iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IV **Month of publication:** April 2019

DOI: https://doi.org/10.22214/ijraset.2019.4636

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.177
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

Visible Light Communication for Audio Transmission

Srilekha.K, Tejaswini.V
Electronics and Communication Engineering, Sreenidhi Institute of Science and Technology

Abstract: ***Use of LEDs in an innovative technological way in Wireless Communication is known as Visible Light Communication. LED's are becoming more efficient and have innumerous applications. Now-a-days rapid growth is seen in LED technology. Visible Light Communications refers to the short range optical wireless communications. From the recent advancements in the LED technology, visible light communication attained the speeds up to 96 mbps by using different fast modulation techniques which may leads to dimming during their operation and dimming can be avoided by other modulation techniques providing flicker-free high data-rate visible light communications. The indoor based visible light communication provides both illumination and communication. Visible Light Communications are rapidly developing now a days. These are now emerging as high-efficient and are providing higher data-rates.***

In current project, we use Visible Light Communication for transmitting Audio Signals from a headphone jack to a speaker in the receiving side. The audio signals which are provided by the headphone jack to our circuit which converts the audio signal into the fluctuations, now these fluctuations are given to the LED, which controls the LED. This process is carried out at very high speeds which cannot be observed by the human eye. The light emitted from the LED is received by the photo-detector or a photo-diode at the receiver side. The received digital signal is now decoded onto the original signal and the received signal is now given to output devices such as speaker. The received signals are generally weak at the receiver circuit, so the received signals are amplified using suitable amplifier circuit.

Keywords: Visible light communication, LED, photo detector, fluctuations, fast, line of sight, amplification.

I. INTRODUCTION

Visible Light Communication is trending in today's world where there is an ever increasing need of band width and fast speed of communication. Using light as a communication medium is introduced by Alexander Graham Bell in 1880 with his invention of photo phone, which transmits the voice signal on a modulated sunlight over several hundred of meters [1]. Again with the invention of LED, Visible Light Communication technology came into use. Visible Light Communication is the embryonic form of wireless communication. The Line of sight between the transmitter and receiver makes the communication possible. The ability of LED to transfer information over light makes it a very good medium of communication. The light we use daily cannot only used for providing light, but also can be used as transmitting medium. Most of the VLC systems used today are unidirectional and we will have bidirectional VLC systems as time progress.

II. LITERATURE SURVEY

We can control the LED brightness from 0% to 87.5% with the modulation techniques. By increasing the depth of modulation we can control the brightness of LED from 0% to 100%.modulation of brightness improves the performance of working [2]. High quality information transmission can be achieved by Visible light communication and the distance of 3 meters is achieved by using focusing lens in between transmitter and receiver [3]. The proposed system works on line of sight between the transmitter and the receiver, this can be advantage in a home environment where all or some of the electronic devices such as TVs, Radio, PC should be on at the same time and there could be more than one people working in same confined area [4]. As the distance between transmitter and receiver increases led light diverges and spreads widely, therefore it is difficult for photo detector to collect all information contained light. Also the distance between transmitter and receiver can influence the value of voltage, power and system loss. The system losses increases as the distance increase, this is because of the sensitivity of photo detector [5]. One of the challenging things to be considered while establishing VLC links is the localization status of transmitter and receiver pair which mainly defines how the signal is transmitted. There are two method in which a VLC link is established, first method can be made whether transmitter and receiver is directed or not to a specific point or coordinate. In order to achieve signal transmission wide beam transmitter and FOV receivers are required. Second type of design is existence of LOS path between transmitter and receiver. In this there are two options first is line of sight where no interruption or obstacles are present, second is non-LOS architecture with non-directed

©IJRASET: All Rights are Reserved

transmitter-receiver which is sometimes called as diffused system, this is robust system easy to implement especially for mobile communication scenarios [6]. Visible light communication is an emerging technology for future high capacity communication links which is used in next generation of communication networks (5G). The 5G – VLC consists of small cells called attocells in the indoor environment, thus enabling many advantages like high data transmission, excellent mobility and energy efficient systems. The LEDs used to produce light can be Organic LEDs or Inorganic LEDs besides these generic OLEDs are attracting attention for future VLC networks they provide advantages over inorganic devices such as mechanical flexibility, low temperature and ultra low costs etc. The slow VLC for indoor positioning was first released by means of an optical camera communication. Recently high bit rate VLC system are under standardization. For indoor applications with a static environment high Qos can be achieved even with the movement of people and shadowing by obstacles perturb the beam. The first mobile VLC system was reported for typical indoor distances between 2m to 20m with decreasing data rates with the distance [7].

