

SMART SHOPPING MALL

Powered by Internet of Things

Ruksar Lukade, Viraj Kulkarni, Faisal Khan, Archana S. Ubale

Student, Student, Student, Assistant Professor
Department of Electronics and Telecommunication Engineering,
AISSMS's Institute of Information Technology, Pune, India

Abstract : The year 2020 witnessed people being afraid of touching things they don't have knowledge of and being in public places like shopping malls, airports and even hospitals. A lot of people still had to step out into these public places and expose them to dangers of a pandemic to buy essential commodities like daily supplies and medicines. A proposed solution to this issue is a system that allows customers to purchase daily supplies or medicines without having to interact with other humans or even without having to touch the products they purchase. The system allows customers to purchase the products through an integration of RFID technology and Internet of Things. The RFID sensor is connected to a microcontroller that is connected to the internet and a dispensing mechanism for products. As soon as the customer scans his RFID tag on the sensor corresponding to the product, the dispensing mechanism kicks in and dispenses the product into the basket or a trolley of the customer. The microcontroller simultaneously updates the billing information to a Web portal where the customer pays the bill. If the customer wishes to cancel the order, the product can be placed in the basket at the exit so that it can be sanitized before placing it back into the system.

IndexTerms - RFID, Internet of Things, microcontroller, Web portal.

I. INTRODUCTION

This Smart Shopping Mall intends to save the time required for shopping by shifting the billing process to the internet from queues. A WiFi enabled microcontroller like ESP8266 in this system is used to connect to the internet. RFID readers are mounted on the shopping aisle just beside the product. Every registered customer is given RFID tag containing information about him/her. Motors are used in the mechanism that dispenses the products.

II. LITERATURE REVIEW

A. "Aisle-level Scanning for Pervasive RFID(Radio Frequency Identification)- based Shopping Applications"

Amine Karmouche in her paper "Aisle-level Scanning for Pervasive RFID- based Shopping Applications" [3] proposed a system that connects RFID technology to the Internet for retail shopping Systems. This paper investigates how RFID technology will revolutionise the future of retail industry. RFID can be possible replacement to the barcodes on the products. A system that adopts a cartlevel scanning of RFID can be very helpful in enhancing our shopping experience. This will end the system of manual work of scanning barcodes in the shopping complex.

B. "A Novel Low-Cost Intelligent Shopping Cart"

Dr. Suryaprasad J, in his paper "A Novel Low-Cost Intelligent Shopping Cart" [2] explained the role of the shopping cart that assists the customers in shopping and billing. This paper demonstrates the integration of billing, location and inventory management technology in the shopping cart itself. It aims at creating a low cost and robust system to reduce the time for shopping required in malls. The smart shopping cart will detect the product on the aisle of the shopping mall and produce the relevant information about the product on the screen on the cart. The User Interface will also contain a billing system embedded in the shopping cart. This will end the hassle of long queues in the malls.

C. "Smart Shopping Cart with Automatic Central Billing System through RFID and ZigBee"

Mr. P Chandrasekar in his paper "Smart Shopping Cart with Automatic Central Billing System through RFID and ZigBee" [1] has also proposed a shopping cart that is connected to the internet via ZigBee that assists in billing of materials. The importance of embedded systems is discussed in this paper. An integration of embedded systems with RFID technology will not only improve the shopping experience, but also make inventory management more efficient with reduced manpower requirement. Each shopping cart is equipped with a mechanism for product identification and information display. RFID scans the product code and product information is displayed on a LCD(Liquid Crystal Display) Display for price, discounts and offers. Billing information and payment options are also displayed on the cart display itself. A ZigBee device is used to establish a connection between the cart and billing database. This paper aimed at an improved, queue-free system for billing and payments.

III. HARDWARE DESCRIPTION

The system will consist of a RFID scanner and tags, microcontroller, motor with a dispensing mechanism and a billing system connected via Internet of Things.

