IOT BASED SMART TOUCHLESS SHOPPING WITH AUTOMATION IN DISCOUNT GENERATION SYSTEM

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Abstract: The "IoT based smart touchless shopping with automation in discount generation system" is capable of buying the products directly without the customer having to touch the products physically. Initially, the customer is given a hardware module consisting of an RFID sensor and LCD. The person then scans the corresponding product and can find information about products such as name, price, number of items, etc. The hardware then gives the customer the option to buy the product, edit the number of items also gives an option to cancel the purchase. Customers will also get a discount automatically depending on the sales of items. Details of the purchase such as items, pricing, the bill will be displayed on the Software interface to the billing counter. Customers can now pay the bill and collect the products. Thus, providing a complete shopping solution for the consumer as well as the retailer. The new normal era of Covid-19 has induced many changes in existing systems, offline shopping also needed a change to suit the new condition. It provides a solution for modern-day shopping problems providing consumers a hassle-free experience.

Index Terms -. *Automation, Covid-19 pandemic, Discount system, IoT (Internet of things), RF transceiver, RFID scanner, RFID tag, Shopping*

I. INTRODUCTION

Shopping is a need for individuals, which covers various fields, from vegetable and staple shop to apparel. For the most part, individuals used to go to isolate shops to purchase their various kinds of things. These days, shops are incorporated, we can track down every one of the important things under a solitary rooftop. The insights of the minor and huge shopping centers develop over the course of the years all through the world because of the solicitation of the local area. Consequently, this prompts an expansion in the level and construction of a shopping center. In developing countries like India, there is as yet a plentiful requirement for overhauling the offices for giving the worthiest shopping to customers. Customers face many problems related to payment, also the existing process takes a lot of time which causes inconvenience to shop. These issues additionally contain agonizing over the aggregate sum of cash, deficient data about the things that are available to be purchased and offers of the day, and furthermore holding up in the line at the charging counter for charge lead to burning through pointless time. For settling the issues expressed above different strategies were developed, yet productivity and efficiency is still an issue. Instances of these different existing strategies, for example, standardized tag innovation, where the cost is put away in the scanner tag, and RFID technology are implemented.[2]. Also, the recent pandemic has shown that traditional methods are not suitable for the situation. Customers are not feeling safe with the traditional methods. This can be concluded by a survey which was conducted by the "Numeretor" website, conclusions of which can be explained by the pie chart given below [6].

Fig. 1. COVID-19 behavioral shifts

So, as we can see after the pandemic situation 50% of the customers do offline shopping less frequently. This shows that customers feel that previous shopping methods were less secure. This brings in the need of creating an ecosystem where customers can shop freely without any fear. The work aims to design and build an IoT-based Smart Touchless Shopping with automation in a discount generation system. The system comprises Hardware and software modules. The hardware consists of a Scanning module and wi-fi module. The Software provides billing information. Information is exchanged via the wi-fi module. The motive of this work is to shop freely and fearlessly without making any kind of contact with the items in the mart or shopping mart. This work

will allow the user to choose the required item and select the quantity to add to the cart for the order. All the information regarding the product will be displayed on the device itself. The cart will store the selected products. These products will be added to the cart by the salesmen and be given to the billing counter directly so that there is no physical contact of any outsider or any customer to the products. The system will calculate and create a discount on particular products depending upon the number of items.

II. LITERATURE REVIEW

Rahul Jaiswal, Anshul Agarwal , Richa Negi proposed COVID situation is not going to be over soon, this situation demands technological advancements in various fields. The use of Smart city technology needs to be adopted everywhere. Touch less shopping needs to be introduced in malls and supermarkets so that it can be risk-free.[1]

R. Singh, S. Verma and M. Kriti proposed Shopping marts have become very popular in everybody's life. Smart and touch less shopping can be achieved through the use of modern electronics. RFID scanner and sensor can be used for such purposes, various goods can be equipped with an RFID tag consumers can use an RFID scanner to scan and select any particular item that consumer needs.[2]

Paxal Shah and Ms. Jasmine Jha proposed using IoT technology, communication technology, and protocols to enable the use of the application without human interference. There is a need for analysis of inventory in supermarkets such can be brought by using IoT, making a database for the same. The generation of embedded smart integration environments is suggested by authors.[3]

Thakur Prerana, Shikha Ranjan, Prachi Kaushik proposed Smart Shopping Cart for Automatic Billing In Supermarket in This RFID framework can be utilized in shopping centers for different running food items, electrical apparatuses and so on and can be utilized for security applications by keeping information secret.[4]

P. Chandrasekar and T. Sangeetha have evaluated the problems faced by the customers at the supermarkets and proposed a system to prevent it, the system also has developed a Central Automated Billing System.[5].

