ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 5, Issue 1, January 2018

A Review of vehicle to vehicle communication using Li-Fi technology

[1] A.Karthikeyan, [2] G.Abilesh Raja, [3] B.Habibullah Khan, [4] B.Jefferson
[1] Assistant Professor, [234] UG Scholar, Department of ECE
SNS College of Technology Coimbatore, India

Abstract: **- Communication between vehicles, a small-scale mock-up using Light Fidelity (Li-Fi) technology, which still needs more organized inquiry on its sustainability for communication between vehicles. Inter-vehicle communication is an effective method with productive results that we have used in order to communicate between two vehicles. Li-Fi technology is a wireless communication in which light is source of transferring data by acting as a carrier signal. In Li-Fi technology, for communication between two vehicle data is transmitted using LED and at receiving end we use photo detector to receive the data. In this technology there is no protocol used so it reduce the complexity. The aim of the paper is to design a module for communication between vehicles through voice transmission.**

Key words: **- VLC, V2V, LED, Li-Fi, ITS (key words).**

I. INTRODUCTION

Wi-Fi is widely used technology for wireless communication in public like home, hotels, workstations, airports, etc., the radio frequency is getting blocked day by day and at the same time use of wireless data is increased. Wireless radio frequencies are often and massively used, so complexities are increased. Hence, radio frequency interference will continue to grow exponentially every year. To overcome this difficulties, Light Fidelity technology came into existence. Visible light communication (VLC) is becoming an alternative for next generation wireless technology by offering low cost, unregulated bandwidth and ubiquitous infrastructures support. This paper will focus on Li-Fi technology over Wi-Fi technology and challenges for the new VLC technology. Li-Fi is now part of the Visible Light Communications (VLC), it deals with the demonstration of Li-Fi data transferring from PC to microcontroller (PIC). The text that send from pc is converted to serial data with help of USB to TTL convertor. The converted serial data is transferred to LED with in fraction of millisecond. This is carried out in Li-Fi module transmitter part. In receiver part of Li-Fi module it as photodiode sensor which convert visible light to data. From receiver module of Li-Fi the Serial data is obtained and feed it into the microcontroller (PIC).

II. LITERATURE SURVEY

Visible Light Communication (VLC) is a new technology that may become an alternative choice for wireless communication in the future. The technology may be used in many indoor applications. The specific presentation of VLC in this study is with the use of light emitting diodes (LEDs) as the medium for transmission. Digital information will be sent through the LEDs as light pulses, and then a receiver will be able to collect the light pulses as a code and translate it to a corresponding audio data. In this study, the visible light communication system uses modulation schemes, such as on-off keying, so that the digital HIGHs and LOWs are representations of the binary code to be transmitted. Acknowledgement lights incorporated in the receiver are also utilized to make multicasting possible, and to signal that transmission is successful. This is implemented with audio multicasting using visible light communication that is used to send location information to aid the visually impaired. The study was executed using light emitting diodes, which has the capability to transmit fast light pulses. The central device is able to transmit using LED as the communication medium to two end devices simultaneously. The end devices can receive the information successful after being placed 1 meter below the central device. The system is also able to function in both dark and bright lighting environments. An Android application is developed to control the connection between the central device and the end device [1]. An approach for wireless data communication between two systems through visible light.

ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 5, Issue 1, January 2018

This approach created a way which can make data transmission faster than current wireless communication technology. Use of visible light for wireless communication solved issue of lack of radio wave spectrum space that will increase the data transmission rate. This system demonstrated transmission and reception of data by switching LED on and off at very high intensity which is too fast to be noticed by human eye. Various data was encoded by varying the rate at which LEDs flicker and transmit it. This paper described the design, fabrication, and capabilities of visible light based data communication, as well as the development of the LED and photo sensor based optical wireless communication system. This data is to be send from one PC to another PC using UART serial communication.

LED does not cause any health hazards thus this communication through LED is safe to use. It provides wider range of bandwidth so availability increased anyone can access service, where light source is present. It also provides secure link due to line of sight, no any intruder standing outside the room can hack the data. In this system, the modulation and detection methods used are easy to design and implement. Thus, the system has provided all the process for transferring data using VLC. The data is in form such as text and an audio. With the help of Python, software to hardware interfacing has been done. It also provides secure link due to line of sight connectivity with its light source. Thus some advance research work is required to overcome this limitation to implement this technology in practical use [3].

