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Automated Shopping Application using IoT integrated LiFi Technique

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Abstract

Now a days, in urban areas, shopping in super market is a highly time consuming process. During weekend days, customers have to wait in long queues due to barcode based system. To avoid to this time consumption process, this work proposed a novel technology using LiFi technology. Every product in a super market is attached with LiFi transmitter. After this, every product information is displayed in mobile. Based on the information displayed in mobile, the customer can easily shop the product and automatic billing is generated. Thus, the proposed system can easily eliminates the time consumed for shopping and it can be easily implemented.

Keywords: LiFi topology; IoT; Automation system; Super market.

1. Introduction

Merchandising process plays a major role in supply management, which can able to promote products among the customers. Super markets provide a space for all kinds of people to purchase their needs. But, they become most crowded one at the week end days. So people have to spend lot of time for shopping the product searching and in billing process section. This may sometimes lead to have conflicts among the people.

Nowadays, under this pandemic condition, online shopping becomes more popular. However, there will be chance for delivery of defected product, risk of fraud etc,. So people are expecting some new technology to get the quality product similar to that of traditional shopping[1,2]. Thus, to endure with this current situation, supermarkets have to reinvent an alternate sources to satisfy the consumer. To overcome these aforementioned drawbacks, huge number of techniques has been proposed so far.

Many of the supermarkets utilize barcode technology [3,4], Zigbee [5], and RFID sensors [6-8], with the product. A novel smart trolley system have been introduced [9]. But it only identifies the product and not generates automatic billing. Many of the researches have been carried out using RFID and Zigbee technology. However, these systems help customers for product identification only. In this, automation of billing is not effective one.[10] [11] utilized RFID and zigBee module to make shopping effective. In this, security over consumer's information becomes a critical one. [12] proposed IoT based methodology to locate the exact location of product.

Thus the proposed LiFi methodology comprises a vast range of frequencies and wavelengths. It contains a LED. If it is in ON condition, '1' is transmitted and when it is OFF, '0' is transmitted.

In this proposed system, IoT is deployed to transmit data from LiFi transmitter. Although, IoT has numerous advantages, it exhibits security concerns. Hence it is necessary that IoT solution providers must the proposed system is safe and secure. This work tailored a decentralized blockchain based contractual routing (BCR) protocol for data communication. Using this approach, the IoT network can find routes its destination device in a decentralized manner.

2. Material and Methods

Figure 1 displays the schematic diagram of the proposed topology. By utilizing the proposed topology, customers are able to select the quality product. In this LiFi module is attached to customer mobile and trolley. Every product in the super market is tagged with LiFi module and has unique ID. Thus, the product placed in the trolley gets updated in supermarket server.

Once after finishing the shopping, payment is done using a mobile app. Finally, the products are passed through a gate section and cross verified once again. It there is any mismatch occurs, buzzer gets activated. The proposed system comprises 4 basic units namely

- Hardware integration
- Software integration
- Communication and data base

2.1 Hardware Components

The hardware units designed to complete this proposed system includes

- Product module
- Trolley segment
- Gate segment
- Product Module

2.1.1 Product Module

Each and Every product is tagged with LiFi transmitter and is depicted in figure 2. It is connected with controller. The details of the product such as ID, price etc., are derived from the server database. It transmits the details about the product to the user mobile, in the form of digital data. To achieve this, Mobile Shopping Application is created and installed in user mobile.

The LiFi receiver connected at the mobile phone enables the user to identify the product details. It is developed using JSP and servlet. The LiFi receiver reads the product ID and it is displayed in the mobile. A Li-Fi receiver is connected to the mobile using OTG cable. Fig 3 shows final circuit for mobile module.

2.1.2 Trolley Module

After choosing a product, it is placed in trolley. The LiFi transceiver located in a trolley reads the product information and maintains a purchasing record. If the product is removed, it gets automatic updation.

2.1.3 Gate Section

After completing the shopping, the details regarding the purchased products are received at the super market unit. Finally at the billing time, cross verification carried out. Whenever the mismatch occurs, a buzzer connected at this model gets activated. This helps to identify the unbilled product. Finally, after completing payment, the things will be delivery to the customers. Thus, figure 5 depicts the gate segment process, which is going to be takes places at the billing section.

2.2 Software components

Software components includes

(i)Android mobile phone

(ii)Web based super market management system

Customer mobile is connected to the shopping mall server with the help of IP address.

(iii)Wireless Communication

Here, IoT is incorporated for data transmission. For secured data transmission, this proposed topology utilized BCR protocol. In this type of protocol, a smart contract is modeled for specific period by an IoT device. These IoT device broadcasts this address to its neighborhood and new routing is adopted for data transmission. Thus, it offers high secured data transmission [13-15].