III. METHODOLOGY

The materials in the smart-shopping system involve the following electronics components:

- RFID Reader
- RFID Tags
- Liquid Crystal Display (LCD)
- RF transceiver
- Pushbuttons/Switch
- Reset button
- PIC microcontroller

In addition to this, we require Microsoft windows for .Net for the software billing interface.

The Functionality of this system is mainly categorized in the following steps:

1) To scan and select items using the scanning module.

2) To display information about the items selected e.g.: weight, cost, etc.

3) To provide discount if necessary conditions are matched.

4) To provide a list of items added.

5) To provide automatic billing [2][5].

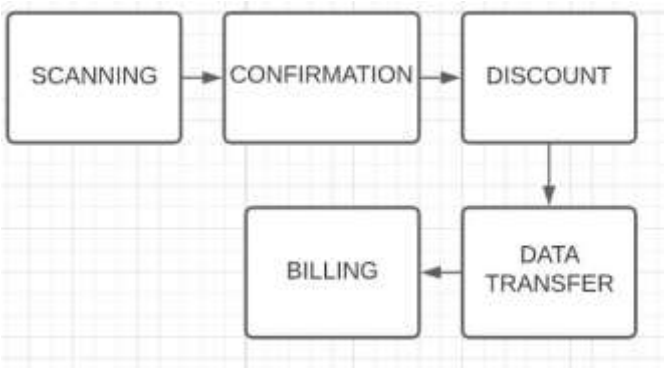

Fig. 2. Block diagram

1. Scanning: Each item has a specified RFID tag. This tag is to be scanned via an RFID scanner. Item information such as weight, cost, etc. is displayed on the L.C.D module.

2. Confirmation: Item information is displayed on the L.C.D module after the scanning process. The user has the option of selecting the product. Also, the user can cancel the purchase if required. The number of items can be modified by scanning the item required number of times.
3. Discount: After selection, a discount is applied if the necessary condition is matched. The default condition is based on the number of items. If the number of items of a particular commodity exceeds 10 then a discount of 10% is provided.
4. Data-transfer: Data about the item/s selected is passed to the main computer via the RF module. Users can now see the complete information about items selected. Information such as the number of item/s selected its/their weight, the cost is displayed.
5. Billing: Users can now confirm their purchase. Automatic billing is done via software UI.

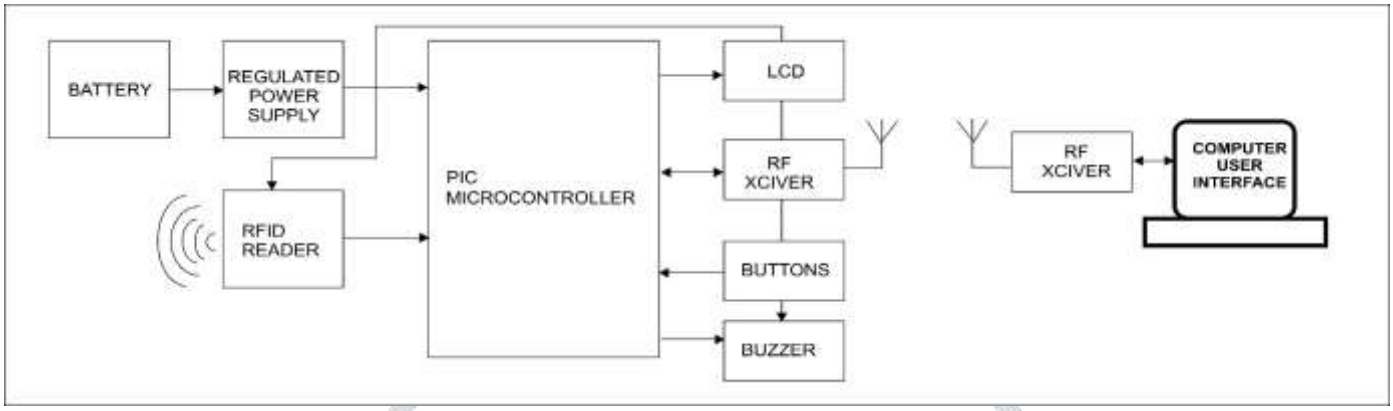

Fig. 3. Simplified block diagram

The input/output modules are interfaced to the PIC microcontroller. Components such as L.C.D, the RFID scanning module, RF Transceiver are interfaced with the microcontroller. RF receiver is connected to the main computer. L.C.D provides information and displays all process control statements. RFID scanning module provides the scanning solution, item data is passed to the main computer via RF transceiver. Automating billing is provided by software UI which is based on the dotnet framework.

