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Enhanced Li-Fi Based for The Detection of Covid Patients

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ABSTRACT

In this pandemic situation public has faced a lot of difficulties and it was the toughest job for doctors as well as all health workers and attendees to be available along with the patent in their daily life, while they were suffering from any disease or physical disorder. So, constant monitoring of the patient's body parameters such as breathing rate, body temperature, pulse rate, etc. becomes difficult. Generally, in ICUs nurses take care of irregularities of the health parameters of the patient but could not be possible for them to stay 24/7. So sometimes in the physical absence of a caretaker, the health of the patient becomes abnormal/critical from the normal condition. To overcome this situation we have proposed an automatic low-cost microcontroller & intelligent Wireless LIFI based advanced patient monitoring system that continuously monitors in the regular interval of time measuring the intensive parameter of the patient's health and if any abnormal condition occurs, it directly sends a message to the doctor's base station machine through LIFI with particular ward number along a patient number of a patient will be notified to doctor if the health parameter is out of normal range, by this alert message, a doctor can do the fast assessment to the patient's health without wasting the time.

Key Word: Arduino, sensors, LI-FI transmitter, LIFI trans receiver, body temperature, pulse rate, and breathing rate, LED

I. INTRODUCTION

LIFI is a wireless optical networking technology that uses a light-emitting diode for data communication, LIFI is designed to use LED light bulbs similar to those currently in use in many energy-conscious homes and offices, Generally in ICU nurses are taking care of irregularities and the health of the patient but they may not be available for taking care of patient's health 24/7, we have projected an automatic low-cost microcontroller & intelligent Wireless LIFI based advanced patient monitoring system which continues in the regular interval of time calculating the concerted parameter of the patient's health and if any irregular condition occurs. The abnormal condition of health of the patient, via measurement from the sensors and through LIFI,

it provides a message of the abnormal condition of the patient's health. So, the doctor can make easy

treatment for the patient's health LIFI is used for message transmission or we can say for communication of the microcontroller with the doctor for any unusual condition of the patient's health

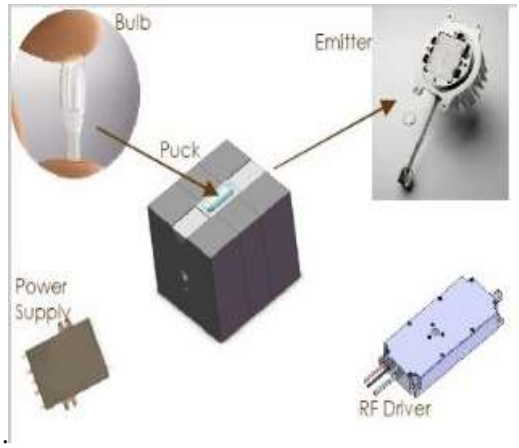

Fig1.System design of L

II. LITERATURE SURVEY

There are very few researchers woked on LIFI technology in [1] author postulated Li-Fi technology during his appearance at TED Talk Global 2011. It was at this step that he was able to highlight one of the newest pieces of technology that is able to transmit high volumes of data at high-speed ability with only the use of overhead lighting. In [2] author observed the Difference Between The Visible Light Communication and Li-Fi.The visible light communication (VLC) and light-fidelity (LiFi). In particular, it will show how LiFi takes Visible Light Communication further by using light- emitting diodes (LEDs) to realize fully networked wireless systems. Synergies are attached as luminaries become LiFi atto-cells, resulting in improved wireless capacity, providing the necessary connectivity to realize the Internet of Things (IOT), and contributing to the key performance indicators for the fifth generation of cellular systems (5G) and elsewhere. In [3] The Li-Fi Modulation and Network Li-Fi Attocell Concept. The cellular Light-Fidelity (Li-Fi) network is considered as a promising approach for high- speed indoor data access. The conventional metric, based on which an access point (AP) is selected for each user, is signal strength. This metric suggests the best channel quality for each user, but does not guarantee the achievable data rate since the resource of an AP is limited. In [4].Design as well as Development of PIC Microcontroller based Wireless Architecture for Human Health Monitoring The implementation of PIC microcontroller based wireless architecture for human health observing system using the two sensors are used, namely temperature and pulse heart rate. The temperature sensor is used to continuously monitor the body temperature. The pulse heart rate sensor is used to measure the heart rate by sensing the change in blood volume in a finger artery while the heart is pumping the blood. In [5]. A wireless body area network of intelligent motion sensors for computer assisted physical rehabilitation .New technological advances in integrated circuits, wireless communications, and physiological sensing allow miniature, lightweight, ultra-low-power intelligent monitoring devices. A number of these devices can be integrated into a Wireless Body Part Network (WBAN), a new supporting technology for health monitoring.In [6]. Activity and location recognition using wearable sensors With stately stepping-up and pointed speed data collected through low priced ,wearable devices, this dead-reckoning method can determine a user's location, detect transitions between preselected locations, and recognize and classify sitting, standing, and walking behaviors. Experiments establish the proposed method's effectiveness. In [7]. Body Area Sensor Network based Health Monitoring System
The improvement in the field of wireless technology in modern years has Led to a wide change of applications. Wireless sensor networks have been an active do-research topic for around a decade now. Moving from early do research in military applications, these are now widely arranged in diverse applications with the health monitoring system. Body-area sensor network is one of those innovative applications, which assist in monitoring of biomedical parameters of a person wearing it. The main purpose of this is to make it potential for a patient requiring permanent monitoring yet to be fully mobile .In [8]. Secured LIFI Upcoming electric lights will be contained of white LEDS (light-emitting diode).White light emitting diodes with high power output are predictable to serve in the next generation of lamps. An indoor, visible data broadcast system consuming white-led lights is proposed. In the system, these devices are used not only for enlightening rooms but also for an optical wireless communication system. This system is appropriate for private networks, such as consumer communication networks. However, it remains essential to examine the properties of white light emitting diodes when they are used as optical transmitters. Based on numerical consideration rand computer simulations, it can be used for indoor optical transmission. Moreover, protected transmission is possible using steganography and password prompt for exchange