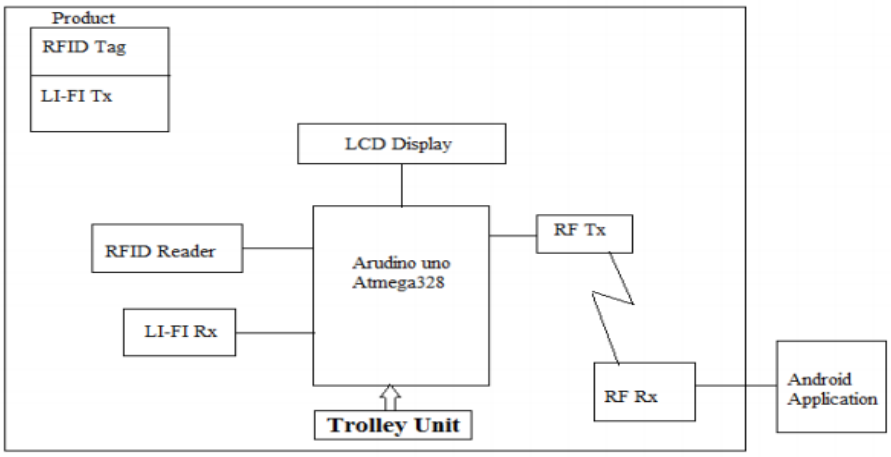

Fig.1. Block diagram of the proposed system

Fig. 2 Block diagram of Product Module

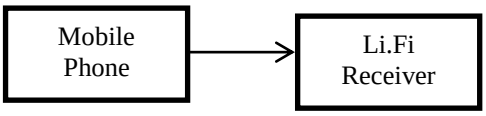

Fig. 3 Block diagram of Mobile module

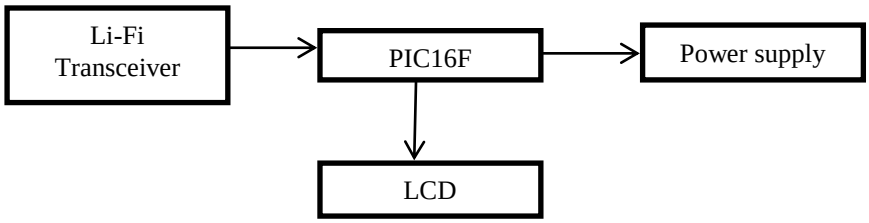

Fig. 4 Block Diagram of Trolley Module

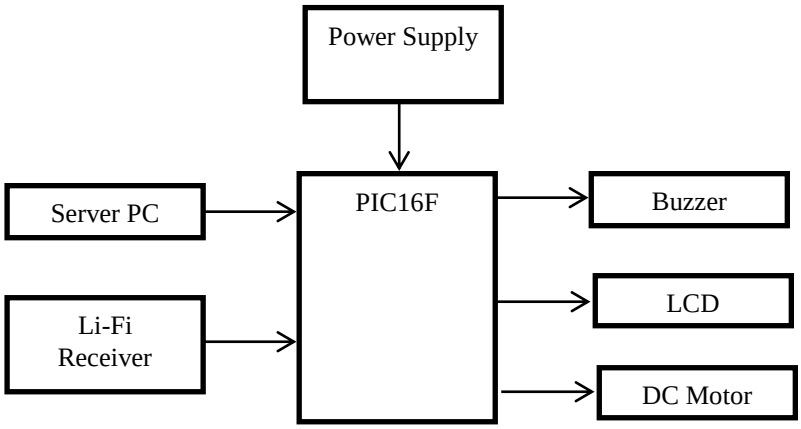

Fig. 5: Block diagram of Gate Module

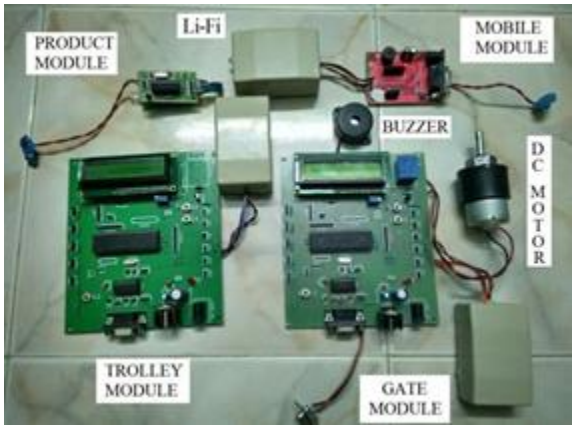

Fig. 6. Photograph of Automated Billing System

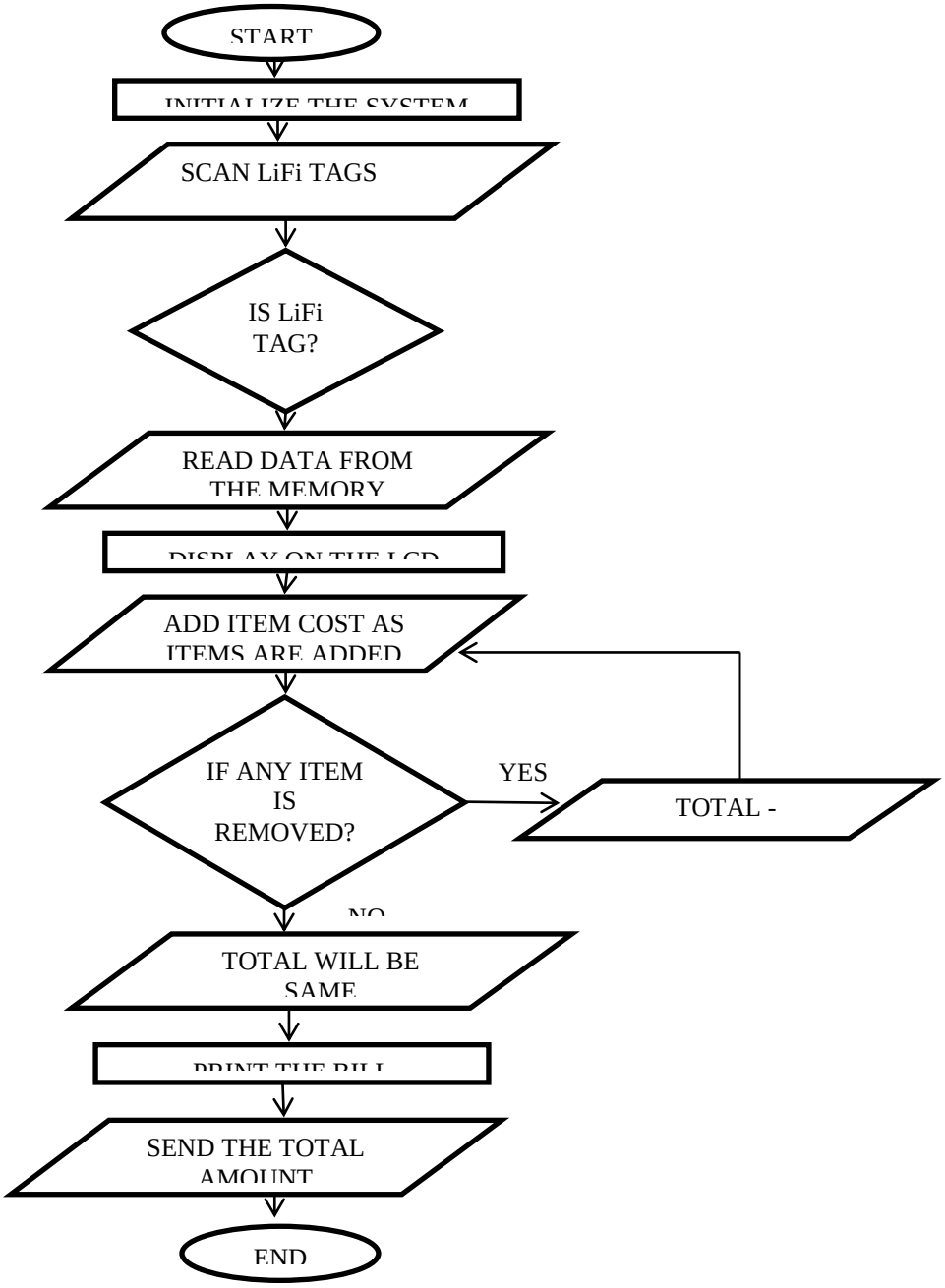

Fig.7. Flowchart representation of proposed topology

3. Result and Discussion

When a customer opens his/her super market application, it displays their previous shopping list along with new inventory products available in super market. The customer can search their product using a search option. It will display the location of product. After finding the product, the customer put the product into the trolley. The Lifi module tagged with the product is read by the LiFi in the trolley. It enables the server to fetch the product details and is displayed on the mobile screen. Figure 6 shows the prototype on the model of the proposed topology. The working scenario of this proposed topology is depicted in Figure 7.

Thus, the algorithm mentioned here explains the shopping process completely.

Algorithm

Step 1: Start

Step 2: Initialize the System.

