interaction throughout the shopping experience.

IV. Proposed Solution

The proposed solution is the implementation of an RFID-based automatic shopping cart system. This system aims to revolutionize the shopping experience by introducing advanced technology and automation. The key components of the system include RFID tags, RFID readers, an LCD display, and a microcontroller. Each product in the store will be equipped with an RFID tag containing relevant information such as product details, pricing, and inventory. The RFID readers, installed in the shopping carts, will scan the RFID tags as customers place items in their carts. The system will display the scanned items on the LCD display, providing customers with a real-time list of their selected products. It will also calculate the total bill, eliminating the need for manual calculations. Additionally, the system will utilize the customer's purchase history and preferences to generate personalized recommendations and offers, enhancing the shopping experience. To ensure ease of use and convenience, the system will incorporate user-friendly interfaces, such as buttons for adding or removing items from the cart. Customers will also have the option to view their cart and total bill on a webpage accessible through their mobile devices. Furthermore, the system will leverage wireless communication, such as Zigbee, to transmit data between the hardware components and the central database. This enables seamless synchronization of purchase history, recommendations, and offers. To enhance customer service, the system will integrate with Telegram bots. Each customer will have a unique bot connected to their shopping cart. The bot will provide real-time updates on the scanned items, recommendations, and the total bill. Customers can conveniently receive information and communicate with the system through the Telegram app. Overall, the proposed RFID-based automatic shopping cart system offers a convenient, efficient, and personalized shopping experience. By automating the checkout process, providing recommendations, and enabling seamless communication, it aims to transform the way people shop, saving time and enhancing customer satisfaction.

V. Methodology

A. Hardware solution

The hardware components of the smart shopping system include RFID tags, RFID readers, an LCD display, a buzzer, an Arduino board, a power supply, and memory. RFID tags are used to attach to individual items, cases, or pallets for identification purposes. They contain a microchip with identifying information and transmit data wirelessly to the RFID reader. RFID readers are responsible for reading the data from the RFID tags attached to the items in the cart. They consist of a radio frequency module, a control unit, and an antenna for communication with the RFID tags. The LCD display is used to show product information such as name, price, expiration date, and the total amount. It provides a visual interface for customers to view the purchased items and their prices. A buzzer is used as an audio signaling device that indicates the scanning of a product by the RFID reader. It provides audible feedback to the customer during the scanning process. The Arduino Uno serves as the microcontroller board that acts as the brain of the smart shopping cart system. It receives data from the RFID reader, processes it, and controls other components like the LCD display and buzzer. A power supply is required to provide power to the Arduino Uno and other components in the system, ensuring their proper functioning. The system utilizes memory in the form of built-in Flash memory, SRAM, and EEPROM in the Arduino Uno. This memory is used to store and retrieve data during the operation of the smart shopping system. Overall, these hardware components work together to enable the identification and tracking of products, display product information, provide feedback to customers, control the system's operations, and ensure power supply and data storage capabilities.

Fig. 1 Trolley section

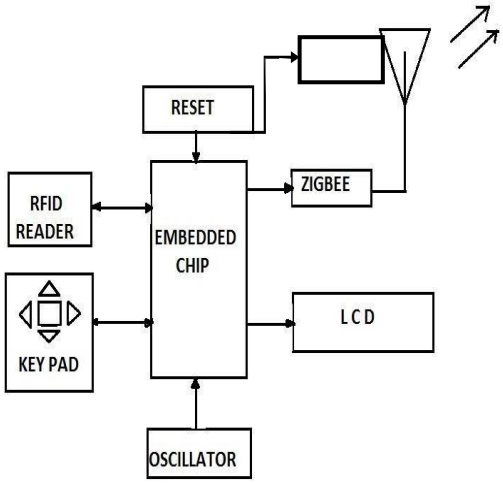
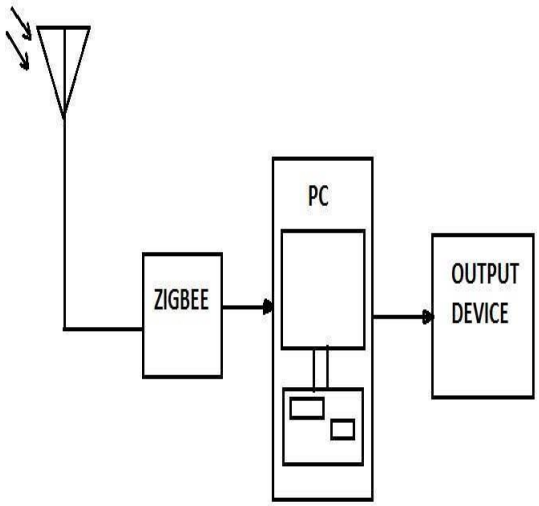


