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DATA TRANSMISSION USING VISIBLE LIGHT COMMUNICATION (VLC) TECHNOLOGY

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Abstract: Li-Fi stands for Light Fidelity. This technology is very new and it was proposed by the German physicist Harald Haas in 2011. It Provides transmission through illumination by sending data through a LED bulb which varies in intensity faster than the perception of human eye. This paper, discuss about the light technology in detail and also implements a Li-Fi system for data transmission through Visible Light Communication (VLC). Li-Fi is ideal for high density wireless data coverage in confined area where there are no obstacles. It is a wireless optical networking technology that uses Light Emitting \Diodes (LEDs) for transmitting the data. In Li-Fi visible light is used as medium to deliver high speed communication in a manner similar to Wi-Fi. Li-Fi provides better bandwidth, efficiency, availability and security than Wi-Fi. This paper will give a detailed study on Li-Fi technology of transferring data (i.e.., audio, video, text etc.) through Li-Fi technology by using both in software and hardware modules.

Keywords- Li-Fi, Visible Light Communication (VLC), Data Transmission

1. INTRODUCTION

Wi-Fi has been ruling the wireless communication since its development. Various other technologies have tried and failed to impress in wireless sector. But a similar technology has emerged recently which is promising as Wi-Fi. And that technology is “Light fidelity” Li-Fi.

As Wi-Fi, Li-Fi is also used for wireless communication but instead of radio frequency it uses visible light as the medium of communication. As the bandwidth of the visible light spectrum is higher than radio very high-speed communication up to 1 Gigabytes per Second data transfer is possible. As it uses visible light, essentially every light emitting source can be used for data transfer.

The worldwide necessity for networking, has in turn increased the need for cellular networks as the user’s counts are increasing in rapid. Data transfer speed has been interrupted by limited bandwidth. Stable network gives a better benefit. Due to the reduced bandwidth available in the RF range, this tool would reach the critical threshold very soon. Radio waves that can be used for transmitting data are only a minor portion of the electromagnetic spectrum. In 2011, a German physicist Harald has introduced the technology in a TED Global talk on Visible Light Communication. Light-Fidelity is abbreviated as Li-Fi. Li-fi had a wider data transmission spectrum.

2. LITERATURE SURVEY

[1] Technology that provides transmission of data through illumination by sending data through an LED light bulb that varies in intensity. In this paper, the authors have discussed the technology in detail and also how Wi-Fi can be replaced by Li-Fi. Wi-Fi is useful for general wireless coverage within buildings while Li-Fi is ideal for high density wireless data coverage in confined areas where there are no obstacles and Li-Fi is considered safer than the traditional Wi-Fi. Li-Fi is a wireless optical networking technology that uses light emitting diodes (LEDs) for the transmission of data from a device. Li-Fi provides better bandwidth, efficiency, availability and security than Wi-Fi and has already achieved high speeds in the laboratory environments.

[2] Over the years, the overdependence on Wireless Fidelity (Wi-Fi) for data transmission necessitated the need for an alternate and more reliable means of communication, hence, Light Fidelity (Li-Fi) was introduced. It involves the use of Light Emitting Diode to transmit data by blinking (i.e. switching them On and Off) at a speed not noticeable to the eye with very low delay.

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[3] Li-fi innovation is the most current innovation that has bunches of extension to investigate on. This paper represents the remote correspondence framework for information move utilizing light devotion. Moving information is done through numerous strategies. . It moves information as light signals rather than radio signs. As straightforward as it sounds, it is likewise an effective strategy. Since light constancy moves information as light signals, it is additionally called as Visual light correspondence. This technique defeats blunders during greatest transmission rate in existing framework and it is more effective. The work implements a system to send an information through Li-fi and contrast it and other existing advances like Wi-Fi. The boundaries utilized for examination and investigation are the Information rate, Information effectiveness and Error rate.

[4] Light Emitting Diode (LED) is utilized in various regions of regular day to day existence. The upside of the gadget is that notwithstanding their helping capacities, it tends to be utilized for information transmissions also. Remembering the significance and need of LED, in this paper a Li-Fi based information correspondence framework is implemented. In this work, a circuit is intended to communicate information from a PC to a collector circuit utilizing microcontroller (AT89C51) and with the assistance of a 16×2 LCD show the information being sent from the transmitter to the beneficiary.

