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Lifi: The Future Technology in Wireless Communication

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ABSTRACT: LiFi (Light Fidelity) is a fast and cheap optical version of Wi-Fi, the technology of which is based on Visible Light Communication (VLC). VLC is a data communication, which uses visible light as optical carrier for data transmission and illumination. It uses fast pulses of light to transmit information wirelessly. The main components of this communication system are a high brightness white LED, which acts as a communication source a silicon photodiode which shows good response to visible wavelength region serving as the receiving element. LEDs can be switched on and off very quickly, which gives nice opportunities for transmitting data. It is possible to encode data in the light by varying the rate at which the LEDs flicker ON and OFF to give divergent strings of 1s and 0s.The LED intensity is modulated so rapidly that LED output appears to be constant to the human eye. By modulating the LED light with the data signal, the LED illumination can be used as a communication source. A data rate of greater than 100 Mbps is possible by using high speed LEDs with appropriate multiplexing techniques. So it has very fast data rates. LiFi is ideal for high density wireless data coverage in confined area and for relieving radio interference issues. It can be used in the places where it is difficult to lay the optical fibre like hospitals where radio interference is high. In traffic signals LiFi can be used which will communicate with the LED lights of the cars and accident numbers can be decreased. Thousand and millions of street lamps can be transferred to LiFi lamps to transfer data. In aircraft LiFi can be used for data transmission. It can be used in petroleum or chemical plants where other transmission could be hazardous. One of the shortcomings however is that it only work in direct line of sight.

KEYWORDS: PIC16F877A,Photodiode,MOSFET,Sensor, LED Lamp.

I.INTRODUCTION

LiFi is transmission of data through illumination by taking the fibre out of fibre optics by sending data through a LED light bulb that varies in intensity faster than the human eye can follow. Li-Fi is the term used to label the fast and cheap wireless- communication system, which is the optical version of Wi-Fi. It is possible to encode data in the light by varying the rate at which the LEDs flicker on and off to give different strings of 1s and 0s.The LED intensity is modulated so rapidly that human eye cannot notice, so the output appears constant. In this busy world, high speed data transferring is highly desirable. LiFi is very brisk data transferring technology, so it is ideal for high density wireless data coverage in confined area and the information or communication source is LED illumination, so there will not be any radio interference and can be used in hospitals where radio waves are high due to medical appliances. It can be used for data transmission under water also. the possibilities are numerous and can be explored further.

If this technology can be put into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wireless data and we will proceed toward the cleaner, greener, safer and brighter future. The concept of Li-Fi is currently attracting a great deal of interest, not least because it may offer a genuine and very efficient alternative to radio-based wireless. As a growing number of people and their many devices access wireless internet, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal. This may solve issues such as the shortage of radio-frequency bandwidth and allow internet where traditional radio based wireless isn't allowed such as aircraft or hospitals.

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II.LITEARTURE SURVEY

LiFi is transmission of data through illumination by taking the fibre out of fibre optics by sending data through a LED light bulb that varies in intensity faster than the human eye can follow. Li-Fi is the term some have used to label the fast and cheap wireless-communication system, which is the optical version of Wi-Fi. The term was first used in this context by Herald Haas in his TED Global talk on Visible Light Communication. "At the heart of this technology is a new generation of high brightness light-emitting diodes", says Herald Haas from the University of Edinburgh, UK, Very simply, if the LED is on, you transmit a digital 1, if it's o_ you transmit a 0,Haas says, They can be switched on and off very quickly, which gives nice opportunities for transmitted data. It is possible to encode data in the light by varying the rate at which the LEDs flicker on and off to give different strings of 1s and 0s.The LED intensity is modulated so rapidly that human eye cannot notice, so the output appears constant. More sophisticated techniques could dramatically increase VLC data rate. Terms at the University of Oxford and the University of Edinburgh are focusing on parallel data transmission using array of LEDs, where each LED transmits a different data stream.
Other group are using mixtures of red, green and blue LEDs to alter the light frequency encoding a different data channel. Li-Fi, as it has been dubbed, has already achieved blisteringly high speed in the lab. Researchers at the Heinrich Hertz Institute in Berlin, Germany, have reached data rates of over 500 megabytes per second using a standard white-light LED. The technology was demonstrated at the 2012 Consumer Electronics Show in Las Vegas using a pair of Casio smart phones to exchange data using light of varying intensity given off from their screens, detectable at a distance of up to ten metres.

In October 2011 a number of companies and industry groups formed the Li-Fi Consortium, to promote high-speed optical wireless systems and to overcome the limited amount of radio based wireless spectrum available by exploiting a completely different part of the electromagnetic spectrum. The consortium believes it is possible to achieve more than 10 Gbps, theoretically allowing a high-definition film to be downloaded in 30 seconds

III.SYSTEM MODEL AND WORKING

If the LED is on, digital 1 is transmitted , if it's off 0 is transmitted. The LEDs can be switched on and off very quickly, which gives nice opportunities for transmitting data. So what we require are some LEDs and a controller that code data into those LEDs. We have to just vary the rate at which the LED's flicker depending upon the data we want to encode successfully. It is possible to encode data in the light by varying the rate at which the LEDs flicker on and off to give different strings of 1s and 0s.The LED intensity is modulated so rapidly that human eye cannot notice, so the output appears constant.

