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Joystick Guided Smart Trolley System

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Abstract

The Guided Smart Trolley System is an innovative solution designed to revolutionize the traditional shopping experience by incorporating advanced technology into retail environments. This system introduces a seamless self-checkout process by integrating barcode scanning technology directly into the shopping trolley. Customers can effortlessly scan items as they shop, with real-time updates displayed on an interactive LCD screen mounted on the trolley. The inclusion of a user-friendly joystick interface enables intuitive navigation, empowering customers to control the movement of the trolley with ease.

Furthermore, intelligent sensor technology detects and alerts customers to any duplicated items, ensuring accuracy in their purchase list. By streamlining the checkout process and reducing reliance on cashier intervention, the Guided Smart Trolley System enhances efficiency and convenience for both customers and retailers alike. Its ability to adapt to peak shopping periods mitigates congestion at billing counters, offering a smoother and more enjoyable shopping experience. With its focus on transparency, efficiency, and customer empowerment, this innovative system sets a new standard for retail technology, paving the way for enhanced customer satisfaction and loyalty in the modern shopping landscape.

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Keywords

Controller, RFID Reader and Tag, LCD module.

1. Introduction

The Joystick Guided Smart Trolley system, a revolutionary advancement poised to redefine the retail experience through the seamless integration of cutting-edge technology. At its core, this system represents a convergence of hardware and software innovation, meticulously designed to address the inherent inefficiencies and challenges plaguing traditional checkout processes in retail stores. By harnessing the power of barcode scanning technology, IOT connectivity, and customer- controlled navigation, our guided smart trolley system aims to streamline the shopping journey, enhance convenience, and promote sustainability.

Through the utilization of Raspberry Pi Pico microcontrollers as central processing units, coupled with an array of hardware components including barcode scanners, LCD displays, and joysticks, us system empowers customers to scan items themselves, navigate the trolley, and receive real-time feedback on their purchases. Furthermore, our project's integration with IOT devices and sensors enables the provision of personalized product recommendations, real-time inventory updates, and location-based promotions, fostering a tailored and immersive shopping experience.

Moreover, our commitment to environmental sustainability is reflected in our digital receipt generation feature, which not only reduces paper waste but also provides customers with a convenient and eco-friendly method of managing their purchase records. In essence, our guided smart trolley system represents a transformative solution that not only enhances efficiency and convenience but also embodies the future of retail, where technology seamlessly intertwines with everyday shopping experiences to create a more connected, sustainable, and enjoyable retail landscape for customers and retailers alike.

2. Literature Review

In 2021 Jaishree.M et al [1] designed an “Smart Shopping Trolley Using IOT” this paper examines The IOT based intelligent trolley for purchasing malls project aims to simplify shopping by using RFID cards and scanners, an Arduino UNO device, and IOT technologies. Instead of relying on expensive and unreliable RFID systems, the project proposes a solution using Raspberry Pis and barcode scanners with LCD displays. This eliminates the need for individual product tags. By integrating the billing system into the store's infrastructure, the

intelligent shopping trolley speeds up checkout times and offers flexible transaction options. Theproject seeks to enhance the shopping experienceand address the limitations of traditional RFID-based systems to present a viable business plan

In 2023 Anusha K, et al [2] designed an "IOT Based Smart Shopping Cart" The paper introduces an IOT-based smart shopping cart that leverages cameras and sensors to automate the detection of items and the creation of bills, alongside an inventory management system for real-time product tracking. It underscores the innovative use of RFID technology for precise product identification and wireless communication for updating item placements within the cart as customers navigate the store, building upon previous research in the field. This solution aims to streamline the shopping experience by integrating an automated RFID readerbilling system and location tracking functionality. Moreover, it offers efficient payment alternatives and enhances convenience and security by sending SMS alerts to customers after transactions. Overall, it serves as a prime example of how IOT technologies can simplify daily tasks and has the potential to revolutionize traditional processes, particularly within the retail industry, by boosting productivity and enhancing consumer satisfaction.

In 2023 **Avinash Shinde, et al [3]** designed an "Design and Implementation of Smart Trolley System" The papers delve into the integration of RFID and IOT technologies within smart trolley systems for automated billing in retail environments, each offering unique approaches and advantages. The first paper underscores the role of smart shelving in inventory management and highlights how RFID tags empower smart carts to display crucial product details, such as expiration dates and identification of damaged items, thereby automating billing processes and enriching the customer experience. While acknowledging the evident benefits, concerns surface regarding the implementation costs, user acceptance of technology, and privacy implications. In contrast, the second paper proposes a smart retail system leveraging ZigBee and RFID tags for billing transmission but retains traditional counter payments, potentially leading to prolonged queues.

