ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering
An ISO 3297: 2007 Certified Organization Vol.5, Special Issue 5, June 2017
8th One Day National Conference on Innovation and Research in Information Technology (IRIT- 2017)
Organized by
Departments of ISE, CSE & MCA, New Horizon College of Engineering, Bengaluru, Karnataka 560103, India

Visible Light Communication Based Information Broadcasting System

Shek Sharuk[1], Shivaraj[2], Syed Ismail Zabiulla[3], Vinaya Bhooshan R[4], Jyothi Pramal[5]

Eight Semester UG Students, Department of Electronics & Communication Engineering, AIET, Moodbidri, Karnataka, India[1-4]

Assistant Professor, Department of Electronics & Communication Engineering, AIET, Moodbidri, Karnataka, India.[5]

ABSTRACT: Optical wireless communication through visible light has been appreciably explored with the development and widespread use of white light emitting diodes (LEDs). Visible light is used as the medium for data transmission between the transmitter and receiver. Visible light communication has few advantages over other standard wireless transmissions. The frequency spectrum bandwidth of visible light ranges from 430 THz to 750 THz which is much larger than the radio frequency bandwidth, which ranges from 3 KHz to 300 GHz. With a larger bandwidth it is feasible to accommodate more users and potentially achieve higher transfer rates because each user can be given a larger portion of the bandwidth to transfer information.

This paper, demonstrates a wireless system via visible light communication (VLC) technology. The prototype demonstrates a transmission baud rate of 9600 without data loss at a distance of about 10 cm for broadcast communication system. This system is proposed to demonstrate how VLC can be used in Super Market/Shopping Malls (indoor environment) as they contain LED lights in every section. Using these LEDs, our proposed system can provide advertisements regarding offers or new arrivals in the mall through an android application to the customers. The prototype is proposed to demonstrate the working of VLC system by means of an indoor application.

KEYWORDS*:* Optical wireless communication, light emitting diode (LED), visible light communication (VLC), pulse width modulation (PWM).

I.INTRODUCTION

VLC is a subset of optical wireless communication technology. The technology uses fluorescent lamps (ordinary lamps, not special communications devices) to transmit signals at 10 Kbps, or Light Emitting Diode (LED) for up to 500 Mbps. VLC can be used as a communication medium for ubiquitous computing, because light-producing devices (such as indoor/outdoor lamps, TVs, traffic signs, commercial displays and car headlights/tail lights) are used everywhere. Visible light is also less dangerous for high-power applications because humans can perceive it and protects their eyes from damage.

The LED lighting system can achieve lower power consumption and has a longer life-time compared to the fluorescent lamp system. The Visible Light Communication (VLC) is a fast-growing technology to provide data communication using low-cost and omnipresent LEDs and photodiodes. In Visible Light Communication (VLC), LEDs used for illumination purpose are simultaneously used for wireless data transmission. It offers numerous advantages such as high data rates, unlicensed large bandwidth and better data security leading to smart spaces.

II.EXISTING SYSTEM

The existing system develops a basic VLC simplex peer to peer and broadcast communication system. Their system allows a 9600 data transmission rate between two end devices without data loss at a distance of 30cm for peer to peer communication system and at a distance of 10cm for broadcast communication system.

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering
An ISO 3297: 2007 Certified Organization Vol.5, Special Issue 5, June 2017
8th One Day National Conference on Innovation and Research in Information Technology (IRIT- 2017)
Organized by
Departments of ISE, CSE & MCA, New Horizon College of Engineering, Bengaluru, Karnataka 560103, India

