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Li-Fi: Data Transmission through Light

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ABSTRACT: In world of wireless technology, the number of devices access the internet growing by a second most of the devices use wireless communication for access internet for sharing data between devices, this has unfortunately led to an increase in network complexity, shortage of wireless radio bandwidth and an increased risk of interference of radio frequencies put limitation on radio frequency which is used in Wi-Fi(Wireless Fidelity).That paper gives remedy on that problem, hence introducing concept of Li-Fi. Li-Fi stands for Light-Fidelity. The main principle of this technology is transmit the data using light illumination by using light-emitting diodes. In Li-Fi based system we analyzes its performance with respect to existing technology.To enjoy high data transfer rates we use of Li-Fi and also for relieving radio interference issues. Li-Fi is the future of high speed data transmission [2]

.KEYWORDS: Light-Fidelity (Li-Fi), Pic microcontroller 16F877A, Light Emitting Diode (LED), LDR (Light Dependent Register).

I. INTRODUCTION

Light-Fidelity technology came into existence in 2011.Harald Haas was coined the term LI-FI and promoted LI-FI. Li-Fi is used for enjoying high data transfer rates. Li-Fi is a fast and cheap optical version of Wi-Fi. It is based on Visible Light Communication (VLC) which is used to transmit data using the spectrum of visible light. In Wi-Fi use radio spectrum to transmit data but due to shortage of radio frequencies and risk of interference it having some limitation. Li-Fi uses visible light instead of Gigahertz radio waves for data transfer. VLC is a data communication medium, which uses visible light between 400 THz and 800 THz as optical carrier for data transmission and illumination. Li-Fi is the wireless communication system which transmission of data through illumination. Li-Fi is transmission of data through an LED light bulb that varies in intensity faster than the human eye can follow. Li-Fi is a framework for providing new capabilities to current and future services, applications and end users.

II. LITERATURE SURVEY

Using a standard white-light LED, researchers at the Heinrich Hertz Institute in Berlin, Germany, have reached data rates of over 500 megabytes per second [1]. Li-Fi Consortium was formed in October2011 by a group of companies and industry groups to promote high-speed optical wireless systems and overcome the limited amount of radio based wireless spectrum. According to the Li-Fi Consortium, it is possible to achieve more than 10 Gbps of speed, theoretically which would allow a high-definition film to be downloaded in just 30 seconds [2]. Researchers at the University of Strathclyde in Scotland have begun the task of bringing

High-speed, ubiquitous, Li-Fi technology to market WANG Jia-Yuan, ZOU Nian-Yu, WANG Dong, IRIEKentaro, IHA Zensei, NAMIHIRA Yoshinori .The Journal of China Universities of Posts and Telecommunications. In this paper, the illumination of the receiving surface for different distances between the LED and photodiode receiver was tested. It was found that with the increase in communication distance, the illumination sharply reduced [3].

III. PRINCIPLE

The basic idea behind this communication scheme is transmission of 'Data through illumination' .Heart of Li-Fi technology is high brightness LED's. The on-off activity of LEDs enables a kind of data transmission using binary codes mode however the human eye cannot perceive this change and the LEDs appear to have a constant intensity.

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Switching on an LED is a logical '1' switching it off is a logical '0'. A light sensitive device (LDR) receives the signal and converts it back into original data. This method of using rapid pulses of light to transmit data is called Visible Light Communication the basic principle of VLC. Shows in Fig.1