The third paper introduces a smart trolley system tailored for shopping centers, aiming to streamline billing processes, minimize wait times, and accelerate payments by automatically adjusting expenses for removed items and presenting billing details on an LCD screen while facilitating data transmission to a local server for inventory management. Similarly, the fifth paper introduces an IOT-based smart trolley solution featuring RFID tags, LED display, and mobile payment capabilities, emphasizing swifter billing and enhanced convenience. Correspondingly, the fourth paper unveils a smart trolley mechanism employing RFID tags and

a web camera for automated billing, complemented by a customer-following feature for added convenience. Collectively, the retail sector's adoption of RFID and IOT technologies holds the promise of bolstering productivity and reducing expenses for retailers, while simultaneously enriching the customer journey, streamlining inventory operations, curbing wait times, and elevating overall efficiency.

In 2022 **Chakshu Manjunath et al [4]** designed "IOT Based Smart Shopping Cart Using RFID", The paper influence of sensing technology has become a cornerstone of modern living, impacting various facets including automobiles, clothing, smartphones, and smartwatches, underscoring the indispensability of internet-driven connectivity. This technological evolution has birthed new horizons, notably within the realm of the Internet of Things (IOT). IOT embodies a transformative paradigm where physical objects acquire communication and computational prowess, enabling seamless interactions and spawning implications across finance, economics, and the environment, albeit accompanied by challenges like data collection, wireless communication, and decision-making. Nevertheless, challenges persist, with consumers expressing discontent over inadequate product information and prolonged wait times at billing counters, particularly pronounced in shopping centers where barcode billing systems have supplanted calculators to streamline processes and minimize human error. However, the incorporation of RFID technology into the billing process holds promise for enhancing speed, simplifying operations, fortifying security, and ultimately elevating the shopping experience. The advent of the smart trolley system represents a pivotal shift in the traditional shopping journey, continuously presenting crucial factors such as product name and pricing, while offering additional features like suggested shopping lists and discount alerts, in essence, the convergence of IOT and sensing technologies within the retail sector holds the potential to optimize operational efficiencies, reshape consumer behaviors, and cultivate a safer and more seamless shopping milieu.

In 2022 **Pradip. R et al [5]** designed "Smart Trolley in Mega Mall Using ZigBee". This paper proposes the implementation of a smart trolley system leveraging RFID technology to expedite the billing process through the introduction of two operational modes: Auto and Manual. In Manual mode, customers navigate the trolley themselves, whereas in Auto mode, the trolley is autonomously guided, easing navigation for those unfamiliar with the store layout. The RFID reader integrated into the smart trolley facilitates product scanning, enabling customers to add or remove items, view item counts and prices, and calculate the total bill. Subsequently, the bill, along with the trolley number, is wirelessly transmitted to the

cashier or server, facilitating prompt cash settlement and reducing wait times. Byempowering customers to make informed decisions based on real-time billing information displayed on the screen, the system mitigates congestion and optimizes processing time at the checkout counters. Furthermore, the incorporation of billing functionality enhances the system's efficacy,positioning it as a superior and quicker alternative.

ZigBee technology facilitates seamless data management by transmitting billing information to a central computer, streamlining administrative tasks. Additional features such as GPS-assisted trolley handling or remote control capabilities further augment the system's functionality and userexperience.

In **2019 M. Rao et al [6]** designed "RFID Based Smart Trolley Using IOT ", The authors have effectively harnessed RFID technology's robust security features and efficient tracking capabilities to develop an intelligent and cost-effective system aimed at enhancing the shopping experience. This system boasts various functionalities, including budget management, product manipulation,recommendation features, and dynamic cost adjustments based on cart contents, effectively replacing the limitations of traditional barcode systems. RFID scanning offers unparalleled flexibility and resilience, overcoming issues such as fixed scanning borders, line-of-sight constraints, and data updating limitations. Security is further bolstered by a servo motor-driven door system, ensuring only scanned products enter the trolley until payment is completed. The inclusion of diverse digital payment methods enhances accuracy and reduces fraud risks, addressing major concernslike lengthy checkout queues and security. Additionally, the authors have enhanced usability by making the accompanying app accessible to all users through the Ionic framework. However, the system's reliance on server functionality poses a potential drawback in the event of downtime. Nevertheless, the implementation showcases significant advancements in efficiency, security,and convenience, with prospects for further enhancements and widespread adoption in retail environments.

In 2022 **Dnyan Urankr et al [7]** designs "Smart Shopping Trolley System "This paper suggested system combines RFID technology, touch screen display, UV-C lighting, and Raspberry Pi to accelerate the billing process, allowing for easy item removal and automatic addition to the bill, with payment options displayed on the screen and the bill sent via email upon confirmation. This technology optimizes shopping time, updates inventory automatically, and ensures trolley handlesterilization in line with COVID-19 safety measures, ultimately saving time and space for both supermarkets and customers by streamlining purchasing, payment, and billing processes.

