LIFI Based Vehicle to Vehicle Data Communication

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***Abstract*- This paper introduces a vehicle-to-vehicle (V2V) communication system supported actinic ray communication technology. A vehicle can transmit information| the info| the information} unendingly to a different vehicle ahead of it victimisation head lightweight and also the data is hold on within the Secure Digital (SD) Card in comma separated price for future reference just in case of emergency at a similar time the info is hold on within the cloud server for presidency reference for find the foremost accident areas. Nowadays, individuals without delay use net in their daily activities to accomplish their task by suggests that of wireless or wired network. As users square measure increasing manifold, information transmission rate consequently decreasing. However, Wi-Fi imparts rate of 150Mbps as per IEEE 802.11n, this speed continues to be not enough to serve the requirements of a user. Considering this, actinic ray communication thought has been introduced. During this project, a comparative and analytic study regarding the speed of actinic ray and Wi-Fi communication is being done and additionally reduction of network ECM downside because of increasing users demand is additionally being done.**

***Index terms*- light emitting diode, photodiode, vehicle to vehicle communication, visible light communication**

I. INTRODUCTION

Unfortunately, most counties in the world has an alarming record in number of death/disability due to tremendous number of accident. Accidents are occurred because of unawareness of the people. Researchers [1] found that 57% of accidents where due to solely driver factors, which include his behavior, decision making ability, reaction speed and alertness. The studies [1] show that the accidents can be avoided if driver was provided with warning message few seconds before so that, they can take some alternative route or be cautious to avoid traffic congestion or accidents [1].The vehicular adhoc network was adopted to mimic the adhoc nature of highly dynamic network. In this network two vehicles can communicate with each other.

For Vehicle safety a new technique can be created. 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 [4], such as car to car communication. The vehicle to Infrastructure communication 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 [3]. There are several obstacles that hinder the safety while driving. The vehicle such as car or buses may break down in 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.

Vehicle1 slows down the speedometer senses the speed if lower than the previous speed an Ultrasonic Sensor attached in the bonnet using Doppler-effect is made to sense continuously. When the distance between the two vehicles decreases a warning message is transferred to back vehicle using the

transmitter attached in the front vehicle it is received by the photo-detector attached to the back vehicle so he can take necessary steps to ensure that collision is avoided.

Fig1. First Scenario of Vehicle to Vehicle Communication Using VLC

The major reasons for accidents are due to the negligence of the driver who might be under the influence of alcohol or might be sleeping while driver [6]. The vehicles are interfaced with an Alcohol as well as an Eye-blink sensor to monitor driver. If the driver is under the influence of alcohol or is sleeping this information is transferred to vehicle within the line of sight so vehicle can speed up or allow the vehicle to go ahead without causing any damage.

Fig 2. Second Scenario of Vehicle to Vehicle Communication Using VLC

The organization of paper is as follows section 2 provides information about the literature review. Sytem design are discussed in section 3. The results and experimental setup are discussed in section 4. The conclusion and future scope is discussed in section 5.

II. LITERATURE REVIEW

LI-FI technology changes the possibility about how we access the internet, videos, audios, emails and many more and the base of it is visible light communication (VLC), which includes for transmitting information is transmitted by using electromagnetic spectrum. The idea of sending information using LED's began during the 1990's and experiments showed that transmitting data wirelessly LEDs can be used. The idea of Li-Fi was introduced by Harald Haas, the teacher of University of Edinburgh in Scotland and he brought the idea of "Wireless data from every light". Haas and his research assistant, Mostafa Afgani, first sent data by using light signals in 2007 [1]. The term Li-Fi was first used by Haas in his TED Global talk on Visible Light Communication. He referred this light signal as D-Light which can be used to produce data rates higher than 10 megabits per second which is much faster than our average broadband connection [2].

Several research works have been carried out on working mechanism of Li-Fi, on how it provides better bandwidth, efficiency and better availability and security, on how it has immense possibilities, on how Li-Fi differs from other wireless communication mediums [3] [4] [5]. But only a few researches have been carried out on practical implementation of Li-Fi. Researches have been done to show how Li-Fi can be used in Indian Railways, how Li-Fi can be used to park vehicles with intelligence is shown in [6], the procedure of detecting the position of a moving person and updating the location in his device using Li-Fi is illustrated in [7], how Li-Fi in conjunction with PIC microcontroller can be used for traffic management and road safety is shown in [8], how vehicle to vehicle transmission can be used to reduce accidents and the decoding of transmitted data by microcontrollers is shown in [9].