[5] In current scenario numerous individuals are utilizing web to achieve their undertaking through wired or remote organization. As number of clients get sped up abatements relatively. In spite of the fact that Wi-Fi surrenders us speed to 150mbps according to IEEE 802.11n, it is as yet deficient to oblige the client strength. To cure this impediment of Wireless Fidelity, this paper presents idea of Li-Fi. According to germen physics Harald Haas information through brightening removes the fiber to fiber communication. Sending information through a LED light that shifts in power quicker than the natural eye can follow. Haas says his innovation, which he calls D-LIGHT, can create information rates quicker than 10 megabits for every second, which is speedier than your normal broadband association. Light-Fidelity is a mark for remote correspondence frameworks utilizing light as a transporter rather than customary radio Frequencies, as in Wi-Fi. Li-Fi has the benefit of having the option to be utilized in touchy regions, for example, in Aircraft and other transportation without causing impedance. It is normally actualized utilizing white LED bulbs at the Downlink transmitter. This kind of gadgets are typically utilized for brightening simply by applying a consistent current.

[6] Prime goal of the undertaking is to make an application that communicates information be it text, sound or video utilizing Li-Fi innovation for adapting to the restricted transfer speed issue as in RF (Radio recurrence) signals. For better, productive, secure and a quicker association Li-Fi is utilized. One of the benefits of utilizing Li-Fi over Wi-Fi is that it dodges radiation created by Wi-Fi. The objective of this venture is to move information with quicker speed which isn't anything but difficult to accomplish through Wi-Fi and see if transmission is conceivable through different mediums. Li-Fi can be thought as an option for Wi-Fi which uses light as a medium to send information. The paper focus on the transmission of information by means of Li-Fi and all the potential parts of communicating information by means of light through different mediums which will give us a wide thought of where and how we can utilize Li-Fi for transmission of information. [6]

[7] Light Fidelity (Li-Fi) is an information move method that utilizations light. Light is undifferentiated from not exclusively to enlightenment yet additionally to speed. Li-Fi is additionally much made sure about since light can't go through dividers. It utilizes obvious light segment of the electromagnetic range to communicate data. Thus the obvious light correspondence takes care of the issue of radio recurrence blockage. In this task we communicate information and sound through light at extremely high information rates without utilization of microcontrollers and its other fringe gadgets.

[8] Light constancy innovation alludes to noticeable light correspondence that utilizations light as a medium to convey fast information which is a lot more prominent than that of Wi-Fi. Li-Fi information is sent in a few piece streams and the beneficiary side comprising an IR indicator translates the message. The transmission occurs as double information where 0 methods LED in "OFF" state and 1 implies that the LED is in the "ON" state.

[9] Internet is a significant assignment where the entrance is utilized for different organizations and house hold works. From little children to more established age individuals presently utilize advanced mobile phones for the reasons for playing, perusing, hearing music, covering tabs, booking, seeing on the web shows to dramatizations in the specific channel, moving cash, video calling, conferencing, and so forth Indeed, even it is utilized as the associate when we are in new spot. Along these lines, Internet with the Smart telephones administers the universe of correspondence. The paper examines how ages of Communication are done and the new current innovation of correspondence with perceivable brilliance is utilized in the innovation. The nuts and bolts of the new innovation and the advantages are examined.

[10] Internet has an essential impact in everybody's life. As the populace rate is expanding, the interest for remote information is likewise shifting at a remarkable rate yet the speed is deficient to oblige with this surpass of populace. It

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is required to create and executed different advances which can give fast correspondence. In the new investigation, the creators are doing significant examination on innovation of Li-Fi and the application is to move the information starting with one PC then onto the next PC. As Light Fidelity is a remote information transmission method in which light producing diodes are utilized as a transporter sign to send the information remotely rather than customary radio recurrence as in Wi-Fi. . In Li-Fi, LED's are considered as a key factor which is to be utilized in transmission since it's having minimal effort and Omnipresence. The point of this paper is to show, how information communicates starting with one gadget then onto the next.

3. PROPOSED SYSTEM

In this work a transmitter block is designed to convert digital signal to analog as shown in Figure 1. Input from the PC is provided using a serial terminal. As newer PCs don't have serial ports, a USB to TTL adapter is used in place of DB9 port. The output of the USB adapter is connected to MAX232 for RS232 to TTL conversion. Then the output of the MAX 232 is connected to the first buffer then the output of the buffer is connected to an inverter stage made up of 6 parallel inverters having common inputs and outputs. The output of this inverter stage is connected to the cathode terminal of the laser.

3.1 Components Used

- Atmega8 microcontroller
- Li-Fi LED
- Power supply
- PC cable
- Rs232 communication
- Photo diode

