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Vehicle to Vehicle Communication using Light Fidelity (Li-Fi) Technology

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Abstract:- Vehicle-to-vehicle communication promises to be a next major step towards safe and efficient road traffic. By modulating the vehicles tail's light, it is possible to transmit even –based messages with the current status of the car. Though self-driving cars could eventually improve safety, they remain imperfect and unproven, with sensors and software too easily bamboozled by poor weather, unexpected obstacles or circumstances, or complex city driving To avoid this, a miniature model was created using Light Fidelity technology . We focus on the security aspects and features of our project. We present that the multimodal data processing of our work is safe and secured. The driver notification and alert messages are intended to keep the driver safe from road accidents. The data transmission using Light Fidelity, instead of Wireless Fidelity, makes the communication secured due to the absence of radio wave' interference with other road users and the absence of electromagnetic interference makes it a green technology.

***Keywords**:- Li-fi, VLC,IP camera.*

I. INTRODUCTION

We present initial designs and results of a small-scale prototype of a vehicle to vehicle communication system using light fidelity (Li-Fi) technology, a new technology that was developed in the last few years, which still needs more investigations on its sustainability for outdoor vehicular networks. Vehicle to vehicle communication is the most effective solution that has been used in order to reduce vehicles' accidents. The proposed use of Li-Fi technology in this paper comprises mainly light-emitting diode (LED) bulbs as means of connectivity by sending data through light spectrum as an optical wireless medium for signal propagation[2]. In fact, the usage of LED eliminates the need of complex wireless networks and protocols.

II. PROJECT OBJECTIVE

Sometimes drivers of a disabled car or truck forget to turn on their hazard lights to indicate to other drivers that there is a disabled car stopped on the side of the road. Forgetting to properly indicate the condition and situation of your disabled vehicle to oncoming traffic can cause a traffic accident if another motorist does not notice your vehicle in time. At other times, drivers of disabled vehicles fail to pull over far enough onto the shoulder of the road, leaving part of their car in the roadway or too close to oncoming traffic. According to the latest report on country's road accidents and deaths, over 48,000 people died in crashes caused due to overtaking and 'diverging' during 2017. For reducing the accidents we have establish the vehicle to vehicle communication

III. EXISTING SYSTEM

The existing system uses IEEE.802.15.4 and IEEE 802.11p protocol for vehicle to vehicle communication for data transfer between vehicles[7] but the ranges of these transceivers are very high and so the data transmitted not only goes to the intended vehicle but also to all vehicles present in the vicinity of its range. Hence many misinterpretations occur as the data from the other or opposite lane crosses the car drivers and misguides them in many aspects. Hence a direction oriented approach has to be made for proper working of vehicle to vehicle communication.

IV. PROPOSED SYSTEM

The proposed system requires a LIFI receiver and LIFI transmitter arrangements on both vehicle[3]. In vehicles, the front and back light can serve as the transmitter for the LIFI system. For receiver, we have to use photo detector or solar panel as shown in Fig.1. we have to do many error detection techniques to improve the efficiency of the receiver. In this system, the vehicle can request the front vehicle for the image after receiving the request the vehicle capture the image from its camera and convert it to a constant size and transmit the image through the back light as LIFI signal. The image requested vehicle receives the image as LIFI signal through the photo detectors after receiving that data it will again convert it into image and display it on screen

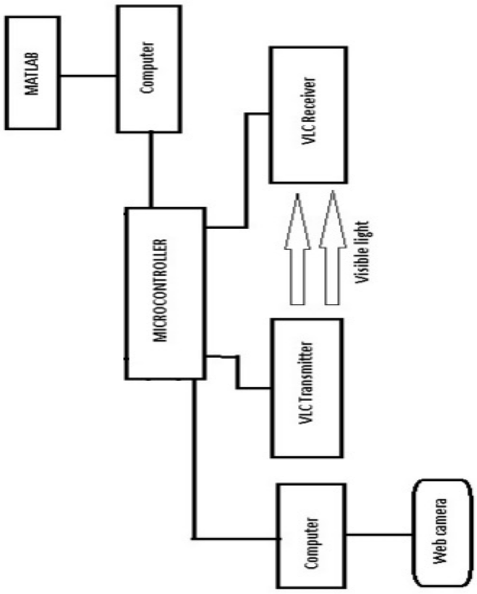

Fig 1:- Block diagram of v2v communication system

V. SYSTEM DESIGN SPECIFICATION

A. Hardware specification

- AT89C51: The AT89C51 with 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, a five vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator. In addition, the AT89C51[9] is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port and interrupt system to continue functioning.