In 2020 **T. Gunasagar et al [8]** designed "Smart Billing System Using RFID and Weight Sensors" This paper proposes the integration of RFID technology into shopping applications to enhance the retail experience. A shopping system employing X bee modules to locate carts and display product availability was introduced, a billing system utilizing microcontrollers and AT89S52 controllers was proposed, but its complexity stemming from the dependence on both barcodes and RFID technology, coupled with the lack of I2C protocol, posed challenges. A novel smart cart design resembling a mailbox was introduced, ensuring item accessibility only after payment, although it lacked wireless functionality. A smart cart equipped with smart shelves for cost delivery upon entering specific regions was designed, an ultrasonic sensor for self- scanning barcodes was implemented, complicating the design and increasing system complexity. NFC technology was employed for shopping and billing, primarily catering to repeat customers. An intelligent 2-D barcode system to prevent online fraud was developed, but the absence of administrator and user control was a limitation., this study suggests a practical smart billing system utilizing weight sensors and RFID to streamline shopping and reduce checkout wait times, such as incorporating LCD screens for item selection and enabling automatic bill payment, to further enhance the shopping experience.

In 2021 **Dr. Suresh M.B et al [9]** designed "Intelligent and Innovative Shopping Cart for Smart Cities Using Internet of Things (IOT)", The reviewed papers explore various methods to improve shopping through IOT-enabled carts. One study suggests a sophisticated cart with LCD, barcode, microprocessor, and Bluetooth to reduce checkout queues. Another advocates for an RFID-based system to manage budgets and items in real-time, though limited payment options remain a challenge. Similarly, a proposal using RFID and ZigBee for centralized billing faces issues with payment alternatives. Another solution, a smart trolley with color sensors and LCDs, tackles mall shopping woes. However, the cost and reliability of RFID lead to exploring alternatives like QR Codes integrated with cameras and Raspberry Pi for automated carts, offering a more affordable and user-friendly approach. Leveraging advancements in RFID and detection tech, this model streamlines processes and enhances cost-effectiveness. Additionally, it improves efficiency by reducing queues and preventing theft, making it invaluable for retailers adapting to technological changes and enhancing customer satisfaction.

In 2019 **Swetha k et al [10]** designed "Self- Directed Smart Cart using RFID Technology", This paper Suggested devised a plan for a smart shopping cart employing RFID and ZigBee for automatic billing, aiming to reduce checkout queues in supermarkets and shopping

centers. smart shopping application, integrating location-based coupon services and barcode scanning, enhances the online and offline shopping journey by enabling users to add items to their mobile shopping carts and place orders with connected online retailers. Introduced an innovative shopping cart for smart cities, leveraging RFID technology to facilitate budget setting, product recommendations, and real-time cost adjustments, thereby enhancing shopping convenience and user- friendliness. Pioneered m-commerce shopping, employing NFC technology to display product details on LCD screens attached to carts, allowing shoppers to manage products and pay bills via mobile thus reducing physical strain during shopping.

In 2021 **Gourav Bidkar et al [11]** designed "Smart Shopping Trolley with Billing System Using IOT and Blynk App", This paper proposes EM18 Reader RFID module decodes data from RFID cards using radio waves, sending product details like name and price to a Node MCU, which displays the information on an LCD screen and shares it with a web server. A Wi-Fi module acts as a receiver, while Blynk serves as a transmitter, allowing users to control IOT devices through iOS and Android devices. Using a joystick created with the Blynk app, customers can steer the IOT-controlled trolley in various directions, with the trolley responding to position data from the joystick along the x and y axes to determine movement angles. The joystick facilitates forward, left, right, and reverse movements, while a slider adjusts the trolley's speed. With the smart trolley's automatic billing system, customers can pay online without waiting in checkout lines or pushing the trolley, leading to enhanced shopping convenience and benefits forboth customers and businesses.

In 2021 **Varshini y et al [12]** designed, "IOT Applications on Secure Smart Trolley System", This paper proposes smart trolley incorporates an RFID reader to scan RFID tags on each item, simplifying the calculation of the total bill directly within the cart. An integrated LCD display allows customers to conveniently view the entire bill while shopping. When the final bill reaches the checkout counter, it is transmitted to the main computer via radio frequency communication. However, a significant drawback is the inability to modify the bill once it has been sent to the main computer, as no further items can be added or removed thereafter. To address this limitation, the author proposes a Secure Smart Trolley utilizing RFID technology to streamline the checkout process. By leveraging RFID signals to identify items, this innovative trolley aims to enhance the shopping experience by swiftly displaying the product name, any discounts, and the total bill on the customer's phone. The inspiration for exploring RFID technology arose from observing lengthy queues and cumbersome procedures at shopping centers, motivating the teamto develop the Secure Smart Trolley. The

ultimate objective is to significantly reduce checkout time compared to conventional billing methods, providing customers with a more efficient and enjoyable shopping experience.

