

Smart Shopping Using Lifi

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Abstract: Shopping at mall is becoming daily activity in various cities. People buy their necessary products and other items in every supermarket and shopping mall by using trolley and baskets. In holidays and weekend we can see the huge rush at shopping mall. Hence it takes more time for billing the products. To overcome this, we are developing a system called as 'Li-Fi Based Automated Smart Trolley Using RFID'. Whenever the customer puts a product into trolley it will get scanned by RFID reader and product price and cost will be display on LCD. Then it calculates the total amount of purchasing items and sends the calculated bill to the device attached to trolley. We are using Li-Fi transmitter which will be at trolley which is used to transfer data to main computer. At the main computer Li-Fi receiver which will receive data from transmitter.

Keywords: PIC Controller (PIC 16f877a), RFID tag, RFID Reader, LCD, LIFI transmitter and LIFI receiver.

I. Introduction

Today every supermarket and shopping mall makes use of the shopping baskets and trolleys to collect the items. When we are in shopping mall it's easy for us to take the trolley and shop whatever we want but when we have to take the products outside then we have to wait in queue for billing the products for long time. Hence it takes more time for billing the products. To overcome we use the technology Li-Fi. The idea of Li-Fi introduced the "Wireless data from every Light", it's also referred as light based Wi-Fi. It consists of LED for transmission and Photodiode for reception. The Photodiode receives the signal and converts it back into original data. This method of using rapid pulses of light transmits the information wirelessly is technically referred as Visible Light Communication. We use RFID for collecting the details of the product in the trolley. After shopping process is over, we use Li-Fi for transmission for billing the products. When the trolley move near to the billing part then the products details automatically upload and bill will be given to consumer.

II. Existing System

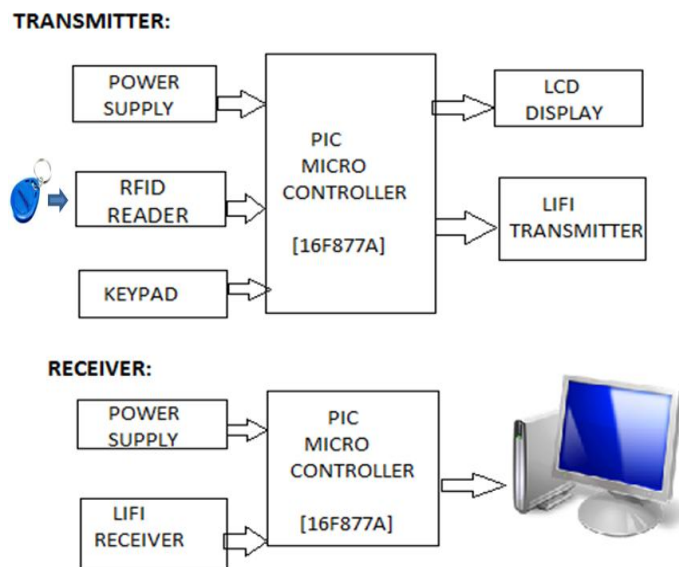
The new technologies are introduced in the shopping malls to get a customer's satisfaction. Presently available billing systems in the shopping malls are using barcode Scanner. Electronic Shopping is equipped with Barcode Scanner for product identification and a consistent Wi-Fi connection with the shop's server [1]. RFID tag is used instead of barcode. It will be directly read by the trolley. Serial communication is used to transfer the data from the trolley to the receiver section [2]. In this paper they handle Bluetooth module. Production selection is done using a mobile app. It displays the list of the products that are available in the supermarket. The user is now allowed to choose their desired product. Once selection is done, the app displays the sorted location for each product [3]. Each trolley need to be interfaced separately via wired connection to the billing system. It still consumes more time. Therefore, Zigbee module is added to the trolley to send the information of the product to the server [4]. After purchasing the product, customer has to stand in a queue to pay the bill. Smart trolley system is used to locate the items in the shopping mall and it automatically carries the goods to the specified location when the product list is entered [5]. The information of shopping mall is shared among the customers using android application [6]. It deviates from the objective of reducing the billing time. Hence we proposed an automated billing system using LIFI. LIFI technology is proposed by the German physicist—Herald Haas, provides transmission of data through illumination by sending data through an LED light bulb that varies in intensity faster than the human eye can follow [7]-[8].

