Smart Trolly with Automatic Billing System using IoT

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***Abstract*— The increasing popularity of Internet of Things (IoT) has revolutionized various industries, including the retail sector. This paper proposes an IoT-based shopping cart system that leverages the power of Arduino Uno, LCD Display, Load Cell, Buzzer, Keypad (Switch), RFID Sensor, ESP8266 Module, and IoT technologies. The system aims to enhance the traditional shopping experience by providing real-time inventory management, personalized recommendations, and seamless checkout process. The shopping cart is equipped with an Arduino Uno microcontroller, which serves as the central processing unit for the system. It communicates with various components, including an LCD display, load cell, buzzer, keypad, RFID sensor, and an ESP8266 module. This data is utilized for real-time inventory management, ensuring that the availability of products is constantly updated. The buzzer acts as an alert system, notifying the customer and store personnel of any discrepancies or errors in the cart, such as an item not matching its recorded weight or improper placement. To facilitate easy product identification and pricing, an RFID sensor is integrated into the shopping cart. Each product is tagged with an RFID tag that contains relevant information such as product details, pricing, and promotions. When a customer places an item in the cart, the RFID sensor scans the tag, and the corresponding information is displayed on the LCD screen.**

Keywords: IoT, shopping cart, Arduino Uno, LCD Display, Load Cell, Buzzer, Keypad (Switch), RFID Sensor, ESP8266 Module

I. INTRODUCTION

The retail industry has witnessed significant advancements in recent years, driven by the rapid development and adoption of Internet of Things (IoT) technologies. IoT offers the potential to revolutionize various aspects of the shopping experience, including inventory management, personalized recommendations, and seamless checkout processes. In this context, this paper presents an IoT-based shopping cart system that utilizes a combination of hardware components, such as Arduino Uno, LCD Display, Load Cell, Buzzer, Keypad (Switch), RFID Sensor, ESP8266 Module, and IoT principles to enhance the traditional shopping process. The traditional shopping experience often involves manual processes for inventory management, price checking, and long checkout queues. These inefficiencies can lead to customer dissatisfaction and loss of sales. The proposed IoT-based shopping cart system aims to address these challenges by automating and streamlining key aspects of the shopping process. The core component of the system is the Arduino Uno microcontroller, which serves as the central processing unit. It facilitates communication and coordination among various hardware components, ensuring seamless integration and operation. The LCD display provides an intuitive interface for customers to view product information, offers, and personalized recommendations. It enhances the shopping experience by offering relevant and targeted information to customers based on their preferences or previous purchase history. The load cell integrated into the shopping cart enables accurate weight measurement of items placed in the cart. This feature enables real-time inventory management by constantly updating the availability of products.

The buzzer acts as an alert system, notifying customers and store personnel of any discrepancies or errors in the cart, such as an item not matching its recorded weight or improper placement. To simplify product identification and pricing, an RFID sensor is incorporated into the shopping cart. Each product is equipped with an RFID tag containing relevant information. When a customer places an item in the cart, the RFID sensor scans the tag, and the corresponding information is displayed on the LCD screen, ensuring accurate pricing and product details. The keypad (switch) provides an easy-to-use

interface for customers to navigate through product categories, add or remove items from the cart, and initiate the checkout process. The ESP8266 module enables seamless connectivity to the internet, allowing the shopping cart to communicate with the store's backend system, inventory database, and online payment gateways.

The IoT-based shopping cart system offers several advantages over traditional shopping methods. It reduces the reliance on manual processes, leading to increased efficiency and reduced errors. Real-time inventory management ensures that customers are informed about product availability, reducing instances of out-of-stock items. Personalized recommendations enhance the shopping experience by providing relevant and tailored suggestions to customers, increasing customer engagement and satisfaction.

II. LITERATURE REVIEW

P CHANDRASEKAR AND T SANGEETHA, "SMART SHOPPING CART WITH AUTOMATIC BILLING SYSTEM THROUGH RFID AND ZIGBEE", IN 2014[1].They have created smart trolley with automatic billing system through product identification device. The device has RFID tag, RFID reader, EEPROM and Zigbee. The product identification is fetched from the centralized billing system when a particular product is scanned through RFID tag and reader. The purchasing detail of a particular cart is sent to the centralised billing system through EEPROM and Zigbee. The product information which is stored in EEPROM will be transferred to the centralised billing system through Zigbee. Zigbee is used to transmit the data over long distance through intermediate devices.Using PID (Product identification), customers no need to wait near cash counters for their bill payment. because their purchased product details will be transferred to central billing system. Customers can pay their bill through credit/debit cards. The microcontroller is used to receive the 8-bit data from RFID reader. [2] sainath, k.surender, v.vikram arvind, "automated shopping trolley for super market billing system", in 2014.