A. SCANNING TECHNIQUES

RFID stands for Radio Frequency Identification. To identify the product the customer desires to purchase. RFID tags are either read or write. The RFID tags belonging to customers will have information of the customer and their billing info. RFID systems are classified according to their operating 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. In the project, RFID Scanners will act as input devices. Every product will have its own RFID Scanner. As soon as the RFID Tag is scanned on the RFID Scanner, it will send the information that tag contains about the customer and the product corresponding to the RFID Scanner to the control device.



Figure 3.1: RFID Scanner and Tag .[4]

B. CONTROL

The microcontroller is the central unit for processing in this project. It will receive the data from the RFID Scanner about the RFID Tag and will send signal to the actuators for dispensing products. After that, it will update the inventory and billing information for the target customer.

Regarding the choice of microcontroller, one with Wi-Fi or internet connectivity is to be used. NodeMCU(ESP8266) is used in this project.

C. DISPENSING MECHANISM OF PRODUCTS

The Smart Shopping Mall uses a spiral coil mechanism to dispense the products. In this assembly, products are placed between the gaps in the coil which is connected to a motor that will rotate as soon as the RFID tag is scanned on the scanner. As the motor rotates the coil, the products are pushed forward and the product on the end of the coil is dispensed into the shopping trolley belonging to the customer as it exits the system. The motor has to run for a fixed time to ensure proper dispensing of items in the shopping trolley. The motor has high torque and a fixed RPM to ensure it always successfully dispenses the products.



Figure 3.2: Squeeze mechanism (Archimedes' screw) in vending machine.

D. BILLING AND PAYMENT

As soon as the product is dispensed to the customer, the microcontroller updates the billing information to the software where the customer can log in and pay the bill before leaving the mall. An Internet of Things platform acts as a data storage for the information about the purchase and billing. The billing software can be an application or a website that is connected to the database containing the information of all the registered customers and products.

IV. SOFTWARE DESCRIPTION

A. INVENTORY MANAGEMENT

The microprocessor will keep record of all the products in the inventory of the shopping complex. It will decrement the quantity of product after every purchase and will be updated by the operator after inventory is replenished. All the display of inventory and notifications regarding the inventory management will be displayed in the admin section of web portal.

B. SOFTWARE DEVELOPMENT

The web portal of the Smart Shopping Mall is developed using React library on the front end and any language can be used at the backend. ThingSpeak was used in this project for back end. The reason for choosing React for front end development of the web portal is to ensure that when the RFID Tag is scanned by the customer, he/she doesn't have to reload the page to view his purchases on the web portal.