III. EXISTING MODEL

Wireless Fidelity uses the radio waves to transmit and receive the information, which is more like two way radio communication. It uses 2.4 GHz frequency radio spectrum for information transfer. The Wi-Fi is a type of wireless local area Network based on the IEEE 802.11 network standards. The main part in the wireless network is the Access Point which broadcast the signal which is detected and tuned by PC's, mobile phones etc. Earlier 802.11a/b/g depends on single antenna and single data stream, but with the introduction of 802.11n specification Wi-Fi can use the power upto three antennas which improves the reliability, speed, range and the number of users. Wi-Fi is based on OSI protocol which uses the physical layer, MAC subo-layer of the data link layer and the other layers are left for the manufacturer to customize according to the requirements [8].

There are many problems associated with this technology some of them are: it uses radio waves which damages the human health. Setting of the router is necessary which increases the cost. The throughput of Wi-Fi is not ideal. Security is a major concern even though wps key encryption is provided, it can be hacked in many ways. With the increasing number of users and demands Wi-Fi cannot serve the purpose, since the traffic is increasing and the bandwidth is limited. The theoretical speed recorder for 802.11n is around 240Mbps and with the advanced 802.11ac specification the theoretical speed increased to 720Mbps.

IV. PROBLEM STATEMENT

With the increasing number of users and demands the wireless technology should provide fastest network, with the security and unlimited bandwidth. The setup cost should also decrease and provide a healthy environment to users.

V. PROPOSED MODEL

This paper presents the alternate to Wi-Fi which is Visible Light Communication and the Li-Fi is a part of it. This paper aims in transmitting and receiving the audio signal using visible light as communication medium.

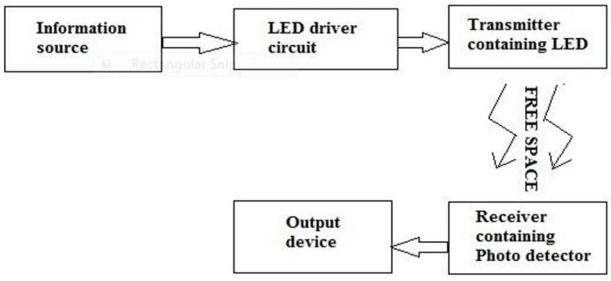


Fig.1 Block Diagram of Visible Light Communication

In the above diagram the information source can be digital data, video or audio. The led driver circuit drives the led that is provides sufficient voltage to make the fluctuations. The transmitter circuit converts the information source into a way that can be transmitted by led. The receiver which contains the photo detector detects the fluctuations and converts into the original information. The output can be display in case of data transmission or speaker in case of audio.

Visible Light Communication system uses the visible light ranging from 400nm – 700nm (428 THz – 750 THz). The Light can travel 186,000 miles in a second so communication via such a source gives the fastest means of communication. VLC uses LED

©IJRASET: All Rights are Reserved

(light emitting diode) which is a light source as the transmitter and photo detector which is a light detector as receiver. It has many indoor applications which are discussed in further sessions. In this prototype we are transmitting the audio signal. The transmitter circuit effectively modulates the intensity of led light which acts as carrier wave, according to the effective voltage difference. The fluctuations in the light are so fast such they are not visible to naked eye. Similarly when we are transmitting data, the data will be converted to binary ones and zeros which will make the light on and off, we think that this on and off nature of light is not used for illumination purpose but the on and off occurs at a high speed which is not visible to human naked eye and the illumination will be at a constant rate.

VI. PROTOTYPE DESCRIPTION

Fig. 2 shows block diagram for VLC to transmit and receive audio signal. The Audio input to the transmitter is given from mobile phone using the earphones. The transmitter circuit contains LED which illuminates and sends the audio. The receiver contains phototransistor which detects the light from led and is given to speaker.