In 2020 **Delsi Robinsha et al [13]** designed "IOT Based Intelligent Trolley for Shopping Mall", This paper Proposes decision to develop an intelligent shopping application was prompted by the waning appeal of outdoor shopping, largely due to the convenience offered by online purchasing. To counteract this trend, our application has been designed to streamline the checkout process by implementing RFID-based billing and enhancing navigation within supermarket aisles. Equipped with features such as order tracking and customer record management, our application aims to elevate the shopping experience by addressing prevailing concerns surrounding security and product quality frequently associated with online shopping. Moreover, our device effectively oversees product expenses and budgets, leading to a reduction in labor requirements and checkout durations, thereby positioning itself as a viable solution for widespread adoption in shopping centers.

In 2020 **Shivika Srivastava et al [14]** designed, "IOT based Human Guided Smart Shopping Cart System for Shopping Center", This paper proposes the study explores RFID for automatic identification and employs ZigBee and infrared sensor modules to transmit billing data, aiming to reduce checkout queues. Xbee and Arduino modules facilitate hardware testing and development. RFID-based membership cards enhance trolley security. Implementation of this system in hypermarkets is expected to streamline checkout processes and enhance the shopping experience. Bluetooth connectivity enables communication, while RFID and an Android app simplify trolley and item tracking. Payment options include card, cash, or UPI. Enhancements such as advanced algorithms for trolley navigation and a more robust Android app for dietary information and item reminders are suggested. The system allows both customers and supermarket staff to monitor trolley locations.

In 2018 **R.N. Jogekar et al [15]** designed,"Automated Shopping Trolley Using Raspberry Pi Device", This paper proposes RFID tags and readers for scanning products and generating bills, but acknowledged the higher costs and reliability issues associated with RFID systems compared to barcodes. To address this, they introduced an automated shopping trolley using Raspberry Pi anda barcode scanner with an LCD display, opting for barcodes over RFID tags. This shift reducesmanagement expenses by eliminating separate tags and enables customers to scan barcodes directly on products, enhancing transparency and convenience. By incorporating barcode technology, users can easily determine the total bill amount at the point of purchase, with anticipated improvements incustomer satisfaction. This transition to

barcode- based automated shopping offers cost-effective solutions and promises enhanced reliability and user experience, aligning with the goals of both businesses and consumers.

In 2022, **B. Kalyan Kumar, et al [16]** designed, "Smart Shopping Trolley and Notification System Based on IoT", This paper proposes RFID-based smart trolley incorporates an RFID reader to detect RFID tags on items placed within, linked to a centralized database for accessing product details, with coordination managed by a microcontroller. Products can be scanned directly, facilitating easy removal through rescanning, while total charges are displayed on the trolley's LCD and at the billing area for simplified payment. The prototype achieves its objectives of enhanced security, affordability, and user convenience successfully, utilizing RFID technology to streamline the shopping experience and billing process.

In 2023 **S.Karthi, et al [17]** designed",IOT Based Smart Trolley System For Automation Billing Using RFID",This paper proposes RFID technology offers a transformative solution to the challenges faced in traditional barcode scanning at checkout. Each product equipped with an RFID tag enables automatic calculation of the total bill and item details display without manual scanning, streamlining the process and reducing errors. Real-time communication between the RFID reader, microcontroller, and GSM/GPRS module ensures seamless transaction data transmission, integration with existing systems, and minimizes interference between trolleys. The system's architecture facilitates efficient data processing and visualization, empowering retailers to monitor inventory levels and provide customers with comprehensive product information, ultimately enhancing overall satisfaction and meeting the evolving demands of modern consumers.

In 2021 **N. Nandhini et al [18]** designed, "Wireless Based Auto Smart Tolley With Time Saver", This paper proposes Utilizing RFID technology, this method employs RFID readers mounted on each shopping trolley and RFID tags affixed to individual products. These components are powered by lithium batteries and controlled by an Arduino UNO microcontroller. The system displays prices on an LCD screen, allowing customers to easily view the cost of items as they shop. Additionally, an instant delete button enables customers to remove unwanted items from their virtual cart, with the updated list promptly reflected on the screen. To ensure reliable data transmission, a CC2500 transceiver is integrated into the system, providing robust communication between components and enhancing overall reliability. In terms of security, the billing process has been adjusted to enhance protection, with the cart now capable of calculating and displaying total costs in real-time as customers shop,thereby streamlining the checkout process.