III. Proposed System

In our proposed system by the usage of smart trolley can decrease the queues in the mall. It saves the customer time. The new technologies, such as RFID and Li-Fi technology, make the shopping processes faster, transparent and efficient. Our aim is to develop the system which makes shopping easier. In shopping system the trolley was equipped with RFID scanner for product identification and LCD display that informs customers

about product name, prices, and the total bill. The consumer will be able to scan the items themselves and the LCD screen on the shopping trolley will keep updating the total. From this people can shop according to their budget. When the consumer completed their shopping, they can just press the 'upload' button and the details are uploading to billing section and the customer has to pay just the amount and leave. In this system there is inbuilt automatic billing system makes shopping freeing staff from repetitive checkout scanning, reducing total number of staffs required and increasing system efficiency. This system provides error free transmission and more number of trolley can be used in shopping zone.

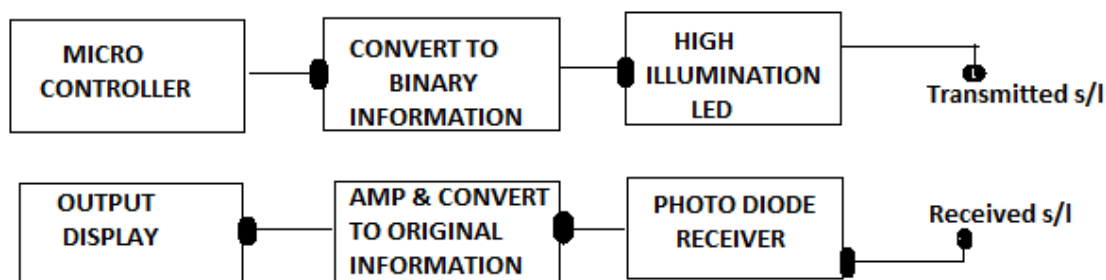
3.1 Block diagram:



3.1.1 Transmitter:

In shopping mall the RFID tag attached to individual product here we use passive key tag the tag usually made up of CMOS IC it gets power and master clock for its operation from electromagnetic field(EMF) produced by the reader it generate and radiate the carrier signal of radio frequency . The tag number will be 12 bit ASCII data, the 10 will be tag number, and 2 will be XOR code for testing. The tag and reader have tuned to the same frequency to communicate. In RFID reader has 3 pins such as power supply, TX, and Ground. It directly interfaces to the microcontroller using Universal Asynchronous Receiver Transmitter (UART) communication. In trolley the product information are pre-programmed in microcontroller. When the customer puts any product in trolley the RFID tag read by reader .The reader send the id code to the controller and it's stored in the system memory. Then the id code and the register Information is compare with the lookup table. If matches are found then the particular product details is display on the LCD. The RFID reader read without line of sight and the new information has been overwritten. The RFID reader updates the current information like the name, cost and count of the product. In our project the usage of 3 keys makes shopping easier and effective. The remove button is used for removing the product in the trolley. When the remove button is press it selects the particular product. Once product Id detected, the product will remove from the list and the amount reduced from the total cost. When complete the shopping, press the upload key. Then the signal will send to microcontroller. The microcontroller transfers the entire product list to PC using Li-Fi.

3.1.2 Receiver:



The microcontroller sends the product details to Li-Fi TX using high brightness light-emitting diodes. By using A/D converter we convert the information as binary form and then transmitted.

In the Li-Fi RX the received signals again transformed using D/A converter; the signals are amplified and displayed. Here the photo diode used for reception.