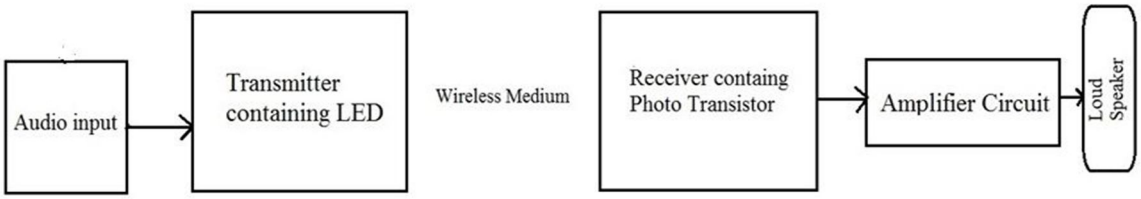


Fig.2 Block diagram of VLC for Audio transmission

A. Transmitter Circuit

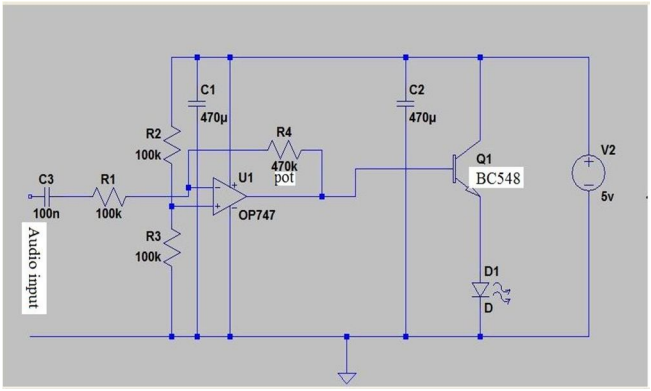


Fig.3 Transmitter circuit

The pot provided as the feedback is used to control the intensity of light further controlling volume at the speaker. When audio signal is not given a positive DC will be present at comparator output and transistor Q1 will be alive and the led glows continuously. When the audio input is given, the audio input is compared with the reference voltage present at non inverting terminal of op-amp and produces a pulse. The width of pulse can be controlled by the input signal frequency. The pulse is amplified and modulated using transistor which then controls the intensity of light. Thus led emits the according to input signal, the fluctuations takes place at a faster rate which cannot be detected.
The voltage to the circuit should be 5v and it is given by the 7805 voltage regulator.

B. Receiver Circuit

The photo transistor detects the fluctuations emitted by the led which is further converted to photo current. The reason for choosing photo transistor instead of photo diode is its efficiency is higher, faster response, less immune to noise. The resistor R3 is used as pull up resistor to keep the transistor in determinant state. The capacitor C2, R1, R2 and operational amplifier acts as first order high pass filter which eliminates the low frequency or noise signals. -R2/R1 gives the pass band gain and the cutoff frequency is determined by the f=1/ (2*pi*C2*R3).