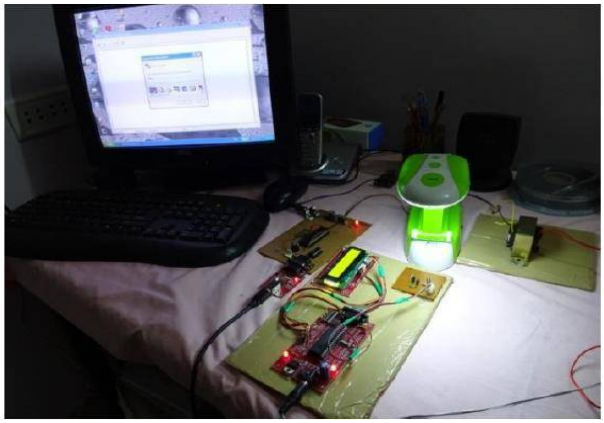

Fig 1: Peer to Peer Communication System

The experimental setup for peer to peer communication system is shown in Fig 1. Their system resulted data transmission at a baud rate of 9600 without data loss is obtained over a distance of 30cm. This system is proposed to send information from transmitter section to receiver section where the data is preloaded in transmitter section. In this system two communication is also possible but this system contains only two users (transmitter and receiver). Information can be sent to only one available user in the receiver section.

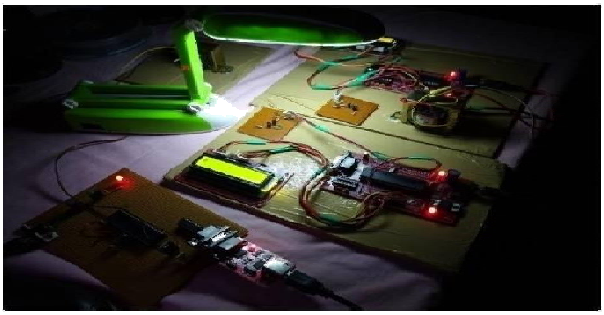

Fig 2: Broadcast Communication System

The experimental setup for broadcast communication system is shown in Fig 2. It resulted data transmission at a baud rate of 9600 without data loss is obtained over a distance of 10cm. This system demonstrated two different communication system through their module.

III.PROPOSED WORK

A VLC system is proposed to demonstrate an indoor application through the visible light channel. The system mainly consists of two module, one is transmitter module and another is receiver module. The proposed system block diagram is shown in Fig 3 and Fig 4.

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering
An ISO 3297: 2007 Certified Organization Vol.5, Special Issue 5, June 2017
8th One Day National Conference on Innovation and Research in Information Technology (IRIT- 2017)
Organized by
Departments of ISE, CSE & MCA, New Horizon College of Engineering, Bengaluru, Karnataka 560103, India

IV.DESIGN AND IMPLEMENTATION

The following section gives the design and implementation of the proposed system:

A. Transmitter module

The transmitter module consists of a microcontroller powered by a power supply, and analog circuitry incorporating the driver device and LED lamp. The input is in the form of text data stored in the microcontroller (PIC 16F877A) of transmitter system in its ASCII equivalent form. Standard Oscillator (20MHz) is used to provide clock input to the microcontroller.

The microcontroller will then modulate the data using pulse width modulation (PWM) scheme for logic 1s and 0s. The driver circuit consists of a power mosfet (IRFZ44N) with high switching frequency. The mosfet then drives the LED lamps which are the reading lamps with 31 surface mount devices (SMD), low power LED with total power output of 2.5W. The transmitter module is shown in Fig 5.

The LED lamp remains on all the time but when data is being transmitted it starts flickering which is not very prominent to human eye but recognized by the phototransistor.

