Biomedical Signal Transmission Using VLC

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Abstract- In biomedical or healthcare application, the implementation of radio communication technologies is frequently flustered by the electromagnetic wave radiations and interference which are harmful to the humanbeings.Hence the transmission of low power (10 to 100µv) Biomedical signals with high degree of accuracy and at very high transmission rate is a challenging job. Thereby we go for a new novel method of transmission of these Biomedical signals using VLC (Visible light communication) technology. White beam light emitting diodes are used as a optical information emitter for efficiently transmitting biomedical data such as patient EEG,CT scan,MRI etc., information. ON/OFF keying modulation is used to modulate the data on to the visible light beam only at the Line of Sight condition. This amplified signal is fed into controller and the Biomedical signal is simulated by interfacing the kit with softwares (Embedded c coded in keil uvision 2.0 and visual basic 6.0).This proposed system has achieved a maximum distance as 10m and the resultant Biomedical signal has SNR greater than 7db with BER of 4.74X10-6.These results proves the excellent reliability and accuracy of proposed system.

Keywords—*Biomedical signal,RF radiation,VLC,accuracy,high transmission rate.*

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I. INTRODUCTION

Biomedical data are the obervations of physiological activities of the humans . An Biomedical data can be used to detect potential problem associated with the activity. Because of their low amplitude of biomedical signal,it is more difficult to detect than the other signal . Visible light communication using white light emitting diode is a promising technology for the next generation communication for high speed data transmission. The usage of RF based device in the healthcare have a dangerous impact on the health of the patient, especially for those person with seizure attacks, infants in incubators, heart attack patient, possibility of brain death patient and head surgery patients. Taking into these considerations, we are using, a harmless effective high speed visible light communication system is used to transmit the Biomedical signal.

II. PROPOSED SYSTEM

To overcome the issues that are caused due to periodical monitoring of the patients and to reduce the signal loss, we are transmitting our Biomedical data in the form of signals,image etc., using Visible Light Communication. In our proposed system we are sensing our Biomedical signal and it is processed and transmitted through the data streams of white LED. The stream is formed after the analog to digital conversion (ADC) and it is modulated and transmitted. The receiver accepts the modulated data. The received data is transmitted via a serial cable to the PC. Run-time and development environment are used to monitor and analyses the transmitted Biomedical signal.

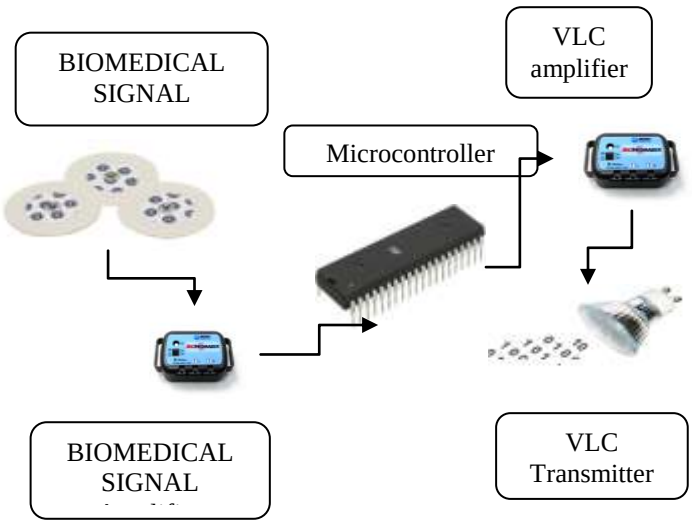
III. LITERATURE SURVEY

The progress in the recent research shows that the light emitting diode can be used for high data rate trasnsmission.The photonic crystal used in LED can help to achieve high efficiency in visible light communication system[1].The modulation scheme used here is On Off Keying(OOK) in order to loss of information because of dimming of light[2].Line of sight(LoS) is one of the important parameter in the visible light communication,LoS must be maintained between transmitter and receiver to achieve high throughput[3].The transmission rate of about gigabit is achieved[4] which enable us for the quick access to the information. LED lamps can be used as communication emitters without losing their illumination functionality. Beam width of the communication link is shrunk to have higher data rate and hence transmitted data can be tuned to point towards the target receiver[5],[6],[7]. New innovative lighting products are developed with this trending technology[8]. Data-driven approaches can be used to create models based on physically sensed data rather than found from analytical methods[9]. There is also a need for LOS channel model to fix the path loss and optical power received for optimization of the receiver under major noise source[10]**.** By manipulating the fast-switching characteristic of commercial white LED devices, digital signals can be transmitted wirelessly via the optical channel [11],[12] using a technique known as visible light communication (VLC) .