©IJRASET: All Rights are Reserved

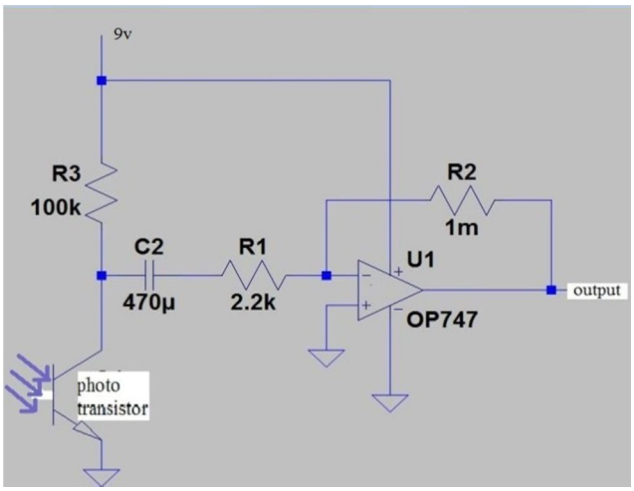


Fig.4 Receiver Circuit

C. Amplifier Circuit

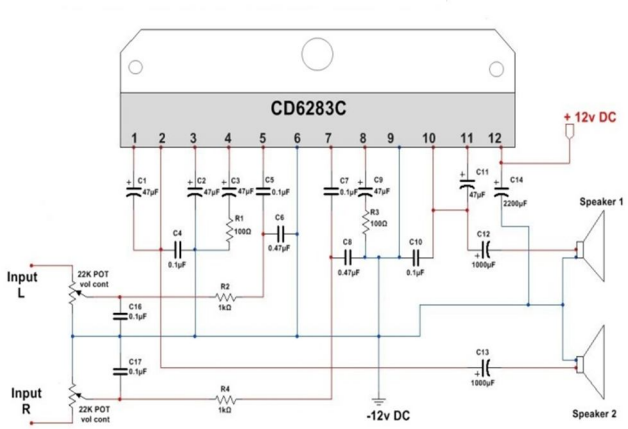


Fig.5 Amplifier Circuit using CD6283 IC

IC CD6283 is a single line package, which has a built in thermal shut down protection. It has dual channel medium. It is low power and best quality audio amplifier. The operating voltage can be 9v-12v, when the operating voltage is 9v the output power will be 4.6w*2. Since it is a dual channel but we are using only one channel, the input can be provided either at L or R. The input is coupled with a capacitor to provide the audio coupling at the output. The resistor R1 and R3 are used for adjusting voltage given the formula Gv=20*log (RF+R1+R2/(RF+R1)) [9].

VII. CONCLUSION

VLC is a new methodology on which research is taking place, this technique needs many improvements in order to satisfy the human needs. The concept of Li-Fi is attracting many of the researchers as it offers high speed (>10 Gbps) and also does not affect the health of human. So this can be used in many applications where the Electromagnetic waves are restricted, these applications include hospitals, space research, under water communication, location based communication.

VIII. RESULT

In this project we successfully transmitted audio signal wirelessly with LED at the transmitter side and received the same at the receiver. The distance of 30 cm is achieved between transmitter and receiver. The audio signal is received with the exact line of sight.

