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# Vehicle To Vehicle Communication Using Lifi

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Abstract

Li-Fi is the latest technology of the world. The aim of this paper is to provide an idea to reduce road accidents by communication between vehicles using Li-Fi technology. Ultrasonic sensor can be used to measure the vibration level in vehicle and to measure the distance of front vehicle. The gas sensor can be used to measure the liquor level of the driver. If any abnormal condition arises in front of the vehicle, vehicle will stop immediately. Li-Fi is connected to UART function to the microcontroller. Serial data communication and Parallel data communication are two ways of communication in UART for communication between two vehicles. Serial data communication is the main function of UART. Light fidelity is an innovative technology based on data transmission using beam of light as a medium. It uses visible light communication which eliminate the entanglement of cable communication. Li-Fi has proven to be safe, efficient and can transmit data at very high speed. A communication system is also presented in this paper. In this communication system information is transmitted from transmitter to receiver for controlling the speed of two motors using light beam as medium.

**Keywords**

Wireless Communication, Li-Fi Technology, Visual Communication, Smart Traffic, LED Transmitter, Transceivers, UART, VLC

## Introduction

Li-Fi is a beamed communication technology which uses gleam to transmit data and position. It is fast and cheap beamed communication system. It is based on visual light communication. LED light emitting diode is used to transmit the data to the receiver side. Photovoltaic cell is used to receive data from the transmitter. The rated speed of data transmission is about 14 Gbps. In the Indian subcontinent road accidents have become a major concern. 3-5 % of India's GDP is invested in road accidents every year.

A prevention system to reduce these accidents has become very necessary at this moment. The data transmission in least amount of time is must as this is a real time scenario. Since data transmission is done by light in Li-Fi and we know that speed of light is maximum and speed is inversely proportional to time so it will take minimum amount of time. Communication between vehicles seems to be effective solution which may help in reducing vehicle accidents. Around 78% of the road accidents in India are due to human mistakes. Common mistakes are drink & drive, rash driving, ignorance of traffic system, fatigue etc. [1]


Fig 1 Data showing the causes of deaths in India

**Existing System**

IEEE.802.15.4 and IEEE802.11p are used in the existing system for communication between vehicles to transmit data, but the range of transceivers are extremely high. Hence the data transferred not only goes to target vehicle but also to all vehicles present in its vicinity. Much interference of data may occur when two vehicles crosses each other which may result in miss guidance to the drivers. LED lights are already being used by traffic system. Siren lights in ambulance and asphyxiator are used to send data to control traffic lights and switching off the signal. [2-3-4]

**Proposed System**

A Li-Fi receiver and Li-Fi transmitter arrangement on both the vehicles are required in the proposed system. The head light & rear end light can be used as the transmitter for Li-Fi, Solar panel or photo detector can be used for receiver. To improve the efficiency of the receiver many error detection techniques are required. This proposed system seems easy to implement as traffic light already use LED lights. The variation of optical output is extremely high. The proposed system consists of illumination and communication. Unconsumed electromagnetic spectrum can be utilized, there would be no health issues. [1-2]

**System Architecture**

It basically divided in 3 parts.

1. Sender
2. Receiver
3. In Accordance to the input given by user

The message received by the micro controller at the receiver end get converted into ASCII (American Standard Code For Information Interchange) message (conversion from normal message to ASCII) and given to NPN switching circuit which in turn used to boost the corresponding signal and then send it to the PNP switching module which in turn revert the message which was inverted by the NPN switching circuit, then this message (reverted message) is given to the LED which further transfer the ASCII message into light spectrum. And at the other end or the receiving side which is nothing but the photo transistor will be

going to receive the message obtained by LED and pass the obtained message to impedance matching circuit which sense and convert the obtained data in proper format, further this signal is fetched to the USB circuit through TTL which converts the ASCII message into normal message.

**Working**

**Case 01**: When the speed of VEHICLE 1 falls suddenly or due to the braking action the speed reduces, the speed meter will sense the real time or current speed of the vehicle. If the current speed is lower than that of the previous speed then the message will be send to VEHICLE 2 through the transmitter which is placed in the rear end lights of VEHICLE 1.

The fetched message is received by VEHICLE 2 using the photodiode which is placed at the front end of VEHICLE 2.

