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"A REAL TIME DESIGN AND DEVELOPMENT OF 2D IMAGE TRANSMISSION USING LIFI TECHNOLOGY"

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ABSTRACT

The main objective of this project is to transmit the image using LED (Light Emitting Diode). With the increasing popularity of solid state lighting devices, Visible Light Communication (VLC) is globally recognized as an advanced and promising technology to realize short-range, high speed and large capacity wireless data transmission. A LED light change in frequency quicker than the human eye can see, it likewise has higher recurrence than Radio wave which bring about considerably higher speed than Wi-Fi. In this report, a prototype of real-time image broadcast system using inexpensive commercially available light emitting diode (LED) lamps is proposed. The extent of the development is to utilize a LED Bulbs as a medium of information and communication in such a way that can be implemented in home, office, organization and industries. Experimental results show that real time image with the maximum distance of 2ft can be achieved through proper layout of LED sources and improvement of concentration effects. The design and construction of the LI-FI (Light Fidelity) light source enable efficiency, long stable life, as well as full spectrum intensity that is digitally controlled and easy to use.

Keywords: Light Emitting Diode (LED), Light Fidelity (Li- Fi), Wireless Fidelity (Wi-Fi), Visible Light Communication (VLC), Photo Diode

I. INTRODUCTION

Li-Fi is a label for wireless-communication systems using light as a carrier instead of traditional radio Frequencies, as in Wi-Fi. Li-Fi has the advantage of being able to be used in sensitive areas such as in Aircraft without causing interference. However, the light waves used cannot penetrate walls. It is typically implemented using white LED light bulbs at the Downlink transmitter. These devices are normally used for illumination only by applying a constant current. However, by fast and subtle variations of the current, the optical output can be made to vary at extremely high speeds. This very property of optical current is used in Li-Fi setup. The operational procedure is very simple-, if the LED is on, you transmit a digital 1, if it's off you transmit a 0. The LEDs can be switched on and off very quickly, which gives nice opportunities for transmitting data. Hence all that is required is some LEDs and a controller that code data into those LEDs. All one has to do is to vary the rate at which the LED's flicker depending upon the data we want to encode. Further enhancements can be made in this method, like using an array of LEDs for parallel data transmission, or using mixtures of red, green and blue LEDs to alter the light's frequency with each frequency encoding a different data Channel. Such advancements promise a theoretical speed of 10 Gbps – meaning one can download a full high-definition film in just 30 seconds.

II. LITERATURE REVIEW

A. Li-Fi Technology: Data Transmission through Visible Light, International Journal Department of Computer science By Anurag Sarkar, Prof. Shalabh Agarwal, Dr. Asoke Nath [July 2015]

Proposed system having Data transmission using Li-Fi technology, In this research the Li-Fi system successfully implemented using the visible light as a medium of communication, where the scattered light signals is used as a Data source through which data can be Transmit and Receive by communication devices

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B. The New Era of Transmission and Communication Technology: Li-Fi (Light Fidelity) LED & TED Based Approach, International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) by Ravi Prakash, Prachi Agarwal [February 2014]

This very property of optical current is used in Li-Fi setup. The operational procedure is very simple-, if the LED is on, you transmit a digital 1, if it's off you transmit a 0. The LEDs can be switched on and off very quickly, which gives nice opportunities for transmitting data. Hence all that is required is some LEDs and a controller that code data into those LEDs. All one has to do is to vary the rate at which the LED's flicker [2] depending upon the data we want to encode

C. A survey on Transmission of data through illumination-Li-Fi by M. Mutthamma Assistant Professor, Department of ECE, GCET, Hyderabad, A.P., India [12 December 2013]

Proposed system implemented as data for laptops, smart phones & tablets can be transmitted through light in room by using LiFi. Researchers are developing micron sized LED which are able to flicker on & off around 1000 times quicker than larger LED. They offer faster data transfers and take up less space so we could save space or add more LED's to further boost the channel of communication.

III. BLOCK DIAGRAM

Li-Fi technology consist of transmission of image using LED light, The LED's which is useful for image transmission and implement the basic concept of Li-Fi. It is divided into two modules Transmitter and Receiver.