In 2024 **Omera Musahaf Ahemad Inamdar's et al [19]** designed ,“IoT Based Smart Trolley for Auto Billing”The Smart Trolley system, employing RFIDtechnology and a Raspberry Pi, is introduced as an innovative approach aimed at revolutionizing retail operations. By automating product identification and pricing retrieval from the store's database, the system enhances the checkout process, providing users with real-time updates on their total expenditure. Extensive testing has demonstrated notable reductions in checkout times and increased customer satisfaction, underscoring the system's potential to improve convenience and operational efficiency in retail settings. The Smart Trolley thus represents a significant advancement in smart shopping .

3. Objective of the Project

The Objective of implementing barcode barcode scanning technology with a sophisticated smart trolleysystem aims to completely revolutionize the traditional shopping experience. The primary goal isto transform the checkout process in retail settings by significantly reducing wait times at billing counters and enhancing overall customer convenience. By incorporating these cutting-edge features, the project hopes to provide a strong and competitive substitute for the rapidly expanding online retail market, blending the tactile immediateness of traditional retail with the unmatched speed and ease of use provided by self-checkout technologies. Through theutilization of barcode scanning technology, the system streamlines and automates the tracking and invoicing processes, allowing customers to easily scan multiple items at once and receive real-time cost updates. This intentional automation not only speedsup the checkout process but also significantly reduces the possibility of errors, ensuring unmatched billing transaction accuracy. Additionally, the system aims to improve transaction transparency by providing clients with thorough product specifications and pricing information through an easy-to-read LCD display attached to the trolley. Byachieving these objectives, the project ultimately aims to transform the retail environment, greatly enhancing consumer pleasure, ease, and efficiency while radically altering the dynamics of in-store buying encounters.

4. Need/Scope for the Projectwork

The Joystick-Guided Smart Trolley System addresses the challenges faced by consumers and merchants in traditional retail settings, particularly during busy periods characterized by long checkout lines and manual scanning procedures, leading to customer frustration. In today's competitive landscape, where online shopping platforms offer efficiency and convenience,

brick-and-mortar stores must innovate to stay relevant. Our project offers a revolutionary solution by enhancing the shopping experience through automation and IOT connectivity. By equipping shopping trolleys with barcode scanning technology and providing customers with an Arduino Bluetooth joystick interface for navigation, we simplify operations and give users more control over their shopping journey. Moreover, our system goes beyond mere efficiency improvements by leveraging IOT connectivity to enable functions such as location- based promotions, personalized product suggestions, and real-time inventory updates. Its scalability makes it adaptable to various retail settings, including malls and supermarkets, offering a competitive alternative to online shopping platforms. The Joystick-Guided Smart Trolley System caters to the evolving needs of customers and retailers alike, leveraging technology to enhance convenience, efficiency, and sustainability in the retail industry, ultimately ensuring a seamless and enjoyable shopping experience for all involved.

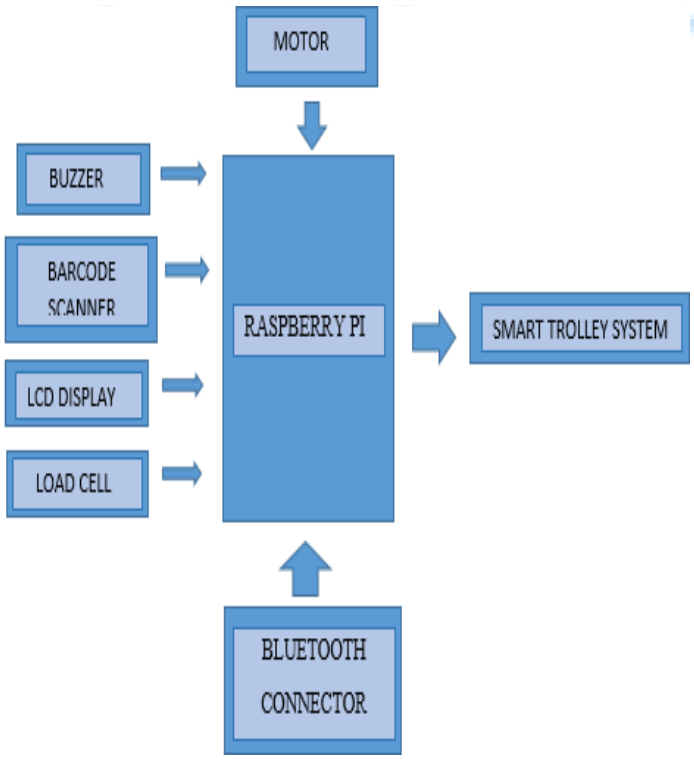
5. Problem Statement

The Joystick-Guided Smart Trolley System addresses the challenges faced by traditional retail environments, especially during busy periods, where long lines, manual scanning procedures, and customer dissatisfaction are common issues. To stay competitive against online shopping platforms, brick- and-mortar stores need to innovate and enhance the in-store shopping experience. In response, our system offers a revolutionary solution that leverages technology to expedite checkout procedures and provide customers with more control. By integrating barcode scanning technology into shopping trolleys and offering customers an Arduino Bluetooth joystick interface for navigation, our device automates and optimizes the shopping experience. Additionally, the integration of Internet of Things connectivity enables real-time inventory updates and personalized product suggestions and promotions based on a store's location, further enhancing the overall shopping experience. Our project's scope includes various retail settings, such as supermarkets and shopping centers, and it is designed to be flexible enough to accommodate a variety of configurations and needs. The ultimate goal of the Joystick-Guided Smart Trolley System is to transform the conventional shopping experience by meeting the changing demands of consumers and merchants, ensuring effectiveness, convenience, and contentment for all parties involved.

