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Visible Light Communication Between Two Devices Using Li-Fi Technology

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ABSTRACT: The main objective of this project is to transmit the data 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. In this report, a prototype of real-timevideo broadcast system using inexpensive commercially available light emitting diode (LED) lamps is proposed. Experimental results show that real-time video 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.Wi-Fi innovation is getting greater and greater today. Each open spot and private office have Wi-Fi in light of the fact that the remote range is impeded habitually. Because of the effectiveness, RF impedance is getting more normal, defeating this issue, the presentation of light fidelity (Li-Fi) innovation. Li-Fi utilizes LED light sources to communicate information remotely. This strategy is also called VLC(Visible Light Communication) Build up another method of utilizing Li-Fi as a remote specialized technique. This is a cunning method to give broadband access. Visual light correspondence is utilized to move information from a host PC. The photodetector will go about as a beneficiary. Li-Fi goes about as a remote interface among transmission and beneficiary. In this project we are going to monitor the patient and update the condition of the patient using Li-Fi technology.

I.INTRODUCTION

Li-Fi is a method of data transmission that eliminates the fibre in fibre optics by transmitting data through an LED light bulb that changes intensity faster than the human eye can track. Some have coined the term Li-Fi to explain the quick and cheap wireless communication device that's the optical equivalent of Wi-Fi. Harald Haas coined the word during this sense in his Teddy boy international speak on visible radiation Communication. “You transmit a digital 1 if the LED is on, and a 0 if it is off,” Haas explains. “They can be turned on and off very easily, which provides pleasant opportunities for transmitted data.” By changing the rate at which the LEDs turn on and off to produce different strings of 1s and 0s, data can be encoded in light. The output tends to be constant since the LED amplitude is modulated at such a high rate that the human eye cannot detect it. With more advanced techniques, the data rate of VLC could be greatly increased. The University of Oxford and therefore the University of Edinburgh supply courses on parallel information transmission mistreatment AN array of LEDs, with every diode sending a special information stream. Another cluster is experimenting with totally different red, green, and blue diode combos to regulate the sunshine frequency and cipher a special information channel. Li-Fi, as it has been dubbed, has already achieved blisteringly high speeds within the work. Researchers at the physicist Institute in Berlin, Germany, have achieved information rates of over five hundred megabytes per second employing a regular white-light diode. The technology was incontestable employing a try of Casio good phones to exchange information mistreatment light-weight of varied intensity emitted from their screens, detectable up to 10 meters away, at the 2012 client natural philosophy Show in urban centre.

Light is of course secure and may be utilized in areas wherever frequency communication may be a concern, like craft cabins or hospitals. As a result, actinic radiation communication has the potential to not solely solve the matter of spectrum deficiency, however additionally to permit novel applications. The actinic radiation vary is untapped; it's unregulated and may be used for high-speed communication.

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Figure1.Li-Fi Environment

The Li-Fi pool was based in Gregorian calendar month 2011 by a gaggle of firms and business organisations to support high-speed optical wireless systems and to deal with the restricted quantity of radio-based wireless spectrum accessible by employing a totally different portion of the spectrum. The pool claims that speeds of quite ten Gbps square measure doable, doubtless granting the transfer of a high-definition film in thirty seconds.

II.LITERATURE REVIEW

1. Using commercial phosphor-based white led for visible light communication:

We show a high-speed visible light communication system using a commercially available high-power phosphor-based white light LED. Using obtained eye diagrams, a passive post-equalizer circuit for the blue LED component is designed to achieve a high 3-dB modulation bandwidth of up to 85 MHz, as well as a transmission rate of 250 Mbps using On-Off Keying.In a high-speed visible light communication system, a commercially available high-power phosphor-based white light LED is used.

2. Patient Monitoring System using Li-Fi:

It shows a patient care system that uses Li-Fi technology. The abbreviation for Light Fidelity is Light Fidelity. Harold Haas, a German physicist, suggested Li-Fi technology, which transmits data by lighting at differing intensities faster than the human eye can detect. Li-Fi is a bidirectional, high-speed, and fully networked wireless optical networking system based on visible light. These sensors collect data from the human body and translate it to digital form using an analogue to digital converter. The data of these sensors is received by the microcontroller. This project makes use of an AVR microcontroller.

3. Patient Monitoring in Hospital Using Li-Fi:

Li-Fi is a type of bidirectional, high speed and fully interconnected wireless optical Networking in visible light communication. To avoid frequency contact with the human body, the proposed model uses the Li-Fi concept rather than Wi-Fi technologies to help in hospital patient monitoring. This model uses temperature, pulse, glucose, and respiration sensors to perform its functions. These sensors collect information from the human body, which is then converted to digital form using an analogue to digital converterbefore being sent to the microcontroller. This project makes use of the PIC16F877A microcontroller.

