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Design and Implementation of High Speed Data and Video Transmission Using Light Fidelity Technology

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Abstract:

Visible Light Communication is the technology uses the visible light from LED devices for effective data transmissions as bandwidth issues takes part in the radio frequency transmission, the demand for faster data transmission has become a vital part for large streaming multimedia. In order to increase the transmission rate and bandwidth efficiency, a new high speed data communication technology termed as Light Fidelity is enabled in this work. Above mentioned bandwidth issue and transmission rate demand is mitigated on employing the Li-Fi technology which as it provides faster data transmission with a high secure environment. However, Visible Light Communication uses optical frequency for data communication on inclusion of 5g. In this paper, a multimedia transmission has been carried out incorporating VLC model utilizing the Li-Fi (light fidelity) module. The proposed model is composed of LIFI transmitter, LIFI receiver, microcontroller and personnel computer. A LiFi transmitter and receiver module is employed to transmit the text data and video data using Li-Fi under changing conditions such as device distance, optic intensity, and data transmission quality. The primary objective is to design a visual light based transmitter and receiver using a Li-Fi module setup for data and video transmission. The proposed model has been applied to varying data types. The employing VLC has attracted due to its fast data rates and large traffic. The significance of VLC has been measured with respect to fast data rates with less power consumption and less architecture cost, it is considered as an exploiting data communication technology which injected in the 5g networks. Experimental analysis of the architectures determines the effectiveness of the proposed and conventional models for data communication with high reliability compared with conventional approaches using WIFI technologies through radio frequency.

Keywords — **Visual Light Communication, Light Fidelity, Data Communication, Video Communication, Optimal Wireless Communication.**

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I. INTRODUCTION

Visual Light Communication is an optical wave technology transfer of data with fast data rate and high security. Light-Fidelity uses the transmission of data on transmitting the data in form of visual light illumination by transmitting the information or bit through an LED light. Li-Fi incorporates the Light Emitting Diodes (LED) for large byte modulation with high bandwidth utilization and reduces the transmission delay by illuminating over a long period of time. LED's based on data transmission will produce the fast switching speeds which enable data transmission to enhance the data

streams which has to be sent. The data transmission occurs in a continuous stream to being transmitted simultaneously.

The LED-based lights are highly utilized for various applications for transferring the data with varied parameters and properties like fast-speed switching and low energy consumption. The proposed approach is considered as environmentally friendly and effective solutions for text and video communication. These diodes collaborate together in for effective data processing and communication [2][3]. As the light emitting diode in LiFi, employed for data transmission [4]. LED are generally uses the light detector to extract the data or information from the LiFi transmitter and passed it to the microcontroller unit for transmitting the digital data to analog data. Analog data is further transmitted in the network and received at the receiver unit. Receiver processes the analog data and transit into digital data and displayed in the personnel computer.

In the proposed model, White color LED's is the highly used for passing the data with increase the data transmission rate.LED producing the optic waves at faster rates for data transmission. It is provides high security for data communication to upload and download operations with less power utilization.

Remaining paper is sectionized as follows, section 2 details the conventional work containing the data communication model using LiFi module as visual light communication. Section 3 provides the proposed architecture for data communication using LiFi technology. In Section 4, an experimental result of the proposed model details the model performance and section 5 concludes the work.

II. RELATED WORK

In this part, data communication approach using Li-Fi technology has been has been investigated in depth on basis of visible light communication models, analysis of network units for optimal path finding towards effective multimedia data transmission between nodes has been analysed with respect to bandwidth and transmission rate. All those conventional techniques have been assessed on its performance by varying the data traffic. Further the data transmission approaches which nearly equivalent to the proposed approaches is described as follows

A. *Li-Fi based Data and Audio Communication*

In this literature, Li-Fi is used for data and audio communication is considered as visual light communication. It is considered as the wireless data transmission technologies which utilizes the visible light for data communication. Li-Fi has gained significant growth as it employs the visible light to produce the high speed data communication and large data security. The model produces the less interference on the large size data in the WiFi based wireless data transmission. Further LiFi is feasible for different fields. In this work, LIFI is used to pass the text (Hexadecimal characters) and video information using light as data carrier.

B. Optical data transmission using portable USB Li-Fi module (dongle)

In this literature, Wireless data communication appearing as primary part for data communication. At present, Radio Frequency spectrum is the more emerging data communication medium for multimedia data. Due to which the RF spectrum is not capable for high bandwidth applications. Hence, Visual light communication is used as alternatives to transmit the data using Light Fidelity [5]. Li-Fi, employs optical wireless communication using fibre optics to pass the data to produce high data transmission rate while it many issues resulted due to Wi-Fi technology.

III. PROPOSED MODEL

In this part, Li-FI topology and its transmitter and receiver elements for effective data transmission has been constructed as effective data transmission infrastructure. Further, numerous design constraints has been projected to develop a architecture with data transmission protocols utilizing the artificial intelligence towards bandwidth management and effective data transmission rate. Particular architecture is as follows

A. *Li-Fi Transmitter*

In this part, LI-FI setup contains the transceiver unit in the hardware architecture for

data communication.LI-FI input as data input (serial data input) has been projected to the transmitter circuit by means of a personal computer from which the data will be transmitted and will be received receiver unit using a Li-Fi component. Figure 1 represents the transmission unit.

