Data Transfer via Light Fidelity (Li-Fi)

Ashwini Jaywant[1]; Tejas Parab[2]; Anandkumar Sharma[3]; Prasuk Sharma[4]; Devesh Shelar[5]
[1]ashwinisj@yahoo.com; [2]tparab5@gmail.com; [3]anandkushrma444@gmail.com; [4]prasuksharma2592@gmail.com; [5]dshelar01@gmail.com
[1]Assistant professor
[2-5]B.E. Students
Department of Electronics and Telecommunication Engineering,
K.C. College of Engineering & Management studies & Research,
Kopri, Thane (E) - 400 603, India

***Abstract*—In this project, a visible light communication (VLC) based on white Light Emitting Diode (LED) has been proposed. We designed the circuitry diagram by using MCU ATmega16 as the coding and decoding devices. In our experiment, the illumination of the receiving surface in different distance between Light Emitting Diode and photodiode receiver has been tested and the indoor illumination has been considered.**

***Keywords*—visible light communication, white light emitting diode**

I. INTRODUCTION

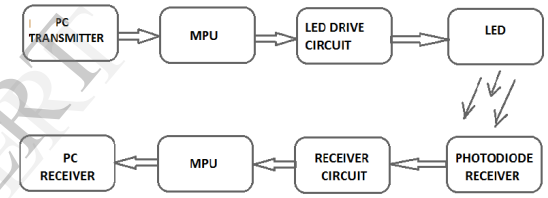
In most of the wireless communication schemes, the transmission is carried out using RF and microwave frequency. As for RF and microwave frequency high quality receivers are available as well as for low frequency broad coverage is achieved and for high frequency line of sight propagation is possible. But the disadvantage of RF is only limited bandwidth is available as the spectrum available is less and interference is more.

Now Li-Fi is a wireless communication technology that uses light that is visible to humans. So Visible Light Communication (VLC) system is used for communication which uses LED illumination as transmitter. Infrared light is already used for communication, such as wireless remote control, IrDA, Infrared wireless LAN, and infrared interbuilding communication. However, visible light LEDs are beginning to be used in every home and office, which makes visible light LEDs ideal for data transmitter. A high-speed wireless communication system, which is embedded in our LED lighting system, was built. The duplex communication system consists of both downlink and uplink media through different frequencies of lights.

Today, VLC system design is being researched and developed at a number of universities and private companies. Most VLC systems are based on modulating LED's using various schemes. There are two types of LEDs being considered for use today. The first is called a "quasi-white" LED. Essentially, this type of LED is a blue LED that has had the correct phosphor added to its structure to add a yellow component to the light, resulting in near white light. With correct implementation of the LED design, higher bandwidths can be achieved that are not only suitable for ambient lighting, but can also be modulated at speeds required for network connections. Additionally, if the proper technology is employed, the ambient light will not seem to flicker to the human eye.

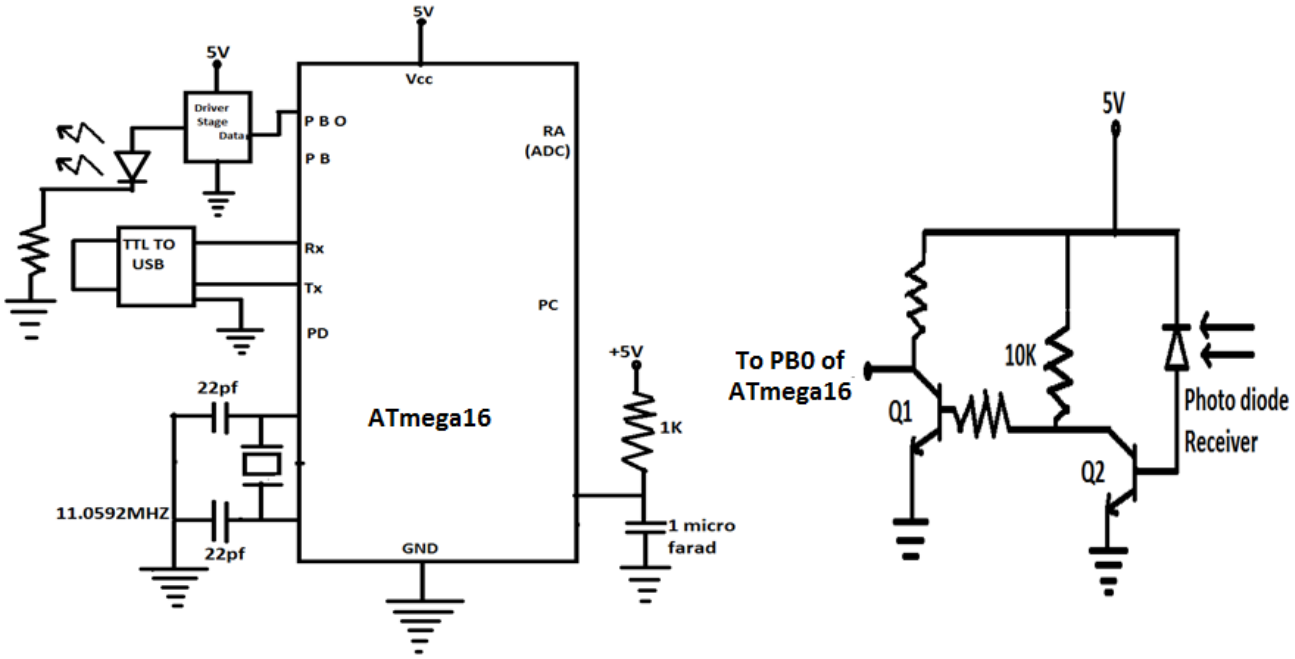
II. SYSTEM ARCHITECTURE

.



