Patient Monitoring System using Li-Fi

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***Abstract*— This paper illustrates the patient monitoring system using Li-Fi technology. Li-Fi stands for Light Fidelity. Li-Fi technology proposed by the German Physicist Harold Haas, provides transmission of data through illumination by sending data through varies intensity faster than human eye can follow. Li-Fi is a bidirectional, high speed and fully networked wireless optical communication and is a form of visible light communication. The proposed model helps in the patient monitoring in the hospitals and can be done by using the concept of Li-fi instead of Wi-Fi technology to avoid the frequency interference with the human body. Sensors such as temperature, heartbeat, motion are used in the model to perform its respective functions. These sensors collect the data from the human body and convert in to the digital form using the analog to digital converter. The output of these sensors is given to the microcontroller. The microcontroller that is used here is the AVR microcontroller. 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 this data of the patient is to the mobile.**

Keywords—Li-Fi , AVR, VLC,Wi-Fi

I. INTRODUCTION

In the era of emerging technology, it is necessary to find better solutions for every activity. Nowadays health care expenses are increasing and to reduce this expenses it is required to have a technology based health care systems. Patient monitoring can be done in a very efficient manner using the Li-Fi technology. Patient monitoring refers to "repeated or continuous observations or measurements of the patient, his/her physiological function, and the function of life support equipment, for the purpose of guiding management decisions, including when to make therapeutics interventions, and assessment of those intervention" (Hudson, 1985,).

Patient monitoring done by the Wi-Fi is slower when compared to the Li-Fi and it also has less bandwidth. Reliability is better in Li-Fi than Wi-Fi. Since transmission of data by Wi-Fi is through RF waves, there is a high possibility that these waves might affect the human body. The designation of these signals may be carcinogenic and this has been given by the World Health Organization. To solve this problem, Li-Fi (light fidelity) technology is used for healthy environment. Light fidelity is transmission of information through optical wireless medium. Sensors such as heart beat, temperature, and motion sensor are used transmitted through the Li-Fi module. Rapid pulses are generated in the form of 0s and 1s. Photo diode is used at the receiver end. Flickering of light takes place at the rate of hundreds of megabits per seconds. By using Bluetooth, the receiver is connected to mobile. The information received in the mobile can be displayed in the mobile through an application. The range of the Li-Fi technology is 10m and secured communication is possible. The transmission of information by light through wireless is termed as Visible Light Communication (VLC).

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, 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 [5]. 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 [6].

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 [7].

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 patients 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 patients perspective [8].

Birgit Wilhelm, Senait Forst ,Matthias M. Weber, MartinLarbig, Andreas Pftzner , Thomas Forst . 2006.

Evaluation of CGMS During Rapid Blood Glucose Changes in Patients with Type 1 Diabetes. Diabetes Technology and Therapeutics 8:2, 146-155. [Abstract] [PDF] [PDF Plus]. 2006. Psychological aspects of continuous glucose monitoring in pediatric type 1 diabetes. Pediatric Diabetes R. Hovorka. 2006. Continuous glucose monitoring and closed-loop systems. Diabetic Medicine [CrossRef] David C. Klonoff. 2006. Continuous Glucose Monitoring Technology Delivers Detailed Diabetes Data. Point of Care The Journal of Near-Patient Testing and Technology [9].

III. PROPOSED METHOD

In the proposed system the patient is monitored using Li-Fi instead of Wi-Fi. It reduces the radio interference in the human body. Patient is monitored using different sensors like temperature, heart beat and motion sensor. The sensed data is then converted into digital form in the microcontroller. The output of the microcontroller is sent to the Li-Fi module. The data is then transmitted in the form of light through the Li-Fi module and detected in the receiver side by the photo detector. The received is sent to the concerned person through mobile. The concerned person can access the data of the patient using the mobile application data monitoring using Li-Fi. The block diagram of the proposed method is shown in the below Figure 1.

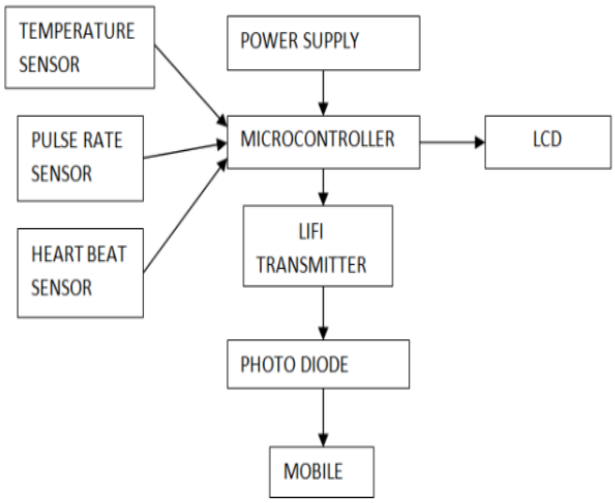

Fig. 1. Block diagram

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, and motion sensors are connected to AVR microcontroller. 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. Motion sensor senses the tilt or inclination or orientation in 2 or 3 dimensions. The readings of the respective sensors are displayed on the LCD display. The AVR microcontroller is a 8 bit RISC architecture and it uses flash memory. The signal is transmitted through the Li-Fi transmitter and the source of transmission is LED.