Block Diagram Of The System

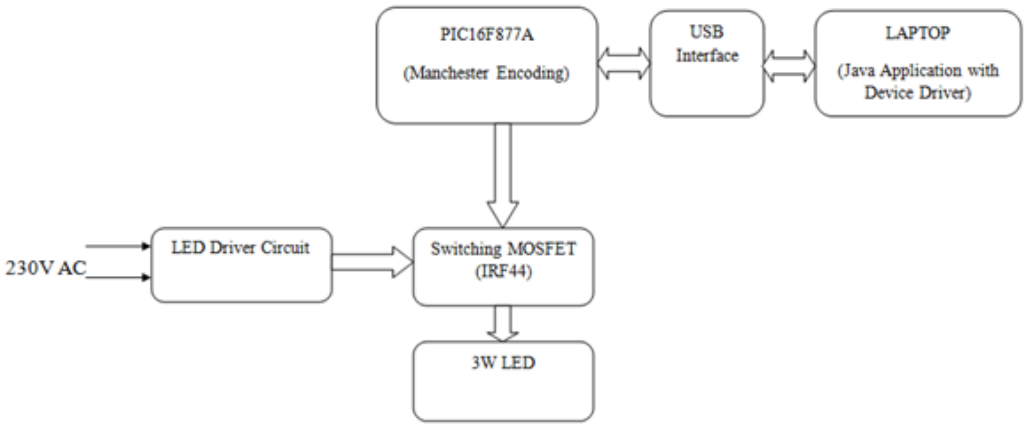

Figure1.1: Block diagram- Transmitter section

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Figure 1.1 shows the block diagram of transmitter section, which consists of a laptop, microcontroller, MOSFET and LED. The data to be transmitted is sent to PIC16F877A microcontroller through a USB to serial connector. The microcontroller will encode the data to be transmitted using Manchester Algorithm. Then encoded data will be sent to the MOSFET. MOSFET is a switching device, so according to the gating signal applied, it will turn ON and OFF. So the LED lamp will blink accordingly. The data to be transmitted is encoded as zeroes and ones. The LED will turn ON when '1' is to be transmitted and LED will turn OFF when '0' is to be transmitted. Since MOSFET and LED are semiconductor devices, it can be switched ON and OFF quickly. So very high data rates can be achieved. Also since this blinking rate is very high, human eye cannot sense it and it appears to stationary.

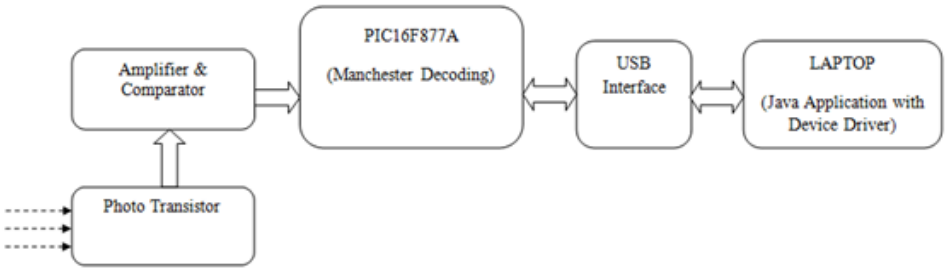

Figure1.2: Block diagram- Receiver section

Figure 1.2 shows the block diagram of receiver section where,the data transmitted serially is detected by the photodiode. When light falls on it positive voltage will be generated. When logical zero or no signal is received , photodiode output will also be low. The Op Amp circuit will compare signal received to the reference voltage to convert to it to logical zero or one. Since the data rate is high, the diode output also very fast. So an Op Amp circuit is provided to compare very data that received. The output of comparator is fed to microcontroller which will decode this signal to regenerate the data sent. This regenerated data is sent to the laptop via serial to USB connector.

IV. EXPERIMENTAL SETUP AND RESULT

The components are assembled and program was burned in the PIC microcontroller. The program is done using the software Mikro C. Mikro C is a powerful development tool for PIC microcontrollers. It is designed to provide the programmer with the easiest possible solution for developing the application for embedded system without compromising the performance of the controller.

Figure 1.3: Transmitter Section.

In figure 1.3, it shows the experimental set up of transmitter section. Here from the laptop the datas (images) is sent through the led. Datas are encoded using Manchester coding and then it is sent serially.

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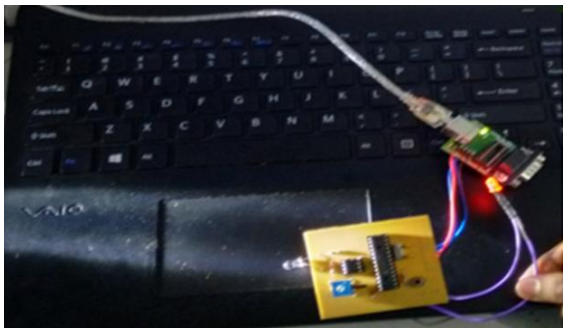

Figure 1.4: Receiver Section.

In figure 1.4, it shows the experimental setup of receiver section. Here the datas transferred through led is detected by a photodiode and it is decoded .Java program is developed to make an interface to sent images. The testing is done and it is possible to transfer images effectively using LiFi. Instantly taken photos are sent using light of an LED as carrier.

V. CONCLUSION

Radio waves are replaced by light waves in this new method of data transmission which is being called Li-Fi. Light-emitting diodes can be switched on and off faster than the human eye can detect, causing the light source to appear to be continuously on. The possibilities are numerous and can be explored further. If this technology can be put into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wireless data and we will proceed toward the cleaner, greener, safer and brighter future. The concept of Li-Fi is currently attracting a great deal of interest, not least because it may offer a genuine and very efficient alternative to radio-based wireless. As a growing number of people and their many devices access wireless internet, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal. One of the shortcomings however is that it only work in direct line of sight.

VLC provides the potential for multi-gigabits per- second data rate communication at short distances with 300 THz of available visible light spectrum at low power and cost, using simple LEDs and photodiodes. As a growing number of people and their many devices access wireless internet, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal. This may solve issues such as the shortage of radio-frequency bandwidth and allow internet where traditional radio based wireless isn't allowed such as aircraft or hospitals.

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