III. MATERIAL AND METHODS

The Architecture of LI-FI system
LI-FI which can be the future of data communication appears to be a fast and cheap optical version of Wi-Fi. Being a Visible Light Communication (VLC), LIFI uses visible light of electromagnetic spectrum between 400 THz and 800 THz as an optical carrier for data transmission and illumination. It uses fast pulses of light to transmit information in the wireless medium. The main components of a basic LIFI system may contain the following:

A high brightness white LED acts as a transmission source

A silicon photodiode with a good response to visible light as the receiving element.

Switching the LEDs on and off can make them generate digital strings with different combinations of 1s and 0s. To generate a new data stream, data can be encoded in the light by varying the flickering rate of the LED. In this way, the LEDs work as a sender by

modulating the light with the data signal. The LED output appears constant to the human because they are made to flicker at a phenomenal speed (millions of times per second) and the human eye can't detect this frequency. A Communication rate of more than 100 Mbps can be achieved by using high-speed LEDs with the help of various multiplexing techniques. And this VLC data rate can be further increased to as high as 10 Gbps via parallel data transmission using an array of LED lights with each LED transmits a different data stream.

The LIFI transmitter system comprises four primary subassemblies:
Bulb: Bulb that emits photons when turned on

RF Power Amplifier Circuit (PA): A radio frequency power amplifier is an electronic amplifier that converts low power radio frequency signals into high power radio frequency

Printed Circuit Board (PCB): A printed circuit board mechanically supports and electrically connects electronic components using conductive tracks

Enclosure: An electronic enclosure is a cabinet for electronic equipment to mount switches

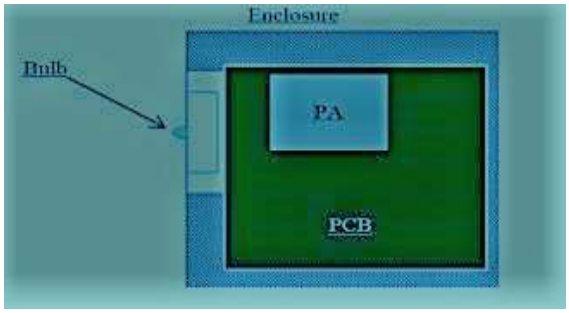

Fig 2: LIFI Transmitter

Temperature sensor:

Fig.3. Temperature Sensor

The temperature sensor that is used in the proposed model is LM35. It is a thermistor that is used to measure the temperature of the patient. The electrical output is proportional to the temperature in Celsius. With the current variations, the temperature of the patient is measured

Heartbeat sensor:

Fig.4.Heartbeat 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.

Ultrasonic sensor:

Fig.5. Ultrasonic Sensor

The ultrasonic sensor works by emitting sound waves at a frequency too high when it gets objected to by any material it gets reflected toward the sensor this reflected wave is observed by the ultrasonic sensor receiver module.

Nasal airflow sensor:

Fig 6. Nasal Airflow Sensor

It is used to monitor the airflow rate of a patient in need of respiratory help. The device consists of flexible thread which fits behind ears and a set of two sponges that are placed in the nostrils. Breathing is measured by these sponges.

Arduino:

Fig 7: Arduino Chip

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards can read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing

Node MCU

Fig 8: Node Mcu

Node MCU is a low-cost open source IOT platform.It initially included firmware which runs on the ESP8266 on the WI-FI SoC from Espressif Systems and hardware which was based on the ESP-12 module. Later, support for the ESP32 32-bit MCU was added.

