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LIGHT FIDELITY

Hetal Solanki , Alisha Mujawar , Enakshi Pujare , Ashutosh Jadhav ,

Prof. Atul Shintre , Prof.Pratik Adhikari

Department Of Computer Engineering

PVPPCOE Sion, Mumbai 400022

Abstract - In this paper, we describe the design and implementation of LI-FI. Abstract - Li-Fi stands for Light-Fidelity. Li-Fi is transmission of data using visible light by sending data through an LED light bulb that varies in intensity faster than the human eye can follow. If the LED is on, the photo detector registers a binary one; otherwise it's a binary zero. This paper deals with the implementation of the most basic Li-Fi based system to transfer data from one computer to another. The main components of this communication system are high brightness LED which acts as a communication source and silicon photodiode serving as the receiving element. The data from the sender is converted into intermediate data representation, i.e. byte format and is then converted into light signals which are then emitted by the transmitter. The light signal is received by the photodiode at the receiver side. The reverse process takes place at the destination computer to retrieve the data back from the received light.

Key Words - Li-Fi, High-Brightness LED, Photodiode, Byte Format Wireless Communication.

I. INTRODUCTION

This paper discusses the implementation of the most basic Li-Fi based system to transmit data from one device to another through visible light. The purpose is to demonstrate only the working of the simplest model of Li-Fi with no major consideration about the data transfer speed.

This model will demonstrate how the notion of 1-way communication via visible light works, in which off-the- shelf light emitting diodes (LEDs) are employed as the light sources. The model will transmit digital signal via direct modulation of the light. The emitted light will be detected by an optical receiver. In addition to the demonstration purpose, the model enables investigation into the features of the visible light and LEDs incorporated in the communication model.

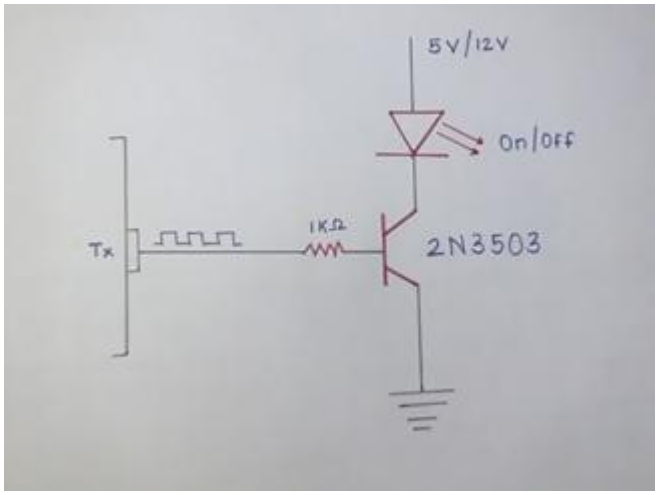
II. RELATED WORK

LiFi has a unique advantage over Radio Frequency (RF) transmission. WiFi is a great for general wireless coverage within buildings and LiFi is ideal for high density wireless data coverage in confined area and for relieving radio interferences issues, so the two technologies can be considered complimentary.

The comparison parameters of any two transmis- sion technology is speed, range, data density, security, reliabil- ity, power available, transmit/receive power, ecological im- pact, device-to-device connectivity, obstacle interference, bills ot materials, market maturity. LiFi is a step ahead against any RF Technology in all aspects or parameters mentioned above. LiFi Technology is based on LEDs for the transfer of data. The transfer of the data can be with the help of all kinds of light, no matter the part of the spectrum that they belong. That is, the light can belong to the invisible, ultraviolet or the visi- ble part of the spectrum.

