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Visible Light Communication Using Li-Fi

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Abstract: ***The main problem during the data transfer is security. In early days various data transferring techniques has been used like wired data transfer, wireless data transfer, satellite based data transfer etc. But each techniques has some drawbacks like security, data transfer rate, data loss etc. The most important problem is the security and data breaching. In order to overcome these problems, Light Fidelity (Li-Fi) is introduced in this proposed work. It is a new technique to transfer secured data using lights. For data transfer, LED (Light Emitting Diode) is used, both in transmitting as well as in the receiving end. Light from the device that can display and communicates to the color sensor on the consumer product, it then converts the light into digital information. The speed is sufficient for the humans to visibly read a file. This portable device is more powerful and can be widely used for communication***
Key words: VLC, Li-Fi, White LED, Photodiode

I. INTRODUCTION

In order to communicate with devices, several methods of communication are followed and each method has its own drawbacks. One such method is the wireless medium of communication called as Wi-Fi. It has some issues in data transfer, data loss, security etc…. Hence Light energy communication using LED's is proposed. The LED assigns the binary value for 0 as OFF and 1 as ON. The light pulse is used for transmitting the data. The LED is very faster means of transmission and reception. The signals are transmitted via wireless communication and the photo diodes are used at the receiving end. The diode converts the optical light signal to electric signal. The visible Light Communication (VLC) uses the visible light source as a signal transmitter, air and/or water as the transmission medium and the photo-diode as a receiving component of signal. In VLC, transmission of data is done via illumination or visible light i.e. Data can be send through an LED light bulb or florescent light bulb that differs in intensity, so fast, that the human eye can't follow. VLC is the fast, cheap, easy to use, license free wireless communication system, it is the optical version of Wi-Fi and can be used both in indoor as well as outdoor. VLC uses visible light instead of Gigahertz radio waves for data transfer.

II. LITERATURE SURVEY

VLC is a popular research topic used for communication. In [3] 2014, the LED flash light is integrated with the system components for making appropriate connection. The flash light needs the focus to allow the strength of the signal to be turned with the signal distance between light source and object. The flashlight beam is turned on and off at the transmitting stage. The microcontroller, controls digital output and is used to switch the flashlight on or off. The microcomputers continuously get the images from the camera. By analyzing the detection values the image can be processed with the transmitter. The gray scale images apply the threshold value for the image and find the binary image and analyze the detection counters. In [4] 2010, the rectangular LED is divergence into light beam. Brightness levels are checked by the light meter for the position of the receiver. The brightness level is needed for the stronger illumination. The wavelength is 500nm in front of photodiode to suppress the LED radiation. The amplitude radiation is directly monitored with offline de-modulation. The channel frequency is response for the small signal of the wave propagation. It directly monitors the amplitude. The presence of the radio interface is enhanced with the noise frequency. The bit and power loading applied to subcarriers adapted to channel quality. Bit error ratio is retained over the transmission band. The electrical signal is received and passed through the high order anti aliasing filter. The beginning of the transmission block has the high fidelity modulated sub carrier. In [5] 2013 Multiple Input and Multiple Output (MIMO) are determined in the matrix format. It has low frequency, with relative average speed of the electrical amplitude; the frequency of the Signal Noise Ratio (SNR) is limited across the frequency spectrum. The low SNR reduces power with high SNR region. MIMO de-multiplexing process is equalized from the time domain of the first order equalizer. Error Vector Magnitude is measured with SNR. LED transmits random data that is encoded. In [2] 2009 the non imaging optical MIMO model is used and it is based on four LED array and it can be illuminated in the room which transmit independent data stream. Light from LED arrays can be received with different receivers. The transmitter

option controlled by channel matrix is known by the receiver. The blue LED emitter excites the yellow phosphor to create white emission.

III. MICROCONTROLLERS

A. *Pic Microcontroller*

The PIC microcontroller is one of the most commonly used microcontrollers. This controller is very convienent to use and the coding of this PIC microcontroller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it uses FLASH memory technology. It has a total of 40 pins and in which 33 pins are used for input and output. It is used in remote sensors, security & safety analysis and home automation system.