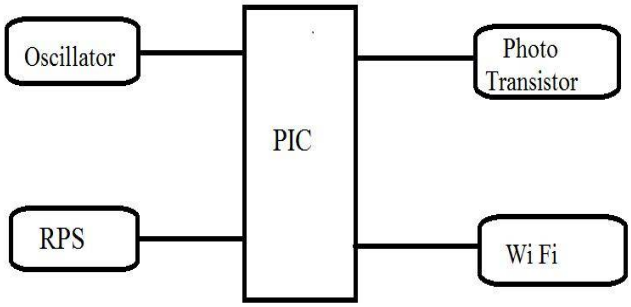

Fig 3: Block Diagram of Transmitter system

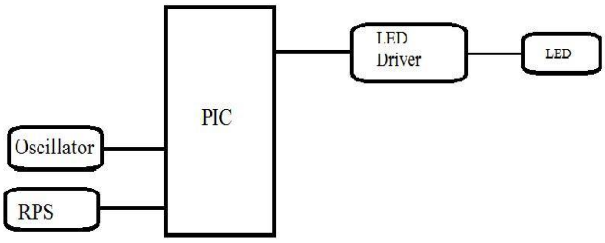

Fig 4: Block Diagram of Receiver System

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering
An ISO 3297: 2007 Certified Organization Vol.5, Special Issue 5, June 2017
8th One Day National Conference on Innovation and Research in Information Technology (IRIT- 2017)
Organized by
Departments of ISE, CSE & MCA, New Horizon College of Engineering, Bengaluru, Karnataka 560103, India

The system components mainly consists of the LED lamps and the driver circuit for transmitter and a phototransistor and an amplifier for the receiver. PIC controller (Microcontroller) is used in both receiver and transmitter to control the system input/output or to encode/decode data.

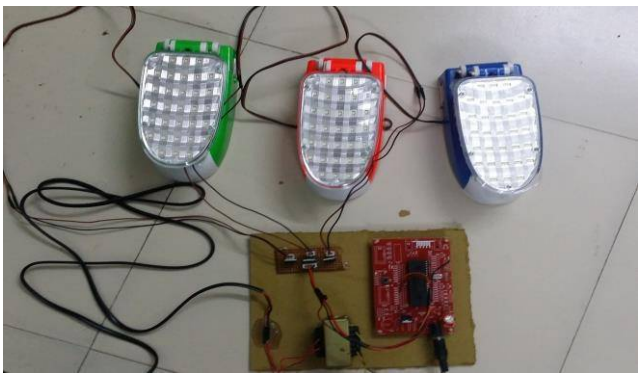

Fig 5: Implemented Transmitter Module

B. Receiver module

The receiver module consists of analog circuitry incorporating phototransistor, a microcontroller (PIC16F877A) and a device capable of receiving and interpreting the output. The weak current signal received by phototransistor passes through custom amplifier (Darlington pair) for further amplification to gain high current and to reduce noise. The output is then fed to the microcontroller (PIC16F877A) circuit which decodes the data and sends it to the receiving end device for displaying it. The receiving end device used here is FT232 serial port to computer or Wi-Fi module (ESP 8266). The receiver module is shown in Fig 6. Receiver system can be further implemented in mobile system as a small hardware chip and provide a phototransistor near the system display.

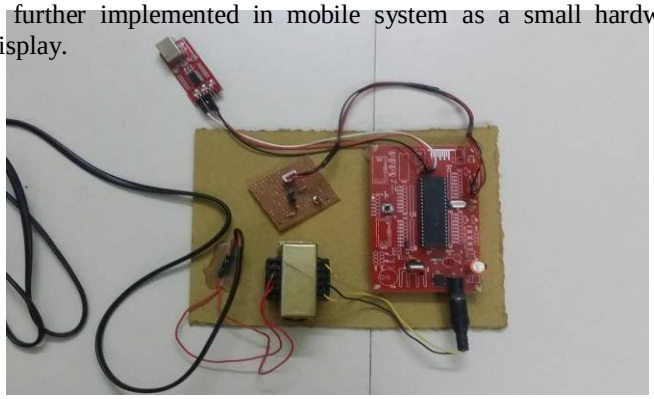

Fig 6: Implemented Receiver Module

C. Optical Channel

Visible light is used as the medium for data transmission between the transmitter and receiver. Visible light communication has few advantages over other standard wireless transmissions. The frequency spectrum bandwidth of visible light ranges from 430 THz to 750 THz which is much larger than the radio frequency bandwidth, which ranges from 3 kHz to 300 GHz. With a larger bandwidth it is feasible to accommodate more users and potentially achieve higher transfer rates because each user can be given a larger portion of the bandwidth to transfer information. The next major advantage that visible light systems have over other communication systems is its abundance. Light sources are everywhere, and can be more efficiently used by increasing its simultaneous functionality by transmitting data in

