

Smart Billing Trolley using RFID and Li-Fi

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Abstract— A progressive product is one that lessens manual labor and aids the society with increased comfort and gives a robust performance in everyday life. Such a product is appreciated by the society. Nowadays, buying necessary items at supermarkets and malls has been a daily activity in numerous cities. We observe tremendous rush at shops, especially in the vacation periods and at the weekends. This rush becomes gigantic during the period of various offers and discounts. On such occasions, customers purchase a variety of objects in the supermarkets and put them in a trolley. The very next thing they have to do is to find the specific product on the list, and a queue to pay at the billing counter. It is a tedious and time-consuming process. To avoid this rigmarole, we are growing a system which we have named as the ‘*LI-Fi Based Automated Smart Trolley*’. In this system, we have used the RFID tags in place of the traditional barcodes. Every product has an RFID tag. Whenever the customer places a particular product inside the trolley, it is scanned through the RFID Reader. The weight and cost of the product could be displayed on a private computer. To implement this, we are using Visible Light Communication (VLC) technology to send the corresponding statistics to the central computer. At the billing counter, a Li-Fi receiver is placed, which is able to obtain the information from the Li-Fi transmitter linked to the RF reader.

Keywords — **RFID (Radio-frequency identification), Li-Fi (Light Fidelity), VLC (Visual Light Communication).**

I. INTRODUCTION

The ‘Smart shopping trolley using RFID and Li-Fi’ is a system that provides consumers with the convenience of billing the products at the time they are being placed in the trolley. The RFID reader placed on the trolley reads the RFID tags for each product, and then the product details are

displayed on the LCD screen. The RFID tag is unique for every product.

As soon as the tag has been detected, its details are transferred via the Li-Fi transmitter to the Li-Fi receiver, based on the line of sight communication. The data is then displayed on the LCD screen, which is the total amount to be paid by the customer. The consumers can also benefit

another way – by managing the budget of their shopping with the help of the net amount being shown on the LCD screen after each product is scanned. Our project is very beneficial for those customers who are in a hurry and covet to avoid standing in the long queues for billing.

II. OVERVIEW OF THE SYSTEM

A. Existing System

- In the existing system, products are billed using the barcodes.
- Long queues for paying at the billing counters.

Disadvantages:

- ☐ Time-consuming.
- ☐ Less flexible

B. Proposed System

- In the proposed system, products are billed using the RFID tags.
- No queue for payments at the billing counters.

Advantages:

- ☐ Time taken is less.
- ☐ More flexible.

III. COMPONENTS IN THE DESIGN

A. ARDUINO UNO: It is used as a microcontroller and also as an interface between the hardware and software parts. It is used at both ends - receiver and the transmitter side.

B. LCD: The LCD is used to display the output - the total amount to be paid.

C. RFID readers: The RFID readers are used to read the RFID tags which are present on the products.

D. RFID tags: The RFID tags are unique for each product and they contain details about the product like name, price, weight, etc.

E. Switch: The switch is used to switch between the reading/deleting the products in the bill.

F. Load cell: The load cell determines the weights of the products in the trolley to determine the billing errors.

G. Li-Fi Transmitter and Receiver: The transmitter and receiver are used to transmit the data in the form of light signals through the Li-Fi technology.

IV. WORKING PRINCIPLE

The working principle of the proposed system is completely based on the presence of a microcontroller that reads the products when the objects are being placed in the trolley. It aggregates the data and the data will be then sent to the receiver. The receiver LCD screen will show the total amount to be paid by the respected customer.

V. CONSTRUCTION AND WORKING

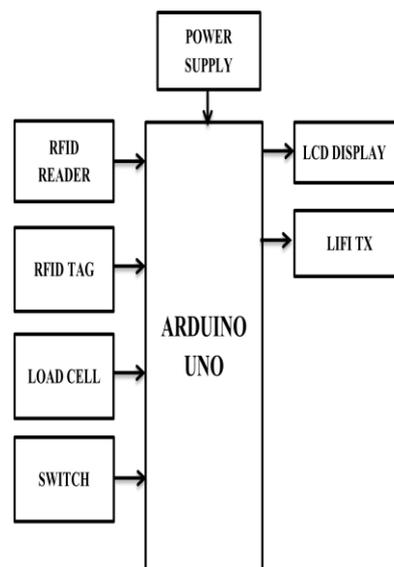


Fig. 1: Transmitter Block Diagram

The above Fig. 1 shows the implementation of the part of the project which is the transmitter section. The above section consists of a Power Supply Unit, an RFID reader, an RFID tag, a Load cell, a Switch, an ARDUINO micro-controller, and a Li-fi transmitter. All of the components are interconnected through a microcontroller.