A notice is displayed in VEHICLE 2 using LCD to reduce the speed or to slow down the vehicle.[6]

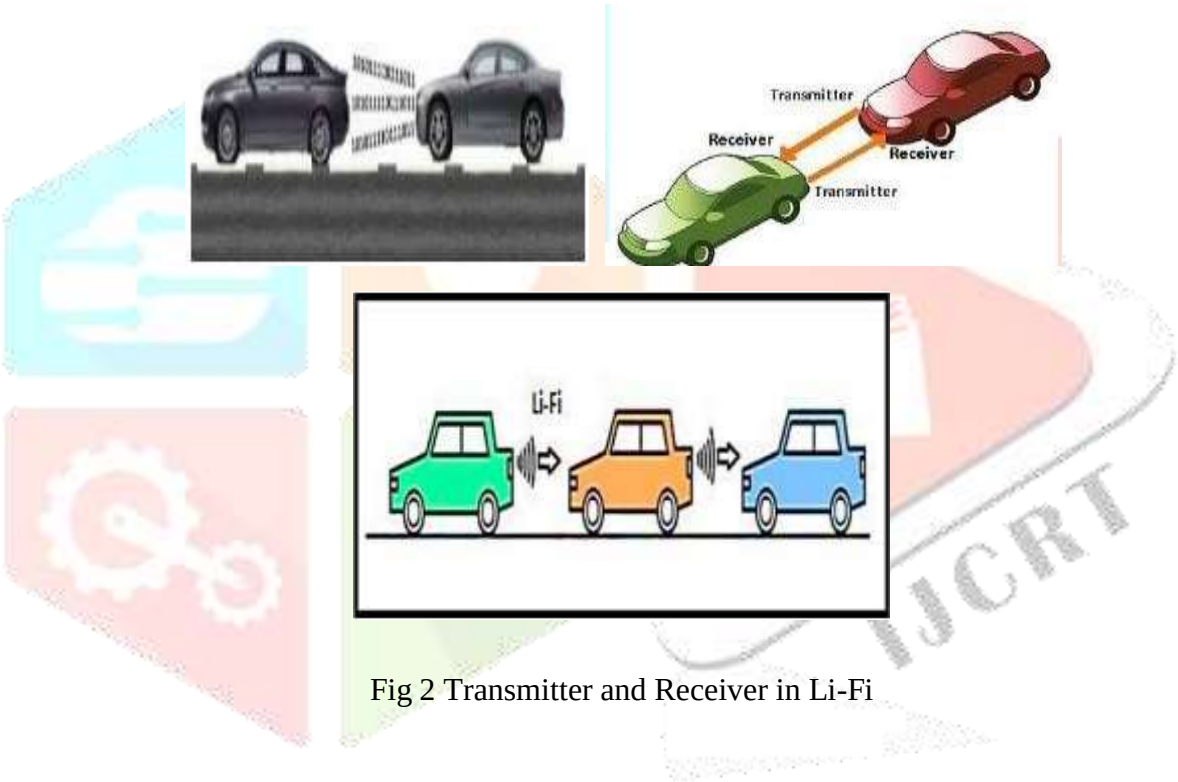


Fig 2 Transmitter and Receiver in Li-Fi

**Case 02:** From Fig C, when VEHICLE 1 is at T- junction, it will send its information related to the current speed to VEHICLE 2 using LED on the headlights. The photodiode in VEHICLE 2 will receive this speed information and will compare it to current speed of VEHICLE 2. And at this situation if VEHICLE 2 which is at lower speed, then of VEHICLE 1 and about to cross the junction, the driver of VEHICLE 2 will get an alert to see the vehicle which is coming from other direction. [6]