Fig. 2 Server side



B. *Software solution*

The smart shopping system described incorporates various technologies and functionalities to enhance the shopping experience. The system utilizes RFID tags and RFID readers for customer identification and product scanning. When a customer selects an item, they can place it near the RFID reader to capture the product's RFID tag information, enabling quick and efficient scanning without manual barcode scanning. The core of the system is built around an Arduino board and RFID module. The Arduino board serves as the central controller, communicating with the RFID readers and capturing product information. The RFID module facilitates the integration between RFID tags and the system, ensuring accurate identification and tracking of products. To provide feedback to customers, the system includes a buzzer and an LCD display. The buzzer emits audio signals for events such as successful product scanning or error notifications. The LCD display shows the scanned items in real-time, allowing customers to keep track of their selected products and view the total bill, which updates dynamically as items are added or removed. Customers can add or remove items from their shopping cart using dedicated buttons integrated into the system. This real-time updating feature enables easy management of the shopping list and informed decision-making during the shopping journey. The system also includes a database to store the purchase history of each customer. This database keeps track of the products they have bought and the total bill incurred. Based on this data, the system can generate personalized recommendations for customers, displayed on a user interface webpage accessible after customer authentication. Wireless Zigbee communication is employed for data transfer between the hardware components, the database, and the user interface webpage. Zigbee ensures reliable and secure data transmission, enhancing system efficiency and responsiveness. To provide additional communication channels, the system integrates with Telegram bots. Each customer is assigned a bot ID, connecting them to the system. Through Telegram, customers can receive notifications, updates, and information about their shopping activities, further enhancing convenience and accessibility. Overall, this smart shopping system offers a comprehensive solution that improves the shopping experience by saving time and effort for customers. It provides efficient product scanning, real-time updates on selected items and the total bill, personalized recommendations, and seamless communication channels.

