LIGHT COMMUNICATION NETWORK FOR REAL TIME MONITORING IN HOSPITAL MANAGEMENT

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ABSTRACT

In the fast-paced world stuffed with technology, to contend with human eye German scientist Harald Haas in 2011 planned a technology which might modification everything the wrong way up error free within the entire world that is Li-Fi lightweight Fidelity information through illumination. Within the Pandemic state of affairs once doctor's square measure afraid to travel close to and attend patients Li-Fi plays a significant role in watching patients. By implementation of this technology, high volume of information is transmitted at extraordinarily high speed because it offers higher information measure. It additionally ensures potency, security, yet because the quality of the the device. for example once doctors cannot move go in corridors, waiting rooms, patient rooms and in operation theatres, Li-Fi technology can permit a light-weight communication network, which can take away magnetism interference problems from good phones and thus the utilization of Wi-Fi in hospitals. Li-Fi may also be used for real time watching and report of patient movement and important signs while not the necessity of wires. We tend to additionally discuss new applications that Li-Fi will unlock within the future.

Keywords: Li-Fi Technology, Security, Pandemic, Monitoring

I.INTRODUCTION

The emergence of Li-Fi is to beat the shortage of the present technology. We all know that immediately Wi Fi is that the most used technology to attach many devices to the web. As time comes by, the utilization of internet based devices is increased. This increasing made the capacity of Wi-Fi is reduced due the limitation of frequency resources.

The term Li-Fi was first coined by the University of Edinburgh, however, this technology was first introduced by Herald Has, a German professor, and physicist. He introduced and demonstrated it at a TED talk in July 2011. He believed light bulbs could act as wireless routers for Data transmission. His demonstration showed how changes in the amplitude of a light bulb at high speeds can be used for energy transmission. He demonstrated the use of LED for the transmission of a high definition video and then showed the same video to the audience. He also formed a company later on by the name of pure LiFi. Since then the use of this wireless technology has increased, now being deployed in more than 20 countries. Li-Fi (also referred to as light fidelity) may be a technology for the wireless transmission of knowledge between devices Li-Fi uses light as a medium for transmission of knowledge. LED lamps are the source used for encoding data by switching the light on and off during regular intervals to create a binary code. This is transmitted to the other end where the receiver decides it. Li-Fi has a huge potential in data transmission since it uses simple LED bulbs to transmit data.

1 COMPONENTS OF A LI-FI SYSTEM:

A Li-Fi system had two main components.

1. A transmitter (most likely a LED lamp)
2. A receiver (used to decode the received data)



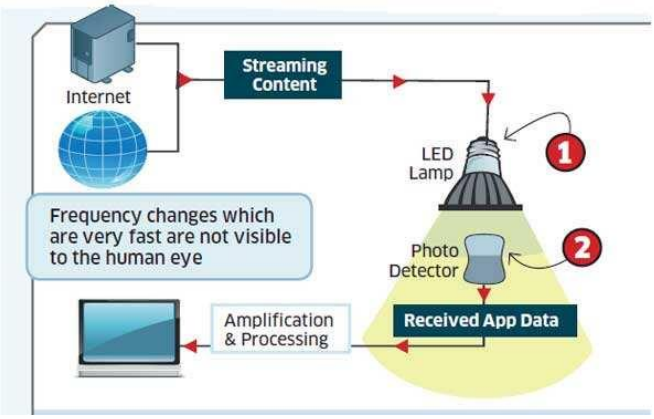
1.1 LI-FI vs WI-FI:

Li-Fi and Wi-Fi are both used for wireless communication and transmission of knowledge. However, they differ in the medium used. Wi-Fi, for instance, uses radio waves transmitted over modems whereas on the opposite hand Li-Fi uses light from LED bulbs for transmission and receiving of knowledge.

1.2 LI-FI ARCHITECTURE:

Li-Fi is a VLC (visible light communication) system. It uses a photo Detector (photodiode) to detect incoming signals and decode the data received into digital form. The LED light bulb uses a fast alternating stream of dim and bright signals that are invisible to the human eye.

First, data is fed to the LED bulb. The bulb operates on signal processing technology so it is capable of sending the data in an embedded format high rapid speed to the Detector which in this case is the photodiode. The photodiode then converts the incoming beam of light into electrical signals. The electrical signals are then converted into streamable data.



The scope for wireless communication in the medical field is set on the rise; there are many devices which work on Wi-Fi such as infusion pumps, defibrillators, lung ventilators and anesthesia machine. When a doctor is supposed to use MRI scanners along with infusion pumps, which work on Wi-Fi there results a frequency overlapping problem. With more and more number of wireless medical devices coming up, utilizing the RF spectrum increases which leads an electromagnetic interference that results in potentially hazardous events related to medical equipment operations.

Apart from the interference with medical equipment, an electromagnetic interference affects human body also in the form of diseases, immune dysfunction, EM hypersensitivity etc. and in worst case, it may lead to cancer. Another major drawback of Wi-Fi in hospital system is its security issue. Patient information must be private and secure but remain accessible to authorized persons. By using WI-FI in hospital where both EMI sensitivity and security of medical details are major issues. To combat the above limitations of Wi-Fi in health monitoring system, Li-Fi is used, which is a novel technology for high density wireless data coverage relieving radio interferences in confined areas.

