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LIFI for Medical care using Visible Light Communication

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Abstract:

The Wi-Fi technology is very popular today and it can be seen almost everywhere. There has been no place devoid of it. This high usage of the wireless spectrum has given way to many disadvantages like the maximum utility of the Radio Frequency causes blocking of the signals to the users, interference, the radiations are hazardous in the sensitive environments like the aircraft, hospitals and industries as well. The solution for these issues comes out with Visible Light Communication (VLC). This is the promising technology which can replace the indoor usage of the Wi-Fi at present. This is further termed as Li-Fi- Light - Fidelity. The Li-Fi rules out the disadvantages of the interference and blocking of the signals due to maximum usage. The Error performance is better and security of information is achieved. The proposed system consists of the LED light source as transmitter and the Photo Diode as the receiver which receives the data transmitted over the Li-Fi medium. The focuses on reducing the error performance and cost. The appropriate components are chosen for modulation, filtering, amplifying and coding to achieve the proposed system. The system is interfaced with the PC to transmit the data, audio and video using the DSP and DIP techniques.

Keywords: Li-Fi, VLC, RF, transceiver, LED and LOS.

INTRODUCTION

Visible Light Communication is the one of the branches of Optical wireless communication which transmits the data using the modulation in the light that is visible to the human eye. The rapid on and off light is used for communicating the information which can be perceived by the human eye but the photo diode receptors are more sensitive and grabs the pulses accurately. The Diode produces the electrical current proportional to the light photons incident on it. Detecting the VLC system is more easier than the RF systems which requires tools. The System supports illumination and wireless communication using the Light Emitting Diode (LED). The Visible Spectrum is having the wavelength about 380nm to 780nmand cover the band 385-789 THz. The standards of the system are complied and followed in the proposed system [1].

The safety purpose of the system over the other existing systems like RF systems could be used in hospitals, aircraft and industries where the radiations are not accepted. The interference between the signals can be solved by this technology. Hence the Li-fi has the potential to solve the two major issues of the critical applications and interference issues. The speed of the L-Fi system is tremendous and can be developed further with the component support. The theoretical speed of the Li-Fi system would be 10Gpbs.The system is designed with off the shelf low cost components widely used in hospital environment [5]. The system can be used for underwater communication and widely used for the safety purpose in Military.

PROPOSED SYSTEM

The system proposed now is built to develop the existing VLC system. The system is dedicated to hospital environment where many types of data transfer is being included. The following are the highlight of the proposed system,

- The data is transmitted over light hence radiation hazards are ruled out which would affect the human and the Bio-Medical equipments.
- Transmitter uses the microcontrollers that allows different types data transfer possible with minimal power requirements.
- Wireless transmission is achieved with height intense Light Emitting Diode (LED).
- Improvement in the speed of the data transmission.
- Reduction in the Error rate.
- ATGP (Automatic Test Generation Pattern) overhead is not required since the system itself is very secured.
- The Audio, Video and data transmission is achieved.
- The receiver uses the Photodiode to for improving the accuracy.

The existing system uses the Solar cell at the receiver that absorbs light and converts into electrical signals [2]. The system proposed is focused on reducing the cost and enabling the transfer of different types of data like audio, video and sensor data. The DSP and DIP technologies are implemented to achieve the image and video transfer. The indoor environment is considered and transmission is made with Los (Line Of Sight). The Micro controller transfers the data to the Li-Fi module which converts into pulses and the receiver receives the light photons accordingly and further decodes the information.

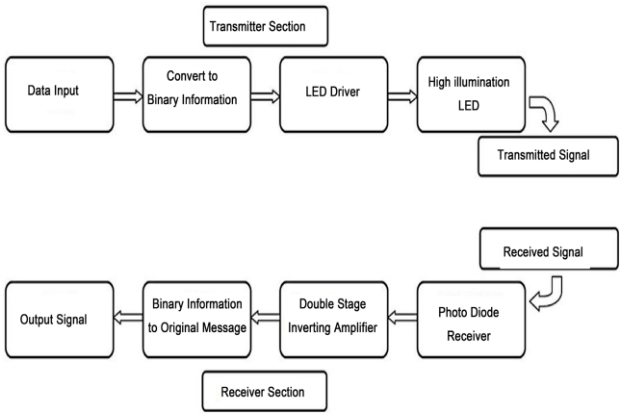


Figure 1 Basic Block Diagram of Li-Fi system

TRANSMITTER SECTION:

BULB SUB-ASSEMBLY

The PCB contained the microcontroller which houses the different input and output for the LED. The RF signal is generated by the Solid state device and passed to the electric field about the bulb. The vaporization occurs in the center of the bulb due to high concentration of energy in the electric filed. The source of light is hence generated by the controlled plasma. These are placed in the enclosure. The LED commercially applied is tested and used in this system [4].