3.2 Transmitter Module

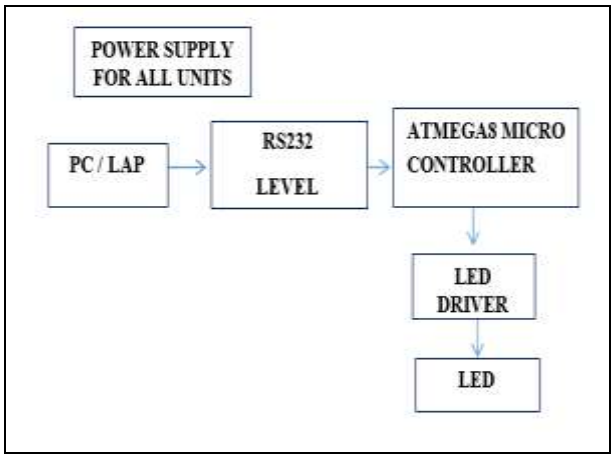

Figure 1. Block diagram of the Transmitter module

3.3 Receiver Module

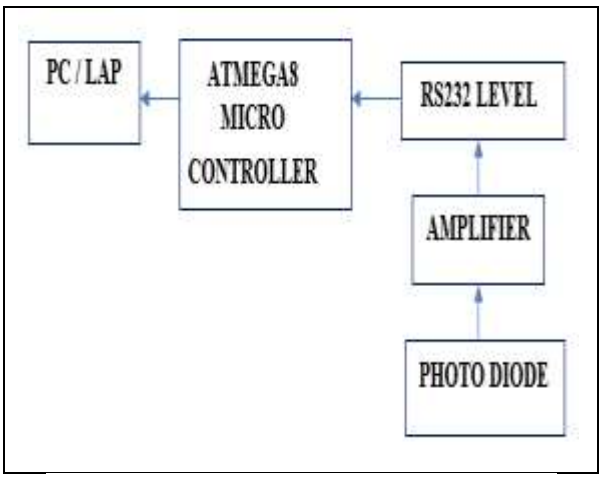

Figure 2 Block diagram of the Receiver module

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3.4 Working

Li-Fi is a Visible Light Communications (VLC) system which accommodates a photo-detector to receive light signals and a signal processing element to convert the data into 'stream-able' content. An LED light bulb is a semi-conductor light source meaning that the constant current of electricity supplied to an LED light bulb can be dipped and dimmed, up and down at extremely high speeds, without being visible to the human eye. For example, data is fed into an LED light bulb (with signal processing technology), it then sends data (embedded in its beam) at rapid speeds to the photo-detector (photodiode). The tiny changes in the rapid dimming of LED bulbs is then converted by the 'receiver' into electrical signal. The signal is then converted back into a binary data stream that we would recognize as web, video and audio applications that run on internet enables devices.

a. Atmega8 microcontroller (8 bit): The ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughputs approaching 1 MIPS per MHz, allowing the system designed to optimize power consumption versus processing speed.

b. Li-Fi LED: It is used to transmit the data, when an electrical current is applied to a LED light bulb a stream of light (photons) is emitted from the bulb. The signal can then be received by a detector which interprets the changes in light intensity (the signal) as data.

c. Photo diode: A photodiode is a photo detector that produces an electrical current that is proportional to the optical power that is incident on the photo detector surface. This simple principle makes possible visible-light communication technology that supports both illumination and wireless communication using an LED

d. LCD display: It is used to display the commands.

4. RESULTS

This project is developed to communicate data effectively by using the light source through the Li-Fi technology. The system provides data communication between the transmitter and receiver using wireless standard. It is a simple one to transfer the data via Li-Fi communication method. This project provides the communication system in a safe and secure in which the video data is transmitted in the form of light through to the receiver circuit and it was detected using photodiode and converts the incoming optical information into corresponding video file which can be viewed using an external display. The hardware module of the system is shown in Figure 3 and Figure 4.

Figure 3 Hardware Module of Transmitter

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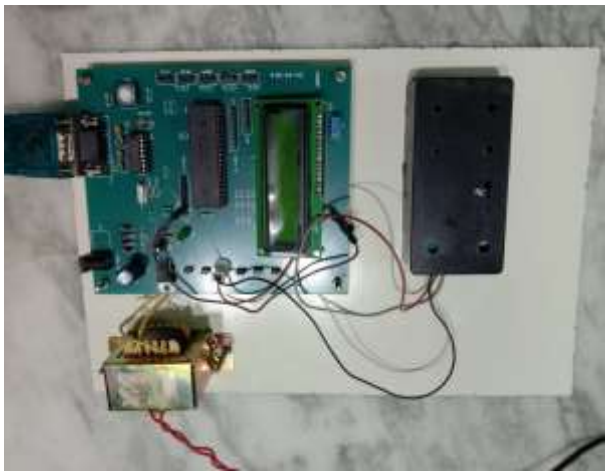

Figure 4 Hardware Module of Receiver

5. CONCLUSION

The demand of wireless data has increased due to the congestion of radio spectrum. In order to reduce the congestion, wireless data transferring system is introduced. A data is transmitted from one PC to another PC with the help of visible light. In this project, data is transmitted between computers using Li-Fi transmitter module. The simulation of the circuit is done using Proteus software. The hardware design is implemented for transferring audio, video, image and message between PCs using the Visible Light Technology. A VLC device consisting of transmitter and receiver, used to transmit and receive data through illumination and enabling of the security of the data transmission is implemented in this work.

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