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering
An ISO 3297: 2007 Certified Organization Vol.5, Special Issue 5, June 2017
8th One Day National Conference on Innovation and Research in Information Technology (IRIT- 2017)
Organized by
Departments of ISE, CSE & MCA, New Horizon College of Engineering, Bengaluru, Karnataka 560103, India

addition to lighting an area. The transmitter and receiver are vertically aligned for the sake of system stability in the line of sight (LOS) channel model.

V.WORKING OF PROPOSED SYSTEM

Data sent through the transmitter system through visible light (LEDs) is received by the phototransistor in the receiver system. Phototransistor converts the photons into electrical signals which is further amplified by the Darlington pair. Darlington pair is a compound structure consisting of two bipolar transistors connected in such a way that the current amplified by the first transistor is amplified further by the second one in order to gain high current. Then signals are decoded through the controller unit. FT232 provides the data received from the transmitter in a computer system which is a serial communication.

In order to improve the transmission distance we have used a Wi-Fi module that is ESP-8266 in order to increase the transmission distance, where the obtained decoded information is passed on the Wi-Fi module and we can increase the transmission distance in the range of more than 150 meters. Where this transmitted data from the Wi-Fi module can be seen through the means of android application (.apk file) provided to Super Market/Shopping Mall customers. Wi-Fi module is linked to the data base server to which android application is linked with. Two applications are made one is for admin and another is for customer.

Admin can set the data which is received by the customer.

This system demonstrates to implement VLC system in Shopping Malls/Super Market where customer can get advertisements of the market regarding new arrivals or discount offers by means of android application through visible light.

VI.RESULT OF PROPOSED SYSTEM

Fig 7 shows the setup of the proposed system which contains both transmitter and receiver module which broadcasts the data to many users through Wi-Fi module.

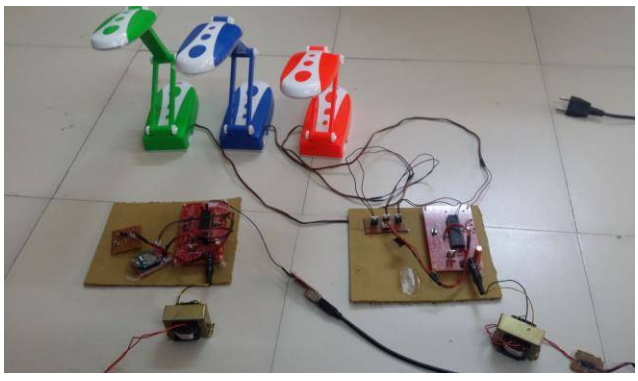

Fig 7: Implemented System Setup

There are three LED panel in the transmitter section. Each LED provides a data through phototransistor in the receiver section. FT232 provides three different data links in the computer system which are shown in the below figures.

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering
An ISO 3297: 2007 Certified Organization Vol.5, Special Issue 5, June 2017
8th One Day National Conference on Innovation and Research in Information Technology (IRIT- 2017)
Organized by
Departments of ISE, CSE & MCA, New Horizon College of Engineering, Bengaluru, Karnataka 560103, India