- VLC Transmitter: The transmitter section modify the LED (Light Emitting Diode) according to the Transmitting data Transmitter section consists of a PC and a LI-FI transmitter. PC is used to generate a sine wave signal of particular frequency. This signal is given as input to the LI-FI transmitter by using a connector connected to the analog output port of PC as shown in Fig.2. The analog signal received from PC first passes through the low power audio amplifier, IC LM386, here the signal gets amplified. The output of the LM386 is encoded in the form of light which transfers the data at high speed. The transmitter receives a signal from the PC using USB Cable then from GPIO pins on the Arduino, this signal controls the transistor which open and close the power supply to the LED[6]. The LED voltage levels. here it can be noted that both 12 v and 5 v supply can be used in the transmitter for powering the LED but for simplicity 5 v supply is preferred for low power operation. Some Common Mistakes

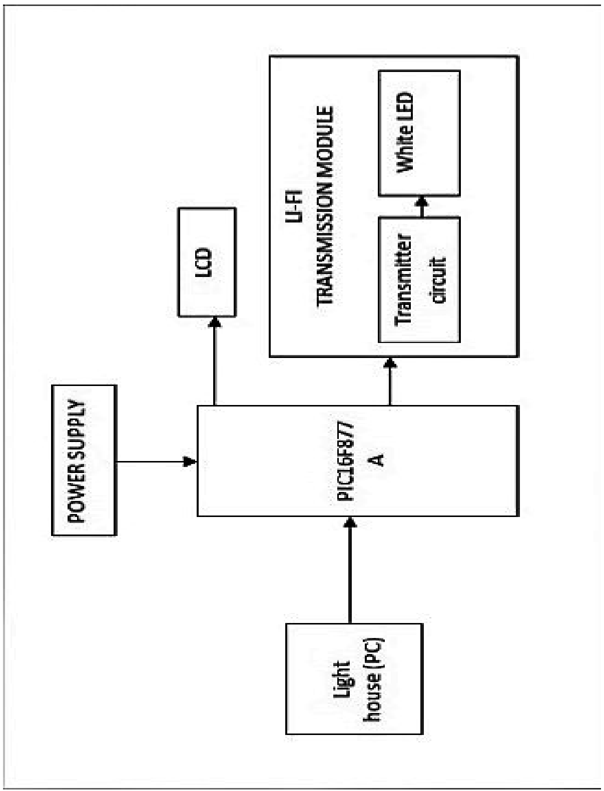

Fig 2:- LI-FI Transmitter

- VLC Receiver: The receiver converts the incoming light into an electrical signal and feeds it into the microcontroller. Receiver section consists of a LI-FI receiver and a PC. Here the transmitted signal from a LI-FI transmitter in the form of LASER beam is incident on the optical detector (solar panel) of LI-FI receiver .The solar panel is connected to the low power audio amplifier. The output of audio amplifier LM 386 is given to speaker as shown in Fig.3. Now the sound generated from speaker is received by the mike connected to the analog input port of second PC[6]. The spectrum of this signal received from mike is plotted using a MATLAB program.

The receiver filters and amplifies the signal. After amplification, the signal is in analog form. Hence, ADC operation is performed, before providing it to the Arduino. The measured signal at the output of the amplifier. The current which is generated by the photo diode is of very low value; hence a high value resistor is used to convert it to voltage. Now this voltage is further amplified for the comparator to give proper transmitted bits. Amplitude of amplified voltage which is the output of the 741 op-amp. The signal value can be further increased by using higher DC voltage

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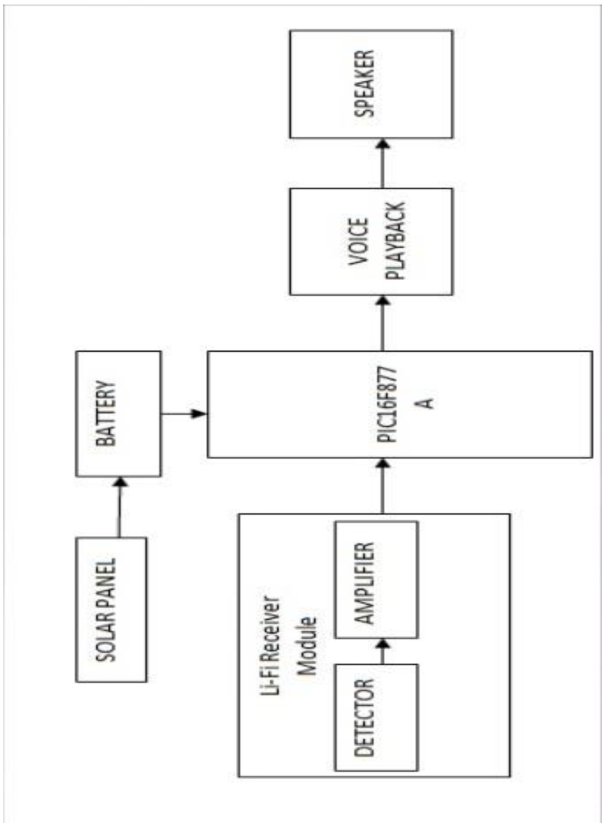

Fig 3:- LIFI Receiver

B. Software specifications

- Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs, as well as web sites, web apps, web services and mobile apps. Visual Studio supports 36 different programming languages and allows the code editor and debugger to support (to varying degrees) nearly any programming language, provided a language-specific service exists. Visual studio used to create the user interface and to interface the web camera to transmit picture as shown in Fig.4(a) & Fig4.(b)

- MATLAB (MATRIX LABORATORY) is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. MATLAB used to resize the limit of the data to 10kb size to keep it as constant

- The µVision IDE combines project management, run-time environment, build facilities, source code editing, and program debugging in a single powerful environment. Keil µ vision is used to program the at89c52 microcontroller for processing light to electrical data and vice verse.