But in our work we proposed the procedure of traffic management, and road safety by using vehicle to vehicle transmission based on Li-Fi but we used Arduino microcontroller to encode and decode data because it is much more effective than PIC microcontroller which is only a chip but the former is a platform. Arduino is much simpler in quick prototyping.

III. METHODOLOGY

Fig 3 is divided into three parts, i) sender ii) Receiver iii) according to user input. sender will send the message to micro controller which convert normal message to ASCII then this ASCII message is given to NPN switching circuit which is used to boost the signal. Then this signal is given to PNP switching module which revert the message which was inverted in NPN switching circuit. Then this reverted message is given to syska LED which transfer ASCII message into LED spectrum. Now at receiver side photo transistor will receiver message obtained by LED. Then photo transistor pass message to impedance matching circuit which sensing data in proper format.

This signal is given to TTL to USB circuit which convert ASCII message into normal message.

A. Transmitter:

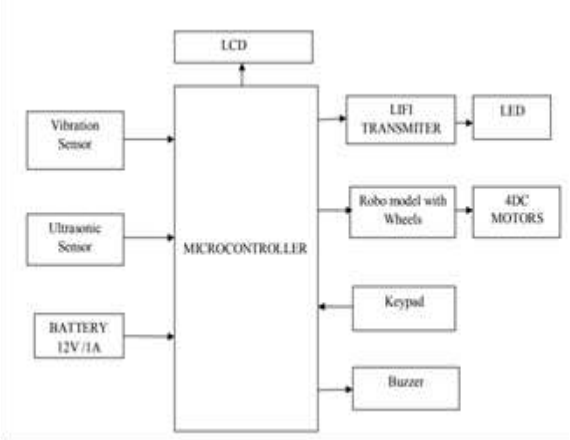

Fig 3: Transmitter Block Diagram

B. Receiver

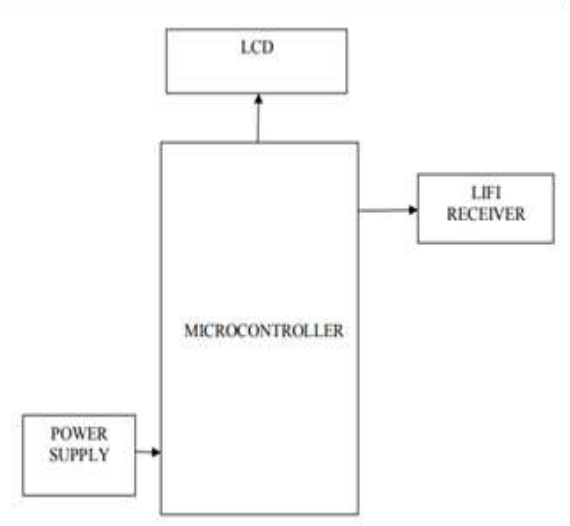

Fig 4: Receiver Block Diagram

C. Hardware Requirements

- Microcontroller
- Dc Motor
- Power Supply
- Ultrasonic Sensor
- Vibration Sensor
- Lifi Transmitter
- Lifi Receiver
- Buzzer,
- Keypad,
- Led,
- Lcd

D. Software Requirements

Arduino IDE

The functionality of the building blocks of the system is described next. The data source e.g. (Speed sensor) reads the speed of the vehicle. The speed data from the sensor is peak to peak AC voltage so it will be converted to DC voltage to be readable by the microcontroller. Then the data will be processed by microcontroller (e.g. to compare between the current and previous speed). New processed data will then be transmitted to the LED driver. LED driver will make the current constant to protect LED. Then, data will transmit by the LED light.