Traffic safety applications using vehicle-to vehicle (V2V) communication is an emerging and promising area within the ITS environment. Many of these applications require real-time communication with high reliability. Li-Fi is a wireless communication system in which light is used as a carrier signal instead of traditional radio frequency as in Wi-Fi. Li-Fi is a technology that uses light emitting diodes to transmit data wirelessly. Li-Fi is a form of Visible Light Communication (VLC). VLC uses rapid pulses of light to transmit information wirelessly that cannot be detected by the human eye. This paper is determined to enhance the quality of Intelligent Transportation System (ITS) with the help of Visible light communication technology using a Li-Fi transmitter and receiver kit. The V2V communication system consisting of the Li-Fi transmitters placed on a leading vehicle and the Li-Fi receiver is placed on a following vehicle. The received data can be used for further development in vehicle control and to avoid collisions by controlling the speed of the vehicle. This system presented a VLC system consisting of a Li-Fi transmitter and receiver that is targeted at V2V applications, and introduced its characteristics and capabilities. In traffic signals, Li-Fi can be used which will communicate with the LED lights of the cars and accident numbers can be decreased. Li-Fi is ideal for high density coverage in a confined region. It is believed that the technology can yield a speed more than 10 Gbps .It is the fastest and cheapest wireless communication systems which is suitable for long distance communication [5].

III. EXISTING SYSTEM

VEHICLE TO VEHICLE COMMUNICATION

Intelligent Transport System(ITS) are advanced applications that are used to provide various innovative services to facilitate road safety and traffic management, Vehicular communication is an advance technology that can be used in ITS. Vehicle to Vehicle (V2V) communication system using the emerging wireless system provides early warning signals to reduce road accidents and congestions. To improve the safety of the users a cooperative driving is proposed it also helps to improve the efficiency by enabling vehicles to communicate accident related messages with each other. Cooperative driving can also be advantageous in improving the safety of the neighbourhood. It assists and help driver to take proper decision and avoid collision and congestion. In this paper design and result of vehicle to vehicle communication using Li-Fi(Light Fidelity),is presented .The proposed use of Li-Fi Technology in this paper comprises mainly of Light Emitting Diode(LED) bulbs as a means of connectivity by sending data through optical spectrum as an optical wireless medium for signal propagation. In fact, the usage of LED eliminates the need of complex wireless networks and protocols.

A small scale prototype of vehicle to vehicle communication system using Light fidelity is presented. VANET Communication is classified into two different types Vehicle to Vehicle communication and Vehicle to Infrastructure Communication. The vehicle to vehicle communication is a communication between two vehicles i.e. one hop communication, such as car to car communication. The vehicle to Infrastructure communication zn is communication between vehicle and road side Infrastructure. It acts as a multi hop communication. The vehicle to vehicle communication is a system designed to transfer basic safety related with vehicles to provide warning to drivers concerning accidents. The main objective of this system is to alert drivers when he closes to front vehicle. The communication between the vehicles takes place by means of Li-Fi.

The distance between two vehicles is measured using Ultrasonic sensor. The microcontroller controls the entire circuit and is programmed to notify the driver with a message when the vehicle comes within the Line of sight. There are several obstacles that hinder the safety while driving. The vehicle such as car or buses may break down in

ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 5, Issue 1, January 2018

middle of the road especially during the night time these becomes a serious obstacles mainly in highways were the roads are not lighted. The vehicle coming behind may not judge the stationary vehicle and may cause accident; the vehicle coming behind may hit hardly to the back of stationary vehicle and may lead to greater damage. Many scenarios were considered for the design of the system.

