International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 03 | Mar 2021 www.irjet.net p-ISSN: 2395-0072

Healthcare System based on Visible Light Communication

Prof. Shailaja Udtewar[1], Om Prabhudesai[2], Rahul Joshi[3], Vedant Jagtap[4]

[1]*Assistant Professor, Dept. of Electronics and Telecommunication, Xavier Institute of Engineering, Mumbai, Maharashtra, India*

[2,3,4]*Student, Department of Electronics and Telecommunication, Xavier Institute of Engineering, Mumbai, Maharashtra, India*

Abstract - *Lifi is fast, cheap and secure optical version of Wi-Fi technology and also it can be regarded as light-based Wi-Fi. In place of Wi-Fi modems, Li-Fi uses transceivers fitted with LED lamps that can light a room as well as transmit and receive information and it operates in the visible layer of electromagnetic spectrum. The working of the Li-Fi module is quite simple. It uses the basic concept of luminaire's where logic 1 represents the data transmission and logic 0 represents no data transmission. The system proposed here is built to develop the prevailing VLC system. The system is devoted to hospital environment where all the specified parameters of the patient are transferred successfully. The patient monitoring using the Li-Fi is done with the help of various sensors. Since Wifi is very popular today it can be seen almost everywhere that can lead to interference in the operation of other devices in the given environment whereas there are no such issues observed in LiFi.*

1. INTRODUCTION

Li-Fi is becoming more suitable networks for the next generation health services at the hospital. In this proposed system the application of VLC is demonstrated in Basic Patient Monitoring System using a prototype model. The Li-Fi network can be successfully used as a high-speed, secure data transfer system to deliver in real time monitoring heartrate, blood pressure, temperature and various other parameters. The use of Li-fi technology in hospital environment makes diagnosis quicker and allows you to access the web with the VLC based apparatus.

2. System Design

The working of the Li-Fi module is quite simple. It uses the basic concept of luminaire's where logic 1 represents the data transmission and logic 0 represents no data transmission. The patient monitoring using Li-Fi is completed with the assistance of sensors. The sensors that are used in this model are temperature sensor which as the name suggests is used for measuring temperature, Heartrate sensor is used to measure the pulse rate of the patient, PIR Sensor (Passive Infrared Sensor) is used to detect the presence of human being, ADXL 335 sensor is used to determine the position of the patients specially affected with paralysis. The received data is converted to the digital form using analog to digital converter .The data is then transmitted in the form of light through the Li-Fi module. When the light is on it indicates the presence of data and vice-versa. Rapid pulses are generated by the flickering of these LEDs which produces string of 0s and 1s .The light is detected in the receiver side by the LDR (Light Dependent Resistor).

2.1 Transmitter Section

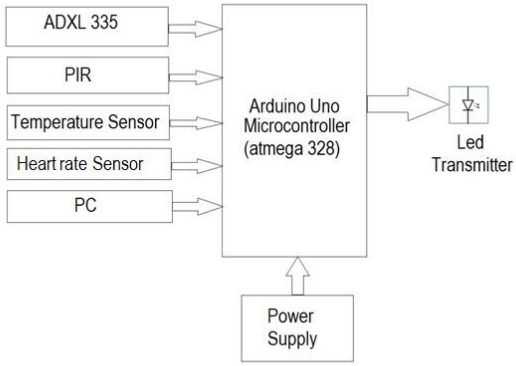

Fig -1: Transmitter Section Basic Block Diagram

The Transmitter Section consist of a PIR Sensor, Heartrate Sensor, ADXL 335 and Temperature Sensor. The function of
The above given sensors are mentioned below

PIR Sensor

The PIR Sensor (Passive Infrared Sensor) is used to detect whether the patient is there at the required position or not and it also shows whether there is motion or not from patients side. It can also be used to detect the presence of human interference in restricted section or bio-hazard section.

Heartrate Sensor

The Heart Rate Sensor is used to detect the blood pressure of the patient. The blood pressure is continuously

recorded and updated in order to act on any anamoly going on with the patient.