No.	Paper Title	Author Name	Key Points	Remark
1	DATA COMMUNICATION BETWEEN TWO PCS USING LI-FI TECHNOLOGY	Dr. Latha R, Sowmya P, Sumith Mandolkar, Dr. Sanjana Prasad, Shaikh Asadur Rehaman, Nischitha CH	The system was tested for different distances to perceive the maximum range without transmission error. Different tests which were carried out with the phototransistor were found to be satisfactory. The maximum distance obtained without transmission error is 15 centimetres.	The proposed system has accomplished the transfer of text data between two computers. As internet is not required for any of its software the bandwidth is also conserved, hence reducing the network complexity. With the Development of the technology, and its application for the industrial use.
2	Transfer Data from PC to PC Based on Li-Fi Communication Using Arduino	Zahraa Tareq Aldarkazalya, Manal Fadhil Younusb, Zainab Salim Alwanc	This research performed a precise analysis and identified the most Li-Fi features compared to Wi-Fi to implement a wireless system capable of transmitting text data between two computers using Li-Fi technology.	The proposed system has accomplished the transfer of text data between two computers, but transferring large multimedia files like (images and video) is still the main point of our concern.
3	Performance Analysis of Integrating Wireless Sensor Network with Li-Fi Wireless Communication Technology	Helmy Milad Helmy Shenoda, Nabil Abd-Rabou Abd-Elaziz, Hala Mohamed Abdel Kader, Aya Hossam	Optical Wireless Communication, Visible Light Communications, Free Space Optical, Light Fidelity, Non-Orthogonal Multiple Access, Wireless Sensor Networks, Energy Efficiency[3].	. Li-Fi technology holds the solution to various short comings of existing radio based wireless communication systems.

III.WORKING TECHNOLOGY

Harald Haas of the University of Edinburgh, UK, first presented this brilliant concept in his TED Global talk on VLC. “It's really clear, if the LED is on, you transmit a digital 1, and if it's off, you transmit a 0,” he explained. The LEDs can be turned on and off easily, providing excellent data transmission opportunities.” So all you need are some LEDs and a controller that can programme data into them. Depending on the data we want to encrypt, we simply need to change the rate at which the LEDs flicker. This approach can be improved further by using an array of LEDs for parallel data transmission or by combining red, green, and blue LEDs to change the light's frequency, with each frequency encoding a different data path. Such developments pledge a theoretical speed of 10 Gbps, implying that a complete high-definition film can be downloaded in less than 30 seconds. Simply amazing! However, blazingly high data speeds and dwindling bandwidths around the world aren't the only advantages this technology has. Since Li-Fi relies solely on light, it can be used safely in aircraft and hospitals where radio waves can cause interference. Imaginehaving the ability to urge public net access by hovering below a street light-weight, or downloading a picture show from your table lamp. there is a new technology on the block that would 'shed light-weight on' a way to satisfy the ever-increasing demand for high-speed wireless networking, each virtually and metaphorically. in an exceedingly new information transfer system called Li-Fi, radio waves are replaced

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by light-weight waves. Since light-emitting diodes will activate and off quicker than the human eye will understand, the sunshine supply seems to air all of the time.

1 ANALYSIS OF THE RELATIONSHIP BETWEEN Li-Fi AND WLAN

Light that can be seen The method of transmitting information wirelessly using rapid bursts of light is known as communication. As a means of touch, LED lighting may be used. The LED production appears constant to the human eye due to the fast flickering rate. Using high-speed LEDs and reliable multiplexing techniques, a data rate of more than 100 Mbps can be achieved. The data rate of VLC can be increased by using LED arrays to transfer data in parallel. Each LED emits a distinct data stream.

TECHNOLOGY	SPEED	DATA DENSITY
WIRED		
FIRE WIRE	800 Mbps	*****
USB3.0	5 Gbps	*****
THUNDERBOLT	2X 10 Gbps	*****
WIRELESS (CURRENT)		
WI-FI-IEEE (802.11N)	150 Mbps	*
BLUETOOTH	3 Mbps	*
IrDA	4 Mbps	***
WIRELESS (FUTURE)		
Wi-Gig	2 Gbps	**
Giga-IR	1 Gbps	***
Li-Fi	>10 Gbps	****