IV. System Architecture

I.PIC Microcontroller 16F877A

II.RFID Reader

III.LCD Display

IV. Keypad

V.LIFI Transmitter & Receiver

TROLLEY UNIT



4.1 Power supply

Power supply unit is the main source for embedded modules to working with real-time system. It has power unit for controller and other modules. This is main unit for hardware module. The 12 volt AC supply was applied to step down transformer. By using bridge rectifier converts the transformer output into 5 volt DC supply for the microcontroller and to the other part.

4.2 Micro Controller

Microcontroller is heart of the system. It has number of features and its controlled over all process .we can write code and load the controller for control real time application processes. Here we use PIC 16F877A microcontroller for transmitter and receiver.



16F877A Specifications

This powerful (200 nanosecond instruction execution) yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into an 40- or 44-pin package and is upwards compatible with the PIC16C5X, PIC12CXXX and PIC16C7X devices. The PIC16F877A features 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I²C™) bus and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications.

4.3 RFID



Radio Frequency Identity & Detection is a technology requires tag and reader to use the database. RFID is the reading of physical tag on single product.

- RFID TAG [Transponder]

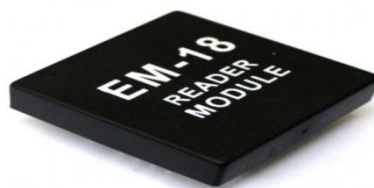


The tag has a unique Id number called on Electronic Product Code in a small silicon micro strip. RFID Tags are automatically identifying a person, an item. These are transponders that send Information. Two types of tags are available.

- 1] Passive Tags- No battery life.
- 2] Active tags- Have battery life.

In this project use passive type tags which send the information over short distance, typically 3 meter. RFID tag has two parts. 1] Integrated circuit for modulating and storing information. 2]The antenna for transmitting signal.

- RFID READER :(Scanner)



RFID reader consists of an RF module that acts as a transmitter and receiver of radio frequency signal. It receives the RF data from tags through antenna. Rather than using light, the Radio wave used to read the number from RFID tag. RFID Reader doesn't need line of sight. It can read multiple data at a time. The RFID reader can read up to 300 feet but the Bar code reader can read 15 feet only.

4.4. LCD Display

A liquid crystal display consists of an array of tiny segments called pixels. It displays numbers, characters and graphics. The display interfaced to I/O port of microcontroller and displays the 16 character per line. Here we use LCD display of (16*2). In this project displays the current status of the details such as name, measure and cost of the product.



4.5. Keypad

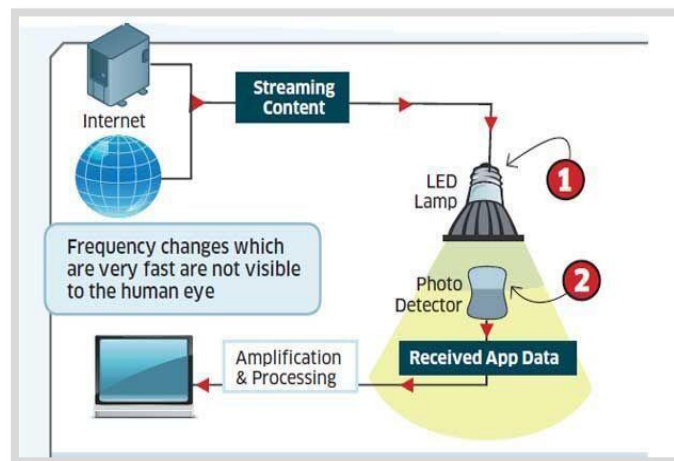
Keypad just like a button to control the process and making the shopping will easier.



Here we using three keys and their purpose as follows,

- ADD – Extra product add to the Trolley.
- REMOVE – Remove the product from Trolley.
- UPLOAD – Entire product list sent to Billing Section.

