Innovation 2020
Organised by
Computer Engineering Department, Dr. D. Y. Patil School of Engineering, Lohegaon, Pune, Maharashtra, India in association with
International Journal of Scientific Research in Science, Engineering and Technology

Inter-Vehicle Communication Using Li-Fi Technology

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ABSTRACT

Ensuring protection of travelers in speedy vehicles and other road-side commuters has always been the main emphasis of urban transportation authorities. Vehicle to Vehicle (V2V) communication is based on DSRC (Dedicated Short Range Communication). DSRCs are highly secure, short to medium range, high-speed wireless communication channels, which help vehicles to connect with each other for a shorter period of time. Through DSRC, two or more vehicles can exchange data regarding their speed, acceleration, distance and direction. Li-Fi (Light Fidelity technology) is defined as a light-based WiFi which uses light instead of radio waves to transmit information. In Li-Fi technology, for communication between two vehicle data is transmitted using bulb and at receiving end, photo detector to receive the data. In this technology none of vehicular protocol is used so it reduces the system complexity. Inter-vehicle communication is an effective method with productive results that the proposed system used in order to communicate between two vehicles and maintain safe distance between vehicles to prevent accidents. This can notify all vehicle drivers about things like lane change, approaching vehicle trajectory and relative speed of the other vehicle in real-time. Smart features of V2V will help vehicles to receive alerts on traffic congestion, obstacles, changing lanes on highways, traffic merging, railway crossing notifications, etc. So, the future of vehicular communication is Vehicle to everything (V2X) communication system, where vehicle communicates with any entity that may affect the vehicle including other vehicles, infrastructure, pedestrians, smart devices, other networks etc.

Keywords : Arduino, Wi-Fi (ESP 8266), Load cell, Database System

I. INTRODUCTION

In this paper, Li-Fi can be thought of as a light-based WiFi. That is, it uses light instead of radio waves to transmit information. And instead of Wi-Fi modems, Li-Fi would use transceiver fitted LED lamps that can light a room as well as transmit and receive information. Since simple light bulbs are used, there can technically be any number of access points.

This technology uses a part of the electromagnetic spectrum that is still not greatly utilized- The Visible Spectrum. Light is in fact very much part of our lives for millions and millions of years and does not have any major ill effect. Moreover there is 10,000 times more space available in this spectrum and just counting on the bulbs in use, it also multiplies to 10,000 times more availability as an infrastructure, globally. It is possible to encode data in the light by varying the rate at which the LEDs flicker on and off to give different strings of 1s and 0s. The LED intensity is modulated so rapidly that human eyes cannot notice, so the output appears constant.

More sophisticated techniques could dramatically increase VLC data rates. Focusing on parallel data

transmission using arrays of LEDs, where each LED transmits a different data stream. Other groups are using mixtures of red, green and blue LEDs to alter the light's frequency, with each frequency encoding a different data channel.

Li-Fi, as it has been dubbed, has already achieved blisteringly high speeds in the lab. Researchers at the Heinrich Hertz Institute in Berlin, Germany, have reached data rates of over 500 megabytes per second using a standard white-light LED. Haas has set up a spin-off firm to sell a consumer VLC transmitter that is due for launch next year. It is capable of transmitting data at 100 MB/s - faster than most INDIA broadband connections.

LiFi is high speed bidirectional networked and mobile communication of data using light. LiFi comprises of multiple light bulbs that form a wireless network.

When an electrical current is applied to a LED light bulb a stream of light (photons) is emitted from the bulb. LED bulbs are semiconductor devices, which means that the brightness of the light flowing through them can be changed at extremely high speeds. This allows us to send a signal by modulating the light at different rates. The signal can then be received by a detector which interprets the changes in light intensity (the signal) as data.

The intensity modulation cannot be seen by the human eye, and thus communication is just as seamless as other radio systems, allowing the users to be connected where there is LiFi enabled light. Using this technique, data can be transmitted from a LED light bulb at high speeds.

II. MATERIAL AND METHODS

According to the condition, user will give the input to the microcontroller using keypad switches. Microcontroller will convert the input into ASCII & then the ASCII value is given to output pins of microcontroller on which Li-Fi transmitter is connected. Li-Fi converts ASCII value into visible light spectrum. Now at the receiver side, Li-Fi receiver will receive the message sent by LED and decode the information and gives it to the output display device.

Fig 1. Li-Fi transmitter

It receives the modulated signal send by Li-Fi transmitter and demodulates the signal to recover the original signal. The receiver part detects these flashes using photodiode and then sends demodulated signal to microcontroller.

Fig 2. Li-Fi receiver

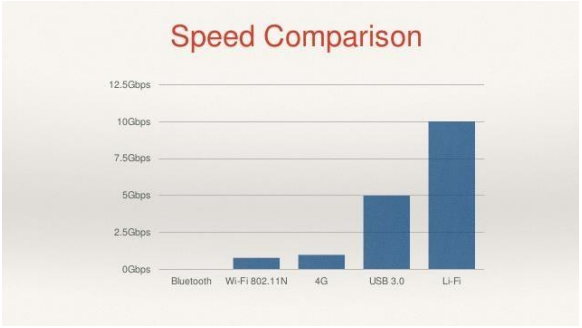
III. RESULT & DISCUSSION

Li-Fi uses the light waves to transmit data wirelessly compared to the radio signals used by Wi-Fi. Thus, it works efficiently within the light source and the environment within the allowed radius which

prevents any unwanted users sniffing the traffic and packets that are being transmitted. Whereas for Wi-Fi, the long-distance capabilities hinder the security as people who are far away can easily monitor packets and potentially carry out a manin-the-middle attack that severely compromises integrity and confidentiality of data.

LiFi could transmit up to 100 Gbps and possibly higher, but this would require a change in lighting technology.

Recent news report that LiFi is 100 times faster than WiFi. The assumption was that the average WiFi speeds are 10 Mbps, and that LiFi can be as fast as 1 Gbps. It is important to highlight that 1 Gbps transmission speeds from an offthe-shelf commercial LED light bulb have not been demonstrated, yet. In this discussion, it is important to compare like-for-like.



Following table is showing a comparison of speed and data density among different wireless technologies.

Technology	Speed	Data Density
Wi-Fi	150 Mbps	*
Bluetooth	3 Mbps	*
IrDA	4 Mbps	***
Li-Fi	>1Gbps	***

Data densities offered by LiFi allows for significantly greater capacity. For example in a room with 6 LiFi integrated lights, each light transmits 42 Mbps leading to a total capacity of 252 Mbps in that room. This results in a reliable and faster user experience.

Data density offers a greater user experience as it reduces the need to share the wireless bandwidth with other users. LiFi can achieve approximately 1000 times the data density of Wi-Fi offering more data per square meter. This is an important factor for wireless efficiency.

IV. CONCLUSION

We have presented an Inter-Vehicle Communication system consisting of a Li-Fi transmitter and receiver that is targeted at communication between vehicles, Li-Fi can be used to communicate with the LED lights of the cars and number of accidents can be prevented. Li-fi is ideal for high density coverage in a restricted region. It is believed that the technology can yield a speed more than 10Gbps.It is the fastest and cheapest wireless communication systems which are suitable for communication. Li-Fi will make all our lives more technology driven in the near future. Further research on Li-Fi is gaining pace in the recent times which will potentially resolve the many unsolved mysteries of the world.

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