ADXL 335

The ADXL 335 is a small, thin, 3-axis accelerometer. It is used to determine the position of the patients. The positions of the patients are defined with X, Y and Z coordinates if any movement is detected the coordinates change accordingly and are updated continuously. ADXL 335 is especially important with patients suffering from paralysis as any movement with paralysis patient is observed the X, Y and Z coordinates varies and it helps the doctors to study the vitals and provide the required diagnosis.

Temperature Sensor

LM 35 is used as the temperature sensor .It is used to measure temperature of patient .The electrical output is proportional to the temperature in Celsius .As the current varies the temperature of the patient is measured and updated continuously.

Microcontroller

The micro controller has an important role in the transmission section as it houses all the sensors, power supply and the LED transmitter. The microcontroller used in the transmission section is Arduino Uno ATMEGA 328P. All the inputs are connected to the system. The PC is connected to the Arduino which processes the data that needs to be transmitted from the source.

2.2 Receiver Section

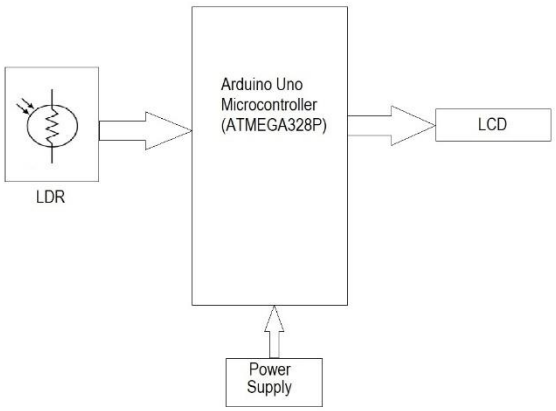

Fig -2 : Receiver Section Basic Block Diagram

The receiver section consist of an LDR, Arduino Uno, LCD And a power supply. The functions of the above given components are listed below.

LDR

A light dependent resistor or photo-resistor is an electronic component which is sensitive to light. When the optical signal is received from the transmission side from the LED the LDR which is on the receiver side will convert the optical signals into electrical signals and give it to the microcontroller. Values of the resistance of the LDR varies upon the optical system .Here we use LDR to collect data from the transmitting section.

Arduino Uno

The microcontroller used in the receiver section is Arduino Uno ATMEGA 328P. The microcontroller receives the data from the LDR. The received data is converted back to analog form and will be given to the LCD screen.

LCD

The LCD receives the information from the microcontroller
And displays it for viewing purposes

3. WORKING

The working of the transmitter and receiver section has been explained in their respected sections below.

3.1 Transmitter Section

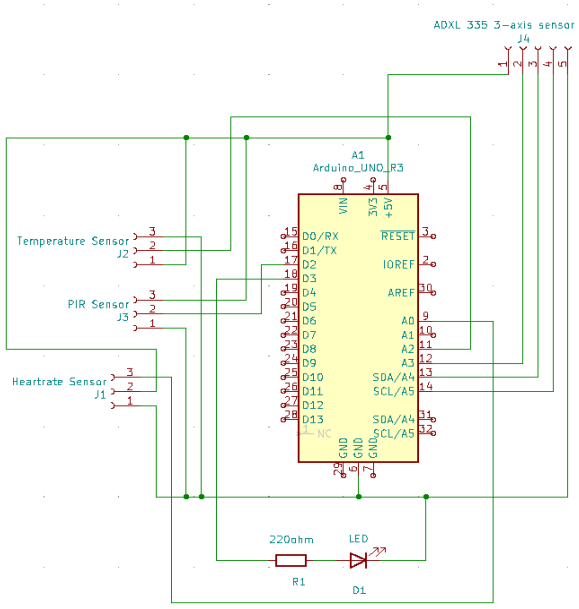

Fig -3: Transmitter Circuit of the Setup

In our proposed system on the transmitter side we included a LM 35 (temperature sensor), Heart rate sensor, PIR sensor and ADXL335 (3-axis accelerometer). When the system is on the first thing the system will read is the patient's body temperature, now for appropriate readings the patient must keep the LM 35 under their armpit for probably a minute and the sensor will record the temperature and will give it to microcontroller. The next parameter check of patient will be their heart rate for which they have to keep their finger on the surface provided to them for 1 min so that the sensor records the measurement and will forward it to the microcontroller. Now ADXL335 sensor is used for checking possible paralysis at the early stages when the patient enters the room. PIR sensor in our system can be used for two purposes, one being to detect the presence of the patient and other, to keep a track if someone enters a bio hazard room without the permission.

