Barcode based Automatic Billing Trolley System in Supermarkets

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Abstract : In this paper, we present the design of smart trolley using Barcode technology automates and enhances the shopping experience and makes shopping easier and faster. Customers can scan items as they shop, view real-time costs on a display, the payment and eliminating checkout lines. The trolley ensure accurate item detection, reducing errors and improving inventory management. Additionally, it collects shopping data for personalized recommendations, offering efficient, and user-friendly retail solution.Nowadays, shopping has become part of our daily routine.When people go to supermarkets or malls to buy products, they often have to spend a lot of time waiting in line to pay, which makes the queues longer. This idea focuses on a smart shopping system where the bill is automatically created in the shopping trolley. Every time customer scans a product and places it in the trolley, the system updates the bill in real-time. This model helps save time by preventing long waits at the checkout[1]. The smart shopping cart uses small computers and automatic identification technology to make shopping better. The main goal of this smart cart is to allow instant billing without standing in long lines and,To help customers keep track of their spending. The idea is to save time in the store and make shopping for daily items more enjoyable, rather than stressful.[2]

Key words: Raspberry Pi, Barcode Scanner with camera, Load cell, Power supply, Buzzer, Liquid crystal display, PC, Notification, LED's.

I. INTRODUCTION

In recent times, day to day life of a ordinary human being has become a lot more hectic. Time has become money. So, people actually do not have much time to spend for shopping which is an inevitable thing. Humans these days always go for the technology which is useful to them and have always invented a technology which will support their needs. Basically, human wants to decrease the tasks using the technology in faster and easier way in various fields available. we can say human spend approximately 1 to 1.5 hours for shopping and most of the customers will always tend to walk out of a queue if it is long. Almost every product you see in stores today has a barcode on it. This barcode is usually either an EAN (European Article Number) or a UPC (Universal Product Code).

The Smart Shopping System is all about making shopping easier and automatic. To do this, every shopping cart needs to have a barcode scanner attached. In our design, we use a camera-based barcode scanner that's placed on the cart. The scanner reads the barcode on each product, so it can look up the price from a database that holds information about all the products. This database is stored in the system.

To start shopping, at first, the customer needs to scan the barcode which is already present on the shopping trolley. After the trolley barcode isscanned, the customer can start shopping by first scanning the barcode of each product and then placing them into the trolley.

The shopping and grocery industry is an important part of our daily lives. experienced the frustration of standing in long lines at the supermarket, which takes up a lot of time. While shopping, customers often face challenges like worrying about whether they have enough money for their bill or not having enough information about the products they're buying. Plus, they have to choose the best product out of a variety of similar options. Store owners also

want to make shopping easier and more attractive for customers, while reducing labor costs. Another common issue is not having the exact change, which leads to more time wasted.[2]

II. LITERATURE SURVEY

2020, Chandan K N, Swathi S, Sushma H J, Sushmitha D Y, Shwetha "Smart Shopping Trolley Using Raspberry PI" proposed a system where the customer is given a card to scan the barcode which generates a unique id. Later the bill details is displayed on the screen and has to pay through online[1]. Oct 2022, Ganesh P Nischay "Smart Shopping Cart with Automatic Billing System" The main goal of this smart cart is to allow instant billing without having to wait in line and to help customers keep track of their spending. The idea is to save time in the store and make shopping a more enjoyable interactive experience rather than a stressful one. In this system, each product in the store will have a unique RFID tag, and each shopping cart will have an RFID reader attached to it. The market there are no existing solutions like the shopping cart connect to mobile which displays purchased items in real-time[2].

Mar 2023,Namith C, Thanush S V, Vibhuti Bisht, Vishnu G Upadhya, Prof. Kiran Y C ,Indu B "A Survey on RFID Based Smart Shopping System and Automated Billing". The data is shown in themobile application when the user scans the product at the billing counter[3]. Mar 2022, Shraddha Wakode, Pranav Arakhrao, Anuja Dive, Kishor Bandal "Smart Trolley with Automated Billing" They proposed a user interface to assist customers in locating the product and provides a centralized and autmatic billing system[4].

April 2024, Anas Usmani, Abhinav Pandey, Pratham Solanki, RahulYadav, Zainab Mizwan "Auto Billing System" Barcode scanning has been the go-to method for product identification and billing, but it often proves time-consuming and labor-intensive for both customers and staff. By leveraging cutting-edge technology, Auto Billing eliminates the need for manual barcode scanning, offering a seamless and contactless alternative[5]. K

Sreenivasa Rao, Ayesha Shaik, N Dineshsairamreddy H Anusha, A Guru Rajesh, 2024, "IoT- Based Smart Shopping cart using RFID Technology", This system will have the ability to reduce a bill for each item added to the cart[6].