Fig. 3 User login interface

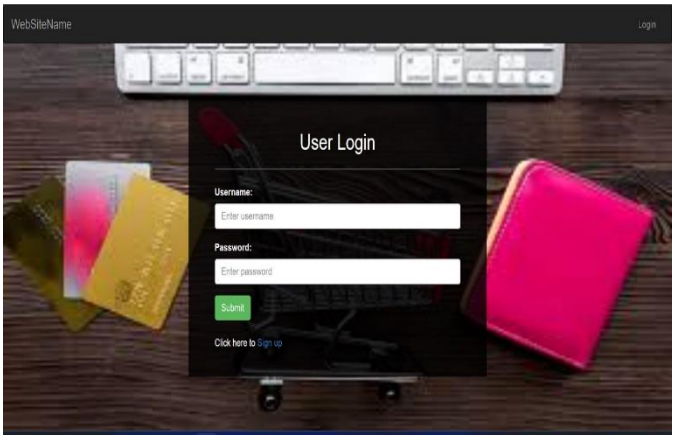


Fig. 4 Interface for personalized shopping

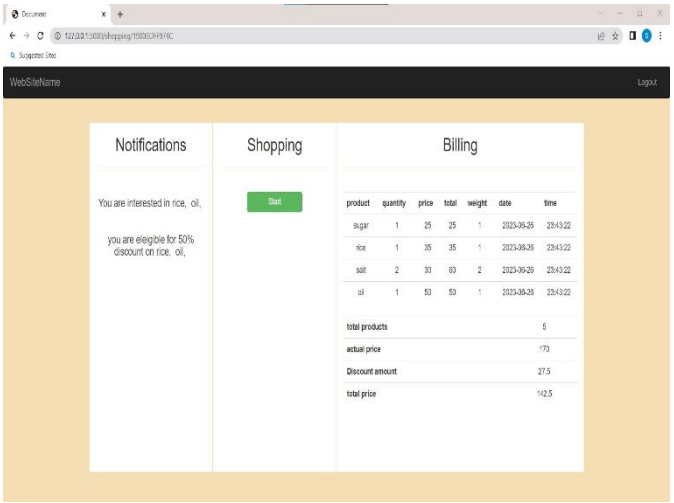
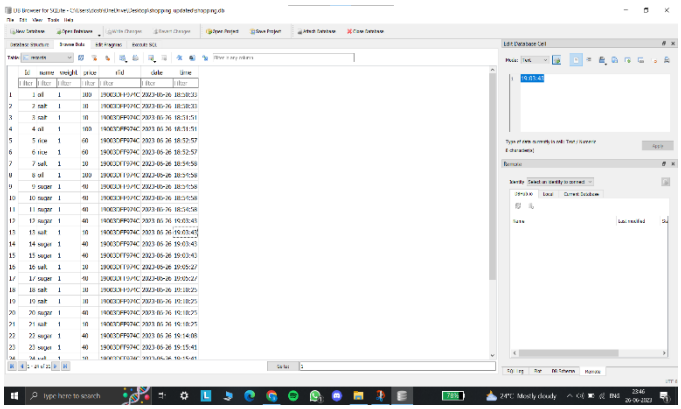
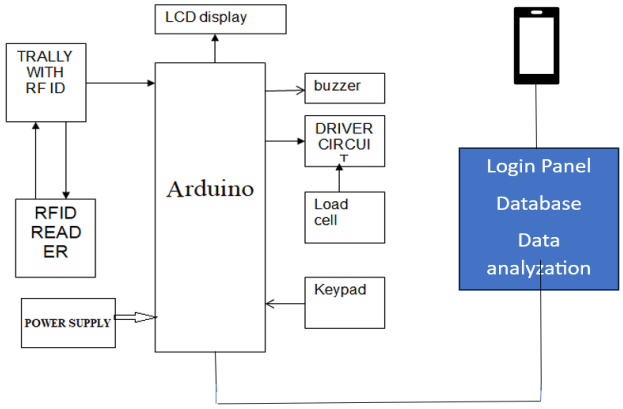


Fig. 5 User history data storage in database



VI. IMPLEMENTATION

Figure 6. Block diagram



A. Working of block diagram

The smart shopping system aims to enhance the shopping experience by incorporating various technologies and functionalities. The first step is customer identification, achieved through RFID tags. Each customer is provided with a unique RFID tag that they carry while shopping. This tag allows for easy identification and tracking of individual customers throughout their shopping journey. To scan the products, RFID readers are strategically placed throughout the store. When a customer selects an item, they can simply place it near the RFID reader, which captures the product's RFID tag information. This enables quick and efficient product scanning without the need for manual barcode scanning. The core of the system is built around an Arduino board and RFID module. The Arduino board serves as the central controller, communicating with the RFID readers and capturing the product information. The RFID module facilitates the seamless integration between the RFID tags and the system, enabling accurate identification and tracking of products. To provide immediate feedback to the customers, the system includes a buzzer and an LCD display. The buzzer emits audio signals for various events, such as successful product scanning or error notifications. The LCD display shows the scanned items in real-time, allowing customers to keep track of their selected products. Additionally, the display also shows the total bill, updating dynamically as items are added or removed. Customer have the flexibility to add or remove items from their shopping cart using dedicated buttons integrated into the system. This real-time updating feature enables customers to manage their shopping list effortlessly and make informed decisions during their shopping journey. The system also incorporates a database to store the purchase history of each customer. This database keeps track of the products they have bought and the total bill incurred. Leveraging this data, the system can generate personalized recommendations for customers based on their previous purchase patterns. These recommendations are displayed on a user interface webpage accessible after customer authentication. Wireless Zigbee communication is employed to transfer data between the hardware components, the database, and the user interface webpage. Zigbee ensures reliable and secure data transmission, enabling seamless integration and real-time updates. This wireless communication technology enhances the overall system efficiency and responsiveness. To provide additional communication channels, the system integrates with Telegram bots. Each customer is assigned a bot ID, which connects them to the system. Through Telegram, customers can receive notifications, updates, and information about their shopping activities. This integration further enhances the convenience and accessibility of the system. By combining RFID technology, Arduino, Zigbee communication, and Telegram bots, the smart shopping system offers a comprehensive and innovative solution. It enables efficient product scanning, real-time updates on selected items and the total bill, personalized recommendations based on purchase history, and seamless communication channels. Overall, this implementation enhances the shopping experience, saving time and effort for customers while providing a personalized and convenient shopping journey.