©IJRASET: All Rights are Reserved

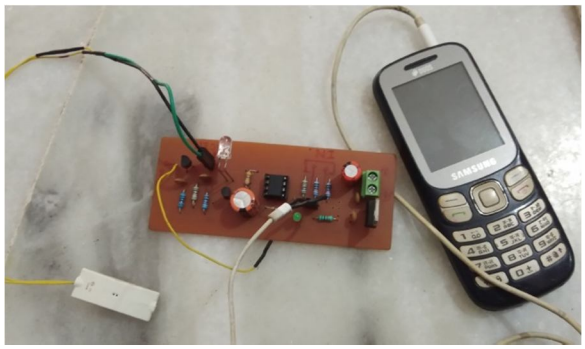


Fig: Prototype of Transmitter

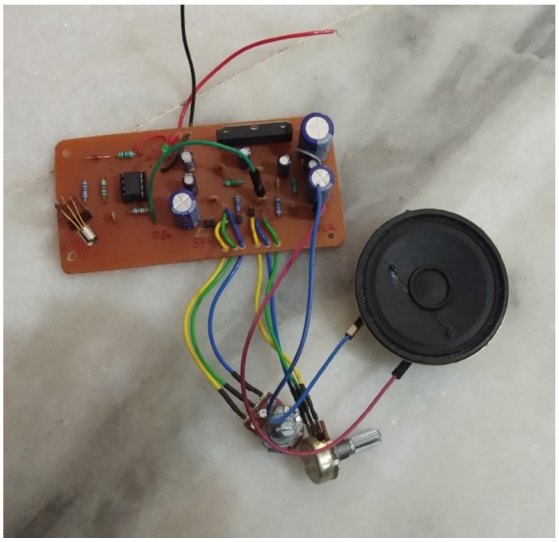
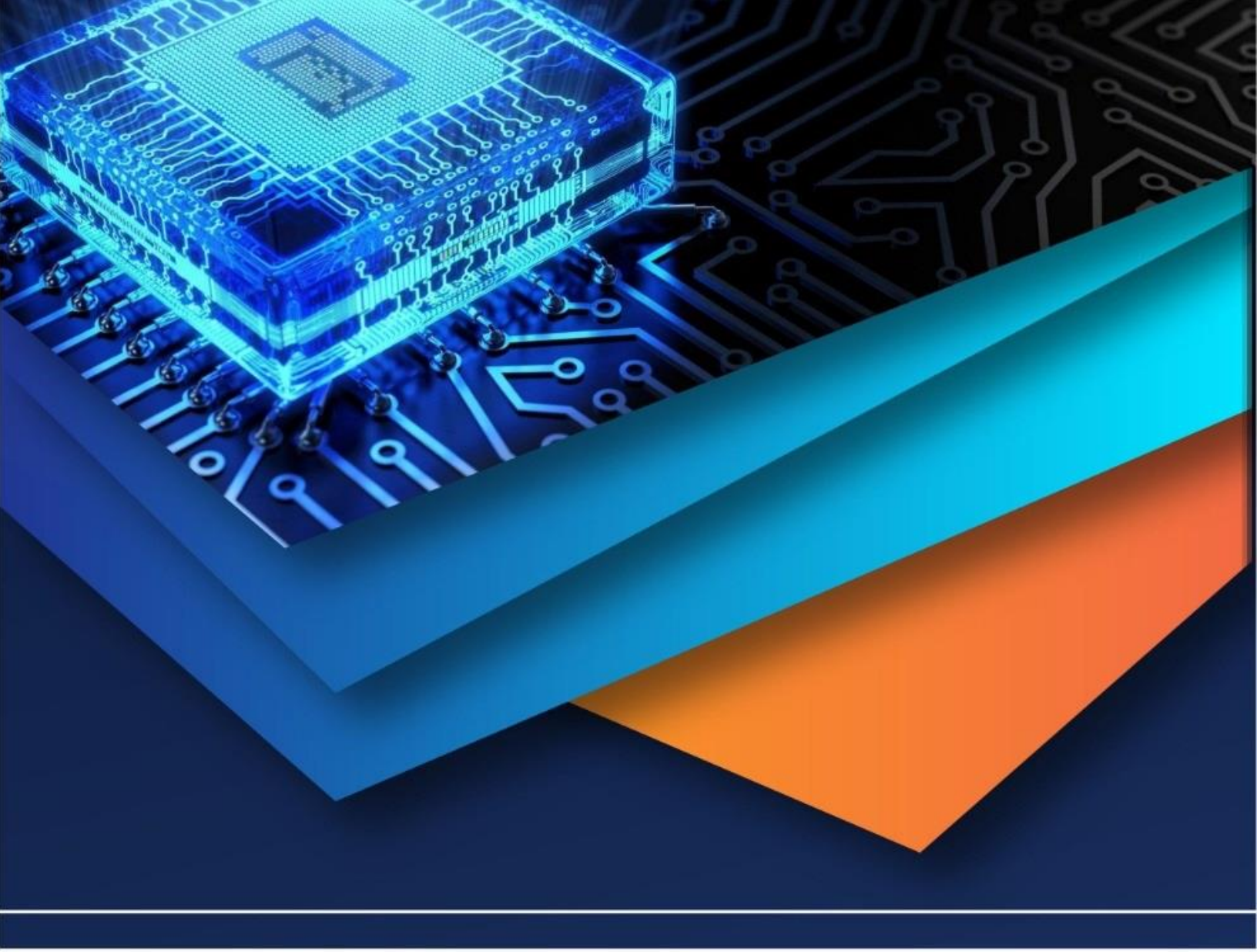


Fig: Prototype of Receiver

REFERENCES

[1] https://en.wikipedia.org/wiki/Visible_light_communication.
[2] "Experimental investigation of modulation method for visible-light communications" by H Sugiyama, S Haruyama… - IEICE transactions on …, 2006 - search.ieice.org
[3] "Real-time audio & video transmission system based on visible light communication" by Y He, L Ding, Y Gong, Y Wang - Optics and Photonics Journal, 2013 – Citeseer.
[4] "Visible Light Communication for Audio Systems" by Grantham Pang, Ka-Lim Ho, Thomas Kwan, Edward Yang.
[5] "Audio transmission using Visible light communication (VLC)" by M.I. Ma'raf, M.B. Othman, Sholeh H.P.
[6] "An overview of Visible Light Communication systems" by Taner Cevik and Sedar Yilmaz.
[7] "Visible Light Communication towards 5G" by Mr. V. B Singh.
[8] "Implimentation of high speed data transmission using VLC" by Sarah Monica, S.V.Muralidharam.
[9] Data sheet of CD6283 IC

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)