III. METHODOLOGY

The block diagram consists of inputs and outputs. The input components are Barcode Scanner with camera, load cell, and power supply. The output components are Buzzer, Liquid crystal display, PC, LED's and Notification. The inputs are given to the Raspberry Pi and outputs are from the Raspberry Pi.

Raspberry Pi- It the central processing unit for the automatic billing trolley that coordinates the activities of various connected components such as Barcode scanner, Load cell, and display screens. Barcode scanner will scan the products barcode through the camera, this information is stored in database and this database is sent to the raspberry Pi it integrates multiple hardware components perform tasks like barcode scanning, weight measurement, and data display.

Raspberry Pi acts as the brain of the system collecting data from the barcode scanner and load cell. It processes the barcode information checks weight accuracy and determines the necessary output actions. It can also store data and communicate with external devices.

Barcode Scanner with camera which captures and decodes barcode information from a product or item. The scanned data is processed for identification and further action. Aloadcell(Weight sensor)convertsaforceintoanelectricalsignalthatcanbemeasured and measures the weight of an object placed on it. The signal is processed using an amplifier before sending data to the Raspberry Pi.

The electrical signal changes proportionally to the forceapplied. Load cells is used check the product the weight and also does the theft detection by checking the product weight and database weights. Load cells help prevent theft by ensuring that the weight of scanned items matches the expected

weight based on the barcode data. If there is a discrepancy between the scanned weight and the actual weight, the system can alert staff or prompt the user to check their cart.

Power supply only given to the raspberry pi, as raspberry pi decides which components requires the power and astablepowersupplyensuresthatallsystemsruncontinuouslywithoutinterruptions.Provides necessary voltage and current for the Raspberry Pi and its connected components. Typically a 5V adapter or battery pack can be used.
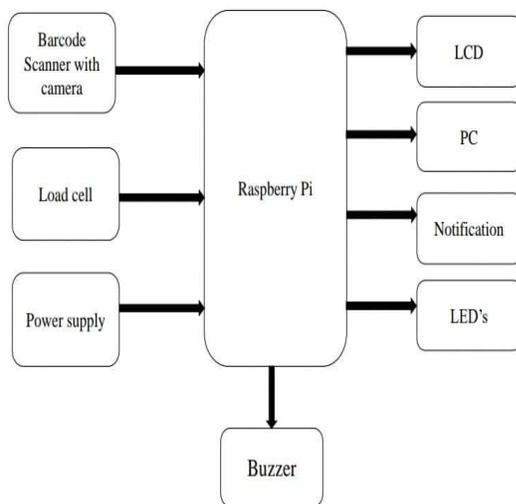

Fig.1. Block diagram

LCD(Liquid crystal display) it displays the product name, cost, weight, manufacture date and expiry dates of the product. Display a vital role in automatic billing systems using barcodes by providing real-time feedback, user guidance, system status updates, and seamless integration with other components. Pc is to use desktop or monitor.Used for real time monitoring, data storage, and analysis.The Raspberry Pi can transmit data via USB, Wi-Fi,or Bluetooth to a PC. Buzzer is use to give alert sounds during the theft detection's and In smart trolley systems, and buzzer provides an audible alert for events like a successful scan, incorrect weight, or system errors. LED indicators are used to provide visual feedback to users aboutthestatusofthesystem and Red LED glow while theft is detected, and also

detect error or mismatch detected. And Green LED glow when successful scan or correct weight. Notifications can provide real-time updates to users as they scan items, after completing the shopping, the bill is generated and sent to the customer's Telegram app.

IV. IMPLEMENTATION

The given flow is used to implement the proposed automatic billing trolley for an enhanced supermarket using barcode using the RealVnc viewer.
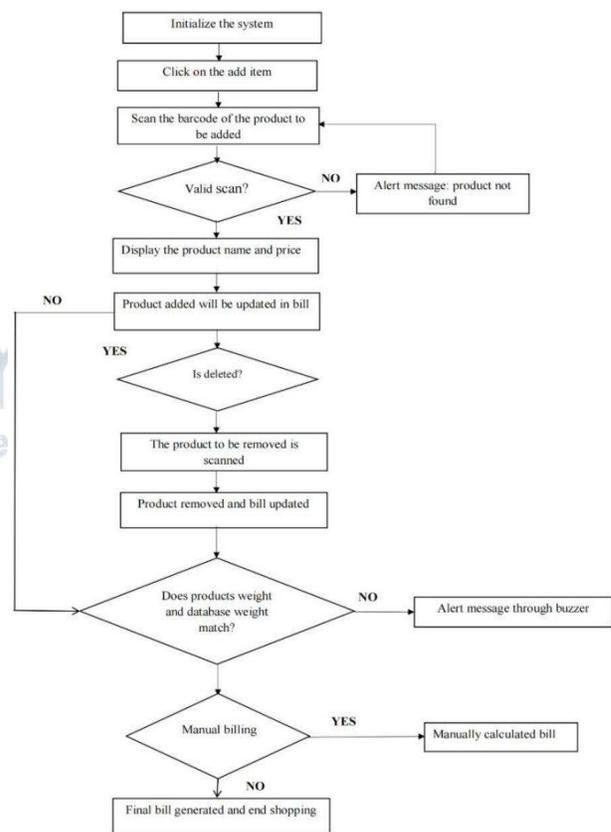