2. LI-FI COMMUNICATIONS IN HOSPITALS

Communication requirements increases in hospitals, Wi- Fi communication devices produces Radio frequency spectrum which is harmful for everybody. So now we want to replace this wi- fi communication via Li- Fi

In hospital, there are many devices which work on Wi-Fi such as infusion pumps, lung ventilators. Apart from the interference with medical equipment, an EMI affects human body also in the form of diseases like immune dysfunction in worst case, it may lead to cancer.

Constant monitoring of patient's health condition in hospital is either manual or wireless fidelity (Wi-Fi)-based system. Wi-Fi-based system becomes slow in speed due to exponentially increased scalability. In this scenario, light fidelity (Li-Fi) finds the places wherever Wi-Fi is applicable with additional features of high speed data network. This experiment proposes an application of Li-Fi network in the hospital for monitoring the patient's conditions such as temperature, heartbeat using respective sensors. The collected data from the sensors is transmitted to the sink, and further these data are processed using microcontroller and display the output in the system.

A Li-Fi-based health-care monitoring hospital system secure patient's body from attack of many types of disease, as the resistance power of patients, is very low. Not only improving the patient's health conditions but also communications among the physicians and clinicians. Wireless technology with LiFi system enables clinicians to monitor patients remotely and give them timely health information, reminders, and support. Li-Fi technology ameliorates medical field to the next level.

3.ADVANTAGES OF LI-FI TECHNOLOGY:

- ✓ **High speed:** Compared to Wi-Fi technology, Li-Fi technology is the fastest. It has the capability to transmit data up to 100 Mbps or 1 Gbps. This means you can download a high-definition video in seconds.
- ✓ **Higher capacity:** Compared to Wi-Fi, Li-Fi can keep up the demand of wireless data networking. After all the increase in radio frequency spectrum occupancy has limited the capacity of data transmission. This is why Li-Fi could lead on to new opportunities and a better capacity of knowledge transmission as compared to Wi-Fi. The visible spectrum used in the transmission of data is much greater than the radio waves spectrum; therefore, it has a greater capacity.
- ✓ **Better security:** By using Wi-Fi radio waves are penetrable and can be intercepted by unwanted people, On the other hand, Li-Fi is much more secure as the signals are confined to the same room and cannot be intercepted easily.
- ✓ **More efficient:** Since the Li-Fi systems use LED lights which are already installed in majors of our homes and commercial areas, therefore, is an efficient use of energy as compared to Wi-Fi.
- ✓ **Free from Interference:** Wi-Fi networking faces problems of neighboring network interference or radio interference whereas Li-Fi is free from all types of interferences that could affect Wi-Fi system and are therefore more efficient for use.

II. LITERATURE SURVEY

Dr. Harald Hass provided a deep insight in this technology, He introduced an illustration of Li-Fi in the year 2011 at TED Global Conference in Edinburgh, and he demonstrated the use of Li-Fi and advantages of Li-Fi over Wi-Fi. His research led many people to work upon this technology [1]. After that Liang Yin (student member IEEE) together with Prof. Harald Hass made an attempt to show the clear difference between visible light communication (VLC) andlight-fidelity(LiFi),Further they enlightened us how LiFi takes VLC by the use of light emitting diodes [2]. Harald Hass in the month of December in year 2013 worked upon the Li-Fi modulation and networked Li-Fi attocell concept, along with Prof. Svilen Dimitrov, Prof. ThiloFath, Prof. Irina Stefan and many others contributed to make this technology a big success [3]. Eugene C Nelson professor, Elena E ftimovska researcher in the year 2014 researched about the Clinicians understanding of the effect of disease and treatment on patient's daily lives is poor.

In response to this problem, over the past three decades, hundreds of standard is edmeasures have been developed to capture patient reported outcomes, including symptom status, physical function, mental health, social function, and well being. However, the patient reported outcome measures (PROMs) movement has largely been driven by the agenda of researchers or service payer sandhas failed to focus effectively on improving the quality of care from the patient's perspective [4].

III. PROBLEM STATEMENT

With a well known fact that radio frequencies are harmful for human beings and can create many other health issues our proposed technology uses LED's for data transmission which acts as a catylst in increasing the speed of data transmission and reduces the power consumption and with wide range of bandwidth.

IV. EXISTING SYSTEM

As like our traditional method, the Temperature, Pressure, Heart Beat and Pulse of the patients in ICU are noted by sensors and monitored with the help of computer or the readings are taken manually. In the pandemic situation when the Doctor's cannot move frequently from room to note a patient's minor changes in Temperature, Pressure etc. the eco-friendly technology called Li-Fi has bloomed into existence as a blessing in this pandemic , where many devices in a room can exchange data using light with which more lives can be saved. This is called as Visible Light Communication (VLC).