BLOCK DIAGRAM

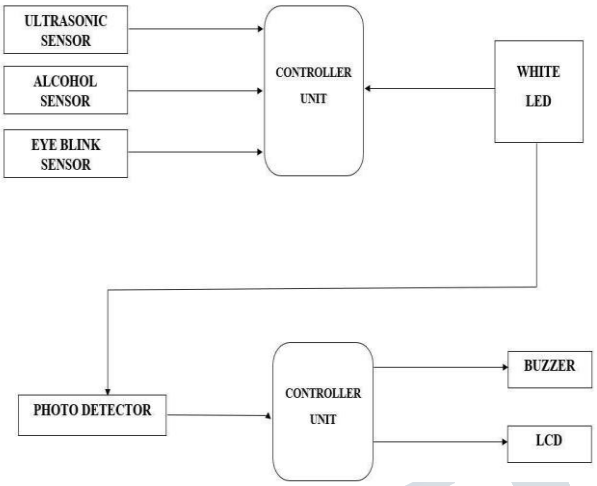

Fig.1 Exsisting system

The Back vehicle consists of Ultrasonic sensor to measure the distance between the two vehicles. An Eye Blink sensor is used to check if the driver is sleeping while driving and alcohol sensor is interfaced with control unit to find if the driver is intoxicated by alcohol and use the LED to transmit the safety related message so that the front vehicle can be notified. The LED transmits the data when the ultrasonic sensor detects an obstruction, when the driver is under the influence of alcohol and is sleeping. The LED transmitter is modulated to greater extent and maximum speed is attained.

SYSTEM DESIGN

The system is designed for two vehicles. The Vehicle Module (VM) is embedded with the vehicle so acts as moving nodes. It is responsible for communicating with vehicles and also the display the message received from vehicles. It consists of different sensors, microcontroller, Light emitting diode and photo diode 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. The Trans receiver unit is responsible for transferring data between two vehicles and the control unit is responsible for controlling the device. The Ultrasonic sensor consists of an ultrasonic transmitter and receiver. Ultrasonic sensor transmits and receives ultrasonic signal. It works on the Doppler Effect. The transmitter transmits the signal in one direction then signal is reflected back and received by the receiver. The distance between the object is measured by the total time taken by the signal to transmit and receive back. The Alcohol Sensor consists of a tin oxide and a heating element inside a tubular casting. The Ethyl alcohol present in the breath is oxidized into acetic acid passing through heating element, which in turn reduces the resistance.

IV. PROPOSED SYSTEM

VISIBLE LIGHT COMMUNICATION

A Visible Light Communications (VLC) system running wireless communications travelling at very high speeds. Li-Fi uses common household LED (light emitting diodes) light bulbs to enable data transfer, boasting speeds of up to 224 gigabits per second. The term Li-Fi was coined by University of Edinburgh Professor Harald Haas during a TED Talk in 2011. Haas envisioned light bulbs that could act as wireless routers. Subsequently, in 2012 after four years of research, Haas set up company pure Li-Fi with the aim 'to be the world leader in Visible Light Communications technology'. As, Li-Fi is a Visible Light Communications (VLC) system. This means that it accommodates a photo-detector to receive light signals and a signal processing element to convert the data into 'stream-able' content. An LED light bulb is a semi-conductor light source meaning that the constant current of electricity supplied to an LED light bulb can be dipped and dimmed, up and down at extremely high speeds, without being visible to the human eye. This technology is envisioned to be used in a wide range of applications both indoor as well as outdoor. Visible Light Communication (VLC) uses light emitting diodes (LEDs), for the dual role of illumination and data transmission. With this leading edge technology, data including video and audio, internet traffic etc., can be transmitted at high speeds using LED light. Using LEDs is helping to drive this technology in the form of Visible Light Communication (VLC).

CIRCUIT DIAGRAM

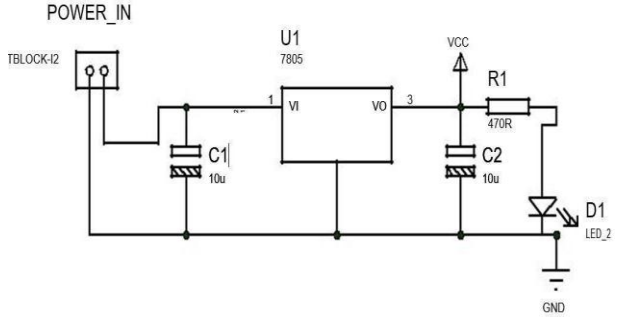

Fig.2 Power supply section

ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 5, Issue 1, January 2018

In the circuit diagram, Power supply section consists of capacitor and regulator to convert dc 12v to dc 5v, to indicate the power supply is turn on one LED is provided with resistor 470 ohms. The transmitted section consists of PC, USB to TTL convertor modules and Li-Fi transmitter module. PC is connected to Li-Fi transmitter module serially through USB to TTL module.