Hence when all the parametric data of the patient and the system is given to the micro-controller, it will process that data and will convert the analog information into digital form i.e. bits ('1' represent data is present and '0' represent data is absent). This digital string of data will be forwarded to LED where with accurate blinking of LED, the data will be now in the optical medium where LED is controlled by a 220 ohm resistor .This data now in optical form will be received by the LDR on the receiver side.

3.2 Receiver Section

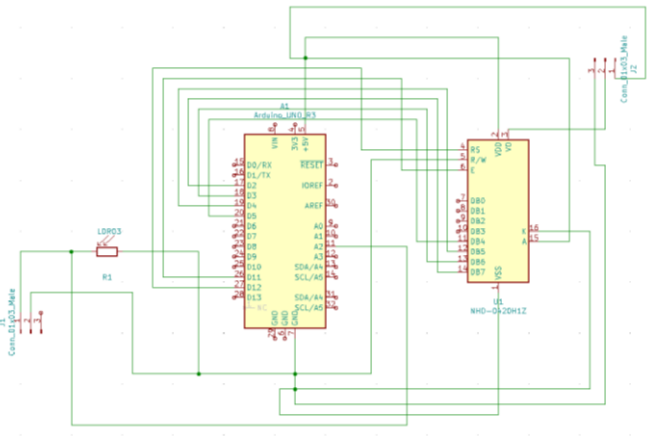

Fig -4: Receiver Circuit of the Setup

When the data is transmitted via blinking of LED (in optical medium) that signals will be received by LDR situated on receiver. This LDR will convert the optical signals into electrical signals and now the string of bits will be given to microcontroller. The microcontroller will now processes these string and converts into respective analog form so that the signal that those sensors catch on the transmitter side will be available again in that same original form on the receiver side. Now the microcontroller will forward these parameters of the system to the LCD screen where the personnel operating at that time will analyze the information and can act on the patient. This is how the LIFI based basic Healthcare system that we proposed will work to ease the patient as well as the hospital management with our product which delivers fast, accurate and secured data with a futuristic yet cheap technology (visible light communication).