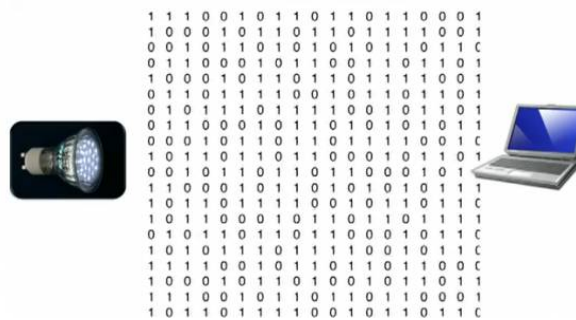


Fig. 1 Basic Principle of VLC

IV. COMPARISON WITH OTHER TECHNOLOGY

Li-Fi is the name which is used for high speed wireless communication, similar to Wi-Fi. Wi-Fi works well for general wireless coverage within buildings, and Li-Fi is ideal for high density wireless data coverage inside a confined area or room and for relieving radio interference issues. Table.1 shows a comparison between wireless technologies. Wi-Fi currently offers high data rates. The IEEE 802.11.n in most implementations provides up to 150Mbit/s although practically, very less speed is received.

Technology	Speed
Wi-Fi – IEEE 802.11n	150 Mbps
Bluetooth	3 Mbps
IrDA	4 Mbps
Li-Fi	>1 Gbps

Table no 1 Bit Rate of various technologies

V. PROPOSED WORK

V.1 Transmitter Section

The system architecture consists of a transmit section and a receive section. The transmit section consists of the data input which is then fed into a switching control system. Based on the data, the switching control generates a stream of 1s and 0s thereby encoding the data in binary. The output of this control is given to the array of LEDs which turn OFF and ON at extremely high speeds. This ON-OFF modulation of the LED light transmits the data. LED is the choice for light source since it consumes very less power when compared to fluorescent lamp or a light bulb. LEDs are also fast switching with good visibility. Transmitter section shown in fig.3

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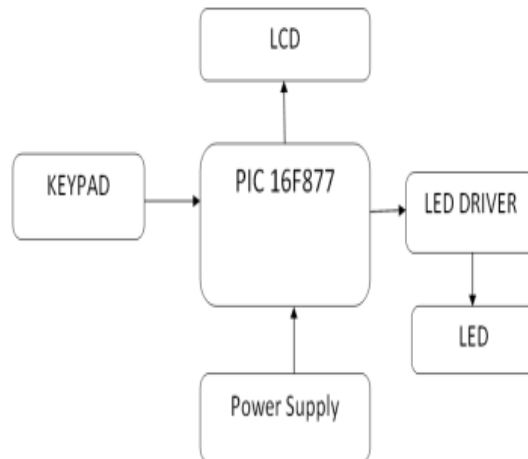


Fig.2 Block Diagram of Transmitter

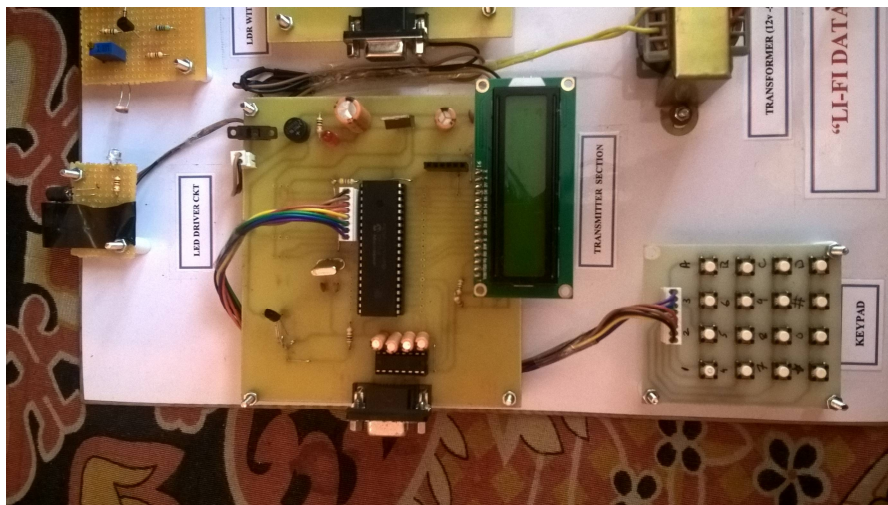


Fig 3 Transmitter Unit

V.2 Receiver Section

The receive section consists LDR as a receiver having high sensitivity. We can also use the photo detector for same purpose. LDR decode the incoming demodulates the incoming received signal based on the sequence of 1s and 0s. The demodulated signal is then sent to a signal conditioning unit than fed to PIC microcontroller, which decode that signal and then given to an output device such as an LCD display. Receiver section shown in fig.5