IV. HARDWARE IMPLENTATION

A. Arduino UNO

The Arduino UNO is AN ASCII text file microcontroller board supported the silicon chip ATmega328P microcontroller and developed by arduino. The board is provided with sets of digital and analog input/output (I/O) pins that will be interfaced to numerous growth boards (shields) and alternative circuits. The board has fourteen Digital pins, half dozen Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a sort B USB cable. It will be power-driven by a USB cable or by AN external nine potential unit battery, although it accepts voltages between seven and twenty volts. it's additionally like the Arduino Nano and carver. The hardware reference style is distributed underneath Common artistic Attribution Share-Alike a pair of.5 license and is out there on the arduino web site. Layout and production files for a few versions of the hardware also are on the market. "UNO" means that one in Italian and was chosen to mark the discharge of Arduino computer code (IDE) one.0.The UNO board and version one.0 of arduino computer code (IDE) were the reference versions of arduino, currently evolved to newer releases. The UNO board is that the 1st in an exceedingly series of USB arduino boards, and therefore the reference model for the arduino platform. The ATmega328P on the arduino UNO comes preprogrammed with a boot loader that enables uploading new code thereto while not the employment of AN external hardware computer user. It communicates exploitation the initial STK500 protocol. The UNO additionally differs from all

preceding boards in this it doesn't use the FTDI USB-to serial driver chip. Instead, it uses the Atmega16U (Atmega8U2 up to version R2) programmed as a USB-to-serial device.

Fig 5: Arduino Board

B. Ultrasonic Sensor

The working principle of the ultrasonic sensor is that it uses high intensity of sound waves and the sound waves are returned as the echo to the sensor, with the help of this concept the distance are measured. Here in this project ultrasonic sensor are used to measure the distance between the two vehicles when they come nearer to some extent. As the two vehicles come across in the contact the data is transferred to the other vehicle about the current status of the vehicle so that the chance of accident reduces. The below figure 6 is shown how the ultrasonic sensor is placed on the vehicle.

Fig 6: Ultrasonic Sensor

C. Motor Driver (L293D)

Motor driver is used for locomotion of vehicles on road. L293D is an integrated circuit (IC) with dual H-bridge that acts as a motor driver. These integrated chips behave as current amplifiers and they amplify the incoming signal to a high current signal. This signal is used to drive the motors. The circuit is usually operated in common mode of operation in which both motors can be driven simultaneously. One motor is controlled by input logic at pins 2 & 7 and enable pin 1 as high. The other one is controlled using logic pins 10 & 15 and enable pin 9 as high. Thus, enable pin is needed to make the drivers work. If enable input is low, the output take high impedance state and motors receive no signal.

Fig 7: Motor Driver

D. Li--Fi Transmitter

Li-Fi Transmitter is the module consisting of mainly the LED and its driving circuitry. This module will help in the transmission of data from one vehicle to the other. The LED in the module acts as the headlight of a vehicle, which then transmits light, along with the data of the user to the other vehicle which in turn has a Li-Fi Receiver, namely a phototransistor which converts the data into photocurrent. The light transmitted from the Li-Fi Transmitter circuitry acts as a medium for the data to be sent from one vehicle to the other.

The LED used in the system has a 12V input voltage and have its luminous flux to be 600 lumen, which is standard for a headlight in a vehicle.

Fig.8. Li-Fi transmitter

E. Li-Fi Receiver

Li-Fi Receiver chiefly contains a phototransistor and a transimpedance amplifier circuit. The light from the LED transmitted from the transmitter is received by the phototransistor, which then converts into photocurrent. The photocurrent is then converted into photo-voltage by the trans-impedance circuit, which can be used for the receiver circuitry. The light from

the transmitter is actually embedded with data from the system of the transmitter vehicle. The data is then retrieved by the receiving vehicle which is then used for different purposes.

Fig.9 Li-Fi Receiver

F. LCD

Liquid Crystal show could be a important device in associate degree embedded system. It offers high flexibility to user as he will show the specified information on that. LCD driver could be a link between the microcontroller and LCD. we have a tendency to set the interface mode, show mode, address counter increment direction, set distinction of LCD, horizontal or vertical addressing mode, color format. Next step when data formatting is to send information bytes to needed show information RAM memory location. Firstly, set the address location victimisation address set command computer memory unit then send information bytes victimisation the DDRAM write command. 14-pin access is provided having 8data lines, three management lines and three power lines. The connections area unit ordered out of in one amongst 2 common configurations, either 2 rows of seven pins, or one row of 14-pins.