A. Discount system

Discounts will be provided depending upon the number of items. The system will take note of items purchased by the customer. Provided the number of items surpasses a limit discount will be generated. This will be reflected promptly on the billing interface [4].

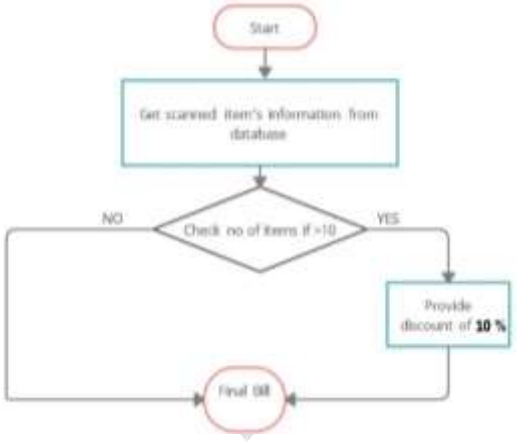

Fig.4. Discount system flowchart

IV. SYSTEM DESIGN

1. Scanning Technologies

RFID: RFID stands for Radio Frequency Identification. To identify the product the customer desires to purchase. RFID tags are either read or write. RFID frameworks are ordered by their working frequencies as Low Frequency, High Frequency and Ultra High Frequency. Frequency of the system determines the range of transmission that is from few centimeters to few meters. The RFID tags will be attached to the products and once scanned LCD will show the details of the product which will be visible to customer [2].

Fig. 5. RFID sensor and tag

2. Radio Frequency Transceiver

A radio frequency transmitter-receiver board receives data and forwards it wirelessly to different components by the use of its antenna. This wireless communication system is extremely useful in small DIY projects where data transfer is needed for the plan to work. Since the connection between the devices occurs over radio waves, it does not require a line of sight. It can happen anywhere as long as the devices are in the range of this mainboard.

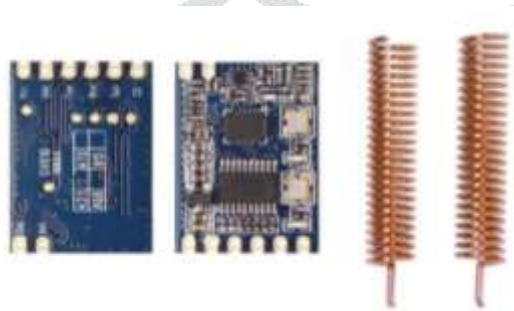

Fig. 6. Radio Frequency Transceiver

3. Microcontroller

PIC16F886 – 8 Bit Microcontroller PIC16F886 is a microcontroller useful for testing and creating applications since it has high flash memory rework cycle. Additionally, there are a ton of instructional exercises and backing accessible on the web. It has 16KBytes flash memory which is sufficient for some applications. Alongside 24 programmable Input/output pins which are created to deal with 20mA current (direct LED driving ability) the framework can interface numerous peripherals without any problem. With Watchdog clock to reset under blunder consequently the controller can be utilized to foster uses of permanent establishment.