1. Transmitter

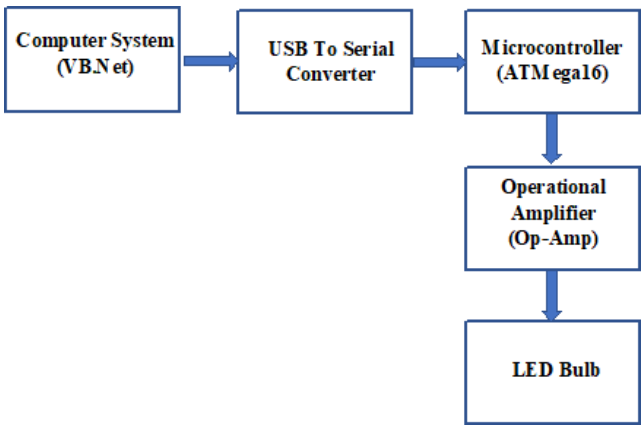

Fig 1. Image Transmitter Module

The Block Diagram of the Li-Fi Transmitter Module is as shown in above figures 1. This Modules works in specific way which is explained below:

Transmitter Module: From Transmitter module, the Image Signal or Information form the Computer system is Serially send by USB-to-Serial Converter Which is interfaced to Microcontroller for further processing. The controller will converted it into PWM signal send it to the LED driver for its amplification whereas LCD Connected with the Controller will display the status of the data transmission.

A. Computer System

Computer system which is used to provide the operation of image processing to be done at transmitter side by sending the image.

B. USB To Serial Converter

A USB adapter Converter is a type of protocol which is used for converting USB data signals to and from other communications standards. Commonly, USB adaptors are

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used to convert USB data to standard serial port data. The USB connector plugs into the computer's USB port. The data that are transmitted by the serial device are sent directly to the USB port.

C. Microcontroller (ATMega16)

A Microcontroller is a small computer on a single integrated circuit, microcontroller as are use in automatically controlled products and devices, it is being common integrated analog components needed to control non-digital electronics system.

ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family with low power consumption. Atmega16 is based on enhanced RISC (Reduced Instruction Set Computing) Know more about RISC and CISC Architecture) Most of the instructions execute in one machine cycle. Atmega16 can work on a maximum frequency of 16MHz.It has 16 KB programmable flash memory, static RAM of 1 KB and EEPROM of 512 Bytes. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000, respectively.

ATmega16 is a 40-pin microcontroller. There are 32 I/O (input/output) lines which are divided into four 8-bit ports designated as PORTA, PORTB, PORTC and PORTD. ATmega16 has various in-built peripherals like USART, ADC, Analog Comparator, SPI, JTAG etc. Each I/O pin has an alternative task related to in-built peripherals.

D. Op-Amp (Operational Amplifier-LM 324)

An operational amplifier (Op-Amp) is a DC- coupled high-gain electronic voltage amplifier with a differential input and, usually, a single-ended output. An Operational Amplifier (Op-Amp) is an integrated circuit that uses external voltage to amplify the input through a very high gain. Operational amplifiers. Amplifiers are devices which take a relatively weak signal as an input and produce a much stronger signal as an output.

The LM324 operational amplifier IC can be worked as a comparator. This a Low Power Quad Operational Amplifier and it has high stability, bandwidth which was designed to operate from a single power supply over a wide range of voltages.

E. LED Bulb

LED bulb is used as a medium which is used as a image transmission with high data rate. LED Bulb is cheap and fast optical device which can be used as light source as well as image transmission. The LED light appears constant to the human eye due to the fast flickering rate. The high data rate can be achieved by using high speed LED's. The working principle of LED is depended on Visible Light Spectrum which have optical carrier range 400THz (780nm) to 800THz (375nm) for Visible Light Transmission. Pulse Rate used by LED's is high for fast data transmission