6. Architecture

The architecture of the Joystick-Guided Smart Trolley System revolutionizes the traditional shopping experience by seamlessly integrating a range of hardware and software components.

At the heart of this system lies the Raspberry Pi microcontroller, serving as the central processing unitresponsible for coordinating all system functions. Connected to the Raspberry Pi are essential hardware components including an LCD screen, joystick, barcode scanner, and strategically placed sensors within the trolley. The barcode scanner simplifies the process of scanning product barcodes, initiating the registration procedure for purchased items. As customers scan items, the Raspberry Pi swiftly processes the scanned data, extracting priceinformation from the barcodes, and dynamically updating the total cost in real-time on theLCD display. This real-time feedback empowers customers with immediate visibility into their shopping expenses, enhancing transparency and informed decision-making. Moreover, the inclusion of sensors within the trolley adds another layer of functionality by detecting instances where customers place multiple quantities of the same product without rescanning. This proactive feature ensures accuracy in the purchase list and prompts customers to reviewand rescan any duplicated items, thereby minimizing errors and enhancing the overallshopping experience. By seamlessly integrating hardware components and leveraging the processingpower of the Raspberry Pi, the Joystick-Guided Smart Trolley System offers a transformativesolution that streamlines checkout procedures, enhances convenience, and promotes efficiency in retail-environments.



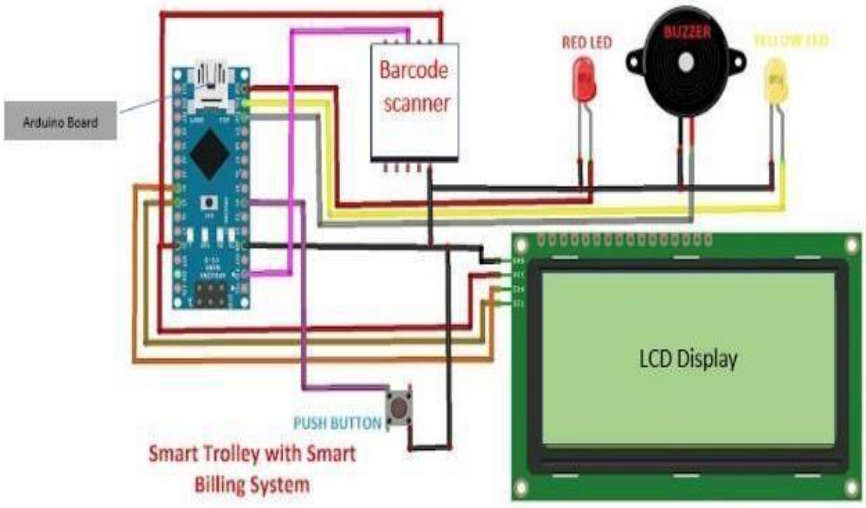


Fig : Architecture Diagram for Joystick Guided Smart Trolley System

7. Methodology

The methodology for developing the Joystick- Guided Smart Trolley System is designed to ensure a systematic and comprehensive approachthroughout the project lifecycle. It begins with a thorough requirements analysis phase, where the team meticulously identifies and documents both functional and non-functional requirements. This phase is crucial as it serves as the foundation for guiding the subsequent stages of development. Market research and stakeholder input play a vital role in shaping the requirements, ensuring that the system aligns with industry standards and effectively meets the needs of its users. Following requirements analysis, the system design phase commences, focusing on the careful selection and integration of hardware and software components. Hardware components such as joysticks, LCD screens, barcode scanners, Raspberry Pi microcontrollers, and sensors are chosen based on their compatibility, functionality, and suitability for the intended purpose. The design emphasizes optimizing utility, ergonomics, and usability to enhance the overall user experience. Simultaneously, software design involves the development of algorithms for various functionalities, including Bluetooth pairing, real- time data processing, barcode scanning, and user interface interactions. Consideration is given to factors such asdata flow, system architecture, and integration with external databases or systems to ensure seamless operation. Prototyping is the next crucial step in the methodology, where a working system prototype is constructed based on the design specifications. This prototype serves as a tangible representation of the envisioned system, allowing for iterative testing and refinement.