Fig. 7. PIC microcontroller

V. PROPESED SYSTEM

A. Hardware Design:

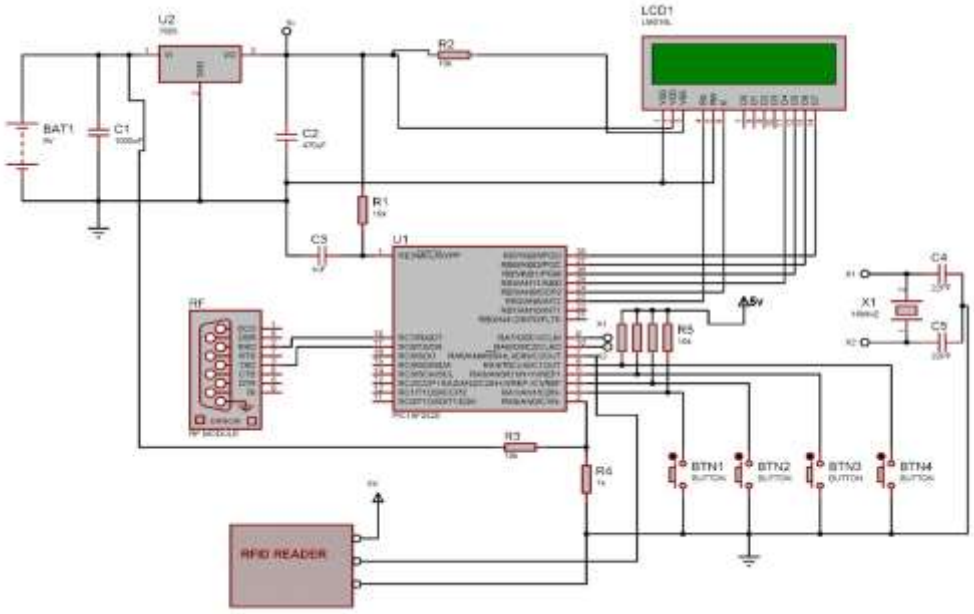

Fig. 8. Hardware Simulation

Following components are interfaced to the microcontroller PIC18F887.

:

1) LCD:
   LCD is interfaced to PORT B Port b.4: Data lines (D4 to D7).
   Port b.3: EN (Enable) pin of LCD.
   Port b.2: RS (Register select) pin of LCD.
   LCD has 2 lines and is alphanumeric (LCD type=1).

2) RFID module:
   RFID uses serial communication protocol for data transfer.
   RFID pin 1: Tx is the data transfer pin of UART.
   RFID pin 2: Rx is the data receiving pin of UART.
   RFID pin 1 is connected to Port A (RA0) of PIC18F887 microcontroller.

3) RF Transceiver SV610
   It is connected to the Port C of microcontroller PIC18F887.
   Data transfer occurs via antennas provided on the transfer and receiver part of the module.

4) Push buttons:
   Four pushbuttons are connected to port A in series with 10kohms registers respectively.

B. Software Design:

The software user interface is based on the Dot Net framework. It displays information received by the hardware. It can be explained by the following sections:

1) Item information: Information regarding Name, weight, price is displayed.

2) Item billing: This provides information regarding the name, price of item/items added to the cart. An automatic bill is generated.

3) Purchase confirmation: After the bill is paid purchase confirmation is displayed on the user interface.

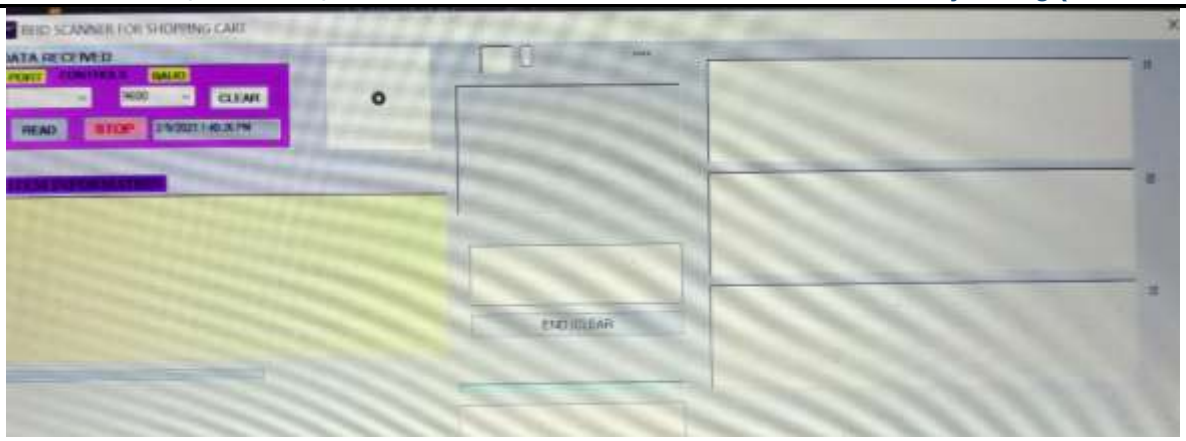

Fig. 9. Software interface

VI. RESULTS

A. Buying process:

1) Initialize the process by switching on the scanning device.

Fig. 10. Display

2) Each RFID tag represents a specific Item.

Fig. 11. RFID tags

Item P1 represents 'Dove',
Item P2 represents 'Parle',
Item P3 represents 'Butter.'

3) Now scan the RFID tags on the product which need to be bought.