DATA SOURCE:

The sensor data forms the major source of the system. Since the proposed system is for the hospital environment. The sensors placed are as follows,

- Temperature Sensor
- Heart Beat Sensor
- PIR sensor
- MEMS sensor

TEMPERATURE SENSOR

The temperature sensor plays a very significant role in hospitals were frequent monitoring of the room temperature and body temperature of the patient is of at most importance. The LM35 is used to measure the temperature of the room and body of the patient in the observation.

HEART BEAT SENSOR

The Heart Beat Sensor is used to measure the pulse rate of the patient. The pulses are recorded and updated to the observation area abruptly to avoid any health problems relating to the patient. LM358 OP-AMP is used as heart beat sensor.

MEMS

The MEMS are used to determine the position of the patients especially affected with paralysis. The positions are defined with X, Y and Z any movements with the patient affected with paralyses is detected, the values of these three parameters varies and help doctors to analyze the patient's behavior and provide further diagnosis.

PIR SENSOR

The PIR (Passive Infra-Red) sensor is used to detect the presence of human being in the restricted section. Any intervention of un authorized people entering the section with throw the message and help to alert the respective authority. This sensor also help to detect the live human in the room. The usage can be made accordingly.

MICROCONTROLLER:

The micro controller plays a significant roll which houses the sensors, power supply, light source and amplifier. The different types of input is connected to the system. The PC is also connected to the Arduino which helps to validate the data that needs to be sent form the source. The microcontroller forms the heart of the entire setup.

POWER SUPPLY:

The power supply unit is used for the dual source which help to supply 12 v for the light source and 5V supply for the other components. This is considered very important since the supply plays a crucial role in the system

AUDIO MODULE:

This block can be directly interfaces to the transmitter source. This contains the recording and play back options which can be done instantly. This can be used by the patient to send instant messages to the doctor and the receiver end. The emergency message can also be recorded previously which can help to send it directly reducing the overhead of the recording. The files are recorded in the APR, the LED blinks when the when the file transmitted [3].

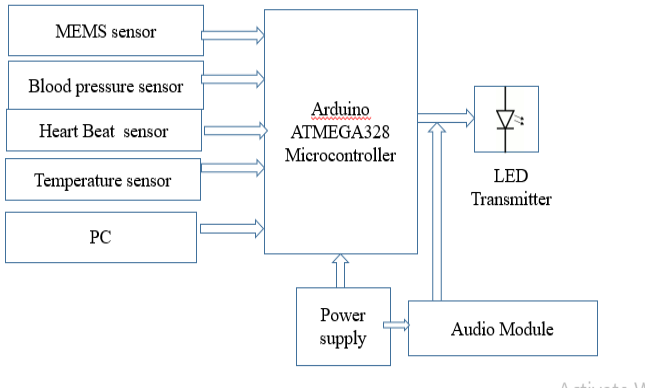


Figure 2. Transmitter Section.

The below is the transmitter setup is show below.

Figure 3. Transmitter Setup.

RECEIVER SECTION:

The receiver section contains the below important components. They play a very significant role is the process of light communication.

- Photo Diode
- Opto Amplifier
- Arduino
- PC
- Power supply

PHOTODIODE:

The photo diode is the most crucial part of the receiving system. This receives the light photons incident on it and converts into the electrical signals. The fast pulses of light is rapidly converted into electrical signals effectively.

OPTO AMPLIFIER:

This gives more strength to received signal and reduces the loss during the transmission there by improving the error performance rate. TLP 250 is used as the Opto amplifier in our system.

MICROCONTROLLER

The microcontroller combines the out unit from amplifier end to the PC were the received data can be viewed. The power supply is regulated based the usage for the system. This is also connected to the micro controller.

PC

Personal computers at the receiving end is used to check the validity of the data transmitted and help to receive the image and video types of information. This is connected across the Arduino to monitor sensor data.

The receiver system block diagram is shown below. The received pulses of light is initially converted into electrical signals by the Photodiode assembly. The signals are amplified which improves the properties of the signals and suppresses the noise. The information is further converted from binary to original data and displayed in the PC.