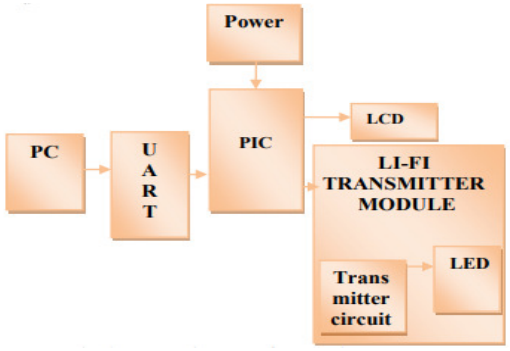

Fig 1: Transmitter Module

B. ***Li-Fi Receiver***

The data will be provided to the LI-FI module using microcontroller for data processing in web application or mobile application. Data will be provided to the LI-FI module from transmitter to receiver. LiFi receiver transmits a light signal to digital signal on reception. Figure 2 represents the LiFi Receiver unit.

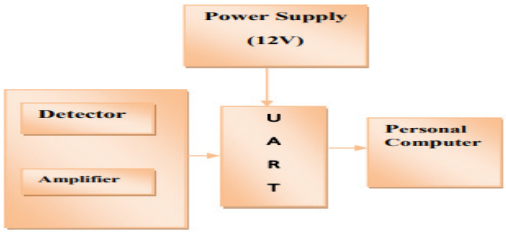

Fig 2: Receiver Module

C. ***UART***

UART is considered as a salient integrated functionality of the any kind of the microcontrollers. The UART extract the data bytes of input data and passes the each bits in a serial manner to reception unit of LIFI.

Fig 3: UART

At the reception, a second UART converts the bits into entire bytes to represent the digital form. Figure 3 represents the UART

D. ***RS232***

RS-232 is a employed for serial binary input signals taken from LiFi Transmitter and receiver by gathering the Data Terminal Equipment (DTE) and a Data Communication Equipment (DCE). It is primarily employed for output serial ports for data communication. Important significant differences between TTL level UART and RS232 has been carried out on basis of the voltage level[6]. Correct to binary signals in RS-232 will be in the range of ±3 to ±15V, and signals near receiver will be 0V. Figure 3 represents the RS232.

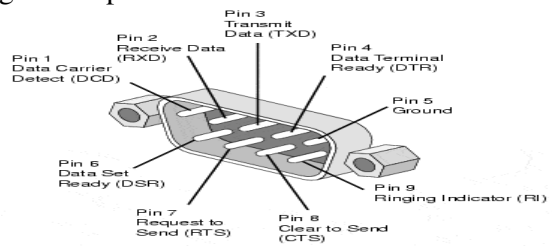

Fig 4: RS232

E. ***Transformer***

The transformer is employed for step down the input supply voltage from the 230V to 6V voltage range. The secondary circuit of the transformer will be integrated with the rectifier circuit for input power supply by amplifying the voltage to different loaded connected in the architectures. It functions using rectifier to produce the voltage output as DC and remaining circuit provides the RMS output. Figure 5 represents the transformer circuit.

Fig 5: Transformer.

IV. SIMULATION RESULTS

In this part, experimental analysis of the proposed architecture has been taken part to achieve fast data rate for

data communication. Initially, the video transmission collects the input data from personnel computer through UART and passes the serial data into parallel data to the VLC technology which considered as LiFi transmitter and receiver. On the receiver side, optical data was received and converted to digital data and transferred to the PC using UART.

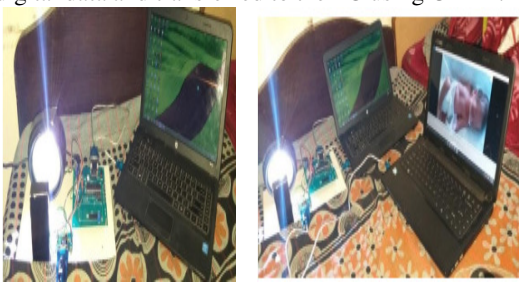

Fig 6: Data and Video Transmission Architecture

Figure 6 illustrates the LiFi transmitter and LiFi receiver part of the data communication has been proposed. The receiver part contains the photo diode element to collect the light signal and store the data in the temporary memory of microcontroller. The UART circuit in the receiver segment will joined using USB device on the personnel computer to obtain the data transmitted content in receiver circuit with high data rate and less bandwidth utilization.

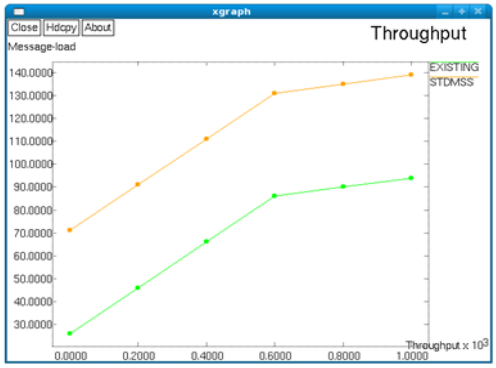

Fig7: Performance analysis

In figure 7, performance of the proposed and conventional wifi technology has been compared in terms of throughput to data communication. Table 1 provides the performance of the Lifi module and wifi module on data throughput and bandwidth utilization on changing the file size and data type.

TABLE 1 – PERFORMANCE EVALUATION

Technique	Throughput in mbps	Overhead in mbps	Bandwidth Utilization
WIFI-Existing	65.58	15.23	36joules
LIFI-Proposed	69.26	12.59	48joules

CONCLUSION

In this paper, a new prototype for the secure data transmission containing text and video data type has been carried out using visual light communication from Li-Fi transmitter and receiver. LiFi module using optic waves has many advantageous over WIFI device using radio frequency. It also provides light sources for data transmission and reception. The experimental results of the proposed architecture are evaluated on various metric termed as throughput and bandwidth utilization against the conventional approaches.

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