Table 1. Comparison between current and future WLAN technology

According to the table, Wi-Fi, Bluetooth, and IrDA are some of the most recent wireless technology that can be used to relay data between users. Only Wi-Fi currently offers incredibly fast data rates. The IEEE 802.11n specification allows for up to 150 megabits per second in most implementations (the standard allows for up to 600 megabits per second theoretically), but in practice, you'll get even less. It's worth remembering that optical technology is used in one in every three of these. Li-Fi technology, which is based on LEDs, is used to transmit data. Every kind of light can be used to transmit data, regardless of which part of the spectrum it comes from. Any type of light, from any part of the spectrum, can be used to transmit information. Li-Fi, or light fidelity, is a term used to describe 5G visible light communication systems that, like Wi-Fi, use light from light-emitting diodes (LEDs) as a medium for networked, mobile, high-speed communication. The Internet of Things, in which every electronic device is connected to the internet and the LEDlights on such devices are used as internet access points, may be a product of Li-Fi. From 2013 to 2018, the Li-Fi market is expected to grow at an annual rate of 82 percent, reaching a value of over $6 billion. The human eye cannot sense visible light communications (VLC) signals so they transform on and off lights in nanoseconds. Although Li-Fi bulbs must be switched on to transmit data, they can be dimmed to the point that they are no longer visible to humans while still transmitting data. Light waves have a far narrower range than Wi-Fi because they cannot travel through walls, but they are more secure against hacking. To send a signal, Li-Fi does not need a clear line of sight, and light reflected off walls can exceed 70 Mbps.

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Li-Fi has the upside of having the option to be utilized in electromagnetic touchy zones, for example, in airplane lodges, clinics and thermal energy stations without causing electromagnetic impedance. Both Wi-Fi and Li-Fi send information over the electromagnetic range, however though Wi-Fi uses radio waves, Li-Fi utilizes obvious light. While the US Federal Communications Commission has cautioned of a potential range emergency since Wi-Fi is near full limit, Li-Fi has basically no impediments on limit.

IV.PROPOSED SYSTEM

We suggested a project that already exists in the hospital community. This is solely for data transmission in the medical field.The light signal is used in hospitals to relay data; since it is not EM waves, it has no effect on humans.

- The light signal is used in hospitals to relay data; since it is not EM waves, it has no effect on humans.
- Using Li-fi as a wireless medium, data transfer between microcontrollers from sensor to PC.
- LEDs use short light pulses to relay data wirelessly.
- Data transfer at a high rate.
- The rate of bit errors is lower.

ADVANTAGES

- Data Transmission between microcontrollers from sensor to PC using Li-fi as a wireless medium.
- LED uses fast pulses of light to information wirelessly.
- High speed data transmission.
- Bit Error rate is less.

Block Diagram of Proposed System

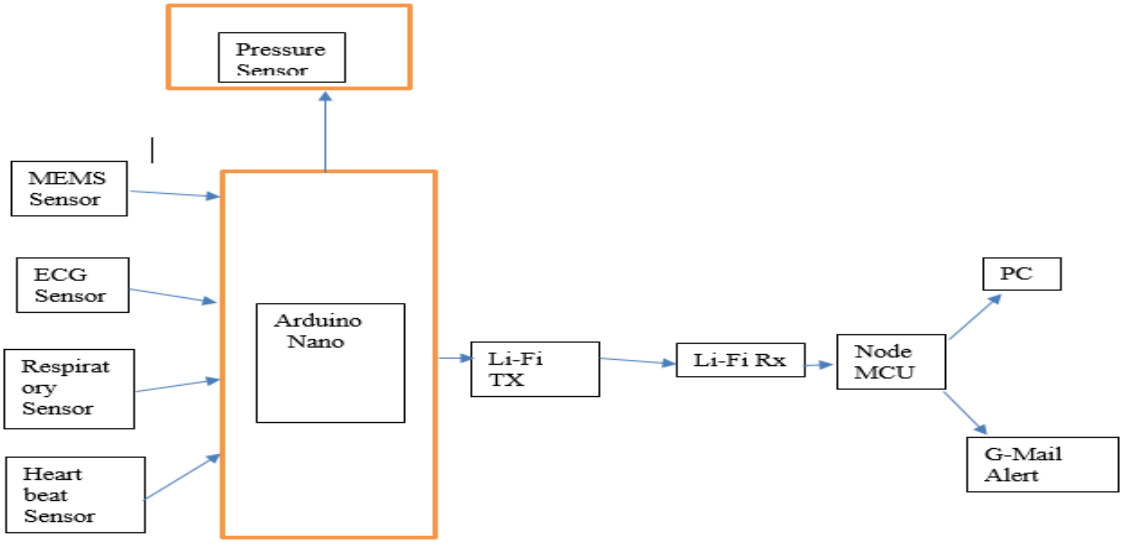

Figure 2. Block Diagram of Proposed System

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Working Principle

LIFI is a modern form of high-intensity light source in solid conditions that offers clean lighting solutions for general and special lighting applications. In terms of energy consumption, a long usable life, full spectrum and dimming, LIFI illumination systems exceed the conventional approaches. This technology brief describes both the general construction of LIFI lighting systems and the basic blocks of technology that allow them to operate.