B. *Photo-Diode*

A photodiode is a semiconductor device that is used to convert the light waves into a current. The current is generated when the photons are absorbed from the light waves to photodiode. Photodiodes may contain optical filters, which used to convert the original information.

C. *LED*

An LED (Light Emitting Diode) is a electronic device, that emits light from the device when the electrical current is passed through it. It is energy efficient naturally and produces brighter light with less energy.

IV. PROPOSED SYSTEM

The system consists of the transmitter and the receiver end.

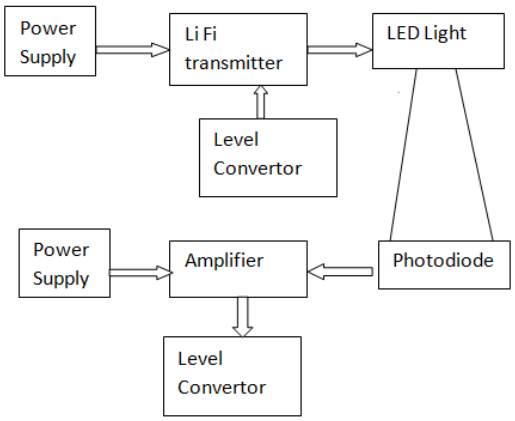

Fig 1: Architecture diagram

By using the proteus software the data communication is done from one system to another system, which sends and receives the information from the system itself. Data is send through the light. So it can be used for the communication without the internet facilities.

A. *Transmitter Circuit*

The transmitter circuit is used as a form of the microcontrollers. Firstly, the power supply is given to the devices. PIC microcontroller is used to send the data from the keypad and is used with the LiFi transmitter. The keypad information is send to the microcontroller, it sends the inform to the level convertor and it converts the original information into the binary format and sends the data to the LED lights. LED light capture the binary information and then sends it through the light. The transmitted data is viewed in the Liquid Crystal Display (LCD). The photodiode receives the information from the LED lights.

B. *Receiver Circuit*

From the receiver end, the photodiode receives the data from the LED lights. The power supply is given in the system. The received data is send to the controller and it is given to the level convertor, it converts the binary information into the original human understandable format. The microcontroller receives the information. The received information is viewed in the LCD display. The

Data transmission between the systems is completed without the internet connectivity instead using by using the Li-Fi technology. The data here is transmitted through light.

C. Physical Design

Rigidity of the case is without any sharp edges and the system is fit together with cabling being a part. It is portable.

1) *Accessibility:* Standard Tool less access on all clustered systems.
2) *Quality of power supply:* The quality of the power supply used is Dranetz-BMI Power Quality Analyzer
3) *Cooling Design:* Reduced the number of systems to do extensive testing on, thereby reducing the amount of time for testing in general.

V. RESULTS AND DISCUSSIONS

Feature	LiFi	WiFi
Operation	Using LED lights	Radio Waves
Speed	About 1 Gbps	WLAN is about 150Gbps
Frequency	10 thousand time frequency spectrum	2.4 GHz , 4.9GHz and 5GHz
Data Density	In high dense of environment	In low dense due to radio frequency
Cost	Low	Medium
Working	Binary data	Topologies
Security	Light blocked by walls	RF signals are transparent

The data was transferred at a rate of 9600 bits per second. This speed is sufficient for the humans to visibly read a file. The overall speed of each user is 1000 times greater. Thus Li-Fi, with its greater number of available access points, of light provides full channel data rates.

VI. CONCLUSION

This Proposed work describes the working of the LED based communication system. Through LED the data can be transmitted and using the photodiode it can be received. It is safe to use and it doesn't cause any of the health hazards. It provides higher bandwidth. There is good line of sight, hence it transfers data securely. The data transferred in the form of text and audios. Interfacing was done with the help of embedded C. LED is distributed with the room and irradiance the light for wide range. This portable device is more powerful and can be widely used for communication. Thus Infrared represents the best choice for communication.