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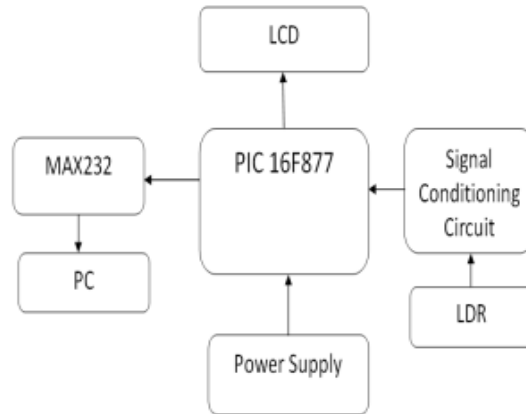


Fig.4 Receiver Section

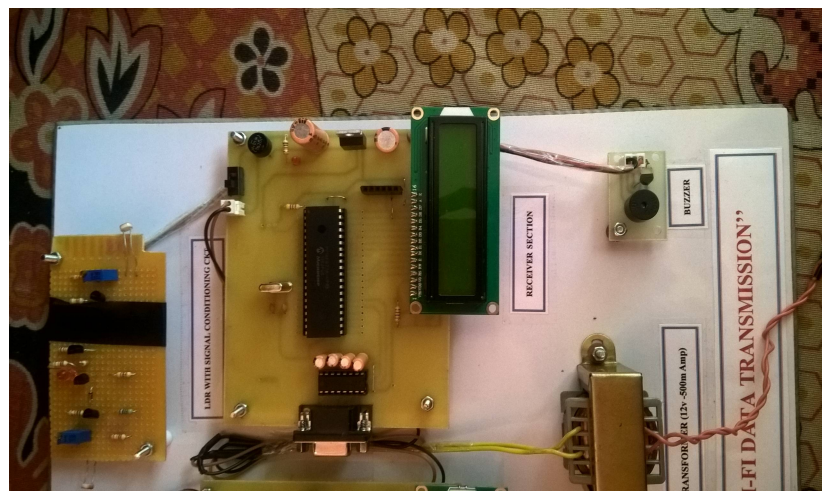


Fig.5 Receiver Unit

VI. EXPERIMENTAL RESULT

Using of that Li-Fi technology we can transmit data from transmitter to receiver. In that project we use two modes for transferring data, first one is Auto mode and second one is manual mode. In Auto mode we transmit store data shown in table no 2. In manual mode we transmit data using 4*4 matrix keypad. By using that model we can transmit data up to 1 kbps.li-fi system shown in fig 6

Sr no	Mode	Input display	Output display
1	Auto made	Auto mode Sending info....	Turn left, temp 30°
2	Manual mode	Manual mode Sending info.... ABCD123	ABCD123