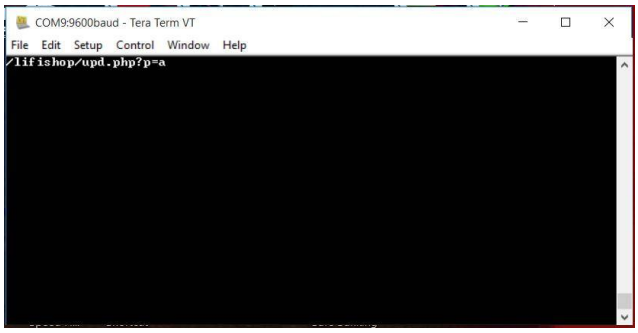

Fig 8: Output from LED1 through FT232

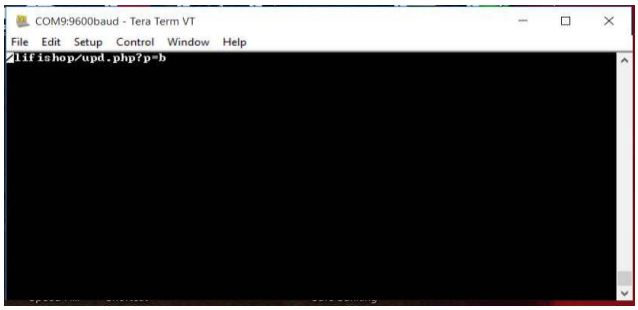

Fig 9: Output from LED2 through FT23

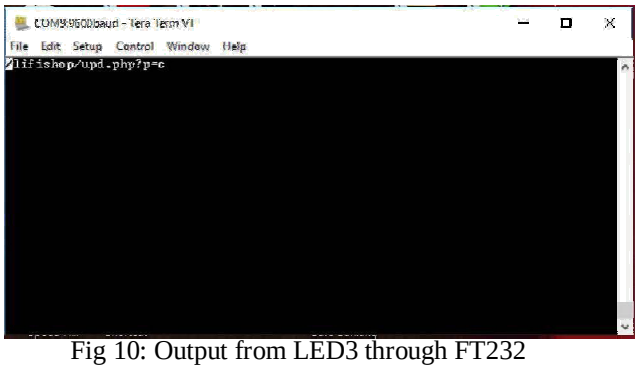

Fig 10: Output from LED3 through FT232

The output from LED1 shows ‘a’ link (Fig 8), LED2 shows ‘b’ link (Fig 9) and LED3 shows ‘c’ link (Fig 10). These links are connected with the Wi-Fi module link in data base server to control the application data.

Admin application which can handle the data contains login procedure for security purpose as not to misuse by third party. Below figure shows screenshot of admin’s application which contains login page for security purpose and update page where admin can update the data at any time.

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering
An ISO 3297: 2007 Certified Organization Vol.5, Special Issue 5, June 2017
8th One Day National Conference on Innovation and Research in Information Technology (IRIT- 2017)
Organized by
Departments of ISE, CSE & MCA, New Horizon College of Engineering, Bengaluru, Karnataka 560103, India

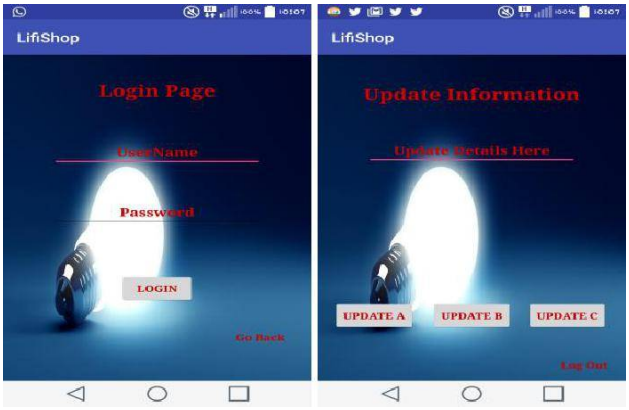

Fig 11(a): Admin's login pageFig 11(b): Admin's update page

Customer application contains the information page, gets the data set by admin. In general, customer gets the advertisement published by the Super Market Executive/Manager. Below figure shows the information received through each LED.