Fig. 12. Scanning instruction

4) Adding an item to the bill. After scanning the item P3: Butter, details like name, weight, price about the product will be displayed on the LCD of the device where the option for buying it in terms of yes/on is available and accordingly the customer can choose the item later this product is added to the bill.

Fig. 13. Scanned item p3.

5) Similarly, other products can be scanned and can be bought. After scanning Item P2: 'Parle' the details will be displayed.

Fig. 14. Scanned item p2.

6) The total will be updated to the user In this case the total being 100rs (80+20).

Fig. 15. Total amount

The same will be reflected on software User interface.

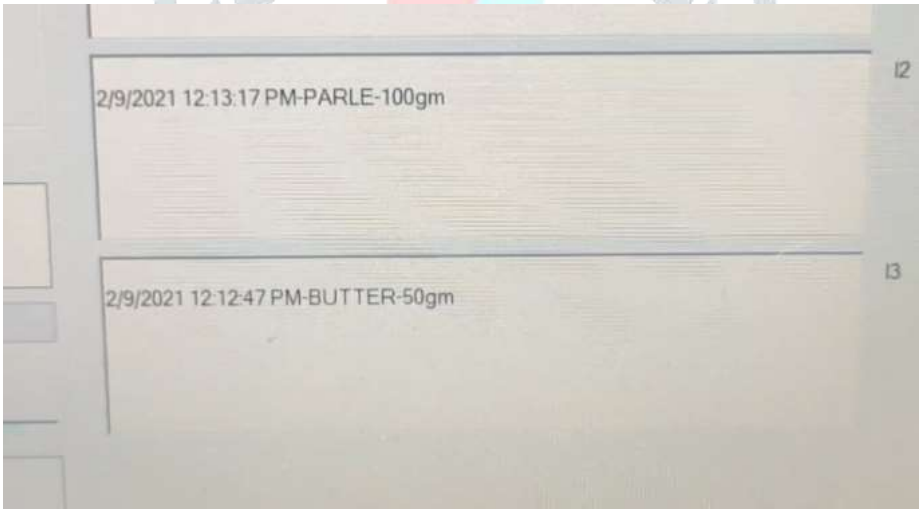

Fig. 16. Information on User interface

7)) This bill is visible on the receiver module where the payment can be made as shown: Once the payment is completed, "Paid" appears on the Software user interface.

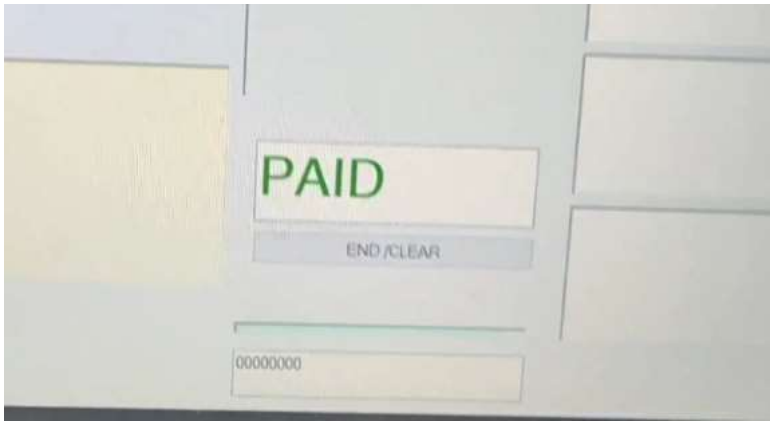

Fig. 17. Payment successful

B. Discounting workflow:

1) Discount is provided if the necessary condition is matched. Condition is if the number of items exceeds 10, a discount of 10% will be provided on the 11th item.

2) The image shows the number of items added to the bill. 10 items of Product P3 are already added to the bill as shown.

Fig. 18. Number of items purchased.

3) After scanning product P3 for the 11th time, the following details will be displayed on the LCD. A discount of 10% will be provided on the 11th item Price is changed to 72 Rs, after the discount of 10% on the previous price of 80 Rs. The same will be reflected in the software UI.

Table 1. Discount Observation

Sr.No	Product	Quantity	Price
1	Parle	5	20
		10	20
		11	18
2	Butter	5	80
		10	80
		11	72
3	Dove	5	25
		10	25
		11	22.5

Fig. 19. Price after discount

4) CONCLUSION

This work will thus help the business owners and customers to lessen human interaction in the process of shopping. In circumstances like a pandemic, this will be helpful. The shopping experience of the customers can be enhanced by analyzing the shopping behavior and providing targeted deals. In the future, an online payment facility can be added on the device itself.

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