

A Future way of Vehicle Communication using Li-Fi Technology

Mohd Farhan Jafri¹, Mohd Yusuf²

¹Department of Electronics and Communication Engineering, Jamia Millia Islamia, New Delhi, India

²Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi, India

Abstract - According to statistics 151 thousands people lost their lives in road accidents in 2018 in India alone. Vehicles are increasing in an exponential rate every year which is a reason for more traffic and eventually road accidents, which is a problem for every developing country. However, the traffic can be controlled and these accidents could be avoided by using Li-Fi (Light Fidelity). The new technology that was developed in the last few years, which still needs more investigations on its sustainability for outdoor vehicular networks. Using the concept of Li-Fi, two vehicles are communicated with the help of LEDs bulbs with the help of transmitter and receiver circuit. With the help of this technology, the road accident can be controlled and many human lives can be saved. The proposed paper reviews the foundation of Li-Fi and studies the possibility of implementing Li-Fi in a communication system. This paper also demonstrates a communication system in which data is sent from a transmitter to a receiver using light.

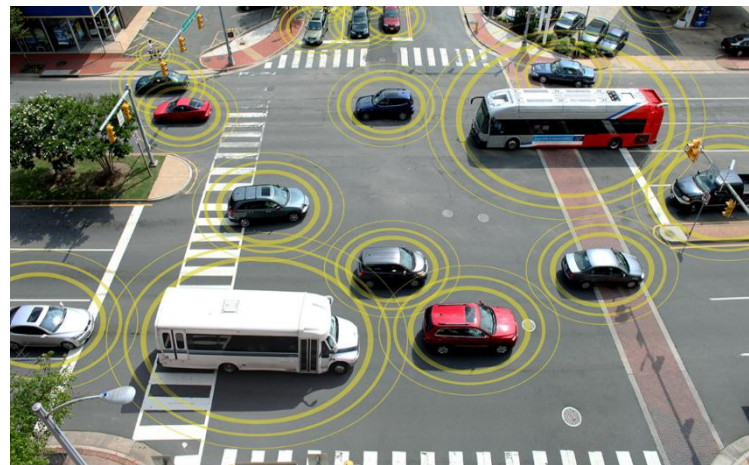


Fig 1. Vehicle to Vehicle communication [3]

Key Words: Li-Fi (Light Fidelity), Visible light Communication, Vehicle to Vehicle Communication, LED and Photodiode.

1. INTRODUCTION

LIGHT FIDELITY OR Li-Fi is a recently developed technology that is a system that uses light for the transfer of data at large speeds compared to other wireless communication technologies. It is a visible light communication system (VLC) that uses light to communicate. Li-Fi was introduced on July 2011 by Prof. Harald Haas at an event. Li-Fi has higher availability because it uses light as a mode of transmission and has a wide range of frequencies and wavelengths. It is more efficient, more secure, and faster than Wi-Fi. The technology makes a LED light bulb emit pulses of light that are undetectable to the human eye and within those emitted pulses, data can travel to and from receivers, then the receivers collect information and interpret the transmitted data [1]. In this paper, we talk about vehicle-to-vehicle communication using Li-Fi in which we transmit the data between two vehicles using Li-Fi to avoid road accidents. [2]

2. COMPARISON OF WIRELESS COMMUNICATION TECHNOLOGIES

In this section, a comparison between the wireless protocols of Li-Fi, Wi-Fi, Bluetooth, and ZigBee is discussed in Table 1 [4-7].