Fig 3 Use of Photo Diode to sense LED

**Block Diagram**

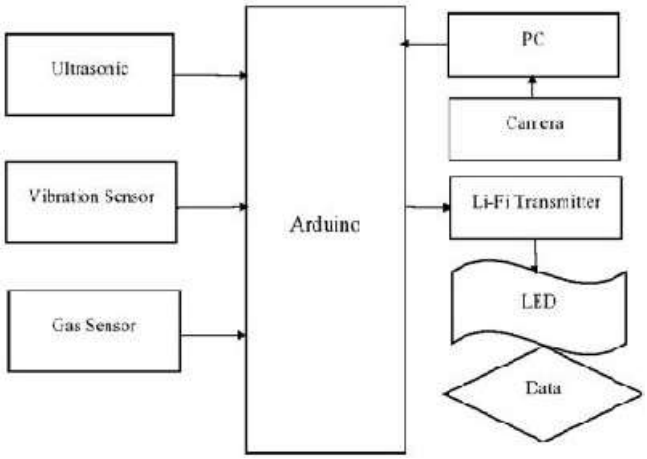


Fig 4 Block Diagram of Li-Fi Transmitter

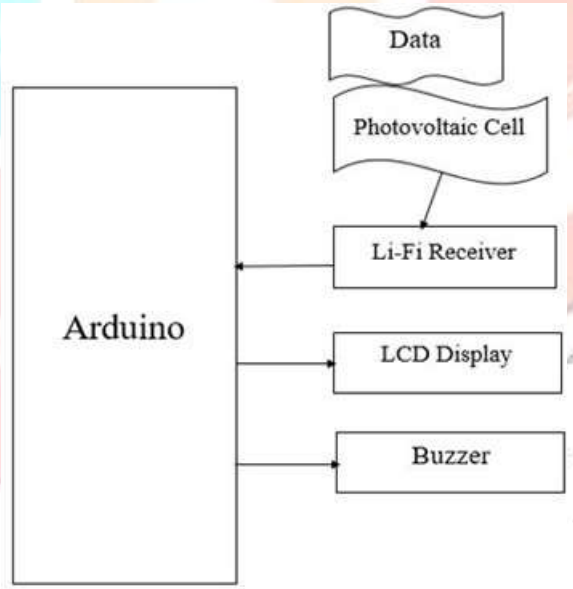


Fig 5 Block Diagram of Li-Fi Reciever

**Li-Fi Transmitter Module 1**

The footway transmitter module 1 consist of arduino controller gas sensor for recognizing any gas leakage of liquor consumption by the driver, detection of any interference in the road, can be done using ultrasonic sensor, the fatigueness of the driver can be detected by pc and camera setup by using eye blink control. Li-Fi transmitter module is used to transfer the data between vehicles.

**Li-Fi Transmitter Module 2**

The footway transmitter module 1 consist of arduino controller to, that will be at the vehicle 2. For exhibiting the contempt received from footway transmitter module 1 and Li-Fi receiver it will only have LCD module. The LED is used to transmit data from one end to the another end. For every side we use 3 sensors, first one vibration sensor to find the vehicle vibration, at least one gas sensor to find the liqour level of the driver and ultrasonic sensor is used to find the distance ofthe front vehicle, these values will be displayed on LCD at an instant when datas are send by Li-Fi transmitter.

**Hardwares Used**

- ARDUINO
- Li-Fi transmitter receiver
- LCD display
- Ultrasonic sensor
- Gas sensor
- PC Camera

**Softwares Used**

- Arduino
- ORCAD design

**Description**

**Arduino Controller**

Arduino is a microcontroller that can be called as tools for making the computers sense more of the real world than the normal desktop computer. It is based on simple microcontroller board and an environment for development of software it can be used for development of interactive objects taking inputs from different types of switches and sensors, and for controlling a diversity motors etc.[1]


Fig 6 Arduino Controller

**Li-Fi Transmitter/Receiver**

Transmitter is a device which is used for transmitting radio or television signal. It generates a radio frequency alternating current which is then applied to the antenna. The light signal generated by the LiFi transmitter is detected by photodiode module in receiver section.[1]

**LCD Display**

LCD is an electronic visual display which uses the modulating properties of light or liquid crystal. Lights are not directly emitted by the liquid crystals. The information about the detected object is displayed by the LCD.[1]

Fig 7 LCD Display

**Ultrasonic Sensor**

The distance between the objects is measured by ultrasonic sensor. Ultrasonic sensor releases sound waves in the direction of targeted object which is then returned to ultrasonic sensor as echo. The distance between objects is measured by the time difference between emission and reception of sound waves. It coverts the reflected sound into an electrical signal. When two vehicle come nearer to some extent the distance between them is measured by ultrasonic sensor. When the two vehicles come nearer to each other the data is transferred to the other vehicle about the current status of the vehicle and hence the chance of accident reduces.[1]


Fig 8 Ultrasonic Sensor

**Gas Sensor**

Gas sensor are sensitive for a range of gases. Concentration and presence of various hazardous gases and vapours can be detected by gas sensor. The output of gas sensor is an analog signal.[1]


**Fig 9 Gas Sensor**

**Application**

- It is used for automobile purpose.
- The data transmission speed of Li-Fi is 10 GB/sec.
- High-density coverage: Li-Fi is more suitable for a high density coverage.
- Secure: Li-Fi provides more security and is dependable than WiFi. Light cannot undergo opaque objects hence it can be easily blocked by many surrounding objects.
- This allows car systems to get data from the network and have actual time data on optimal routes to take.
- It allows development of anti-clash systems between vehicles.

**Advantage**

- LiFi can transmit the message to a distant range with high speed.
- Emergency vehicle can propagate fast through the areas having dense traffic using communication between vehicles.
- Vehicles or automobiles can reach out to each other through front and back light which will reduce road accidents.

**Conclusion**

The proposed systems in this paper uses many sensors such as vibration sensor, ultrasonic sensor, gas sensor, LED lights, LCD display, PC Camera along with arduino microcontroller. Light fidelity ( Li-Fi ) attributes enormous use in traffic supervision and implementing cautious transit of vehicles. Using this method the amount of road accidents can be reduced. In future, Li-Fi technology is going to play an important role in our daily life. A large number of traffic issues can be resolved by using lifi. As Li-Fi technology is an optical wireless communication technology, lights emitted from light emitting diode is used as a medium to transmit data. Thus, the harmful effects of radio waves can be minimized using Li-Fi.

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