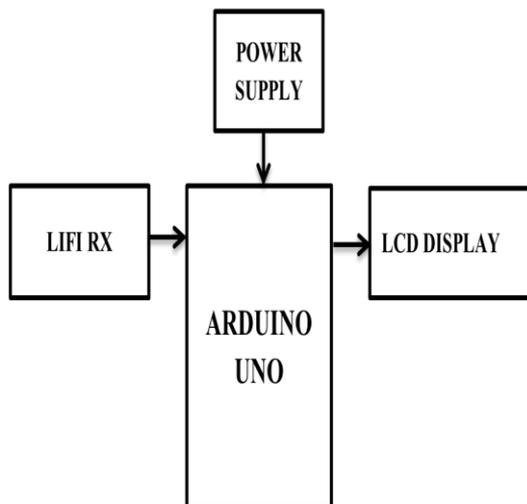


Fig. 2: Receiver Block Diagram

The above Fig. 2 shows the implementation of the receiver section. It consists of a Power Supply Unit, an LCD screen, an ARDUINO micro-controller, and a Li-fi receiver. The components are interconnected through a microcontroller.

Transmitter Section

- Reading the tag

When an RFID tag is read by the reader, the ARDUINO microcontroller at the receiver analyses the tag ID with the help of the software code, which is embedded onto it and recognizes the tag.

- Identification of the tag

Each tag has a unique identification number and product details like the name of the product, its price, and weight, etc.

The microcontroller identifies the tag.

- LCD output

The LCD screen at the receiver side displays the relevant details of the product which are programmed in the tag. When another tag is read, its price is added to the total amount, and its weight as well.

- Role of switch

Whenever a consumer wants to remove any product from the already scanned products, he can flip the tag on the switch to scan the tag on the reader and the tag will be identified. Then the tag will be removed from the list of the scanned products.

- Role of load cell

The load cell performs the role to identify the products that are not billed but yet present in the trolley. The load cell will calculate the weight of all the products in the trolley and the transmission of data takes place through the Li-fi (line of sight communication). Whenever the receiver and transmitter are in line of sight, the data is transmitted.

- Li-fi Transmitter

It transmits all the data to the receiver through the Light fidelity mechanism.

Receiver Section

- Li-Fi Receiver

The Li-Fi receiver receives all the data from the transmitter through the LOS (Line of Sight) communication.

- LCD Output

The LCD screen present in the receiver section will show the amount which is to be paid by the consumer for the products that have been purchased. The micro-controller will compare the weight of the billed products with the load cell weight to identify “Billing error”.

VI. FUTURE SCOPE

The proposed RFID reader can be substituted with the barcode reader which will be able to read the product put in the trolley in any angle, regardless of the

orientation of the product. This project deals with the consumers but it can also be added with the database to keep the track of the products in the shopping mall. An amount of budget can be set up which may turn beneficial to the consumers for the further implementation of the project.

VII. RESULT

The output of the proposed work can be obtained in the transmitter section as well as the receiver section. The LCD screen located in the receiver section displays the total amount of money for which the consumer has purchased the products and the total weight. After the data transmission is completed, the receiver section LCD screen also displays the same amount of money and weight. This double display can be used for verification by the user or seller to prevent any fraudulent activity. Thus, this is the output for the proposed work with the help of the LCD screen.

VIII. CONCLUSION

The plethora of people at malls and supermarkets makes the shopping and billing of products a time-taking process. To eliminate this rush, and increase the pace of such operations, we are developing a project of 'Smart Billing Trolley using RFID and Li-Fi'. The prominent goal of our project is to supply a technology-oriented, palpable, modern but economical, easily scalable, and robust system for aiding the shopping and billing process, which has been a daily activity of people these days.

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