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Smart Health Monitoring using Li-Fi Technology

S. Devaganapathy[1], G. Dinesh[2], P. Hari[3], M. Karmugil[4]
[1,2,3]*Student, Department of Biomedical Engineering, Rajiv Gandhi College of Engineering and Technology, Pondicherry, India*
[4]*Assistant Professor, Department of Biomedical Engineering, Rajiv Gandhi College of Engineering and Technology, Pondicherry, India*

***Abstract*: Generally monitoring requires more man power to monitor and control the hospital parameter such as temperature, pressure, heart beat, ECG, respiration, blood pressure etc. In some occasion of non-availability of the technician, leads to abnormality condition. In order to avoid this condition, we prefer the Li-Fi technology monitoring system in the hospital parameters. In case of any abnormal condition it sends the message to the administrator vi Li-Fi technology. Li-fi technology provides communication through the LED light bulb. It varies from the other devices through its intensity. The data encoded by the Li-fi technology can be decoded by the LED flicker based method. To monitor all these parameters, it requires the use of the sensor. It is very helpful by reducing the human work in monitoring these parameters.**

***Keywords*: Li-Fi LED, software IDE, LM35, SEN11574, AD8232, SA9311**

1. Introduction

The main objective of the use of Li-fi technology is to measure the important parameters in hospital. Monitoring of patient is the most important in hospital. It is done with the help of the sensor with more accuracy and reliability. The control process is also done by the Li-fi communication. Here with the help of Arduino the data can be decoded through Li-fi and with the help of LED and control the hospital devices through relays. The interfacing phase between Li-fi transmitter and Li-fi receiver is done by Arduino.

2. Methodology

The project mainly aims at the alleviating the problem when monitored by the human. Now a day hospitalization increases as well as increasing population. The idea of the project is to monitor the patient parameter, to interface and communicate with Li-fi technology. Here the input sensor are temperature sensor, heart beat sensor, respiration sensor, ECG sensor, blood pressure sensor, are given to the Arduino development board. Li-fi is used to send a message through -fi provides transmission of message through LED bulb. The application is developed for monitoring the heath care condition of the patient. In the existing Wi-Fi concept, it uses high cost and the data is transfer at the speed of 150mbps. In Wi-Fi technology it is very difficult to transmit the data through the long distance. Here the applicability of the Li-fi technology in the health care monitoring works as both the monitoring and control of the patient heath care.

Li-fi is also cheaper than the Wi-Fi technology, it does not need license and also it makes use of the light.

3. Block diagram

A. *Transmitter section*

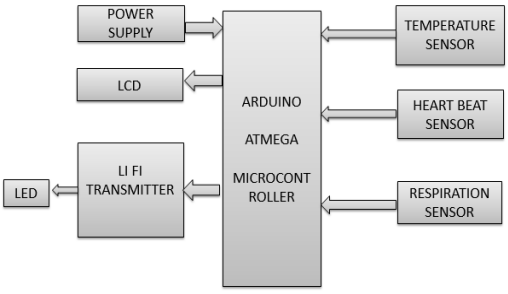

Fig. 1. Transmitter

B. *Receiver section*

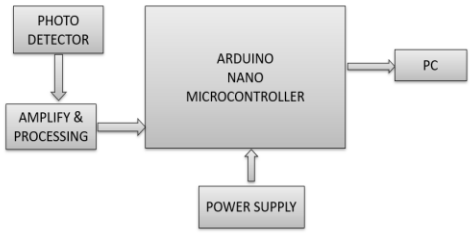

Fig. 2. Receiver

4. Li-Fi

Illumination by sending the data via LED light bulb that varies in the intensity faster than human eye can follow. To encode the data in the light the rate of flicker is varied by on and off method. The light intensity is regulated so that the human eye cannot observe, so the output appears constant. Li-

fi means light fidelity. Li-fi has better bandwidth, efficiency, availability and security. It also has high data to transmit and accuracy.

Fig. 3. Li fi

5. Hardware components

The hardware components consists of various components such as the Arduino Uno atmega328, temperature sensor, heart beat sensor, ECG sensor, respiration sensor, blood pressure sensor, Li-fi transmitter, photo detector, external device (power distributor) dc supply of 5V.

A. Arduino Uno (Atmega 328)

Arduino Uno is a microcontroller based on atmega328, with 14 digital pin and 6 analog pin. It is easy to interface and USB cable can be connected easily. It requires fraction of time to send the message. It is programmed with Arduino software IDE.

