



# VISIBLE LIGHT COMMUNICATION BASED AUDIO TRANSMISSION SYSTEM USING LI-FI

Kavitha, Mariselvi

Mrs.R.Lalitha Lakshmi, (AP/ECE)

Dhaanish Ahmed College of Engineering, Padappai

**ABSTRACT :** Visible Light Communication (VLC) technology, one of the advanced optical wireless communication technologies, in which light in the visible region (375nm-780nm) is used as a medium for data transmission is more secure and achieves high data rates as compared to conventional wireless technologies like Wi-Fi, Bluetooth, Wi-max etc., which use radio waves for communication. While using wireless internet, when more than one device is tapped into the network, then bandwidth got frustrated at the slow speeds. To overcome the shortage of bandwidth we can use light to transfer the voice which can be known as “VOICE THROUGH ILLUMINATION. The idea behind is that, infra-red remote is slightly modified i.e., LED light bulb that varies in intensity which cannot be followed by the naked eye. It is possible to encode the data in the light by varying the light at which the LEDs flicker on and off to give different strings of 1s and 0s. While using mixtures of red, green and blue LEDs to alter the light frequency encoding a different data channel. If you can't see the light then you cannot access the voice so the security would be snapped.

**KEYWORDS:** Visible light communication (vlc), LED (Light emitting diode), Li-Fi, data rates high, more secured.

## 1. INTRODUCTION

Light Fidelity (Li-Fi) is future technology which replaces the Wi-Fi. Because Li-Fi overcomes disadvantages of Wi-Fi like data Transfer speed of Li-Fi is more than 1Gbps while in Wi-Fi it is about 150 Mbps. Li-Fi uses light as a carrier but Wi-Fi uses radio Spectrum. In Li-Fi Visible light Spectrum has 10,000 broad spectrums in comparison of radio frequency. Operating Frequency in Li-Fi is Hundreds of Tera Hz where as in Wi-Fi it is 2.4 GHz. Li-Fi is Cheaper than Wi-Fi because free band doesn't need license and it uses light. Li-Fi is abidirectional, high speed and fully networked wireless communication

technology similar to Wi-Fi. This term was developed by Harald Haas and is a form of visible light communication and a subset of optical wireless communications (OWC) and could be a complement to RF communication (Wi-Fi or Cellular network), or even a replacement in contexts of data broadcasting. It is so far measured to be about 100 times faster than some Wi-Fi implementations, reaching speeds of 224 gigabits per second. Li-Fi technology in the audio transmission is must faster and secured communication. In future this technology can be



used in industry automation for controlling various machineries and robotics



## Related work

Voice and data transmission is done previously by using various technologies like wireless communication protocols to transmit data, such as infrared, Bluetooth, and Wi-Fi. Also the voice and data transmission is done by LDR and Laser torch. The voice and data transmission is done most popular is using wireless LAN. The use of Li-Fi in the voice transmission and in home/office automation increases the speed of operation of voice transmission also the switching speed of devices i.e. the devices ON and OFF speed is also increases. Use of Li-Fi is more secure, speedy and cheap communication

## 2. Visible Light Communication System

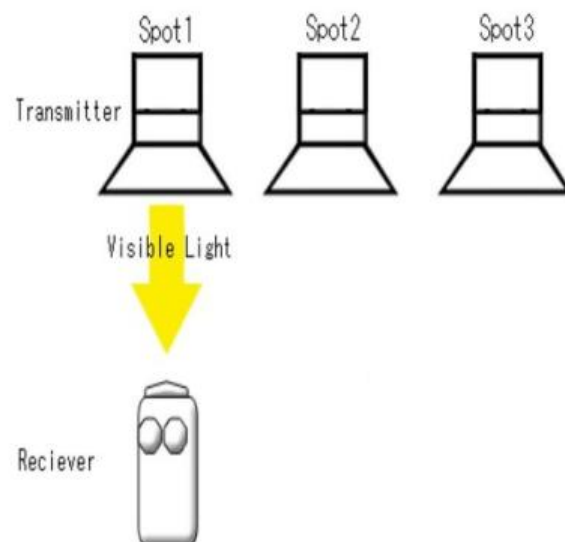
This section provides overview of voice transmission in VLC, thus it uses white LEDs for transfer the voice, thus the voice transmitted using intensity modulation (IM) technique.