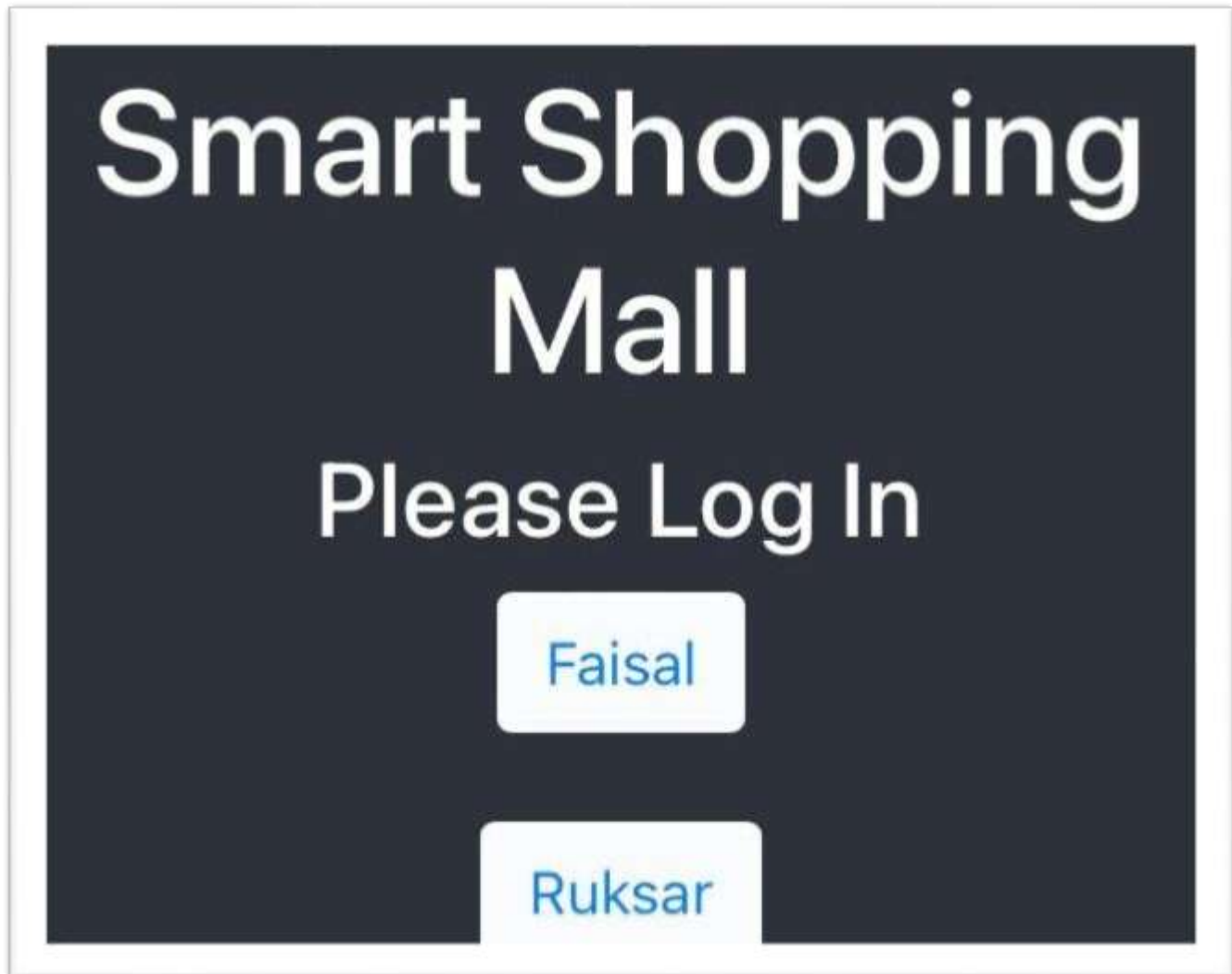
C. ALGORITHM OF PURCHASE

- 1) Initialize.
 - The microcontroller connects to the internet and an LED turns ON to signal the system is connected and ready to operate.
- 2) Scan the RFID Tag.
- 3) Identify the person and the product being scanned.
- 4) Run the dispensing mechanism motor.
- 5) Stop the dispensing mechanism motor.
- 6) Update the billing information and inventory to the Web portal.
- 7) Display bill on software.
- 8) Payment of bill.
- 9) Wait for next Tag to be scanned.

IV. RESULTS AND DISCUSSION

The Smart Shopping Mall did work as it was supposed to. When the RFID Tag was scanned on the scanner, the motors were activated and product dispensing mechanism dispensed the product and billing information was updated on the web portal. The following are the images and screenshots of the project and the software.

The billing and payment process:



Faisal. Here's your bill:

you bought 1
chocolates Your total
amount to be paid is

Rs. 100

Pay Rs 100

Cancel order

[Back to Home](#)

Bill Paid!



your bill:

you bought 1
chocolates Your total
amount to be paid is

Rs. 100

Pay Rs 100

Cancel order

Back to Home

A. FUTURE IMPROVEMENT POTENTIAL

The Smart Shopping Mall can be used as a unit and many such units containing RFID Scanner for each product can be multiplexed to create a bigger shopping complex. Conveyor belts can be used instead of springs to dispense heavier and larger products. Mobile apps can be used instead of web portal for convenience.

V. ACKNOWLEDGEMENT

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- [4] Image source: <https://pixabay.com/images/id-4312260/>