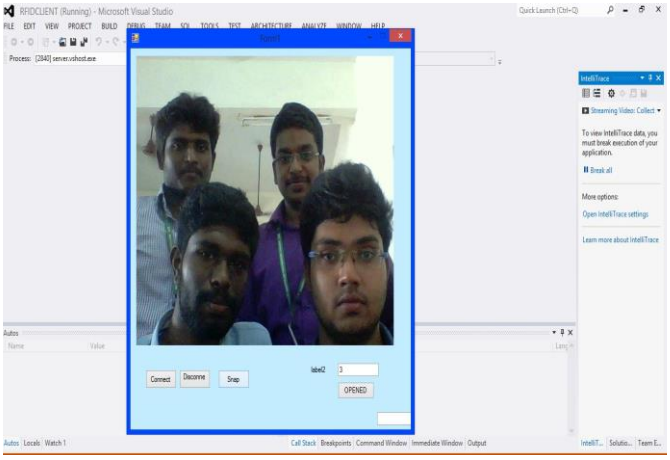
Fig 4(a):- Li-Fi transmission interface

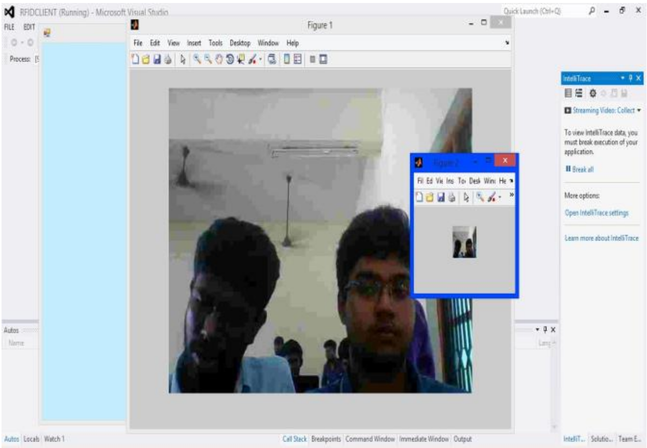
Fig 4 (b):- Li-Fi Receiver interface

VI. IMPLEMENTATION OF PROPOSED SYSTEM

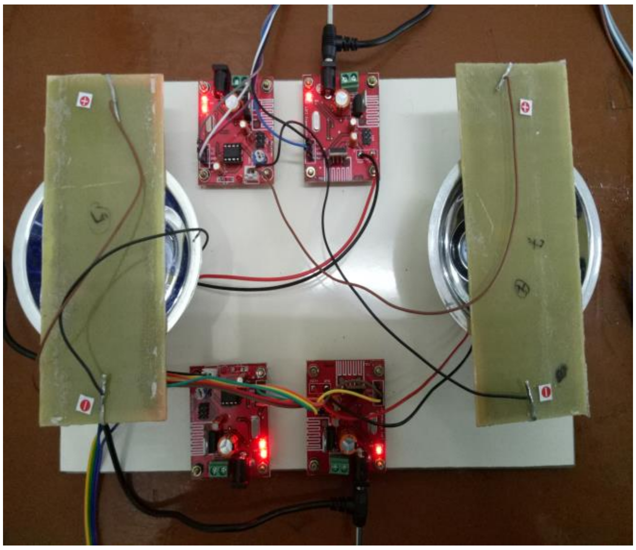
Fig 5:- Li-Fi Proposed system circuit

When the image is requested from the neighbor vehicle, the LIFI request signal is sent to the neighbor vehicle after that it will capture the image data from camera

The main difference and advantage of IP cameras is that they provide output in digital form, and can be plugged directly to an Ethernet switch and accessed over an IP network. To achieve this, IP cameras not only have the camera, but also a small computer on board, which usually run embedded Linux. The IP cameras are accessed by the URL using visual studio and then it will send the image data to the LIFI Transmitter.

The LIFI transmitter has its micro-controller for converting the raw image from the PC to LIFI signal by switching the LED through PWM signal as shown in Fig.5. In this case, back light LED is used for the transmission of data.

The receiver of the image requested vehicle receives the data transmitted by the transmitter of front vehicle and continuously converting it in to the image file[4] and show it on the screen in the vehicle for a better navigation. In previously existing system, the ranges of these trans-receivers are very high and so the data transmitted not only goes to the intended vehicle but also to all vehicles present in the vicinity of its range. Hence many misinterpretations occur as the data from the other or opposite lane crosses the car drivers and misguides them in many aspects. Hence a direction oriented approach has to be made for proper working of vehicle to vehicle communication.

VII. CONCLUSION

Visible Light Communication is a recent technology and has a wide possible playing field to be explored. Vehicle-to-vehicle Communication, as shown in this paper, represent a practical implementation of VLC technique because evidence that communication technology can be used in a social aspect such as accident prevention in the roads. Besides, using visible light for communication does not influence in the radio-frequency frequencies from the electromagnetic spectrum used for other common communication devices[8].

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