SOFTWARE REQUIREMENT

Software is a collection of instructions that enable the user to interact with a computer, its hardware, or perform tasks. Programming is an accumulation of directions that empower the client to communicate with a PC, its equipment, or perform errands. Without programming, most PCs would be futile. For instance, without your Internet program programming, you couldn't surf the Internet or read this page and without a working framework, the program couldn't keep running on your PC. Microchip has a vast suite of programming and equipment improvement apparatuses incorporated inside one programming bundle called MPLAB Integrated Development Environment (IDE). MPLAB IDE is a free, coordinated toolset for the advancement of inserted applications on Microchip's PIC and ds PIC microcontrollers. It is called an Integrated Development Environment, or IDE, in light of the fact that it gives a solitary coordinated condition to create code for implanted microcontrollers. MPLAB IDE keeps running as a 32-bit application on MS Windows, is anything but difficult to utilize and incorporates a large group of free programming parts for quick application improvement and supercharged investigating. MPLAB IDE likewise fills in as a solitary, brought together graphical UI for extra Microchip and outsider programming and equipment advancement instruments. Moving between apparatuses is a snap, and overhauling from the free programming test system to equipment trouble shoot and programming devices is done in a blaze in light of the fact that MPLAB IDE has a similar UI for all devices.

PROTEUS

It is programming suite containing schematic, reproduction and additionally PCB outlining. ISIS is the product used to draw schematics and reenact the circuits continuously. The recreation permits human access amid run time, in this way giving constant reenactment. ARES is utilized for PCB planning. It has the element of survey yield in 3D perspective of the outlined PCB alongside parts. ISIS (SIM) has extensive variety of parts in its library. It has sources, flag generators, estimation and examination devices like oscilloscope, voltmeter, ammeter and so forth., tests for ongoing observing of the parameters of the circuit, switches, shows, loads like engines and lights, discrete parts like resistors, capacitors, inductors, transformers, computerized and simple Integrated circuits, semi-conductor switches, transfers, miniaturized scale controllers, processors, sensors and so on. ARES offers PCB planning up to 14 inward layers, with surface mount and through entire bundles. It is installed with the impressions of various classification of segments like ICs, transistors, headers, connectors and other discrete segments. It offers Auto directing and manual steering choices to the PCB Designer. The schematic attracted the ISIS can be straightforwardly exchanged ARES.

USB TO TTL DRIVER CP2102

CP2102 chip from Si Labs is a solitary chip USB to UART Bridge IC. It requires negligible outer segments. CP2102 can be utilized to move inheritance serial port based gadgets to USB. Specialists can utilize it as an intense instrument to make a wide range of PC interfaced ventures. This module help each one of the individuals who are alright with RS232/Serial Communication convention, to construct USB gadgets effectively.

PIC 16F877a PIN MAPPING

Each of the 14 computerized sticks on the PIC can be utilized as an information or yield. They work at 5 volts. Each stick can give or get 20 mA as prescribed working condition and has an inner draw up resistor (disengaged as a matter of course) of 20-50k ohm. A most extreme of 40mA is the esteem that must not be surpassed on any I/O stick to stay away from lasting harm to the microcontroller.

V. APPLICATION

Li-Fi applications are changed because of its key highlights, for example, directional lighting, vitality proficiency, natural security, high information rate capacity, flag hindering by dividers and coordinated systems administration ability. Each light installation in the application condition turns into a different information channel. These channels can supply diverse information into each different pool of light, conveyed at the full appraised download speed for that channel. The application such as:

- Underwater communication
- Intelligent transportation systems
- Indoor navigation
- EMI sensitive environments

VI. ADVANTAGE OF Li-Fi

- The data transfer rate for internet application is higher.
- It provides high amount of security as data communication is line of sight (LOS). Moreover Li-Fi signal covers low region does not pass through the walls. This will avoid unwanted access of Li-Fi signal by unauthorized persons.
- The Li-Fi devices consume low power for operation and hence used in IoT applications.
- It uses optical spectrum and hence avoids already crowded RF spectrum.
- As it operates on optical bands which are not harmful like RF spectrum. Hence there is no health concerns in Li-Fi based system.
- There is great amount of energy reduction in lighting industry which uses Li-Fi based devices.
- It is easy to install.

VII. CONCLUSION

The total equipment and programming is developed and worked palatable. Where the development part of equipment is less demanding and not more mind boggling. Clearly the cost of undertaking is fairly low. In this project, the aim is to propose a cost effective solution to reduce accidents. The hardware aspects regarding the development of a VLC communication system consisting of a commercial LED-based traffic light and a vehicle will mount receiver. Throughout the implementation process, we also efforts on keeping the implementation cost as low as possible.