VII. FEATURES OF MART SHOPPING CART

A. Personalized Discounts:

One key feature of our system is the ability to provide personalized discounts to users based on their purchase behavior. When a returning customer with a recorded purchase history uses the Smart Trolley, the system automatically identifies them through their RFID tag. If the customer's purchase amount exceeds a predetermined threshold, the trolley intelligently applies a discount to their final bill, enhancing customer loyalty and satisfaction.

B. Item-Specific Discounts:

To further incentivize customer loyalty, the Smart Trolley recognizes when a user purchases the same product consecutively. Upon detecting three consecutive purchases of the same item, the system applies a 50% discount on that particular product, encouraging repeat purchases and enhancing customer engagement.

C. User Interface and RFID Mapping:

Our system incorporates a user-friendly interface that allows store personnel to easily map RFID tags to customer profiles. This interface simplifies the onboarding process, enabling.

VIII. RESULTS AND DISCUSSIONS

A. *Results for LCD Display Instructions:*

The LCD display serves as an interactive interface for the smart shopping system. It provides clear instructions to the user regarding the scanning, adding, and removing of products. When the user initiates the shopping process, the LCD display can show a welcome message along with instructions to scan an item using the RFID module. Once the item is successfully scanned, the LCD display can confirm the product name and prompt the user to add it to the cart. Similarly, when the user wants to remove an item, the LCD display can display the instructions accordingly. Throughout the shopping experience, the LCD display keeps the user informed about their actions, making the process more intuitive and user-friendly.

B. *Results for Telegram Message with Total Bill:*

The smart shopping system is integrated with Telegram bots to provide additional convenience and flexibility. Users can interact with the system through Telegram by sending messages to their respective bots. When a user sends a message to the bot requesting the total bill, the system retrieves the current state of the shopping cart, calculates the total bill based on the added items, and sends a reply message back to the user via Telegram. The message includes the total bill amount and any applicable discounts or offers. This enables users to stay updated on their expenses and make informed decisions while shopping.

C. *Results for Total Bill Calculation with Discount and Offer Notification:*

To enhance the shopping experience, the smart shopping system incorporates the analysis of purchase history and customer preferences. Based on this analysis, the system identifies potential offers or discounts that can be applied to the current shopping session. When the user requests the total bill, the system calculates the bill amount, taking into account any applicable discounts. If a discount is available, the system displays the reduced bill amount along with a notification regarding the discount applied. For example, if a user frequently purchases a particular product, the system may offer a discount on that product, and this information is communicated to the user through the GUI. By providing personalized offers and discounts, the system aims to encourage repeat purchases and enhance customer satisfaction. In summary, the smart shopping system combines various technologies such as RFID tags, Arduino, RFID module, buzzer, LCD display, buttons, a database, a webpage user interface, and Telegram bots to create a seamless shopping experience. The LCD display provides clear instructions for scanning, adding, and removing products, while the Telegram integration enables users to receive updates on their total bill and avail offers or discounts. By leveraging these technologies, the system streamlines the shopping process, enhances customer engagement, and facilitates informed decision-making.

IX. Conclusion and Future Scope

A. *Conclusion*

The proposed model is easy to use, low-priced and does not require any special training. This model keeps an account and uses of the existing developments and various types of radio frequency identification and detection technologies which are used for item recognition, billing and inventory update. As the whole system is becoming smart, the requirement of manpower will decrease, thus benefiting the retailers. Theft in the mall will be controlledusing this smart system, which further adds to the cost efficiency. The time efficiency will increase phenomenally since this system will eliminate the waiting queues. More customers can be served in same time thus benefiting the retailers and customers as well.

B. *Future scope*

The proposed system does not make use of intricate routing system architecture. Rather it uses simple algorithms inorder to banish existing problems. Model can be further extended, to prevent the loosing of the intelligent/smart shopping cart. It can be concluded that the initial cost of the model may be high but the in subsequent years the model will be beneficial as compared to the system using barcode or manual system. Further, a more advanced micro controller, larger display module and a service to pay the bill within the cart by using swapping card can be used, thus providing the customers better services, improved consumer experience and improving time complexity to a great extent.

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