Step 3: Enable Interrupt for RFID.

Step 4: Check RFID tag

Step 5: If the tag is registered, read related data from the memory.

Step 6: Display the data on LCD

Step 7: Add item cost as items are added.

Step 8: If an item is removed display a message 'ADD OR REMOVE'.

Step 9: Press REMOVE and continue the shopping as the total amount will be reduced, else ADD and hence there will be no change.

Step10: When upload key is pressed send data to the counter.

Step11: Print the Bill.

Step12: Stop

3.1 Performance Evaluation

Thus the performance of the BCR protocol is examined by comparing its efficiency with SCOTRES and TMM. Figure 8 depicts the comparison of throughput of proposed scheme with the existing scheme. It is observed that the proposed scheme exhibits better performance than the conventional methods. At the same time, the proposed system also reduces the delay performance of the system as shown in Figure 9.

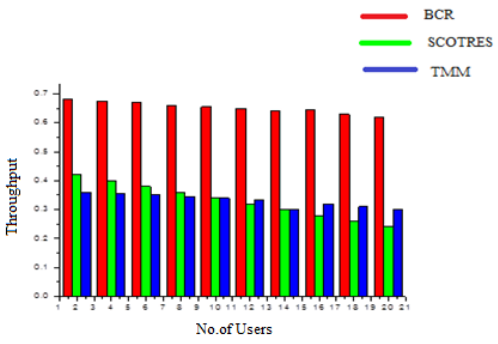

Fig.8 Throughput of various schemes

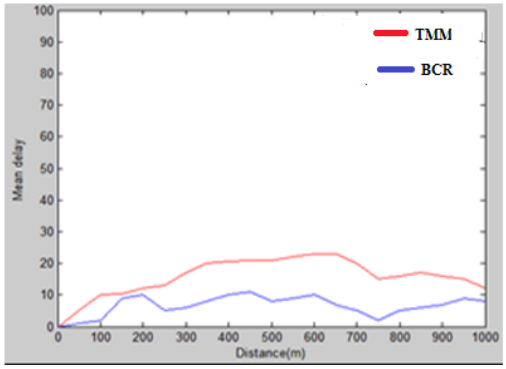

Fig. 9 Delay performance

4. Conclusion

In this work, the automated shopping is carried out using LiFi technology. The whole process involves the integration of both hardware and software components. This proposed system utilizes IOT for secured communication. It prevents the customer from buying expired products. It is a time consuming process and the data of consumer is maintained in secured manner. Hence, it can be implemented in real time application