4.6. LIFI Device



Li-Fi is the new emerging technique in trend which uses the light wave to transfer the data. It's called as "Optical version of Wi-Fi" but based on the Visible Light Communication (VLC). Using Li-Fi it can send the data very quickly. Using Li-Fi to solve the insufficiency of radio spectrum and offer the multi user communication. It is faster & flexible than Wi-Fi. Li-Fi is safer than Radio waves. The main components of Li-Fi system are, a) A high brightness white LED –Transmitter. b) Air-Transmission medium. c) A silicon photo diode –Receiver. VLC is a data communication medium, which uses visible light between 400 THz (780 nm transmission) and 800 THz (375 nm illumination).

- **Lifi Transmitter**

Li-Fi is the Latest Technology makes the use of LED that helps in the transmission. It consists of many LED bulbs or other lamp. The spectrum which works by flickering the bulbs ON and OFF within nano seconds. The ON and OFF is very quickly is adds another advantage. The on-off activity of the bulb which is invisible that enables data transmission using binary codes (0s and 1s): The LED is ON the logic is '1'; LED is OFF the logic is '0'. LED's are able to serve as a communication point.



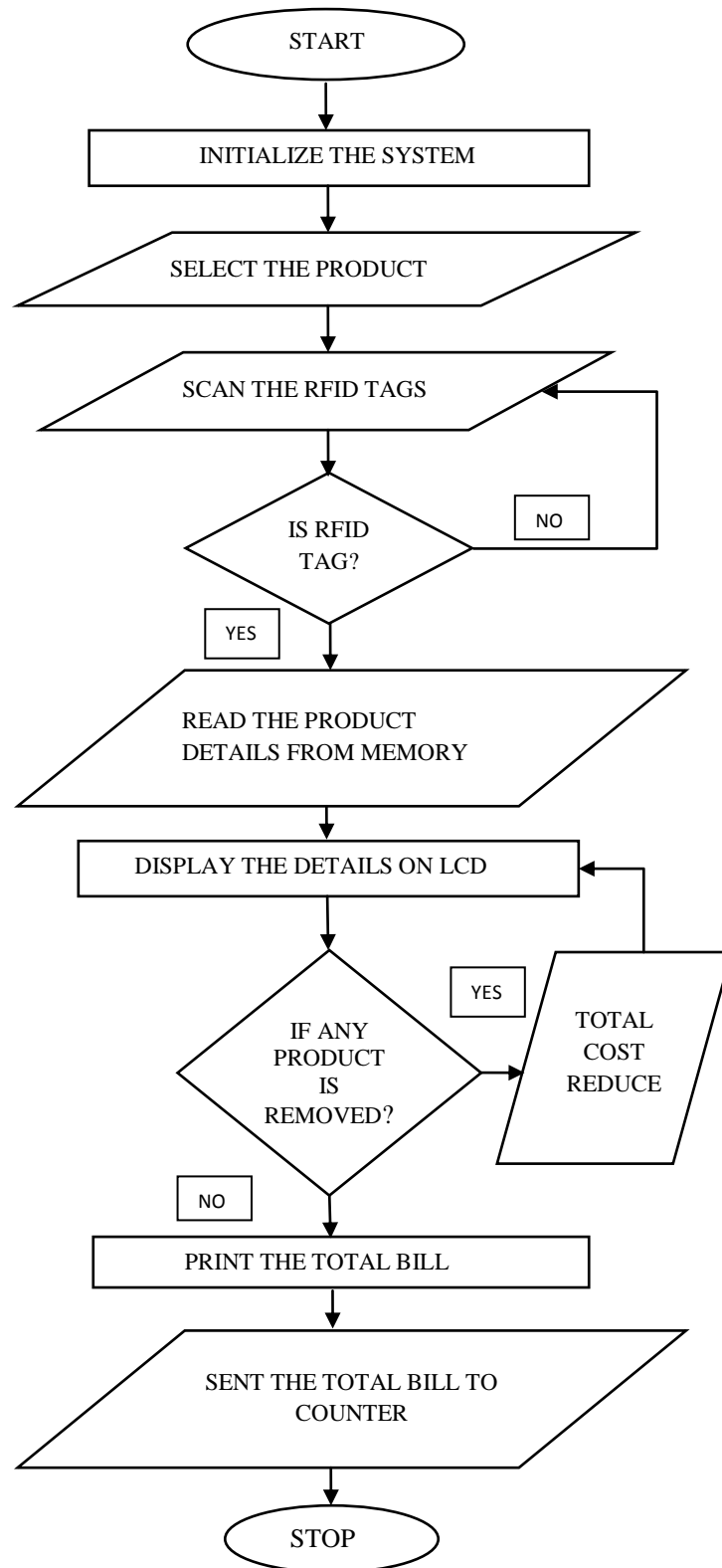
B. Billing Unit

- LIFI RECEIVER



Specially designed electronic devices generally containing a photo diode receive signals from light sources, although in some cases a cell phone camera or a digital camera will be enough. The image sensor used in these devices is in fact an array of photo diode (pixels) and in some applications it may preferred over a single photo diode. Using visible light is also less dangerous for high-power applications because humans can perceive it and act to protect their eyes from damage. The Li-Fi proves best replacement technologies like Wi-Fi, Bluetooth and IR waves

Flow Chart



V. System Work Flow

A customer enters into a shopping mall. On entering, she/he first picks up a trolley. Each trolley is associate with a RFID reader, LCD display, Keypad unit & Li-Fi Transmitter. The functioning of the system is explaining below:

1. In shopping Mall each product is attach with RFID tag.
2. When customer selects the product and put in to trolley.
3. The RFID reader fixed in trolley; it will scan the RFID tag and store the information in system memory.
4. Information stored in system's memory is compare with the lookup table. If matches are found than cost, name of the product gets displayed on the LCD.
5. These steps are again, at the same time billing information is also updated.
6. There is also an option provided to drop some of the products from the trolley and the bill will update so, This goes by the customer choice.
7. Once the "upload" button pressed the total bill will transfer to the receiver section.
