
Smart Shopping Cart with Automatic Billing System

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Abstract.

The “Smart Shopping Cart with Automatic Billing System” is endeavoured to provide an enhanced conventional shopping cart experience to the end consumer with the help of smart application for improving the speed and efficiency of the process. This also embeds RFID (Radio Frequency Identification) and IoT (Internet of Things) to the process of scanning the products and the billing. When the customer puts an item into the cart, RFID readers scan the tags of the corresponding goods and update the cart balance continuously. A self-scanner screen is installed with bar code indicators of the item counting process and the accumulated total of the final price of all items in the basket. After the shoppers have selected the products, they wish to purchase, a secure, integrated, tended payment channel clears the payment and eliminates the need for check out queues. Improving the level of satisfaction which the customers have which consequently improves on the store’s operations through the reduction in the number of cashier employees and eradication of the many errors that come with the manual preparation of bills. This innovative approach aims to transfigure supermarket operations and increasing customer satisfaction

Keywords. Smart Shopping Cart, Automatic Billing System, RFID, IoT, Real-time Product Scanning, Integrated Payment System.

1. INTRODUCTION

The “Smart Shopping Cart with Automated Billing System” is an innovation in the retail shopping technology to overcome the limitations of the traditional shopping process. Each item is assigned RFID number to enable the use of an automatic bar code scanning as the product is placed on the cart. This cuts down the time spent in the process of having someone scanning the barcode at the checkout point thus the time taken in checking out is minimized. This is a shopping cart design which has RFID readers that update both a digital display and record the product detail and the aggregate amount for purchase. This enables the customers to be monitoring their spending in realtime hence avoids shocking balances at the till. Furthermore the IoT connectivity allows it to communicate with the stores inventory management, so that the inventory levels are replenished automatically which reduces the chances of stockout. Indeed, one of the greatest advantages of this kind of system is on the payment side where most of the payments are automated. Once the shopping is done the customer has the option to go directly to a self-check out or if it is integrated into the cart the option to pay again without having to re-scan the articles or wait in a line. Acceptable payment methods could be through mobile money, credit/ debit cards or through store mobile apps and the transactions would be contactless. This also reduces cases of bill errors, ensures minimum handling of cash thus avoids cases of theft and also shortens the time taken to complete checkouts hence making it easier and faster for the customers. The system also contributes in the saving of labour by cutting down the cashier staff since the cashiers are not heavily relied upon.

In addition to customer convenience what the system brings to the retailers is enhanced organization in their operations. The constant updating of cart totals supplemented by automatic tracking of inventory and fast processing of payments all help to minimize congested points that are created in the shopping process. Whereas in a physical store, the system may be able to capture the information regarding the customer shopping and purchase behavior that is useful for procurement planning, marketing and design of the store. Besides, it can minimize possible errors that human being may make while preparing the bills and also making stores more secure from theft and losing items at the time of payment. In general, the “Smart Shopping Cart with Automated

Billing System” is one of the effective solutions that improves the customers’ experience and increases the productivity in retail businesses.

2. METHODOLOGY

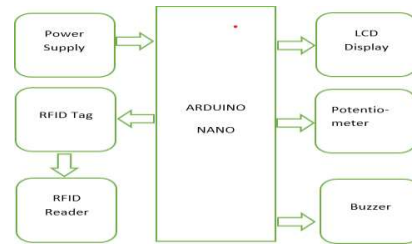


Figure 2.9. Block Diagram of Smart Cart Billing System

1. Power Supply: Supplies the required electrical voltage (9V) to all the subsystems and it checks whether all the Arduino UNO board and all affixed modules are working satisfactorily.
2. Arduino UNO Board: The circuitry found in each developed system and controls each component as well as interprets the results from each device. It oversees the entire system because it performs stored instructions in the computer.
3. RFID Tag: A portable and usually small device that may be clipped to such things as clothing or handbags. It has what is known as an RFID tag, which is an identity file that an RFID reader can read.
4. RFID Reader: Scans the diffused data such as the information that is stored on RFID tags. It sends the read data to the Arduino UNO board for interaction with the outside world.
5. LCD Display: An interface that acts as a television to display information to be seen on the user end. It may display messages, instructions or data concerning the content or state of the related element, namely the shopping cart.
6. Buzzer: A device that can output sound allowing it to produce sound alarms. It may be employed to indicate that there are errors, operations executed smoothly, or any other message.

Algorithm:

- Step 1: Start Begin the process.
- Step 2: Initialize System Establish all the preparatory conditions that are related to the running of the system.
- Step 3: Search for RFID Tag to always look for an RFID tag within the detectable distance of the RFID reader.
- Step 4: Check if RFID Tag is detected: - Yes: When an RFID tag is found the process move to the next step. - No: If the RFID tag is not read proceed to the next step.
- Step 5: Read Data from Memory Request the data related to the RFID tag that has been identified from the system’s cache.
- Step 6: Display Data on LCD Display the obtained information, including items’ characteristics on the built-in LCD display.
- Step 7: Add Item Cost as Items are Inserted into the Trolley Make sure that in the actual scenario of putting more items in the trolley, the total cost on the LCD changes with each addition.
- Step 8: When push button is Pressed, Send Data to the Counter. After the user closes the application and presses the push button, send the accumulated data to the counter, which can process it.
- Step 9: The total amount of the items will be calculated, and it will display the total amount on the LCD display.
- Step 10: Stop - End the process.