APPENDIX

Circuit diagram of the modules of the proposed system

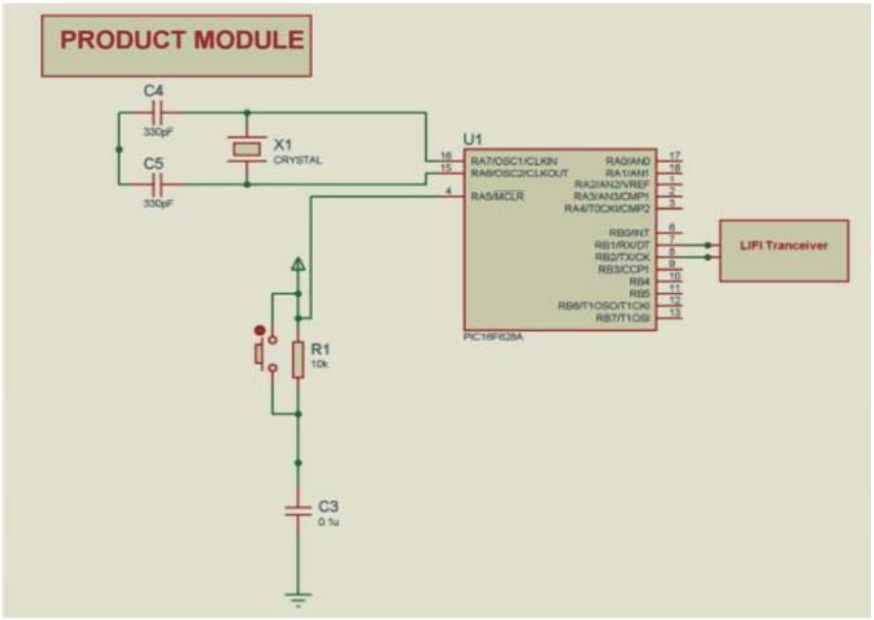

Fig. 10: Product module

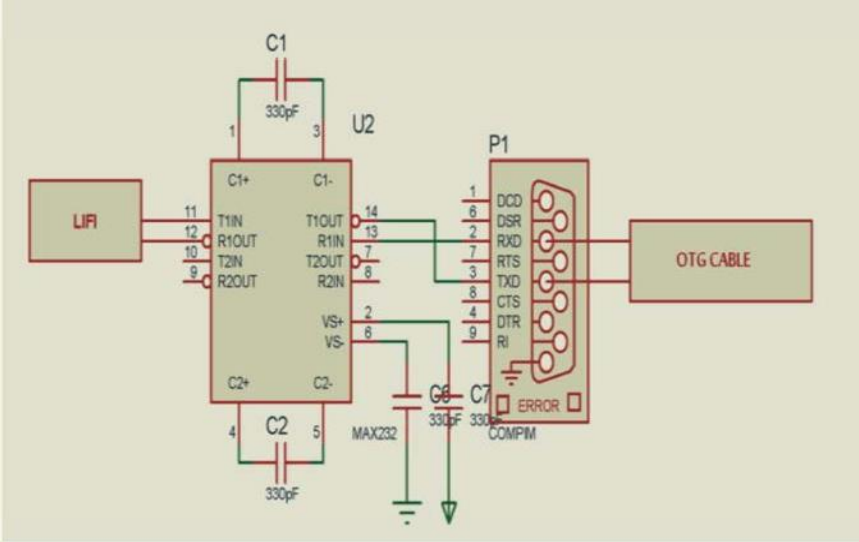

Fig. 11: Mobile section

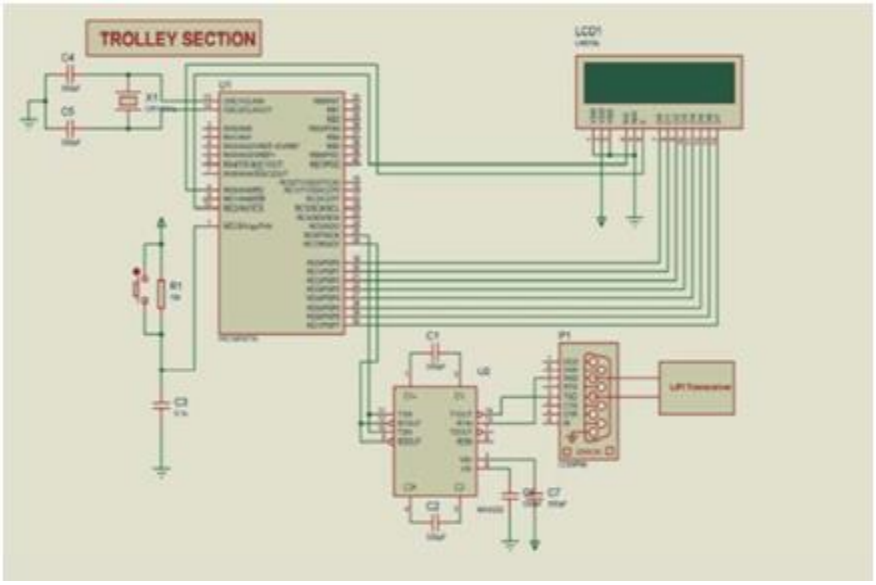

Fig. 12. Trolley section

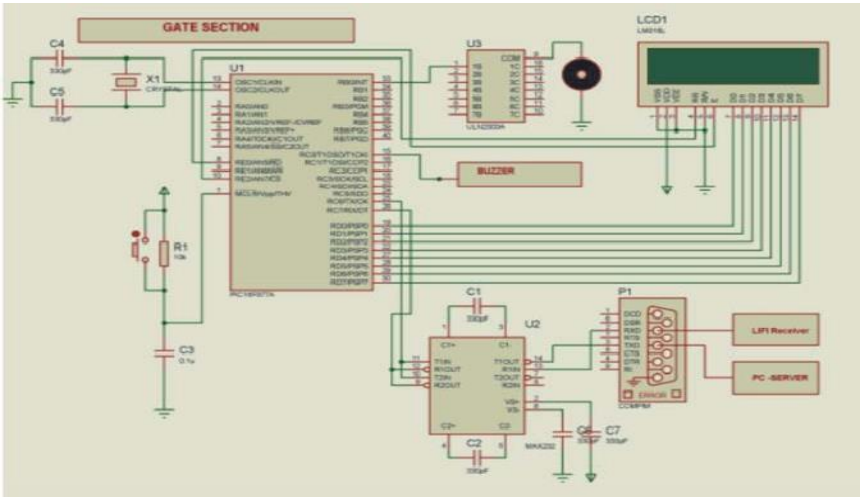

Fig. 13: Gate section

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