4. OUTPUT AND RESULTS

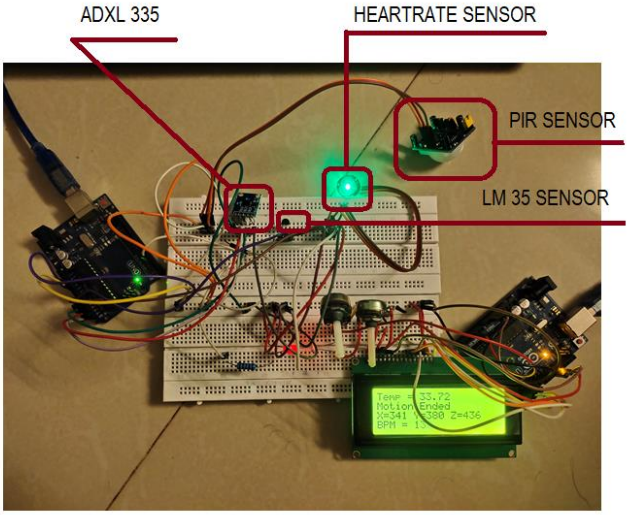

Fig-3 : Transmitter And Receiver Setup

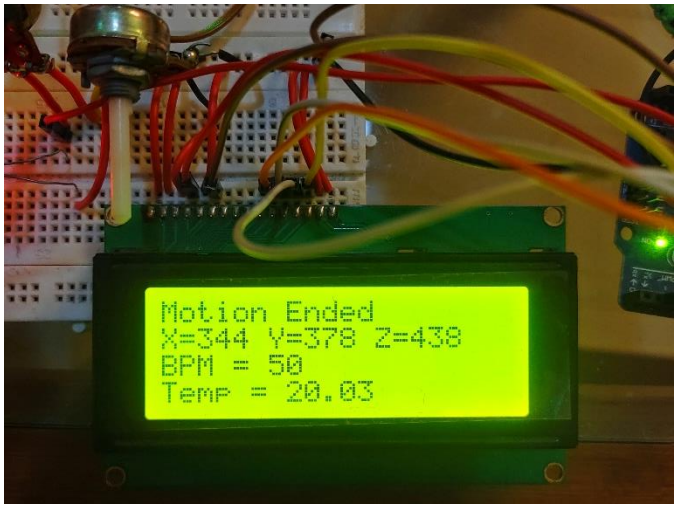

Fig -4 : Output On LCD

We successfully transmitted the required biological parameters of the patient using LIFI technology. All the parameters of the patient were successfully displayed on the LCD and were continuously saved and updated.

5. CONCLUSION

We managed to successfully transfer and receive the data using LIFI technology securely without any data loss or data corruption. Also we managed to negate all noise regarding issues successfully by using elegant transmitter-receiver setup. Since we were using VLC we were not

facing any issues regarding traditional Electromagnetic interference with the hospital equipment's because the traditional use of WIFI based system was under the radio waves section of electromagnetic spectrum whereas LIFI uses visible section of electromagnetic spectrum so EM interference was negligible. Since the bandwidth appointed to LIFI is not licensed the bandwidth usage of LIFI is way greater than WIFI. Also data transmission is more secure in LIFI as compared to WIFI. As LIFI is becoming more accessible in day to day circumstances it is becoming more suitable for next generation health services as well as various other applications. Since LIFI cannot penetrate through opaque objects it is not used for long distance transmission, it can only be used as a line of sight communication, with future advancements in VLC's domain problems like this can be solved. We managed to collect the biological parameters of the patient successfully by using our dedicated VLC based system and we were able to observe the same biological parameters at the transmitter and the receiver sections respectively .As we can see above that LIFI based healthcare system is more effective and more efficient it has the potential to replace WIFI based systems successfully. Thus this technology will be a better alternative to traditional radio wave based systems in any hospital environment.

REFERENCES

[1] Impact of IEEE 802.15.7 Standard on Visible Light Communications Usage in Automotive Applications. IEEE Communications Magazine •0163-6804/17/$25.00 © 2017 IEEE April 2017

[2] Eco-friendly Data Transmission In Visible Light Communication IEEE Transaction On Biometrics Vol 12, No 4, March 2016

[3] Audio Transmission Through Visible Light Communication International Journal of Science, Engineering and Technology Research (IJSETR) Volume 06, Issue 05, May 2017, ISSN: 2278 -7798.

[4] Voice and Data communication USING Li-Fi International Journal of Advanced Computational Engineering and Networking, ISSN: 2320-2106, Volume-4, Issue-10, Oct.-2016

[5] Design of Li-Fi transceiver Wireless Engineering and Technology, 2017, 8, 71-86, October 31, 2017

[6] B. Ekta and R. Kaur, "Light Fidelity (LI-FI) - A Comprehensive Study", International Journal of Computer Science and Mobile Computing, Vol.3, Issue 4, pg. 475- 481, ISSN 2320 – 088X, April- 2014.

BIOGRAPHIES

Assistant Professor, Dept. of Electronics and Telecommunication, Xavier Institute of Engineering, Mumbai, Maharashtra, India

Student, Department of Electronics and Telecommunication, Xavier Institute of Engineering, Mumbai, Maharashtra, India

Student, Department of Electronics and Telecommunication, Xavier Institute of Engineering, Mumbai, Maharashtra, India

Student, Department of Electronics and Telecommunication, Xavier Institute of Engineering, Mumbai, Maharashtra, India