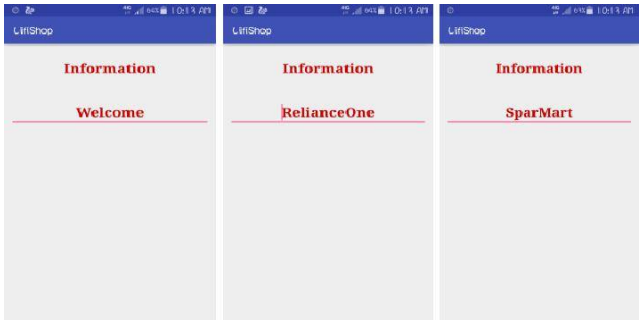

Fig 12: Customer Output page for three different LEDs

Above figure shows the customer output for different LEDs. For LED1 output is "Welcome", LED2 output is "Reliance One" and for LED3 output is "Spar Mart".

VII.CONCLUSION AND FUTURE SCOPE

In this project we implemented a low cost VLC system for indoor application. Our main aim was to transmit data through LED and we have successfully transmitted the data from our implementation. As per our indoor application, providing information in super market/shopping malls through an application from the VLC system is demonstrated through a prototype. Our project gives an idea to use the LED system of the super market to provide advertisement and offers to the customers by means of VLC method rather than using advertisement banners or television, as VLC System is low cost compared to other system used in super market for advertisement purpose. Main advantages of this system are,

1) It is Eco-Friendly.

2) Highly energy efficient since illumination and transmission of data are done at the same time.

ISSN(Online) : 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering
An ISO 3297: 2007 Certified Organization Vol.5, Special Issue 5, June 2017
8th One Day National Conference on Innovation and Research in Information Technology (IRIT- 2017)
Organized by
Departments of ISE, CSE & MCA, New Horizon College of Engineering, Bengaluru, Karnataka 560103, India

3) VLC uses light instead of radio waves, which is intrinsically safe and does not create EMI.

4) LEDs in Shopping Malls can be used for providing advertisements and offers to the customers rather than just providing lighting in it.

Disadvantage of our system is the data we upload through VLC cannot be downloaded with VLC itself, downloading requires internet connection.

In future, a high sensitive phototransistor with wide viewing angle will be used to increase the data transmission rate and the transmission distance. Currently VLC technology is in a development stage with several limitations and challenges. After the complete development of VLC technology, our prototype can be converted into a large system for the real time implementation. Transmitter section can be installed in mall/market in a large system and Receiver section can be installed in mobile system as small chip. In VLC system user can easily upload the data but one cannot download the data. In future if downloading is achieved then everyone can use this system without internet.

REFERENCES

[1] Josline Priya Dsouza, Daya Naik, Srinivas Institute of Technology, Mangaluru, "Visible Light Communication using White LEDs for Indoor Wireless Data Transmission" National Conference on Advanced Innovation in Engineering and Technology (NCAIET-2015) Vol. 3, Special Issue 1, April 2015.
[2] Rajan Sagotra and Reena Aggarwal, "Visible Light Communication" International Journal of Computer Trends and Technology (IJCTT) - volume4Issue4 –April 2013.
[3]Jacqueline J.George, Mohammed Hayder Mustafa, Nada Mahjoub Osman, Nuha Hashim Ahmed, and Da'ad Mohammed Hamed, "A Survey on Visible Light Communication" International Journal of Engineering and Computer Science ISSN: 2319-7242 Volume 3 Issue 2, February 2014.
[4] Carlos Medina, Mayteé Zambrano and Kiara Navarro Electrical Engineering School, Universidad Tecnológica de Panamá, Panamá, "LEDBASEDVISIBLELIGHTCOMMUNICATION: TECHNOLOGY, APPLICATIONS AND CHALLENGES – A SURVEY" International Journal of Advances in Engineering & Technology, Aug., 2015.
[5] Casey Barney, Alexander Dich, Dennis Koufos "VISIBLE LIGHT COMMUNICATION SYSTEMS," Project Report-Degree of Bachelor of Science, 2014.