Fig.2. Flow diagram

The steps to follow:

1. Initialize the System: The billing system is turned on and prepared for scanning products.

2. Click on "Add Item": The cashier or customer (in self-checkout) selects the option to add a new product to the bill.

3. Scan the Product's Barcode

o The barcode of the product is scanned using a barcode scanner.

o The system checks whether the product is registered in the database.

4. Is the Scan Valid?

o If No: An alert message appears, stating "Product not found." This means the barcode isn't recognized, possibly due to an incorrect barcode, a missing product entry, or a scanning error.

o If Yes: The system proceeds to the next step.

5. Display Product Details: The system shows the product's name and price on the screen so the user can verify the correct item is scanned.

6. Update the Bill: The product is added to the bill, and the total amount is updated.

7. Product Removal (If Needed):

o If a customer decides they don't want a product anymore, the system allows deletion.

o The product is rescanned to confirm it's the correct item being removed.

o Once verified, the system removes the product from the bill and updates the total amount.

8. Weight Verification Check:

o The system compares the scanned product's weight with the expected weight stored in the database.

o If the weight doesn't match: An alert (buzzer sound) is triggered, warning of a possible mistake or fraud. This prevents incorrect or unauthorized product swaps.

o If the weight matches: The process continues.

9. Manual Billing (If Required):

o If the automatic billing system fails, or there's an issue with weight verification, the billing is done manually.

o A cashier manually calculates the total and updates the bill.

10. Final Bill Generation and Checkout:

o Once all items are scanned and verified, the system generates the final bill.

o The customer pays, and the shopping process is completed.

This system helps streamline the shopping experience by reducing the need for manual billing and minimizing queues at the checkout counters.

V. RESULTS AND DISCUSSION

Fig.3. Golden glow added to data

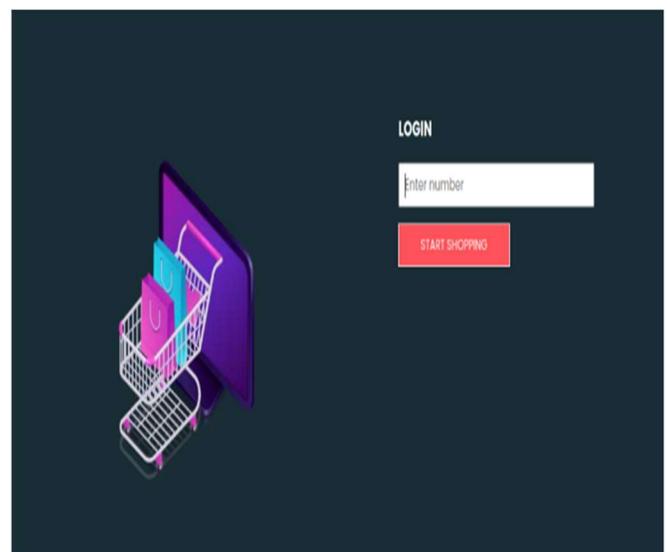
Fig.4. Program upload

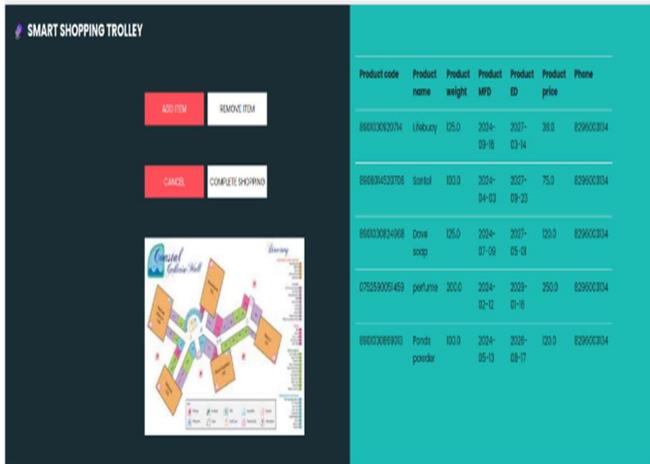**Fig.5. Login with customer mobile number**