Fig. 4. Arduino model

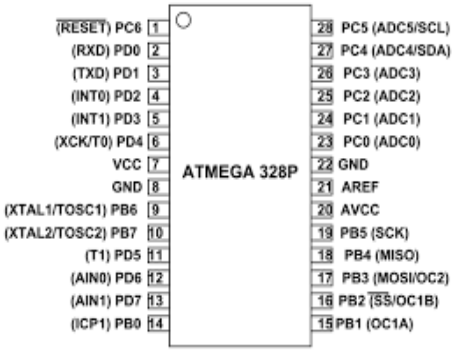

Fig. 5. Pin diagram

6. Transmission section

The power supply for the module is converted from AC to DC with the use of step down transformer from230V to 5V dc with the bridge rectifier; the voltage regulator LM7805 is used to regulate the voltage supply, filter capacitor of 1000muf used for noise filtration from the circuit. The sensors are connected to the Arduino uno328, the heart beat sensor measures the pulse by varying the optical power of light which is scattered or absorbed during its path through the blood as heart beat changes. LM35 is used to measure temperature of patient where the electrical output is proportional to Celsius. The respiration sensor (SA9311A) measures the flow of atmospheric air into the lungs. The blood pressure measures mean arterial blood pressure and calculate both the systolic and diastolic blood pressure using oscillometric method. The atmega328 is a low power high performance microcontroller with 32k bytes in system flash memory.

7. Receiver section

Receiver section consists of Arduino nano used to display the output measurement. Buzzer is used to produce alarm when an abnormal measurement is possessed. Potentiometer is used to vary the resistor to find out the voltage drop across the resistance. Voltage regulator IC7805, LCD display16*2, Potentiometer 100kohm, 10kohm, Buzzer. Arduino nano is used to receive the transmitted data. IC7805 is used to regulate the voltage supply for the circuit

A. Temperature sensor

LM35 is used as a temperature sensor, which is an integrated circuit sensor that is used to measure the temperature with the electrical output proportional to the temperature in Celsius. It has unique advantage and varies from linear temperature sensor calibrated in kelvin because in linear temperature sensor it requires to subtract a large constant voltage from its output to obtain the correct centigrade scaling.

Fig. 6. Temperature sensor

B. Respiration sensor

The respiration sensor (SA9311A) is latex-free, magnet-free, and Velcro-free, and can be worn over the clothing. It is sensitive to stretch. It is strapped around the patient chest or abdomen, it converts the expansion and contraction of the rib cage or abdominal area, to a rise and fall of signal on the screen and the output reading is viewed in the LCD display.

Fig. 7. Respiration sensor

C. Heart beat sensor

The heart beat sensor (SEN 11574) consists of a light emitting diode and a detector like a light detecting resistor or a photodiode. It causes a variation in the flow of blood to different regions of the body. The tissue is illuminated with the light source, i.e. light emitted by the led, it either reflects or transmits the light. The amount of light absorbed depends on the blood volume in that tissue.

Fig. 8. Respiration sensor

D. ECG Sensor

The ECG module (AD8232) is the cost effective board use to measure the electrical activity of the heart. It acts as an op-amp to help obtain a clear signal from PR and QT intervals easily. It is designed to extract, amplify, and filter small conditions; such as those created by the motion or remote electrode placement.

Fig. 9. ECG sensor

8. Advantages

- Source of transmission is easy and cheap.
- Information transmitted is secured and cannot be misused, since light waves cannot penetrate through the medium.
- It has higher bandwidth.

9. Disadvantages

- It is not used for long distance communication.
- It is only used as a line of sight communication.

10. Applications

A. Medical applications

As radio waves are harmful for the patient because of its high radiation effect it is not suitable for the healthy environment. Here visible light is used for medical applications.

B. Accident management

The Li-Fi technology can use to communicate between vehicles and traffic light and transmitting data through LED lights and the occurring of accident is avoided.

11. Output and result

The output readings of the sensor are displayed in the LCD and the information of the patient is sent to the end user through the E-mail.

Fig. 10. Sample output data

12. Conclusion

Since the improvement in the field of wireless communication gives us flexibility to make our life easier and secure. Now the proposed module replaces the need for the Wi-Fi and Li-fi is used as a source to transmit information. The information is transmitted through Li-fi faster and easier. It is more efficient as it travels through areas where human intervention is not possible. It plays a great role in the communication sector and it will be utilized at greater speeds in every field of communication and the data is accessed instantly. This technology is safe and clean way of communication.

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