V. PROPOSED SYSTEM

More attention is required when a patient is in ICU, where continuous monitoring is mandatory. With sensors the Heart Beat, Pulse rate can be sensed. Sensed Analog signals are converted into Digital form and are stored in a Microcontroller. From the microcontroller the data is transmitted through the Light i.e., LED Bulbs and received by a Photo detector. The receiver which is placed in the separate room, containing Universal Asynchronous.

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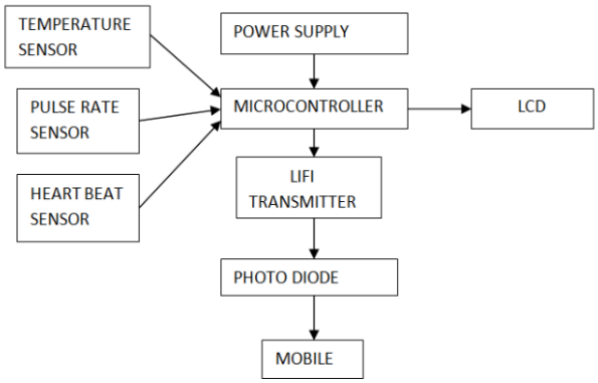
WORKING OF LI-FI



In the proposed system the patient is monitored using LiFi instead of Wi-Fi. The objective of the system is to monitoring the pulse rate and temperature of the patient using LI-FI. The sensed data is then converted into digital form in the microcontroller. The microcontroller that is used here is the Arduino Nano microcontroller (ATmega328). The output from the microcontroller is fed to the Li-Fi module which transmits the data in the form of light and the receiver end collects this data and display the output in the system. The transmitter consists of the LED bulb and the receiver consists of a solar panel. The Operating Voltage (logic level) used here is 5 V. The input voltage recommended is 7-12v and the limited input voltage value is 6-20

VI. MODULE DESCRIPTION

Arduino IDE, which is used to write and upload the computer code to the physical board Arduino is a prototype platform based on an easy-to-use hardware and software. It consists of a circuit board, which can be programed. LM35 Temperature Sensor is used which is a semiconductor based sensor. The transmitter is used to receive a signal from the PC using USB Cable then from GPIO pins on the Arduino, this signal controls the transistor which open and close the power supply to the LED. The receiver converts the incoming light into an electrical signal and feeds it into the microcontroller. The receiver filters and amplifies the signal. And, a solar panel is connected with the receiver to transmit the data.

A. TRANSMITTER SECTION

The power supply is converted from AC to DC using the step down transformer from 230V to 5V DC with the bridge rectifier; the voltage regulator LM7805 is used, filter capacitor of 1000muF is used to filter the noise produced from circuit. Three sensors –heartbeat, temperature sensors are connected to Arduino NANO (AT-MEGA 328) microcontroller shown FIG: 6.4.1. In the heart beat sensor the pulses are recorded based on optical power variation as light is scattered or absorbed during its path through the blood as the heart beat changes. Temperature sensor LM35 is used to measure temperature of patient with electrical output proportional to Celsius. The readings of the respective sensors are displayed on the system.

B. TEMPERATURE SENSOR

The temperature sensor that is used in the proposed model is LM35. It is a thermistor that is used to measure temperature of patient. Temperature sensor LM35 can be used to measure body temperature. The electrical output is proportional to the temperature in Celsius. With the current variations the temperature of the patient is measured. The transmitter is used to receive a signal from the PC using USB Cable then from GPIO pins on the Arduino, this signal controls the transistor.

C. HEART BEAT SENSOR

It consists of a bright red LED and a light detector. When the finger is placed close to the sensor a certain amount of light passes through the finger and depending upon the intensity of the light detected in the detector the current is produced accordingly. When no finger is placed brighter light intensity is detected by the detector. So based on the current variations the pulses are recorded and data is obtained.

D. RECEIVER SECTION

A photodiode is used as a receiver in this section which works as a light to electricity convertor. In the receiver section the data transmitted is received with the help of photo detector the receiver section is kept line of sight to the transmitter. The transmitted data is collected and transmitted to the system. The receiver converts the incoming light into an electrical signal and feeds it into the microcontroller. The receiver filters and amplifies the signal. And, a solar panel is connected with the receiver to transmit the data.

VII. CONCLUSION

In the Pandemic situation when necessity of saving life is more important, Technology plays an important role where LIFI saves lives of many. With a greater bandwidth it secures data and helps the mankind immensely. A low cost, harmless, user friendly LiFi based advanced patient monitoring system is developed. The purpose of this paper is to help those peoples who need help in emergency in remote location as fast as possible When a controller detects abnormalities in the patient's health at that time it gives intimation to the doctor via Li-Fi so the fast treatment can be provided by the doctor.

We proposed a biomedical sensor based system by which we are getting some necessary parameters of patient such as temperature, blood pressure and heart rate. As the sue of radio frequencies are restricted in hospitals so we are using LiFi for communication. Patient data is send to doctor via LiFi communication. This system is much useful in hospitals.

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