Smart Real Time Health Monitoring System In Hospitals Using Li-Fi

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Abstract- *In recent medical field it is difficult for doctors to monitor patients continuously because it is a time-consuming process. So, we proposed a system which will overcome the monitoring process with the help of Internet of Things. IoT makes medical equipment more efficient by allowing real time monitoring of health. This system monitors the patient's health conditions such as heart beat, pulse rate, humidity, oxygen level and temperature and then sends to doctor's PC through Li-fi module, so that doctors can continuously receive data regarding the patient's health conditions and their history will be stored in the web server. The doctor can thus access the information whenever needed.*

Keywords- Li-Fi; Medical Sensors; Light-Emitting Diodes; Visible Light Communications.

I. INTRODUCTION

Nowadays, Wi-Fi (Wireless Fidelity) is rapidly growing communication technology in every field. But in certain situation, we cannot use Wi-Fi due to some reasons. We can't use Wi-Fi in ICU (Intensive Care Unit), Aircrafts, Underwater Communications etc. So, to overcome this we can implement the new blooming technology called Li-Fi (Light Fidelity). The main technical difference between Li-Fi and Wi-Fi is that Li-Fi employs modulation in intensity of light to transport data, whereas Wi-Fi uses radio frequency to get a voltage in an antenna. The patient health monitoring is one of the big advancements in research and development field. Here we use the temperature sensor, ECG sensor, pulse rate sensor, humidity sensor and blood oxygen sensor to monitor the patient's body heat level, heartbeat rate, pulse rate, humidity of the patient and environment and the oxygen level of the patient respectively. The li-fi transmitter and receiver sends and receives data through li-fi module to the doctor. This proposed model can be used in ICU to monitor reports regularly by doctors remotely. Like one parameter say Heartbeat rate of the patient is measured by keeping the index finger on ECG sensor. The heartbeat rate, and the body temperature information is then sent to the doctor's PC through Li-fi module. A basic consumer product, similar to an IoT (Internet of Things) gadget, with a colour sensor, microprocessor, and embedded software, makes up the BG-Fi Li-Fi system. The colour sensor on the goods receives light source from the mobile display and turns it into digital data. The consumer goods and mobile device can communicate synchronously thanks to light-emitting diodes.

II. LITERATURE SURVEY

1) Asmita Tirkey and Jesudoss A, "A Non-Invasive Health Monitoring System for Diabetic Patients" [2020]

The proposed system is designed to be used by various patients suffering from diabetes, where the patients don't have access to the hospitals and the monitoring of the glucose level can be done without the use of invasive methods. It is mandatory for every diabetic patient to continuously monitor the level/amount of glucose content in their body. Diabetes is a common and prominent diseases which occurs in most the people in the world. It is necessary to check the glucose levels in the body for them by making use of many methods. The proposed system makes use of Li-Fi technology, where the light is passed through the patient to detect the amount of level of glucose within the body. The efficiency of the proposed monitoring system is evaluated and tested on real-time environments and it is observed that it performs better when compared to the previous traditional health monitoring systems [1]

2] Toha Ardi Nugraha, Yudhi Ardiyanto, "Li-Fi Technology for Transmitting Data in Hospital Environments" [2020]

Wireless communication in hospitals are used to enhance convenience for patients. Wireless communication for telemedicine is becoming popular in current research studies and practical installations in hospital environments. It improves the flexibility of data acquisition of medical healthcare and supports mobility for user devices. By using wireless, various medical applications could be realized in hospital environments, for example, patient health monitoring. Patient health monitoring is used to monitor vital signs, maintaining an electronic medical record (EMR), transmitting orders to caregivers, and also providing nonmedical services

without worrying about distance problems. Unfortunately, there is always a chance that electromagnetic waves will disrupt the precise medical equipment and cause interference. radio-frequency (RF) communication in hospital environments raises a problem due to electromagnetic interference which causes an effect on medical devices, also concerning patient safety. The radiation from RF sources may result in potentially harmful effects on patients' health. Consequently, employing a light-emitting diode, this work replicates a new light fidelity (Li-Fi) technology in hospital settings (LED). In this study, we model Li-Fi using three different transmission powers, two different LED lamp angles, and the effects of the separations between photo detectors (PDs) and LED lights in the transmitter and reception sections. [2]

III. HARDWARE SPECIFICATIONS

1. Li-fi Transmitter:

Li-Fi Transmitter is a IOT custom-design chip front-end device used for VLC as known as visible light communications. It has a wide bandwidth (25 MHz) to support even the most demanding video streaming applications. The transmitter has a LED to transfer data

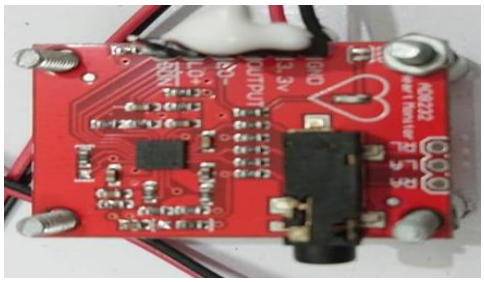

Fig 1 Image of li-fi transmitter

2. Li-fi Receiver:

Li-Fi Receiver is a custom-design chip front-end for VLC also known as visible light communications. It has a wide bandwidth (20 MHz) to support even the most demanding video streaming applications. The receiver features a photodetector enabling a robust performance in non-line-of-sight conditions.