Feature	Wi-fi	Li-Fi	Bluetooth	ZigBee
Mode of Operation	Using radio waves	Using light waves	Using short wavelength UHF radio waves	Using radio waves
Coverage distance	32m	10m	10m, 100m, Based on classes	10-100m
Frequency of operation	2.4GHz, 4.9GHz, And 5GHz	10000 times radio waves	2.4-2.485 GHz	2.4GHz
Speed of transmission	150Mbps	1 Gbps	25Mbps	250 kbits/s

3. SYSTEM DESIGN

The system is designed for two vehicles. The Vehicle Module (VM) is embedded with the vehicle so it acts as a moving node. It is responsible for communicating with vehicles and also for displaying the message received from vehicles. It consists of different sensors, a microcontroller, a light-emitting diode, and a photodiode to retrieve data. The vehicle module has many different features such as high

performance, architecture simplicity, cost sensitivity and ultra-low power consumption. It consists of two major units Trans receiver Unit and a Control Unit. [8-9] The Trans receiver unit is responsible for transferring data between two vehicles and the control unit is responsible for controlling the device.

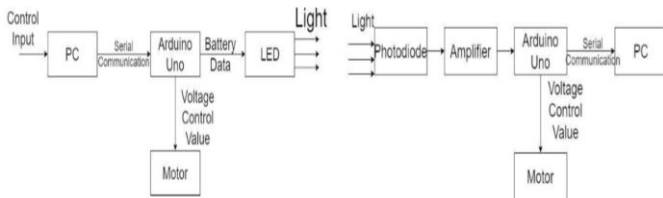


Fig. Block diagram for transmitter and receiver

4. SYSTEM IMPLEMENTATION

Light source is equipped in the form of headlights in the vehicle the data is transmitted through this source the data is very important for the vehicles to avoid accidents the data can be anything like load, velocity, position etc. The vehicles present near this vehicle are equipped with light detectors these detectors capture the data in form of light and the communication is done. This is the way in which we can connect vehicles using Li-Fi technology which is safer more efficient and faster way of connecting.

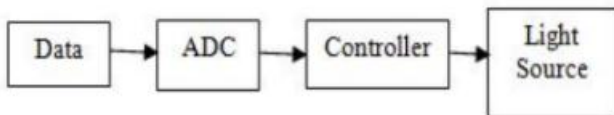


Fig. 2. Data at Transmission End

The data is transmitted in the form of Digital, using an Analog to Digital converter (ADC) and that data is passed on to a controller. The controller varies the intensity of light source through which the data is transmitted. The light transmitted from the transmitter is received by the photo diode. The data is in a Digital form and converted into an Analog by Digital Analog converter(DAC). The output of DAC is Analog data and hence the data is transferred through light. [8]

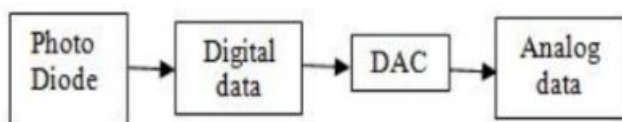


Fig. 3. Data at Receiver End

5. ADVANTAGES OF LI-FI IN VEHICLE TO VEHICLE

The advantages of Li-Fi are as follows:

1. Li-Fi is almost 250 times faster than broadband connection and can transmit data at the rate of 10Gbit/s.
2. Li-Fi data bits can be transmitted parallelly which brings about the expanding efficiency.
3. Li-Fi technology is free and light bulbs are present everywhere
4. Since data can be transmitted wherever there is a light source, this could even help in high speed data transmission in air planes also.
5. Li-Fi provides another layer of security as light cannot pass through opaque objects so it is only available to users within a boundary or room.

6. CONCLUSIONS AND FUTURE SCOPE

The transmission of data from one vehicle to another is done in a very easier by Li-Fi technology by using led light. This technology helps in preventing road accidents and furthermore this technology could be used in future driverless vehicles which works by Machine learning and Artificial intelligence to avoid collisions and accidents. Here in this report we are going to sort out the problem like speed and jamming in WI-FI by using LI-FI technology. Li-Fi cannot be easily hacked because of the less range and high frequency.

LiFi is introduced as a communication system with its modulation techniques and complete architecture explained. The challenges and advantages of LiFi are outlined with its purpose to provide high speed data transmission being one of its biggest pros.

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