IV. PROCEDURE METHODOLOGY

The working Principle of the Li-Fi module is very unassuming. It uses the concept of Light Emitting Diodes, where logic 1 represents the data transmission and logic 0 represents that there is no transfer of data. The patient intensive care using the Li-Fi is done with the help of sensors. The sensors that are used in this model are temperature, heartbeat, and Ultrasonic sensors, which will perform their necessary function. The sensed data are converted into the digital form using the analog to digital converter, which is inbuilt in the microcontroller AVR ATMEGA. The data is then passed on in the form of light through the Li-Fi module. The on and the off of the lights indicate the being there and the non-appearance of the information. Rapid pulses are generated by the flickering of these Light Emitting Diodes, which produces a string of 0s and 1s. The light is identified in the receiver side by the photo detector**.**

V. RESULT

- ***PULSE RATE***

Pulse rate	Status
60BPM – 100BPM	Normal
>100BPM	High
<60BPM	Low

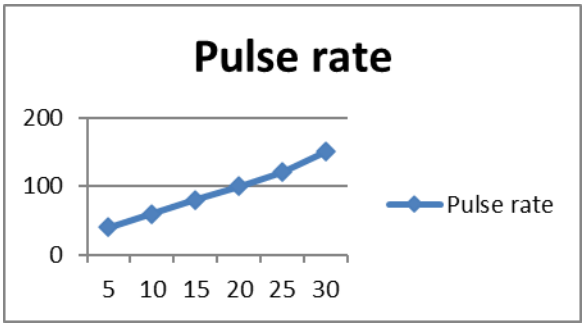

Fig.7. Pulse rate with Time

Pulse rate: It measures the number of times per minute that the heart contracts or beats. The speed of beats increases as a result of physical activity.

- ***TEMPERATURE RATE***

Classed as	Temperature (Celsius)
Hypothermia	< 35 c
Normal	37 c
Fever	39 c
Hyperpyrexia	>41 c

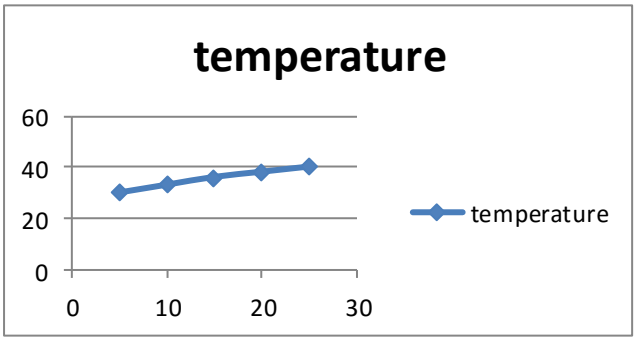

Fig.8. Temperature with Time

Temperature sensor: when you compare the readings from the above table to the graph and if found any difference to normal readings then you can take the further step to treat the patient to normal stage

- ***NASAL FLOW***

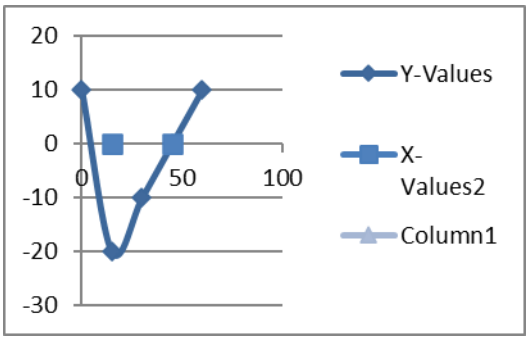

FIG 9: Nasal flow sensor with time

- Nasal flow sensor: To understand the abnormal nasal physiology, you can compare the graph to the normal values of the nasal flow or breath rate of the patient

Patient intensive care can be done powerfully using Li-Fi equipment. It reduces radio intrusion in the human body. It measures the data of the patient spontaneously and continuously. In the upcoming, this system can be used to monitor countless patients. Every Each Bulb in the hospital can be used to monitor the patient. We had designed a biometric sensor-based system by which we are getting required parameters of patient such as temperature, blood pressure, and heart rate. As the radio frequencies are circumscribed in hospitals, so we are using Li-Fi for communication. Patient data is sent to the doctor via Li-Fi communication. Further, we are sending the same data on the server so that if the doctor is not available in the hospital, he can access it on the internet and can take the decision. This system is much useful in hospitals

VI. CONCLUSIONS

Patient intensive care can be done powerfully using LIFI equipment. It reduces radio intrusion in the human body. It measures the data of the patient spontaneously and continuously. In the upcoming, this system can be used to monitor countless patients. Every Bulb in the hospital can be used to monitor the patient. We had designed a biometric sensor-based system by which we are getting required parameters of patient such as temperature, blood pressure, and heart rate. As the radio frequencies are circumscribed in hospitals, so we are using LI-FI for communication. Patient data is sent to the doctor through LI-FI communication. Further, we are sending the same data on the server so that if the doctor is not available in the hospital, he can access it on the internet and can take the decision. This system is much useful in hospitals.

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