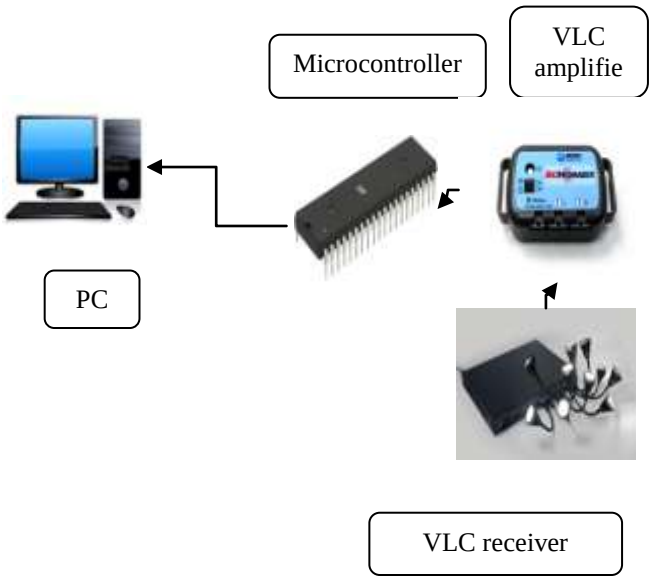
IV.EXPERIMENTAL SETUP

Fig 1:VLC hardware setup

A. *TRANSMITER*



B. *RECEIVER*



The above figure shows the transmitter and the receiver module of our proposed system. In this VLC system captured Biommedical signal is processed and transmitted via a parallel data streams of white LED. Then the obtained signal is amplified as signal strength are of few mV range. The LED (VLC) transmitter was connected to a printed circuit board (PCB) via microcontroller (AT89s52). An amplified Biomedical signal is given to this transmitter. This PCB consists of an on-off keying (OOK) non-return to zero (NRZ) modulation circuit that generates a carrier signal.OOK is a type of amplitude shift keying (ASK), which is the simplest form of bandpass data modulation. A carrier signal with a frequency of 100 kHz is selected to ensure that the LED appears illuminated to the human eye while transmitting data. A microcontroller (atmega 89s52) was used to interface the VLC transmitter module with the PC database containing the desired information. Transmission occurs only if the VLC setup is placed in LoS (Line of Sight) condition. The modulated signal is given to the VLC amplifier. Then it is fed to the controller. The software part is rest. The coding in Embedded C is executed using keil uvision 2.0 and output (Biomedical signal) is viewed in Microsoft Visual Basic 6.0. This is interfaced with microcontroller kit i.e. coding is dumped. Here we neglect interference of multiple voltage signals i.e. noise by connecting a capacitor, transformer, IC555 timer, and a voltage regulator(IC 7805).

Interlinking of these components eliminates noise and regulates voltage (stabilizing supply to PCB and PC i.e. 12V to 5V) and also to convert AC to DC signal. The received data signal is then amplified and demodulated in VLC receiver module in the PCB, which is connected to a microcontroller LCD display device for displaying the received information. Here the Signal to Noise ratio of greater than 7 DB can be achieved.

V.EXPERIMENTAL RESULT

The experiment is carried out on the visible light communication as described above. Line of sight configuration is used in indoor environment with all the external light being turned on. The experiment is conducted with 50 cm distance between the transmitter and receiver. The output is viewed in the simulation software Visual Basics 6.0.The output is viewed as follows.

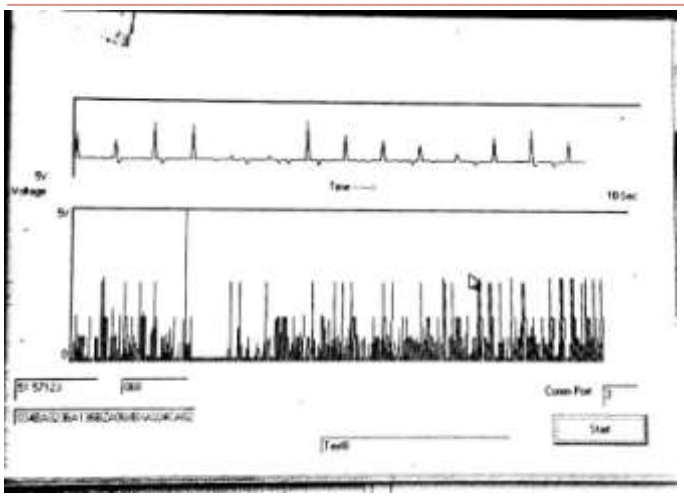


Fig2:Transmitted EEG signal

And also we can transmit a image, video and files through VLC (Visible Light Communication) technology. Here we took a CT scanned image which is successfully transmitted and received through VLC (Fig. 3&4 shows it).This proves that we have only negligible interference negligible interference or distortions in our process.

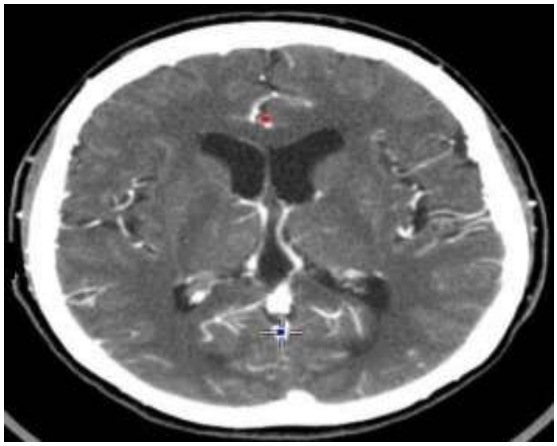


Fig 3: Transmitted CT scan image

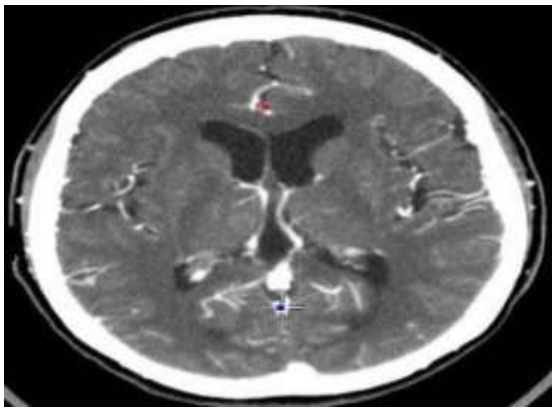


Fig 4: Received CT scan image

VI.CONCLUSION

A comprehensive real time health monitoring system using commercially available LED and VLC was successfully developed to transmit the information about the Biomedical signal with high speed of transmission and accuracy. In future application the transmission distance may be increased by live streaming through networking technology.

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