G. DC MOTORS

The DC Motors provides reliable speed control environment. When the Bluetooth based device like mobile phone is connected to the microcontroller which sends data to the Bluetooth in the microcontroller to run the motor by controlling the speed and direction of motor with pulse width modulation signals.

Fig 10. DC Motor

V. RESULTS AND DISCUSSION

Communication between vehicles is also possible by using Li-Fi technology. Vehicle to vehicle communication can be used to reduce accidents by calculating distances between vehicles. To calculate distance active ultrasonic sensors are used which generate high-frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Each vehicle includes a circuit consisting of ultrasonic sensors, head-lights and tail-lights attached to Arduino microcontroller. Vehicles must maintain a minimum distance from each other. The distances between the vehicles are continuously calculated by the ultrasonic sensor and being compared with the minimum distance. If any two vehicles come closer than the minimum distance then a slowdown command is generated and a signal is sent to the second vehicle to slow down through tail-light to head-light of another vehicle using Li-Fi technology which is then decoded by the Arduino microcontroller. Thus accidents can be reduced. Figure 11 gives a experimental setup picture of the above discussion.

The top view of the front vehicle and back vehicle is presented. The top view presents the various sensors interfaced with the control unit. The Top view of the front vehicle consists of a buzzer and a LCD monitor to notify the driver with a warning message. The Photo detector is used in front vehicle to receive the data transmitted by the LED. 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.

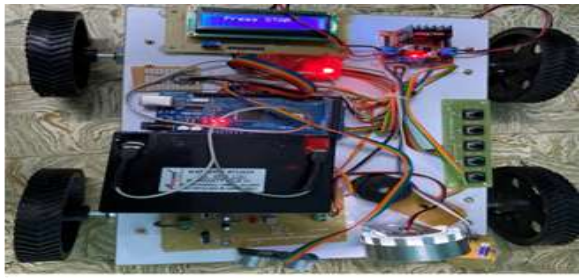

Fig 11. Experimental Setup for Transmitter side

In case of emergency situation or any break failure the buzzer sound is produced. These information are transmitted to the Li-Fi transmitter. Receives the information from the controller and it modulates the data to light signal and transmits to the receiver section. The transmitter part modulates the input signal with the required time period and transmits the data in the form of 1‟s and 0‟s using a LED bulb. These 1‟s and 0‟s are nothing but the flashes of the bulb. In the receiver section, it receives the modulated information from the transmitter section and demodulates the signal in order to recover the original data. . The receiver part catches these flashes using a photodiode and amplifies the signal and transmits to the controller so that the speed of the following vehicle can be reduced which will be indicated in the LCD display present in the receiver section.

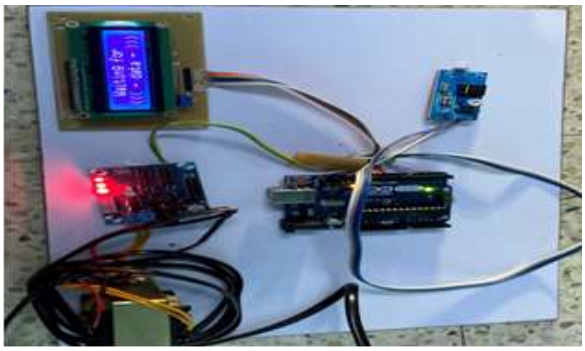

Fig 12: Experimental Setup of Receiver Side

VI. CONCLUSION

The paper is introduced in a way to increase accountability to reduce road accidents. It also introduces a vehicle-to-vehicle (V2V) communication system based on visible light communication. The prototype successfully uses visible light to transmit data from one vehicle to other. The concept of Li-Fi will introduce along with existing techniques and classical trends used for vehicle to vehicle communications. In this project aims to propose a cost effective solution to reduce accidents in Oman, the design guideline. We will present the approach we follow, some of the difficulties we encounter and explain the choices we have made. Throughout the implementation process, we also efforts on keeping the implementation cost as low as possible. Due to unavailability of all system components, sending data through Li-Fi small-scale prototype.

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