Block Diagram of Visible Light Communication

Light-Fidelity is basically a short range optical wireless communication via VLC using LEDs for illumination and communication simultaneously. LEDs will be the future of modern lighting system as they enjoy many advantages over conventional lighting devices such as long life, high lighting efficiency, specific spectrum and environmental friendliness. Data transmission in VLC is done by changing the light intensity Change in amplitude is so small for a naked human eye that it is un-noticeable. LED can be modulated at higher speeds which make it a suitable candidate for data transmission. Right choice of microprocessor (MPU H8/3069F or ATmega16) , selection of line coding scheme, use of equalizer at transmitter and receiver, selection of LED drive circuit can further improve the performance of LED.



Experimental circuit diagram of Visible Light Communication System

III. CIRCUIT DIAGRAM AND EXPLANATION

In the above figure shows the full circuit diagram of our visible light communication system. VLC Circuit diagram is divided into two parts- VLC transmitter and VLC receiver as shown in the figure.

TTL to USB converter is used in both transmitter and receiver to connect PC to ATmega16 microcontroller.

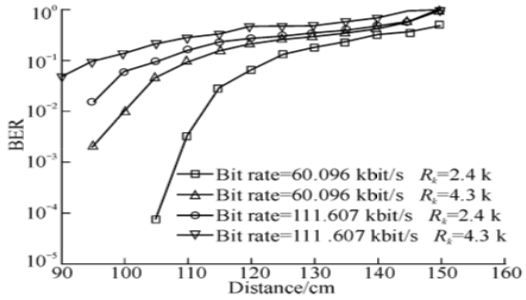
ATmega16 is used for coding. Hence it will code the data into 8 bit binary digit. After coding, the coded data is fed to transmitter circuit. The transmitter circuit is used to drive the LED to emit the coded data towards receiver. This coded data is in the form of visible light illusions as shown in the figure.

At VLC receiver, Photodiode receiver receives the information in the form of light. Photodiode receiver converts these optical signals into electrical signals. This weak electrical signal is then amplified by receiver circuit. Amplified signal is then given to ATmega16 microcontroller. Here ATmega16 is used for decoding the received data. This decoded received data is converted to original form and fed to PC through TTL to USB converter.

Fig shows the 5 V constant power supply is used for both transmitter and receiver. 5 V supply is used to apply steady current to LED light.

IV. EXPECTED RESULTS

The results of bit error rate (BER) vs. communication distance are shown in Fig.



BER vs. communication distance

These are the results from the reference (Reference [1]) as shown in figure. Our results will be compared with the results of reference.

When bit rate is 60.096 Kbit/s and Rk equals to 2.4 kΩ (amplification factor is 40), the system has a perfect performance without any mistake in the first 100 cm. However, when the bit rate is 111.607 Kbit/s and Rk equals to 4.3 kΩ (amplification factor is 27), the none-mistake distance is 85 cm. And when the distance is longer than 90 cm, the

BER is very high. It is because that the communication distance limits the data transmit bit rate and BER. Therefore, our visible light communication system still has a large space to be improved.

With the increase in communication distance, the illumination is sharply reduced. Therefore, in practical application of indoor illumination, we should according to demand of actual lighting to choose the reasonable number of LED. We should use the concept of 'smart lighting' where all fluorescent light system is interchanged by High brightness LED (HBLED) light system.

CONCLUSION

Li-Fi is a promising candidate of the future lighting system. Data Transmission is done via Li-Fi using Visible Light Communication.

In addition, the data transmission rate could be enhanced by using fast switching LED. The driving speed of the circuit could also be enhanced if fast switching transistors were used. Finally, the wireless communication technology could be embedded into the visible light source which is the ultimate goal of the project.

REFERENCES

[1]http://www.sciencedirect.com/science/journal

[2] 2002.A Review on Indoor Optical Wireless Systems--IETE Technical Review-C Singh, J John, YN Singh, KK Tripathi.

[3]2008.Visible_Light_Communications_recent _progress_and_challenges.

[4] Lopez-Hernandez-Fj, Poves-E, Perez-Jimenez-R, and Rabadan-J: 'Low cost diffuse wireless optical communication system based on white LED'. Proc. 2006 IEEE Tenth International Symposium on Consumer Electronics, St. Petersburg, Russia 28 June 1 July 2006 pp

[5] P. Amirshahi and M. Kavehrad, (2006) Broadband Access over Medium & Low Voltage Power-lines and use of White LEDs for Indoor Communications, In IEEE CCNC 2006 proceedings

[6] Toshihiko Komine, (2004).Fundamental Analysis for Visible-Light Communication System using LED Lights.

[7]David J. T. Heatley, "Optical Wireless: The Story so far", *IEEE Communication Magzine,* 1998.

[8] Olivier Bouchet, Pascal Besnard, "Indoor Free Space Optic: A new prototype, realization and evaluation".