III. WORKING

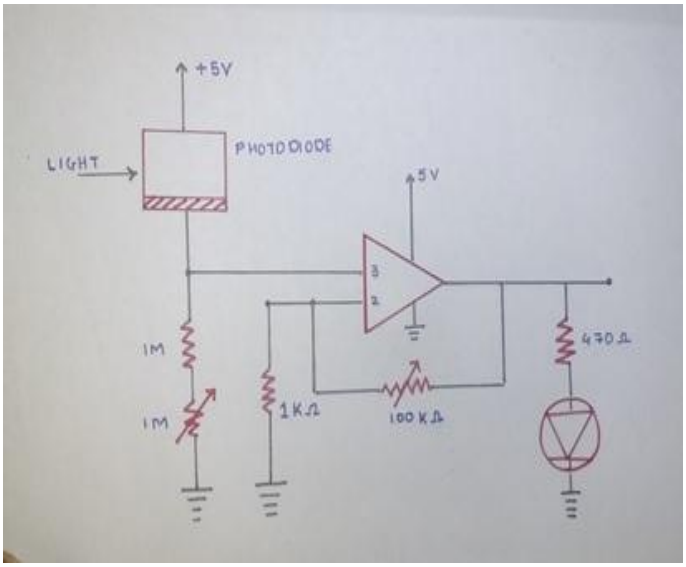
LI-FI TRANSMITTER CIRCUIT



As per the given diagram, the transmitter section consists of the input,high voltage n-p-n transistor and a LED bulb. The input can be any type of data that you wish to transmit, for example voice, text etc. The input is received from USB-TTL which can come at the speed of 9600 bps. As this speed can give garbage values along with the data it is beneficial to achieve a speed of 4800 bps for the demostration purpose.The n-p-n transistor drives the led at the speed of data recieved. The bits i.e. 1"s and 0"s are transmitted in the form of flashes

of the LED bulb. LED turned ON indicates logic 1 and turned OFF indicates logic 0. The resistance R1 is to divert collector-base leakage current which flows from the collector to the base of the transistor. If this current is not diverted, it will flow from the collector into the base-emitter junction, which will lead it to act as a base current coming from outside. This can be a problem because this base current can amplify the transistor‘s gain.

LI-FI RECEIVER CIRCUIT



The switching point is determined by the pin 6 (inverting input terminal). The light intensity on the photodiode controls the switching process of the reference voltage. The 2K pot is connected to pin 7 (non-inverting terminal); It is used to set the input threshold voltage of any desired value by comparing the input voltage of pin 6.

The experimental setup is started by the 10cm distance between the transmitter and the receiver; 1kBps speed has been obtained in the presence of ambient light. But when increased the distance to 50cm, the electrical signal from PIN photodiode suffers from distortions at 50cm distance away from the transmitter. The data transmission was unable to be obtained by the receiver if the distance exceeds 40cm distance apart from the transmitter. In this case, the maximum distance is 40cm for the transmission for this VLC prototype model. Since the photodiode area is small, it is unable to capture the optical signal for large distances.

DATA PACKET FORMAT

CHR(30)	DA	SA	CHR(1)	FILE LNTH

CHR(2)	FILE NAME	CHR(2)	FILE BYTES	CHR(1)

DA- Destination Address

SA- Source Address

The above figure is the data packet format for asynchronous transmission of data. The characters used in the packets are the non printable characters.

Chr(30) indictaes the start of file, chr(1) indicates the start of file length, chr(2) indicates the start of file name and end of file length, the next chr(2) indicates end of file name and start of data, the last character chr(1) indicates end of the data packet.

During actual project we transfer .jpg, .doc, pdf files by using laptop in that we achieve speed of 1 kbps. As bit rate increases photodiode fail to detect changes in intensity of LED lamp due to higher pulse width of data. Some result of speed and distance between light source and receiver photodiode are shown below-

File Size	Band Rate	Speed	Maximum Distance
8kb	1200	133kbps	7 Feet
8kb	9600	1kbps	5 Feet
8kb(error)	14400	20kbps	1.5 Feet

V. CONCLUSION

In this paper, we discuss the implementation of basic li-fi setup. We discuss about the asynchronous transmission of data and its format. Efforts on improving the speed and accuracy of data has been put up and its requirement is further needed. Analysis has been carried out with respect to the distance between transmitter and receiver, baud rate and speed. More research work is to be done to deploy the technology for practical use.

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