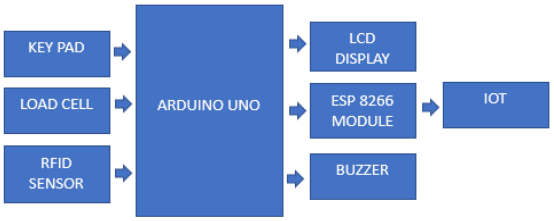
They used barcode scanner, sensor and embedded system to scan the product. Embedded chip which controls the entire operation of raspberry pi and the android application is installed on the chip. [3] sudhir rao rupanagudi, fathima jabeen, vaishnav ram savarni k r, sindhu adinarayana, vinay k bharadwaj, karishma.r and varsha g.bhat, "a novel video processing based cost effective smart trolley system for supermarkets using fpga", in 2015.They explains a novel methodology to overcome the problems faced by a customer at a shopping mall.

This is achieved by developing a smart trolley system which is capable of not only carrying goods which has been purchased by the consumer but also guiding the consumer to prescribed the locations in the mall. The authors discuss the methodology of creating a Personal Shopping Assistant (PSA) which is connected with a trolley. The PSA's basic role is to communicate with the user and intimate the user based on voice recognition and tell where the item is located in the shopping mall. In this approach, both issues of carrying goods and searching for products in a shop have been taken care and this is made possible by a mix of robotics and also cost-effective real- time video processing all in a single unit.

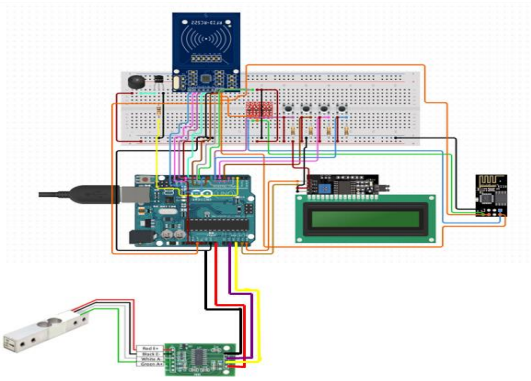
A novel methodology of mapping the complete store with only 3 different colors - blue, light orange and dark orange, was discovered. All trolleys follow a single route which starts from the left-hand bottom corner of the shop and ends at the billing counter.

III. SYSTEM IMPLEMENTATION

The selection of components includes the study of their characteristics, advantage, availability, cost, user friendly property of the components that we have selected. In our project we have selected components only by thoroughly studying the component

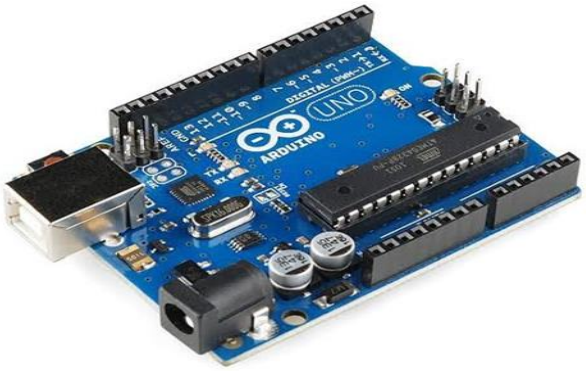


A. CIRCUIT DIAGRAM:



B. Arduino UNO:

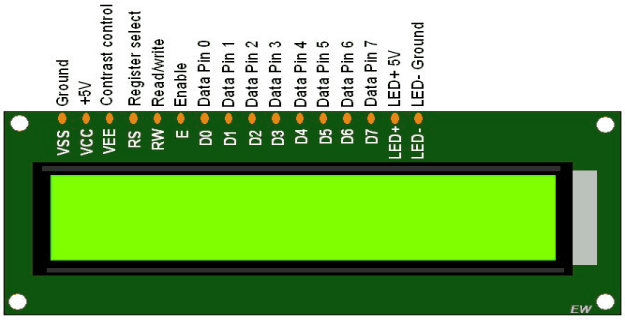
Arduino is an open-source electronics platform based on easy-to-use hardware and software.



Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button.

C. LCD (LIQUID CRYSTAL DISPLAY):

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation .LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. LCD's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology.



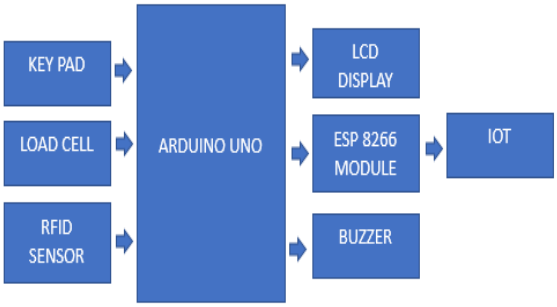
D. BUZZER:

A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.