### VLC= Illumination+communication

Humankind has been utilizing light as a communication medium for many years, and light continues to be of great benefit in the field of

communication. Fire has been used to make smoke signals on clouds; that is a kind of visual communication. After the invention of the electric light bulb by Thomas Alva Edison in the 19th century, new ways were developed to use light to communicate. The invention of the electric bulb led to the invention of the Signal Lamp, a visual signalling device used for optical communication invented by Arthur C. W. Aldis. Typically, the Signal Lamp uses Morse code to give information to the observer by making shutters mounted on the front of the lamp open and close. The idea of using light as a communication medium was implemented by Alexander Graham Bell in 1880 with his invention of the photophone, a device that transmitted a voice signal on a beam of light. Bell focused sunlight with a mirror and then talked into a mechanism that vibrated the mirror. The vibrating beam was picked up by the detector at the receiving end and decoded back into the voice signal, the same procedure as the phone did with electrical signals

【Structure of the system】



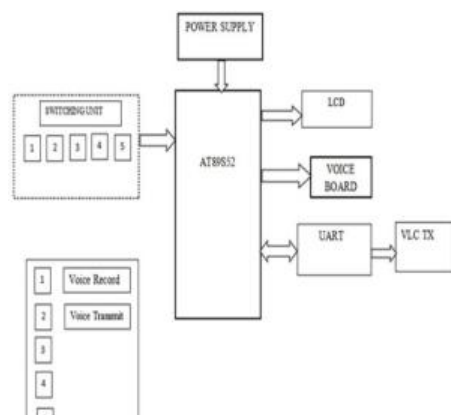


In the proposed system, we have used visible light communication for data transmission. The entire system consists of two sections, the transmitter section and receiver section. The main objective of the project is to implement Voice Transmission system using VLC communication. In the transmission section, voice board is used for voice storage. Switch unit is used for mode selection if we press switch 1 for voice recording is done. Switch 2 is used for voice transmission purpose. The stored voice will be transmitted by using VLC transmitter.

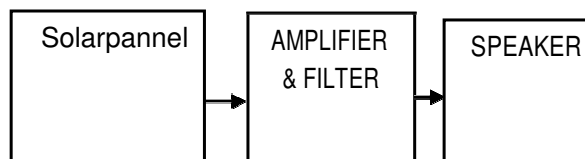
The receiver section used solar panel instead of VLC receiver. By using solar panel, we can reduce the power consumption of the receiver side because the solar panel doesn't need a power source; it can directly get the power from the solar source. [2] discussed about an eye blinking sensor. Nowadays, heart attack patients are increasing day by day. Though it is tough to save the heart attack patients, we can increase the statistics of saving the life of patients & the life of others whom they are responsible for. The main design of this project is to track the heart attack of patients who are suffering from any attacks during driving and send them a medical need & thereby to stop the vehicle to ensure that the persons along them are safe from accident.

### 3. BLOCK DIAGRAM

#### 3.1 TRANSMITTER



#### 3.2 RECEIVER



#### Microcontroller AT89S52

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out.

#### Power supply

230V AC is used to supply to convert into 5V. We are using the stepdown transformer. Thus, the power supply is the reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output or group of loads is called a power supply unit (PSU).

#### Voice board

It is used for storing the voice and transmitting through VLC transmitter. It has high quality and voice recording and also playback. No battery backup required. It is user friendly and easy to operation.

#### Solar panel

It is used for power consumption and required high power consumption.



## UART

A UART is usually an individual (or part of an) integrated circuit used for serial communications over a computer or peripheral device serial port. UARTs are now commonly included in microcontrollers. A dual UART or DUART combines two UARTs into a single chip. Many modern ICs now come with a UART that can also communicate synchronously; these devices are called USARTs

## Solarpanel

A solar panel is a packaged interconnected assembly of solar cells, also known as photovoltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications.