8. At the end of shopping, the customer can straight away pay the bill and leave.

Algorithm

Step 1: Start the system.

Step 2: Initialize the System.

Step 3: Select the product.

Step 4: Check RFID tag.

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

Step 6: Display the data on LCD.

Step 7: If any item will remove press "REMOVE" and continue the shopping as the total amount will be reduced.

Step 8: When upload key is press it send the total purchasing product list to the counter.

Step 9: Print the Bill.

Step 10: Stop.

Experimental Result

The Smart trolley consists of two modules namely product scanning module and transmission module. Product scanning completed by using RFID.



Initial stage of the system

Initial stage of the system In first we select the product and place in to trolley



After scanning the tag, the price and name of the product is display on LCD.



After detecting the RFID

After detecting the RFID the products added continuously, the cost is also generated.



Display the total cost & count

When upload key will press the total bill sent to the PC.

PURCHASING PRODUCT LIST			
Sl.No	Product Name	Weight of the Product	Amount
1	Chocolate	100 g	50.00
2	Sugar	500 g	50.00
3	Cookies	50 g	25.00
4	Soap	125 g	75.00

Total item: 04 Total cost: 200.00

[Print Bill](#)

Total Bill

VI. Future Work

- The RFID reader is increase further development.
- Automatic billing system with credit/debit card facility in the trolley itself and it reduces the time.
- The LCD also provided with a layout of the shopping market by which the customers can able to get the exact information about the products. This system increase user-friendly
- The smart trolley has be made automatically with the help of various sensors. In this way, there is no need to pull the heavy trolley.
- Continuous development in this area will lead to a revolutionary change in shopping experience.

VII. Conclusion

Thus the system creates the automatic bill of the purchased items from the trolley using RFID technique. By using this technique increase the security and it is also managed by checking products in trolley and verifying it with billing products. With the usage of LI-FI technology, the billing process takes place automatically. This will take the overall shopping experience to a different level. The main goal of this system is truly time-saving method and the less consumption of time out of all present billing methods. This process saves the time of customer and reduced the staffing requirements in the malls. Different limits of smart trolley like products name, products cost, product weight is continuously display. so this becomes a easiest way of the shopping.

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