There are two types are buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beeeeeeppp.... sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it. But, the one shown here is most widely used because it can be customised with help of other circuits to fit easily in our application.

This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used, but it is recommended to use a regulated +5V or +6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval.

E. BLOCK DIAGRAM:



IV. EXISTING SYSTEM

The traditional shopping experience relies heavily on manual processes and limited technology integration. In the existing system, inventory management is often performed manually. Store personnel manually update stock levels and monitor product availability. This process is time-consuming and prone to errors, leading to inaccuracies in inventory records and potential out-of-stock situations. Customers often need to manually check prices by referring to price tags or seeking assistance from store personnel. This process can be tedious, especially in large stores with numerous products. It may also result in discrepancies between the displayed price and the actual price at the point of sale.

V. DISADVANTAGE OF THE EXISTING SYSTEM

- Developing and deploying an IoT-based shopping cart system involves integrating various hardware components, software systems, and connectivity protocols. It requires technical expertise in IoT technologies and may pose challenges for businesses without sufficient IT resources or expertise. The complexity of the system can lead to longer implementation times and potential issues in troubleshooting and maintenance.
- Implementing an IoT-based shopping cart system requires investment in hardware components such as Arduino Uno, LCD Display, Load Cell, Buzzer, Keypad (Switch), RFID Sensor, and ESP8266 Module. Additionally, there may be costs associated with system integration, software development, and maintenance. These upfront and ongoing expenses can pose financial challenges, particularly for small retailers or businesses with limited budgets.

VI. PROPOSED SYSTEM

The proposed IoT-based shopping cart system aims to overcome the limitations of the existing system and provide an enhanced shopping experience. The system leverages Arduino Uno, LCD Display, Load Cell, Buzzer, Keypad (Switch), RFID Sensor, ESP8266 Module, and IoT technologies to automate and streamline various aspects of the shopping process. The system integrates a load cell into the shopping cart to accurately measure the weight of items placed in the cart. This real-time weight data is utilized to automate inventory management. As customers add or remove items, the system updates the inventory database, ensuring accurate stock levels and minimizing instances of out-of-stock products. Store personnel can also monitor inventory levels in real-time.

VII. ADVANDAGE OF THE SHOPPING KART

- The system automates various processes, such as inventory management, product identification, and checkout, resulting in improved operational efficiency. Real-time inventory updates ensure accurate stock levels, reducing instances of out-of-stock products. Automated product identification eliminates the need for manual price checking, saving time for both customers and store personnel. The streamlined checkout process reduces waiting times and enhances overall efficiency.

- The system provides a more interactive and personalized shopping experience. Customers can access detailed product information, including pricing, promotions, and recommendations, through the LCD display. Personalized recommendations based on customer preferences enhance engagement and satisfaction. The intuitive keypad (switch) allows for easy navigation and selection of items, simplifying the shopping.

VIII. CONCLUSION

The IoT-based shopping cart system offers significant advantages over the traditional manual shopping experience. By leveraging technologies such as Arduino Uno, LCD Display, Load Cell, Buzzer, Keypad (Switch), RFID Sensor, ESP8266 Module, and IoT principles, the system automates and streamlines various aspects of the shopping process. Through automated inventory management, real-time product identification,

personalized recommendations, streamlined checkout processes, and seamless connectivity, the system enhances efficiency, improves customer experience, and provides valuable data-driven insights for retailers. While there are challenges to consider, such as cost, technical complexity, security risks, and user adoption, proper planning, resource allocation, and implementation strategies can mitigate these challenges and ensure the successful deployment of the IoT-based shopping cart system. The integration of IoT technologies revolutionizes the shopping experience, offering convenience, personalization, and efficiency for both customers and retailers. By embracing these advancements, retailers can optimize their operations, enhance customer satisfaction, and stay competitive in the rapidly evolving retail landscape. The IoT-based shopping cart system represents a significant step forward in transforming the traditional shopping experience, enabling retailers to deliver a seamless, personalized, and technologically advanced shopping experience that meets the expectations and demands of modern customers.

IX. FUTURE ENHANCEMET

In the future, LIFI technology can be used for car-to-communication. The LCD can provide store layout where customers can get accurate information about products in different rows. This increases the user-friendly. The smart shopping cart can interact with customers during the shopping process. For example, cross discount coupons based on their location in the supermarket. The movement of the trolley can be performed The trolley can be made with the help of various sensors. This eliminates the need to tow a heavy cart.

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