Fig 2 Image of li-fi receiver

3. Node MCU:

The Node MCU (Node Microcontroller Unit) is an open-source software and hardware development environment that is built around a very inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266 is designed and manufactured which contains all crucial parts of the new gen computer: CPU, Random Access Memory, networking (Wi-Fi), and even a modern OS and SDK.

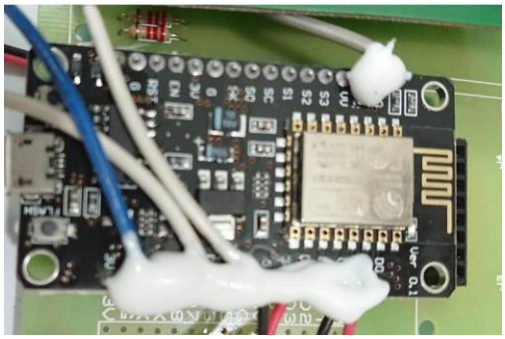

Fig 3 Image of Node MCU

4. Heartbeat Sensor:

Pulse waves are changes in a blood vessel's volume brought on by the heart pumping blood which are measured by an optical heart rate sensor. An optical sensor and a green LED are used to measure in order to identify pulse waves. The sensor block's use of an optical filter designed for detecting pulse wave which reduces the impact of ambient light, including red light and infrared rays. This makes sensor possible to collect high-quality pulse signals even outside.

Fig 4 Image of Heartbeat Sensor

5. Temperature Sensor:

A temperature sensor is an instrument that detects, gauges, and converts heat and cold into an electrical signal. At Temperature Connectivity, we create a variety of temperature sensors, such as NTC thermistors, thermopiles, thermocouples, and, RTDs, that are reliable, easy to install,

and capable of integrating technology that reacts to human behaviour.

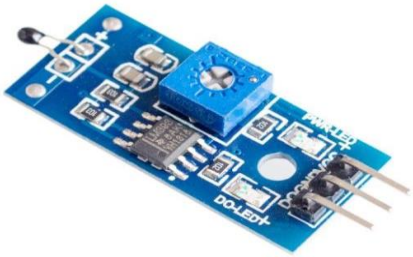

Fig. 5 Image of Temperature Sensor

6. ECG Sensor:

The electrocardiography or ECG is a method for gathering electrical signals which are produced from the human heart. When someone experiences sudden irregularity in heartbeat and high BP then the ECG sensor allows us to recognize the level, however, it is also used for understanding the psychological state of humans. A small chip with which the electrical action of this can be shown like an ECG (Electrocardiogram). Electrocardiography can be used to diagnose different conditions of the patient's heart.

Fig. 6 Image of ECG Sensor

7. Humidity Sensor:

An electronic device known as a humidity sensor monitors the humidity in its surroundings and converts the data into an appropriate electrical signal. Humidity sensors vary greatly in size and capability; some humidity sensors are found in devices such as smartphones, whereas others are built into larger embedded systems. In the meteorology, healthcare, automotive, HVAC, and manufacturing sectors, humidity sensors are frequently utilized.

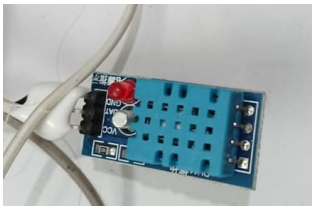

Fig. 7 Image of Humidity Sensor

8. Male / Female Jumper Wires:

Male-to-male, male-to-female, and female-to-female jumper wires are the most common types of jumper cables. Each wire's termination point differs from the other, making them different. Whereas female ends do not have a pin and are used to plug into items, male ends do.

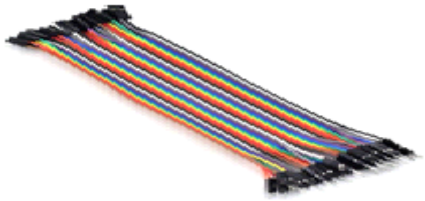

Fig. 8 Image of Male / Female Jumper Wires

9. Oxygen Sensor:

Oxygen sensors are used to monitor various level of oxygen concentration in patient's body, (i.e.) oxygen which is inhaled and exhaled by the patient who is connected to ventilator or an anaesthesia machine. Oxygen Sensor incorporated in a respiratory gas monitor (RGM) is used to measure oxygen concentration (or) pressure of oxygen in a breathing gas mixture. Oxygen sensor which is also known as FiO2 sensors or O2 Cells. The gas mixture in atmospheric room has an air concentration of oxygen at room air is 21%.