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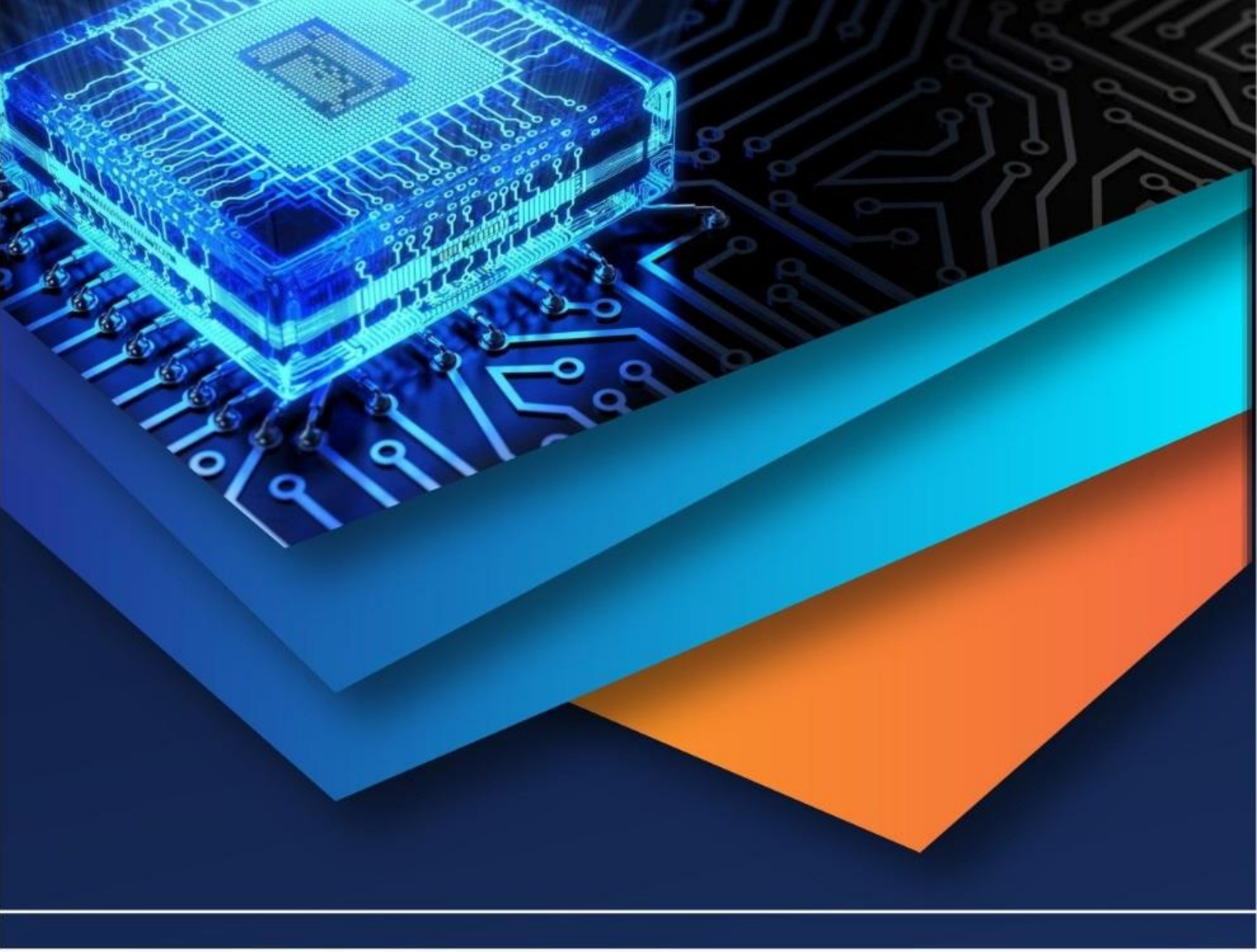

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