Fig.6. Web page

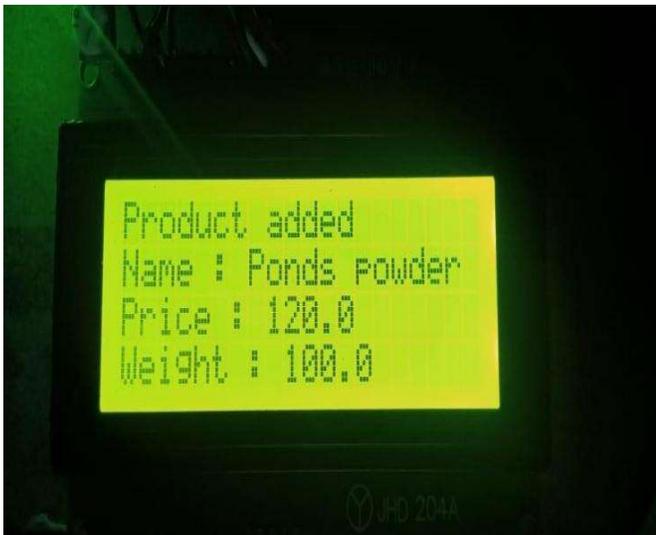**Fig.9. Total number products added to cart**

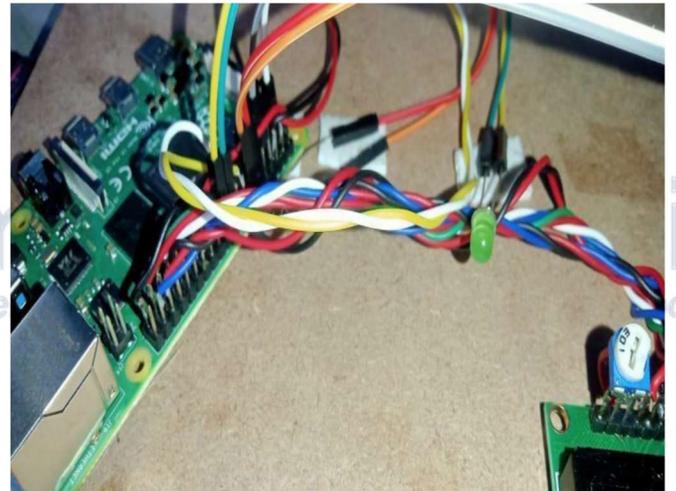**Fig.7. Ponds powder added to cart**

Fig.10. Raspberry pi connections

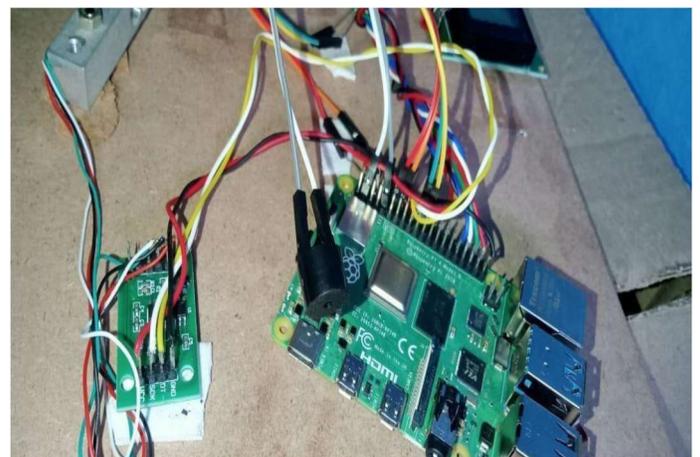**Fig.8. Dove soap added to cart**

Fig.11. Buzzer connections

VI. CONCLUSION

The Smart Trolley inevitably will require very good and flexible design that will attract the client to use the product. The first question during the group discussion before the design was "Who are the users, where it will be used and the space the trolley to be placed".

The answer is the Supermarkets and the users will be anyone using the product in the store however the space for the trolley will be decided by the store owner. Basically,   the trolley play and remain an integral part of the customers' shopping experience and businesses who uses them should ensure that the design meet the requirement of the customers.

The Smart Trolley should be easy to move around. It should be fitted with a Barcode Scanner and a screen device (shopping tablet)to display all   the scanned product and prices.

VII.   FUTURE SCOPE

- To develop the item Navigation which can help customer to find the products easily.
- To store the   data of products which is previously purchased
- To develop Stock analysis which will be help full for the retailers and notification sent to the retailers.

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