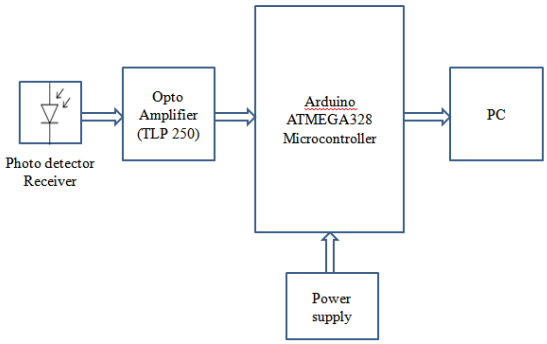
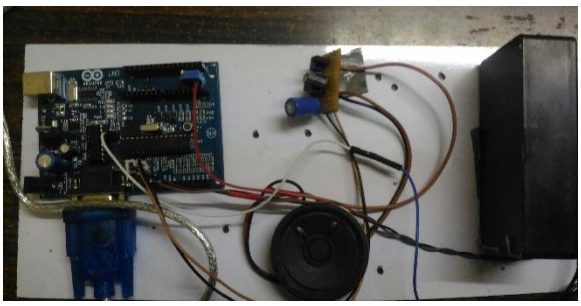


Figure 4. Receiver Section.

The receiver setup is given below.



Figur 5 Receiver Setup.

RESULTS

The transmitter and receiver results of Arduino based Li-Fi system is described in the sections below. The transmitted and the received signal is shown below.

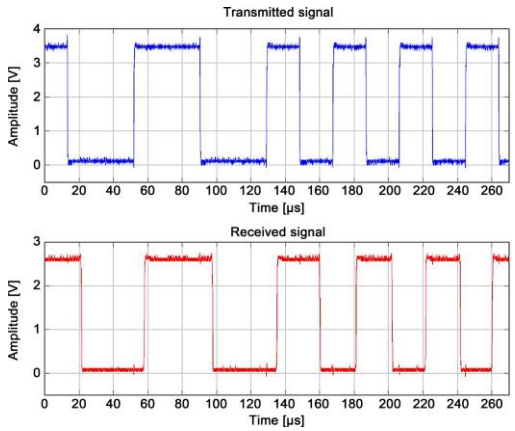


Figure 6. Transmitted and received signal.

The data transmitted and received is verified.

Figure 7. Transmitted Data.

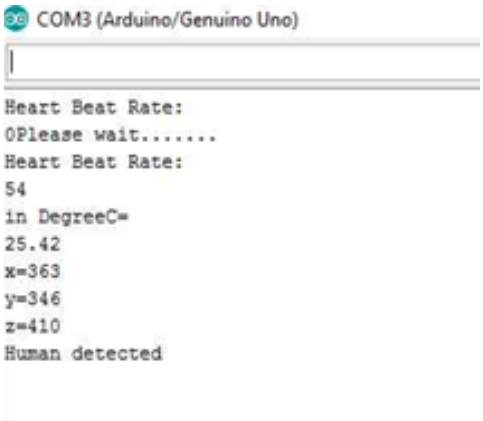


Figure 8. Received Data

The video transmission was made successful from transmitter using VLC. The data is converted into frames. Further the frames are converted into bytes with order of frames intact and transferring the data from transmitter. The receiver receives the frames in the given order and combines the frames into video using media player. Below is the video receiving screenshot attached.

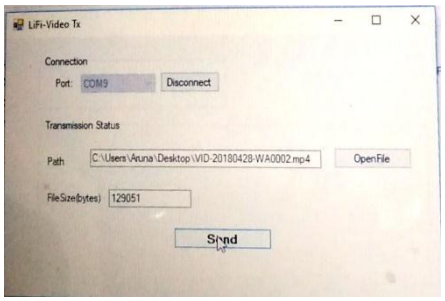


Figure 10. Receiver widow

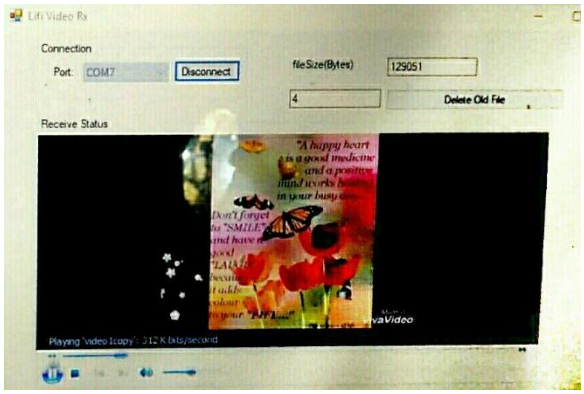


Figure 11. Transmitter widow

CONCLUSION:

Li-Fi is becoming more suitable networks for the next generation health services at the hospital. In this document, the application of VLC is demonstrated in HMS using a prototype model. He is shown. The Li-Fi network can be successfully used as a high-speed, secure and secure human body data communication to deliver in real timemonitoring heartbeat, blood pressure, temperature and various other parameters. The use of this technology in the field of medicine makes faster diagnosis and allows you to access the internet with the radio wave-based apparatus. The proposed system is completely automated and this could be a milestone in the medical field if it is implemented successfully.

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 Tschnology, 2017, 8, 71-86, October 31, 2017