Through extensive testing, performance bottlenecks, usability flaws, and technological challenges are identified and addressed to enhance the system's functionality and reliability. User feedback isactively sought during this phase to validate the functionality, usability, and overall user experience ofthe prototype. successful testing and prototyping, the project progresses to the deploymentphase. This phase involves finalizing hardware configurations, deploying software components, and conducting comprehensive system testing in real- world retail settings. End users and retail employees receive training on system operation, troubleshooting techniques, and maintenance procedures to ensure smooth implementation and operation.

Throughout the entire development process, collaboration and iteration are key principles that drive the methodology. Ongoing communication between stakeholders, end users, and project team members facilitates feedback exchange and ensures that evolving requirements are effectively addressed. Agile methodologies such as Scrum or Kanban may be employed to manage project tasks, prioritize development efforts, and adapt to changing requirements in a dynamic environment. Grounded in principles of user-centric design, iterative development, and collaboration, the Joystick-Guided Smart Trolley System's methodology aims to deliver a reliable, user-friendly, and innovative solution for enhancing the retail experience. By following this systematic approach, the project endeavors to meet the evolving needs of users and stakeholders while delivering a solution that is robust, efficient, and user- friendly.

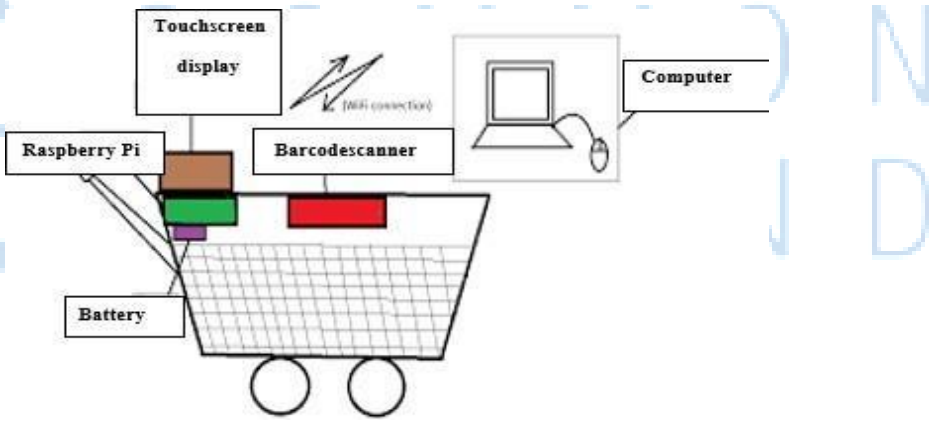
8. Implementation

The implementation of the Joystick Guided Smart Trolley System encompasses a series of meticulous steps crucial for its construction, configuration, and deployment, ensuring seamless operation and alignment with user expectations. Comprising five key stages, the implementation process begins with users directed to the Account Login page, where they input their credentials for validation and access to the system. Upon successful validation, users are directed to the Login page to commence their session, or alternatively, they navigate to the Register page to complete the registration process and gain access to the system's functionalities. Once logged in or registered, users are directed to the output page, which serves as the interface prior to any scanning or system functions initiation. Subsequently, users proceed to configure the system for IP address processing, a critical step for establishing connectivity.

This involves launching the command prompt and executing the "ipconfig" command to

retrieve the required IPv4 address. Once obtained, the IPv4 address is copied and pasted into the appropriate field in the MySQL administrator, along with the necessary password for server access, facilitating seamless integration and data exchange within the system. Through meticulous attention to each stage of the implementation process, the Joystick Guided Smart Trolley System ensures robust functionality, user accessibility, and operational efficiency, thereby meeting the diverse needs and expectations of its users effectively.

In setting up database interaction for the Joystick Guided Smart Trolley System, users navigate through a systematic process aimed at ensuring seamless operation and user engagement. This involves launching the MySQL query browser, inputting the necessary password, and confirming access, thereby facilitating uninterrupted system functionality. Alternatively, users may choose to streamline the process by copying the IP address from the command prompt using tools like Mobaxterm, thus simplifying system operations. However, the efficiency of this process is contingent upon the speed of internet connectivity, with users patiently awaiting the completion of system startup and configuration.



Users further set up database interaction by launching the MySQL query browser, entering the password, and confirming, facilitating seamless system operation. Additionally, users may opt to copy the IP address from the command prompt using Mobaxterm to initiate the execution process, thereby simplifying system operations. However, the pace of internet connectivity significantly influences process completion speed. Users patiently await the output screen indicating system startup and configuration completion. Once the output screen confirms system readiness, users can seamlessly interact with the system from the Login page onward to perform intended activities or tasks. This methodical approach ensures a smooth transition from setup to operational functionality, promoting user engagement and system utilization.