VIII. FUTURE WORK

The idea of Li-Fi is right now drawing in a lot of intrigue, not minimum since it might offer real and proficient contrasting option to radio - based remote. This innovation can wager into down to earth utilize, each globule can be utilized something like a Wi-Fi hotspot to transmit remote information. This may tackle issues, for example, the lack of radio recurrence transmission capacity. The future of LI-FI is GI-FI. GI-FI or gigabit remote alludes to remote correspondence at an information rate of more than one billion bits (gigabit) every second. It will permit remote exchange of sound and video information at up to 5 gigabits for each second, ten times the present most extreme remote exchange rate, at one-tenth the cost. The accessible 7 GHz of range brings about high information rates, up to 5 gigabits for each second to clients inside an indoor domain, for the most part inside a scope of 10 meters.

REFERENCES

[1] Adoptante, E.B., Cadag, K.D., Lualhati, V.R., Torregoza, M.L.D. and Abad, A.C., 2015, December. Audio multicast by Visible Light Communication for location information for the visually impaired. In Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM), 2015 International Conference on(pp. 1-6). IEEE.

[2] Boukerche, A., Oliveira, H.A., Nakamura, E.F. and Loureiro, A.A., 2008. Vehicular ad hoc networks: A new challenge for localization-based systems. Computer communications, 31(12), pp.2838-2849.

[3] Choudhari, Z.P. and Devane, S.R., 2016, November. High sensitivity universal Li-Fi receiver for enhance data communication. In Green Engineering and Technologies (IC-GET), 2016 Online International Conference on (pp. 1-5). IEEE.

[4] Kumar, A. and Nayak, R.P., 2013, April. An efficient group-based safety message transmission protocol for VANET. In Communications and Signal Processing (ICCSP), 2013 International Conference on (pp. 270-274). IEEE.

[5] Nachimuthu, S., Pooranachandran, S. and Aarthi, B.S., 2016. DESIGN AND IMPLEMENTATION OF A VEHICLE TO VEHICLE COMMUNICATION SYSTEM USING Li-Fi TECHNOLOGY.

[6] Ng, S.C., Zhang, W., Zhang, Y., Yang, Y. and Mao, G., 2011. Analysis of access and connectivity probabilities in vehicular relay networks. IEEE Journal on Selected Areas in Communications, 29(1), pp.140-150.Prabhu, T.N., Adharsh, M., Ashok, K.M., Gokul, K.M. and Dhayanithi, G., 2017. Vehicle to Vehicle Communication using Light Fidelity. International Journal of Computer Applications, 164(2).

[7] Shaikh, S.N. and Patil, S.R., 2016, June. A robust broadcast scheme for vehicle to vehicle communication system. In Advances in Signal Processing (CASP), Conference on (pp. 301-305). IEEE.

[8] Sou, S.I. and Tonguz, O.K., 2011. Enhancing VANET connectivity through roadside units on highways. IEEE transactions on vehicular technology, 60(8), pp.3586-3602.

[9] Takai, I., Harada, T., Andoh, M., Yasutomi, K., Kagawa, K. and Kawahito, S., 2014. Optical vehicle-to-vehicle communication system using LED transmitter and camera receiver. IEEE Photonics Journal, 6(5), pp.1-14..

[10] Tanaka, Y., Haruyama, S. and Nakagawa, M., 2000. Wireless optical transmissions with white colored LED for wireless home links. In Personal, Indoor and Mobile Radio Communications, 2000. PIMRC 2000. The 11th IEEE International Symposium on (Vol. 2, pp. 1325-1329). IEEE.

[11] Thomas, Z., Kumar, N. and Preshiya, D.J., 2016, April. Automatic billing system using Li-Fi module. In Communication and Signal Processing (ICCSP), 2016 International Conference on (pp. 2216-2219). IEEE.

[12] A.Karthikeyan, N. Rajeswaran "Design and Implementation of multiple Fault Diagnosis on VLSI Circuits Using Artificial Neural Networks" in International Journal of Advanced Engineering & Technology (IJAET) Volume 3, Issue 2, May 2012, pp 685-695, ISSN: 2231-1963.

[13] A.Karthikeyan, S.Vigneshwaran, A.Santhosh kumar, S.Srikanth "Energy saving system using embedded system for street light controller" in International Journal of Advance Research in Science and Engineering (IJARSE), Volume: 6, Issue: 1, January 2017, pp 193-199, ISSN:2319-8354.