Fig. 9 Image of Oxygen Sensor

10. LED Bulb:

The high efficiency and reduced cost of LEDs makes them ideal for many industrial uses. LEDs are increasingly common in street lights, walkways and outdoor area lighting, refrigerated case lighting, and task lighting. The major uses of LED (Light Emitting Diodes) are to illuminate materials, objects and even places. Its application is everywhere due to its small size, low consumption of energy, extended lifetime, reduced cost and flexible in terms of use in various applications.

Fig 10 Image of LED Bulb

IV. SOFTWARE SPECIFICATIONS*:*

- Operating System : Windows
- Platform : IA-32, x86 - 64
- Language : Embedded C

V. METHODOLOGY

This project is designed to monitor the patient health care and send information to the respective receiver (doctor) with the help of Li-Fi Technology. Unlike Wi-fi, Li-Fi is a new and wireless technology to transfer information wirelessly without and radio waves using only light. Various sensors are connected to the patient's body to monitor various health conditions. The temperature sensor converts the temperature of human body radiated into the voltage waveform. The blood oxygen sensor monitors the oxygen level in patient's blood. The ECG sensor monitors the heartbeat of the patient. Further, the pulse rate sensor monitors the rate of blood flow in the body. The humidity sensor monitors and calculates the humidity of patient and the environment. These sensors collect data from human body and convert it to digital form using analog to digital convertor. The output of these sensors will be transmitted to microcontroller. The output from the NodeMcu is fed to the Li-Fi transmitter module which transmits the data in the form of light with LED and the Li-Fi receiver end collects this data and displays the report. The doctor or concerned person receives the updated report.

VI. IMPLEMENTATION OF PROPOSED MODEL

In medical field, smart healthcare uses a new generation of information technologies such as Internet of Things, cloud computing etc to transform the traditional medical system in all round way, making health care more convenient more personalized and more efficient. Li-Fi is a new and wireless technology to transfer information wirelessly.

These smart devices are used to collect data such as temperature of patient, blood pressure, glucose level etc, which are used for evaluating the health condition of the patient. Sending the collected information to the doctor, making accurate decision on the data collected and notifying the patient is the challenging task in the smart devices.

This project is designed to monitor the patient health care and if any emergency is there it will send information to the respective receiver with the help of Li-Fi Technology. These sensors collect data from human body and convert it. The output from the NodeMcu is fed to the Li-Fi transmitter module which transmits the data in the form of light with LED and the Li-Fi receiver end collects this data and displays the report. The doctor or concerned person receives the updated report.

VII. CONCLUSIONS

Patient monitoring can be done conveniently and consistently using Li-Fi technology. It reduces the interference of radio waves or even no radio waves in human body. It monitors the patient automatically without any nurses and continuously. It is shown that Li-Fi network can be used as a high-speed and safe to human body data communication to provide real time monitoring of heartbeats, temperature, and various other parameters. Li-Fi is emerging as more suitable networks in healthcare services in the near future in the hospital. Using this technology in medical field makes diagnosis faster and allows to access the internet along with the radio waves-based devices. The proposed system is fully automated.

REFERENCES

[1] Asmita Tirkey, Jesudoss A, "A NON-INVASIVE HEALTH MONITORING SYSTEM FOR DIABETIC PATIENTS", International Conference on Communication and Signal Processing, 2020.

[2] Toha Ardi Nugraha, Yudhi Ardiyanto, "LI FI TECHNOLOGY FOR TRANSMITTING DATA IN HOSPITAL ENVIRONMENTS",1ST International Conference on Information Technology, 2020.

[3] Rizwana Ahmad and Anand Srivastava, "Optimized User Association for Indoor Hybrid Li-Fi Wi-Fi Network", Indraprastha Institute of Information Technology 978-1-7281-2779-8 (IEEE), 2019.

[4] Ankita Saha, Swarnali Chatterjee, "ANALYSIS ON DATA TRANSMISSION USING LIFI", IEEE International Conference for Convergence in Engineering, 2020.

[5] A Abiramasundary, M S Swetha, "REAL TIME EMBEDDED HEALTH MONITORING SYSTEM

USING LIFI", International Journal of Engg Research and Technology, ISSN – 2278-0181, 2018.

[6] Yasser Nozad Mohammedtawfig, Ayad Nozad Mohammedtawfeeq, "REAL TIME MONITORING SYSTEM BASED ON LIFI NETWORK TECHNOLOGY IN HEALTHCARE", ISSN -1812-125X, 2021