2. Receiver

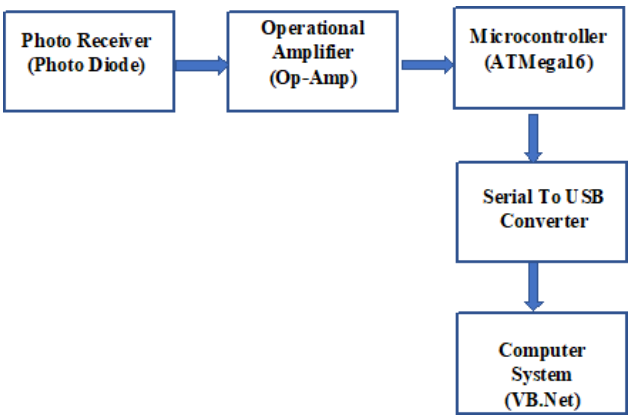

Fig 2. Image Receiver Module

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The Block Diagram of the Li-Fi Receiver Module is as shown in below figures 2.

Receiver Module: At Receiver side the encoded data signal through LED panel is received by Photodiode, the Photoreceiver will detect the digital data and decoded into the original format by the microcontroller which will sent to the microcontroller via USB to Serial converter.

A. Photo Receiver (Photo Diode)

A Photodiode is one type of light detector, used to convert the light into current and voltage based on the mode of operation of the device. Photodiode is a PN-junction diode that consume light energy to produce electrical current. Some time it is also called as photo-detector, A light detector. This diode is very complex to light so when light falls on the diode it easily changes light into electrical current.

IV. WORKING

High brightness LEDs are the heart of Li-Fi technology. The logic is very straightforward. If the LED is 'ON', binary data '1' is transmitted and if the LED is 'OFF' binary data '0' is transmitted. These LEDs can be switched on and off at high speeds, giving huge opportunities for transmitting data through LED lights.

- **Step 1:** Image is given as an input to the sender PC.
- **Step 2:** Image processing is done in the sender PC, the output of which is processed by the microcontroller connected to PC via a serial port.
- **Step 3:** Depending upon the output of microcontroller the led's connected to one of its port get toggled.
- **Step 4:** At the receiver side photodetection takes place using photodiode placed at the receiver end. The photo detector will register a binary '1' when the light is on and a binary '0' when the light is off.
- **Step 5:** Then the microcontroller at the receiver side conducts the binary conversion of the input data taken from phototransistor output.
- **Step 6:** This data is received by the receiver PC connected to microcontroller via serial port processed the data in order to reconstruct the send image at the receiver side.

V. HARDWARE AND SOFTWARE USED

A. Hardware Used

1. USB To Serial Converter
2. Microcontroller ATMega16
3. Op-Amp (Operational Amplifier LM324)
4. Photo Receiver (Photo Diode)
5. L293D LED Driver IC (Motor Driver)
6. Voltage Regulator (7805) 7. LCD (16x2)

B. Software Used

1. AVR Studio
2. PCB Artist
3. Win AVR

C. Language Used

1. VB.Net
2. Embedded C

Why Embedded C?

Embedded C is actually the extension of c language. Embedded C is one of the most popular and most commonly used Programming Languages in the development of Embedded system, there are many popular programming languages like Assembly, BASIC, C++ etc. Also Embedded C remain popular due to its efficiency, less development time and portability, Embedded system programming is different from developing application on a desktop computer. Embedded C is not different but C languages reduced version which is designed to work with small processor with low RAM etc.

1. It is easier to understand.
2. It performs the same task all the time so there is no need of any hardware changing such as extra memory or space for storage.
3. It performs only one task at one time.

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4. Hardware cost of embedded c system are usually so much low.
5. Embedded applications are suitable for industrial application.

VI. CONCLUSION

In future, data for laptops, smart phones & tablets can be transmitted through light in room by using Li-Fi. Researchers are developing micron sized LED which are able to flicker on & off around 1000 times quicker than larger LED. They offers faster data transfers and take up less space so we could save space or add more LED's to further boost the channel of communication. If his 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. This may solve issues such as the shortage of radio-frequency bandwidth and also allow internet where traditional radio based wireless isn't allowed such as aircraft or hospitals. One of the shortcomings however is that it only work in direct line of sight

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