Table no.2 Display Mode

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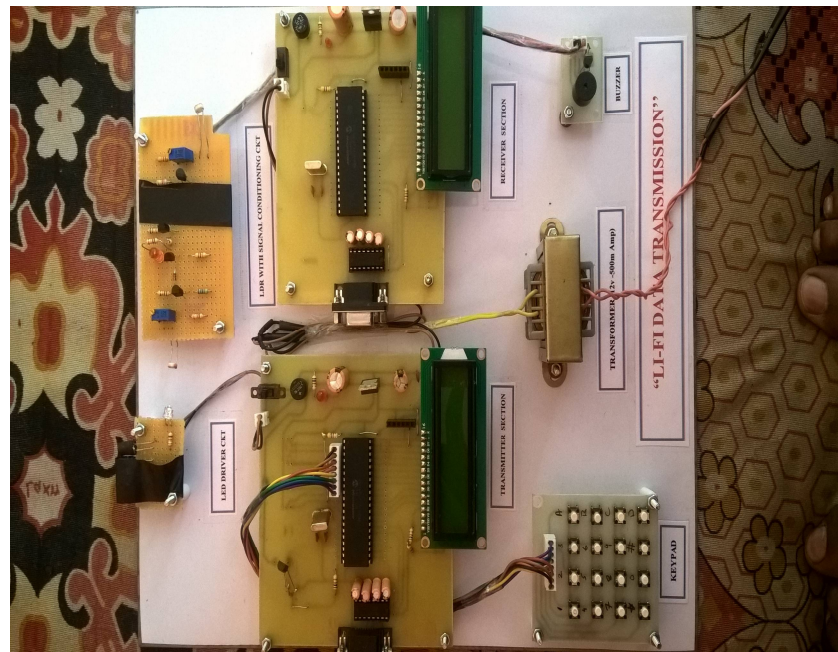


Fig.6 Li-Fi System

VII. APPLICATIONS

1. Replacement for other technologies-as compare with other wireless technology Li-Fi have great features, for money applications we can use Li-Fi as a wireless technology.
2. Road Safety and Traffic Management- Li-Fi can be used for communication between the LED lights of vehicles. It can also be implemented in the traffic lights for vehicle to roadside communication to update traffic information.
3. Public internet access through street lamps- Any lighting devices like street lamps, etc. are performed as a hotspot. It means that the any light able to spread internet using visual light communication which helps us to low cost architecture for a hotspot. The hotspot is a limited region in which some amount of device can access the internet connectivity.
4. Auto-piloted cars that communicate through their headlights which is useful to exchange traffic information between heavy traffic.
5. Point to point data communication between no. of devices.
6. Hazardous Environments: Li-Fi is a safe alternative to RF communication in environments such as mines and petrochemical plants which are susceptible to electromagnetic interferences.
7. Underwater Communication- for underwater communication use of radiofrequencies (RF) & use of Sound waves is impractical due to strong signal absorption. Li-Fi can be employed in such cases for underwater communication.

VII. ADVANTAGES

1. Li-Fi has low implementation and maintenance costs.High data transmission rates of up to 10 Gbps can be achieved.
2. It is safe for humans since light, unlike radio frequencies, cannot penetrate human body.
3. Efficiency: Data transmission using Li-Fi is very cheap
4. .A free band that does not need license.
5. Availability: Availability is not an issue as light sources are present everywhere.



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IX. LIMITATIONS

1. Only works if there is direct line of sight (LOS) between the transmitter and receiver.
2. Data transmission can be easily obstructed by opaque obstacles.
3. The use of very high frequencies (400-800THz) limits it to very short distances and
4. Point to point communications only.

X. FUTURE SCOPE

1. We use MOSFET instead off BJT FOR high switching purposes.
2. We use CMOS sensor instead off LDR for greater response.
3. It is possible to achieve more than 10 Gbps of speed, theoretically which would allow a high-definition film to be downloaded in just 30 seconds.
4. We can focusing on parallel data transmission using arrays of LEDs, where each LED transmits a different data stream while other groups are mixtures of red, green and blue LEDs to alter the light's frequency, with each frequency encoding a data channel.

XI. CONCLUSION

Li-Fi has great technology in the field of wireless data transmission. It is advanced Conventional methods of wireless communications that use light as data carrier. Many Enhancements can be made to the existing technology, by using fast-switching LEDs, data transmission rates can be further enhanced. The driving speed of the circuit can be improved by using fast-switching transistors. Li-Fi is feature key of high speed data transmission. If LI-FI technology can be put into practical use, every bulb used to transmit a data and will lead toward the brighter future.

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