B. *Receiver section:*

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 mobile.

IV. WORKING PRINCIPLE

The working of the Li-Fi module is very simple. It uses the concept of LEDs where logic 1 represents the data transmission and logic 0 represents that there is no transfer of data. The patient monitoring using the Li-Fi is done with the help of sensors. The sensors that are used in this model are temperature, heart beat and Accelerometer which will perform its 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 transmitted in the form of light through the Li-Fi module. The on and the off of the lights indicates the presence and the absence of the information. 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 photo detector. The working model of Li-Fi is shown in the below Figure 2.

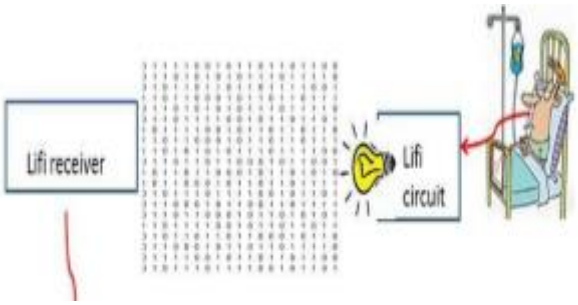

Fig. 2. Working Model Of Li-Fi.

A. *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 .The electrical output is proportional to the temperature in Celsius. With the current variations the temperature of the patient is measured.

B. *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. So based on the current variations the pulses are recorded and data is obtained.

C. *Motion Sensor*

One of the most common inertial sensors is the motion, a dynamic sensor capable of a vast range of sensing. Motion sensors are available that can measure motion in one, two, or

three orthogonal axes. They are typically used in one of three modes:

- As an inertial measurement of velocity and position;
- As a sensor of inclination, tilt, or orientation in 2 or 3 dimensions, as referenced from the acceleration of gravity (1 g = 9.8m/s^2);
- As a vibration or impact (shock) sensor.

There are considerable advantages to using an analog accelerometer as opposed to an inclinometer such as a liquid tilt sensor – inclinometers tend to output binary information (indicating a state of on or off), thus it is only possible to detect when the tilt has exceeded some thresholding angle.

V. RESULT

The output of the three sensors are displayed in the LCD as shown in the Figure 3.The information regarding the patient is sent to the end user using the mobile application Li-Fi data monitoring.

Fig. 3. LCD Output

VI. CONCLUSION AND FUTUREWORK

Patient monitoring can be done efficiently using Li-Fi technology. It reduces the radio interference in human body. It measures the data of the patient automatically and continuously. In the future this system can be used to monitor many patients. Every Bulb in the hospital can be used to monitor the patient.

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REFERENCES

[1] O.D. Alao, J. V Joshua, A.S Franklyn, O. Komolafe “Light Fidelity (Li-Fi): An Emerging Technology for The Future” IOSR Journal of Mobile Computing & Application (IOSR- JMCA) e-ISSN: 2394-0050, P-ISSN: 2394-0042.Volume 3, Issue 3. (May. - Jun. 2016), PP 18-28.

[2] Pawar, A. Anande, A. Badhiye, I. Khatua 'Li-Fi': Data Transmission through illumination International Journal of Scientific & Engineering Research, Volume 6, Issue 10, October-2015.

[3] Ankit Navalakha, NeeluMaheshwari, “Data Services of Li- Fi in Hospital Management”, International Journal of Science and Research (IJSR) 2015.

[4] Kalpana.P.M, “Design and Development of PIC Microcontroller based Wireless Architecture for Human Health Monitoring", International Journal of Innovative Research in Science, Engineering and Technology Vol. 4, Issue 4, April 2015.

[5] Dr. Harald Haas, “ wireless data from every light bulb “, TED Global, Edinburgh, July 2011.

[6] Harald Haas, Liang Yin,: ‘What is Li-Fi?’ published in journal of light wave technology, Volume: 34, Issue:6, March 15, 2016.

[7] Harald Haas with Prof Svilen and Prof Thilo and Prof Irina: ”Li-Fi modulation and networked Li-Fi attocell concept” 2012.

[8] Kalpana.P.M, "Design and Development of PIC Microcontroller based Wireless Architecture for Human Health Monitoring", International Journal of Innovative Research in Science, Engineering and Technology Vol. 4, Issue 4, April 2015.

[9] Birgit Wilhelm , Senait Forst , Matthias M. Weber , Martin Larbig , Andreas Pftzner , Thomas Forst "Evaluation of CGMS During Rapid Blood Glucose Changes in Patients with Type 1 Diabetes", Diabetes Technology and Therapeutics 8:2, 2006, pp.146-155.

[10] MohitHapani, Mangesh Joshi and RajkumarMaradia, "Secured li-fi (secured visible light communication", International Journal of Students Research in Technology and Management Vol 1, No.05, September 2013, ISSN 2321-2543 2015.

[11] Moussa Ayyash, Hany Elgala, Abdallah Khreishah, Volker Jungnickel,Thomas Little, Sihua Shao, Michael Rahaim, Dominic Schulz, Jonas Hilt, Ronald Freund, "Coexistence of WiFi and Li-Fi towards 5G", Concepts, Opportunities, and Challenges 2016.

[12] Rahul R.Sharma, Raunak, Akshay Sanganal, "LiFi Technology", Department of Computer Engineering 2014.