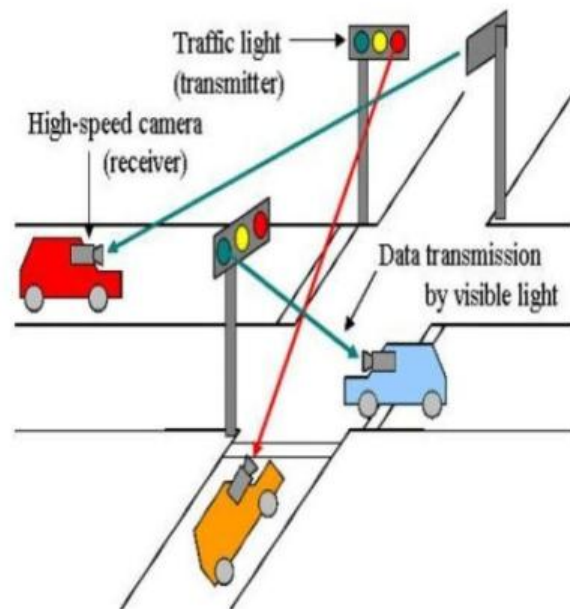
## Applications

Why use LEDs? LEDs have many advantages both in communication and lighting purposes. Some of them are:

- Longer life time (on average, LEDs last three to five times longer than fluorescent and 20 to 30 times longer than incandescent light).
- High brightness (3 watt LED can produce as much illumination as a 45 watt incandescent lightbulb).
- Lower energy consumption (and environmentally friendly).
- Fast switching (due to an LEDs' short response time, it can modulate easily for the purpose of communication. By quickly switching LEDs on and off (brighter and dimmer). Current adoption for traffic signals

## 4. Visible Light Road-to-vehicle Communication Using High-Speed Camera

LEDs are already being used in traffic lights, and they can be used as the communication medium. Road-to vehicle communication using the LEDs in the traffic signal lights was proposed.



The above Fig. shows the basic usage of LED as a transmitter and CAMERA as a receiver. In this model, they mounted a camera before the front end of the car. The camera is used as the information receiver from traffic signal lights. The advantage of using the camera is that multiple data can be transmitted by the LEDs and received by High-speed cameras.

The voltage gain for the filter is given as a function of the feedback resistor (  $R_2$  ) divided by its





corresponding input resistor (  $R_1$  ) value and is given as:

$$\text{DC gain} = \left( 1 + \frac{R_2}{R_1} \right)$$

## 5. Gain Of A First-Order Low Pass Filter

$$\text{Voltage Gain, } (A_v) = \frac{V_{out}}{V_{in}} = \frac{A_F}{\sqrt{1 + \left( \frac{f}{f_c} \right)^2}}$$

Where:

□  $A_F$  = the pass band gain of the filter,  $(1 + R_2/R_1)$

Σ  $f$  = the frequency of the input signal in Hertz, (Hz)

Σ  $f_c$  = the cut-off frequency in Hertz, (Hz)

Thus, the operation of a low pass active filter can be verified from the frequency gain equation above as:

□ **At very low frequencies,**

$$f < f_c \quad \frac{V_{out}}{V_{in}} \cong A_F$$

□ **At the cut-off frequency,**

$$f = f_c \quad \frac{V_{out}}{V_{in}} = \frac{A_F}{\sqrt{2}} = 0.707 A_F$$

Σ **At very high frequencies,**

$$f > f_c \quad \frac{V_{out}}{V_{in}} < A_F$$

## 6. SOFTWARE ANALYSIS

### 6.1 KEIL compiler

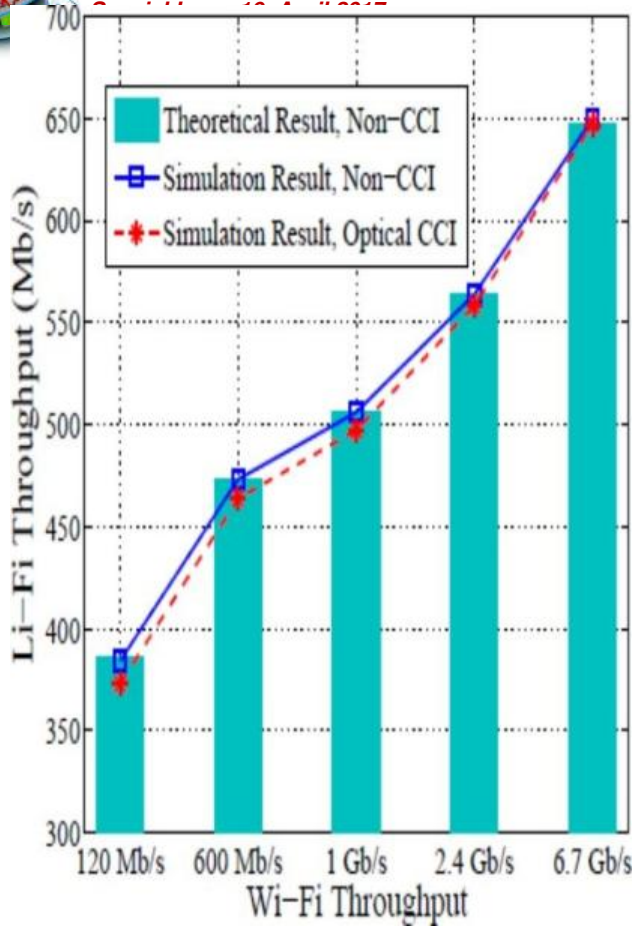
The C programming language is a general-purpose, programming language that provides code efficiency, elements of structured programming, and a rich set of operators. C is not a big language and is not designed for any one particular area of application. Its generality combined with its absence of restrictions, makes C a convenient and effective programming solution for a wide variety of software tasks.

### 6.2 EMBEDDED C: Basic Concepts of Embedded C and Embedded Programming

Embedded C, even if it's similar to C, and embedded languages in general requires a different kind of thought process to use. Embedded systems, like cameras or TV boxes, are simple computers that are designed to perform a single specific task. They are also designed to be efficient and cheap when performing their tasks.

## 7. Comparison between Wi-Fi and Li-Fi

We are living in the age of internet and Wi-Fi is a very famous as well as useful wireless network technology which is used for the purpose of allowing electronic devices to connect to the internet. The world is very accustomed to the technology of Wi-Fi but how familiar are you with the term "Li-Fi". While Wi-Fi is a technology which is local- area wireless network- based internet service, Li-Fi is bidirectional as well as a fully- connected wireless communication technology.



### Analysis of the wi-Fi and Li-Fi

#### References

- [1] C. P. Kno, R. M. Fletcher, T. D. Owentowski, M.C. Lardizabal and M. G. Craford, "High performance ALGaInP visible light-emitting diodes," Appl. Phys. Lett., vol. 57, no.27, pp.2937- 2939, 1990.
- [2] Christo Ananth, S.Shafiqa Shalaysha, M.Vaishnavi, J.Sasi Rabiyaathul Sabena, A.P.L.Sangeetha, M.Santhi, "Realtime Monitoring Of Cardiac Patients At Distance Using Tarang Communication", International Journal of Innovative Research in Engineering & Science (IJRES), Volume 9, Issue 3, September 2014, pp-15-20
- [3] T. Mukai and S. Nakamura, "White and W LEDs," OYO BUTURI, vol. 68, no. 2, pp.152-155, 1999.

[4] T. Tamura, T. Setomoto and T. Taguchi, "Fundamental characteristics of the illuminating light source using white LED based on InGaN semiconductors," Trans. IEE Japan, vol. 120-4 no. 2, pp. 244-249, 2000.

[5] T. Taguchi, "Technological innovation of high-brightness light emitting diodes (LEDs) and a view of white LED lighting system," OPTRONICS, vol. 19, no.228, pp.113-119, 2000.

[6] PakistanTelecommunicationAuthority (PTA) Consultation Papers of Radio Frequency Hazards <http://www.pta.gov.pk/media/rfh>.