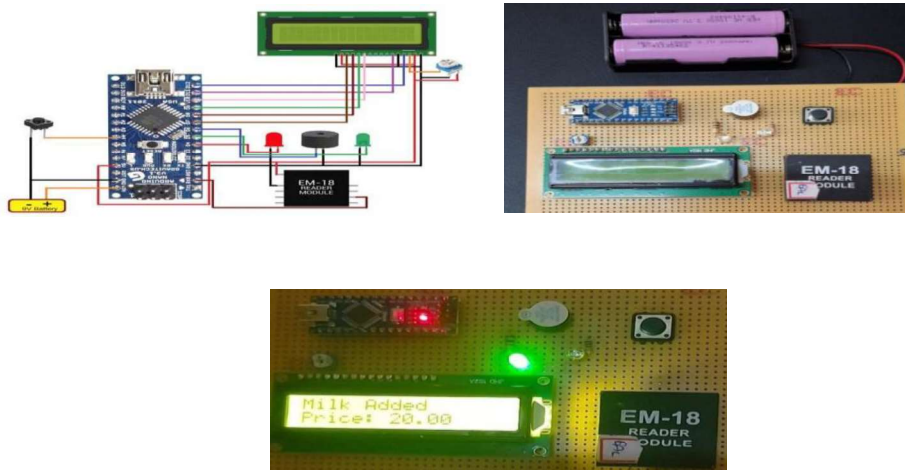


Figure 2.3. a) Pin Diagram of Arduino and b) Prototype

The main controller of this project is Arduino Nano Board which stores the code of the project. Arduino take care of everything by reading the stored data of RFID card and calculating the value. The RFID module we use here is EM18 module which works at 125 KHz. LEDS were used for the indication of adding the product or removing the product.

The most important of this project is LCD screen. In this project we are using 16x2 LCD monitor. When you hold down the reset button and start scanning, the RFID object can be removed. An intelligent cart that has an intelligent billing system makes the shopping more convenient through innovative systems that enhance the shopping process. These carts are fitted with a number of sensors, cameras or RFID technology aimed at sensing and or recording the contents placed in the carts. Depending on the RFID tags and the security cart installing in the store, the RFID tags in the product can be detected by the RFID reader of the security cart or by computer vision method according to the appearance of the product.

2.2 Result Displayed in LCD

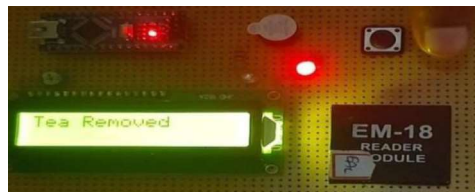


Figure 2.4. a) Product Removed and b) Product Added shown in LCD Screen

A Smart Shopping Cart with Automatic Billing System is an application that will, in the near future, do away with the traditional shopping experience. With technology infused into the process, such a system may put items into a cart whereby the following most likely happens

1. **Sensors Automatic Detection** The cart is installed with sensors such as RFID or barcode scanners. In this case, when a shopper puts an item into the cart, the sensors automatically detect and identify it through its bar code, RFID tag, or weight.
2. **Live Statistics:** In this, once the items are put into the cart, the information about the item like its name price, etc is shown live on a monitor attached to the cart. Hence, the customer will be able to view his ultimate count in real time and hence keep track of how much he spends.
3. **Instant Stock Check:** The system immediately counts the stock. Whichever item is put into the cart automatically reduces the stock of that item as well thereby serving as an improvement in the process

of running inventory for the selling person.

4. Automatic Billing: The smart cart is connected to a bill system. All items added are automatically recorded in the customer's virtual cart for billing. The benefit is that once the shopping is done, then the customer pays directly through any mobile app or kiosk without manual checking out.
5. Error Detection: The machine can detect the addition of an item if scanned inadequately or the removal of an item without accounting for it, which guarantees accuracy and stop theft.

The intelligent cart provides customers with real-time information concerning the total sum, customers will be at liberty to know their spending level and thus buy whatever is needed. Customers get to make decisions on whether to add or remove items based on what's made available in their current total, creating an overall heightened level of control in the shopping process. In total, the overall pricing feature in a smart shopping cart equipped with an automatic billing system is crucial to offer transparency, user-friendliness, and efficiency in both customer and retailer shopping experiences.

CONCLUSION

The incorporation of IoT technology in smart billing machines can be considered as a revolution in the current retail industry that has impacted a lot in modifying the conventional billing system. Connected billing machines utilize the use of IoT to interconnect and exchange data which makes the billing process more efficient and easy for the users. Linking these machines and different systems can enable these machines to easily update and handle transaction information, decrease customer's waiting time and thus practically improve shopping experience. The smart billing machines integrated with IoT also have the efficiency of processing payments in real time and with little possibility of errors. It means due to IoT technology integration with the billing machine is possible to interact and synchronize with payment gateways as well as inventory management systems. This makes the payments to be processed correctly, and reduces instances of errors which would harm the reliability of payment process. Also, the real-time data processing offer the possibilities of automatic generation of receipts, and check transactions and effectiveness of the checkout. Smart billing machines are also beneficial for retailers because they also offer data concerning consumers.

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