LIFI CONSTRUCTION

The Li-Fi product is divided into four main sub-assembilies

- Printed Circuit Board (PCB)
- Bulb
- RF Power Amplifier Circuit (PA)
- Enclosure

The lamp's electrical inputs and outputs are regulated by the PCB, which also houses the microcontroller that manages the lamp's various functions. The solid state PA generates an RF (Radio Frequency) signal that is directed through an electric field around the bulb. The high concentration of energy in the electric field causes the contents of the bulb to vaporize, resulting in a regulated plasma state at the bulb's base, which producesan intense source of light. An aluminum enclosure contains all of these subassemblies.

The Sub-Assembly Bulb Feature

At the core of LIFI is the bulb subset, which contains a screened bulb in a dielectric material. This idea outperforms conventional sources of light using degradable bulb electrodes. The dielectric material has two functions: firstly, the RF energy transmitted by the PA is a wave guide, and secondly it acts as a concentrateur for the electric field which concentrates energy in the bulb. The energy of the electric field heats the material in the bulb rapidly into a plasma state which gives full-spectrum, high intensity light.

Light Fidelity Applications:

Li-Fi has a variety of uses, including aviation, green information technology, multi-user connectivity, and underwater ROVs, among others. It also has a number of benefits, which are addressed in this project study. This Li-Fi report can only be used for research and reference.The LIFI light source's design and construction allow performance, long-term stability, digitally regulated full spectrum intensity, and ease of use.

Alternative to Radio Waves in Electromagnetic Spectrum

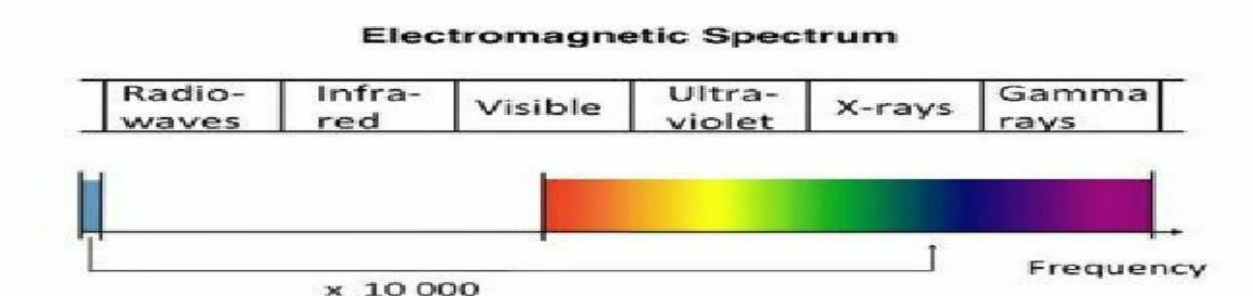

Figure 3.Electromagnetic Spectrum

- Since gamma rays are extremely harmful, they cannot be used for our contact purposes.
- X-Rays are useful in hospitals but cannot be used at home.

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- Ultraviolet rays are often beneficial to our skin, but they are harmful if used for an extended period of time.

V.CONCLUSION AND FUTURE SCOPE

CONCLUSION

Li-Fi is becoming a more fitting network for next-generation hospital health facilities. The implementation of Visible Light Communication (VLC) in HMS is illustrated in this document using a prototype model. The Li-Fi network can be used as a high speed, safe and accurate human body data communication device to track human body data in real time of heartbeat, blood pressure, temperature, and pressure, as well as other parameters.The application of this technology in the field of medicine allows for faster diagnosis and internet access through radio wave-based apparatus. The proposed system is entirely automated, and if it is introduced effectively, it will be a watershed moment in the medical industry.

FUTURE SCOPE

Since light is ubiquitous and free to use, there is a lot of room for Li-Fi technology to develop and evolve. Each Li-Fi Bulb will be able to transmit data until the technology matures. As Li-Fi technology becomes more widely used, it will result in a communication system that is cleaner, greener, more cost-effective, and safer. While Li-Fi is committed to tackling problems like radio frequency bandwidth deficiencies and removing restrictions on radio communications technology.In the medical sector, WIFI is not suitable for use in hospitals or other health-care facilities because it uses radio waves, which reach the human body. LIFI can be applied and is an excellent substitute in this industry.

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