Website Images

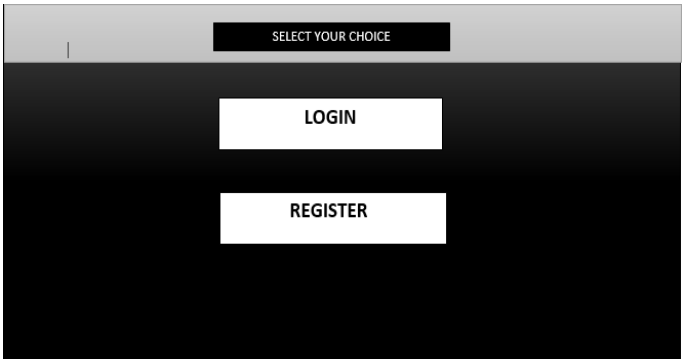


Fig : Account Login page

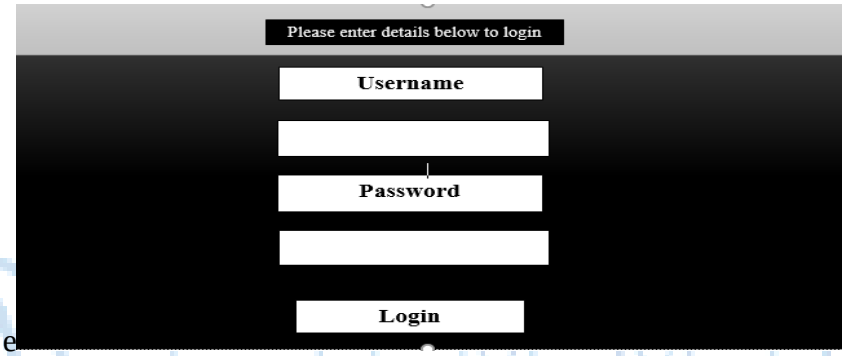


Fig : Login Page

Fig : Billing Screen Before Scanningthe product

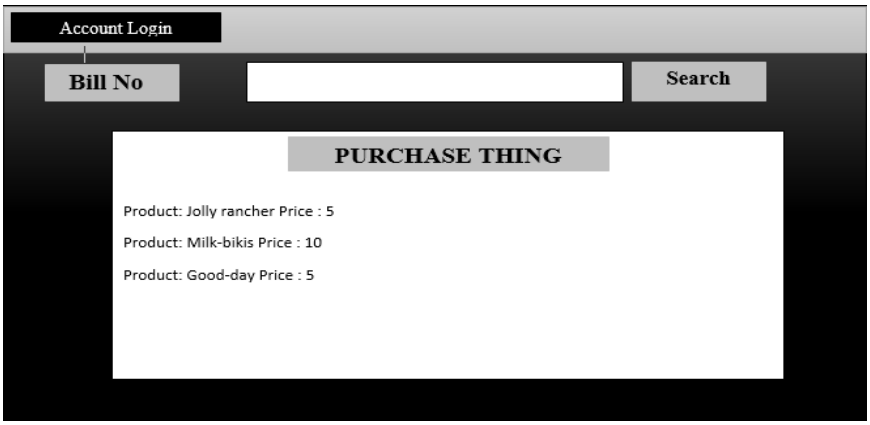


Fig : Billing Screen After Scanningthe Product

The picture shows Software applications for Joystick Guided Smart Trolley System presents acomprehensive account management and billing solution meticulously designed to optimize operational efficiency in diverse business settings. At its core, the system seamlessly integrates robust user authentication and billing functionalities, offering a seamless experience for account setup and secure access.

Through a user-friendly interface, users are provided with registration and login options, ensuring streamlined access to their accounts. Authentication mechanisms rely on the use of usernames and passwords, prioritizing security by implementing stringent password requirements. Beyond authentication, the system incorporates a sophisticated bill generator software, revolutionizing billing processes through its array of advanced features.

Each transaction is assigned a unique bill number, facilitating efficient retrieval of past bills and enhancing record-keeping capabilities. The software's capability extends to real-time calculation of total costs and weights, ensuring unparalleled accuracy in billing processes.

Conclusion

In conclusion, the integration of IOT technology into smart shopping trolleys represents a significant advancement in the retail industry, benefiting both customers and retailers alike. With RFID technology, trolleys can efficiently identify items, streamlining the checkout process and reducing wait times. The seamless data transfer between devices provides retailers with valuable insights into customer preferences, allowing them to optimize pricing and inventory strategies to enhance profitability and product availability. Personalized recommendations and rewards further improve customer satisfaction and loyalty, while automated payment procedures expedite transactions and enhance security. Looking ahead, smart trolleys are poised to revolutionize retail by offering personalized shopping experiences and transforming inventory management practices. Overall, the incorporation of IOT technology into smart shopping trolleys signifies a shift towards a more technologically advanced and efficient retail environment, aligning with the evolving demands of modern consumers.

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