Automotive Wireless Communication Using Li-Fi Technology

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Abstract- *This project investigates the technological development being made for better and faster data rates, and for better and improved security measures. where the Li-Fi technology has a faster data rate, high bandwidth, fast switching, high power efficiency, safe to human vision and a very secure medium of transmission. The proposed system presents the elaborate view to design and implement a wireless system for effective communication between the vehicles using the concept of Li-Fi technology. This project presents about data communication between the vehicle through visible light which consists of the white LEDs that acts as a medium to transmit the data like video, audio or text. The Light transmitted from the transmitter part which has the data collected by the microcontroller from sensors and other inputs connected to the microcontroller and the sent data. The data is received by the LDR placed in the receiver and collects the information and sends the data to the microcontroller of the receiver circuit and the received data is displayed in the LCD module. Light transmits data which brings data transfer rate to a greater extend so that the space required is less.*

Keywords- Pic Microcontroller, Sensors, Light Fidelity, LDR.

I. INTRODUCTION

Visible light communication (Li-F) is the term given to an optical wireless communication system that conveys information by modulating light that is visible to the human eye. Continuous improvements in wireless communication systems, e.g. 3G, 4G, etc.., a coming crisis is expected due to the lack of sufficient Radio Frequency (RF) resources, this limitation in bandwidth can't support the growth in demand for high data rates and the large numbers of communication systems, the extension or enrichment of wireless services and other being increased in user demand for these services, but the available RF spectrum for usage is very limited. So the new technology of Li-Fi came into picture Light fidelity (Li-Fi) is a new short range optical wireless communication technology which provides data transmission like text, audio, video by using Light-Emitting Diodes (LEDs) to transmit data depending on light illumination properties In this technology, LEDs are used to transmit data in the visible light spectrum. The Communication is achieved by switching LED lights on and off at a speed higher than what is perceptible to the human eye. This concept promises to solve issues such as the shortage of radio-frequency bandwidth and boot out the disadvantages of Wi-Fi. Hence the future applications of the Li-Fi can be predicted and extended to different platforms and various walks of human life.

Section II: To describe the objective of the project, Section III: Literature survey of the project, Section IV: Methodology of the project, Section V: Hardware components of the project, Section VI: verification and output, Section VII Conclusion and future scope of the project, Section VIII: References of the project.

II. OBJECTIVE

To design and implement a wireless system for effective communication between the vehicles using the concept of Li-Fi technology. It uses light as the media for transmission and reception of data like video, audio or text. It uses light to transmit data which brings data transfer rate to a greater extend so that the space required is less. It is used where a smart traffic transportation system is needed. The receiver section consists of LDR connect with an Li-Fi receiver to recover the original inputs. Li-Fi technology is simple to use and implement and it is highly reliable which enables faster transfer of data between the vehicles.

III. LITERATURE SURVEY

Burak Sooner and Sinem coleri designed a Visible Light Communication Based on Vehicle Localization for Collision Avoidance and Platooning. Automotive research is currently heavily oriented towards the vehicular automation and autonomy and foremost objective is improving driving safety and efficiency.The federal report of Federal Statistical Office of German shows that 63% of traffic accidents are due to collision of vehicles. For straitening the collision avoidance and safe platooning for future autonomous vehicle safety concepts.

Dinak Milivancev, Nemanja Vokic Hannes Huble and Bernhard Schrenk designed a Visible Light

Communication with Low cost Receiver Based on Single Color LED. The growing trend on mobile device use a ubiquitous connectivity is not slowing down and by 2022 the number of mobile connections will be raised to 12 billion worldwide.The author proposed a low-cost commercial LED which is applicable in consumer electronics. DSP function can be emitted through analog design optical link. Large amount of data is transferred over optical wireless link in place of ethernet connection. VLC is based on illumination to cover a larger footprint at lower data rate and potentially eye safe narrow pencil beams capable to deliver higher data rates.

Jay H. Bhut, Dharmrajsinh N. Parmar, Khushbu V. Mehta designed a A Visible Light Communication. Due to increasing of internet users exponentially, Radio Spectrum is congested but the demand for wireless data double each year. This paper has come up with a solution for those problems "Data through illumination". LI-FI is a new epoch of high intensity light source of solid-state design which bring clean lighting solutions to general and specialty lighting. LI-FI is now part of the VLC as is implemented using white LED light bulbs. Data transmission takes place from this LED bulb by varying the current at extremely high speeds which undetectable by the human eye.

Juan F. Gutierrez, Charles E. Hunt and Jesus M. Quintero designed a Visible Light Communication LED Based Luminaire for General Lightning. The development of VLC has allowed the emergence and improve the technology of light in factor of high quality and increased lifetime.In restricted area where RF signal are restricted the Li-Fi technology is used to track the location of the vehicles. It aims to increase the data rate and bandwidth, in this condition the computer network the connections can be made between the devices such as phone, printers, computers, tables or high-level network.

Weibin Jiang, Xianquing Jin, Yingwen Zhang, Meiyu Jin, Chen Gong and Zhengyuan Xu designed a Trajectory Prediction of Target Source for Dynamic Visible Light Communication System with Narrow Field Of view. In this paper the author proposes that in order to maximize the received optical intensity for high speed signal to noise ratio a real time light source tracking system with tragic prediction function based on Kalman filter is experimentally designed and demonstrated for VLC applications. The effectiveness of the scheme is verified in both the simulation and experiment, were the alignment deviation is improved by more than 50%.

IV. METHODOLOGY

The LIFI technology the system is controlled with pic micro-controller that's has been implemented and thus reducing the time wasted by the system. Li-Fi brings the data transfer rate to a greater extend value. Since the speed of transmission rate of LED light is high. Pic microcontroller sense and control more of physical and real world than your desktop computer. Pic can be used to develop interactive objects, taking input from variety of switches or sensors, controlling our variety of lights, motors and other physical input. Light dependent resistor is used to send the data using the LED. When the LED light falls on the LDR, the receiver circuit will be activated and start to receive the data from the vehicle. The reception circuit the detector detects the signal received by the LED and amplifies the signal and sent to the pic microcontroller, where the original signal is generated.

BLOCK DIAGRAM:

TRAMSMITTER:

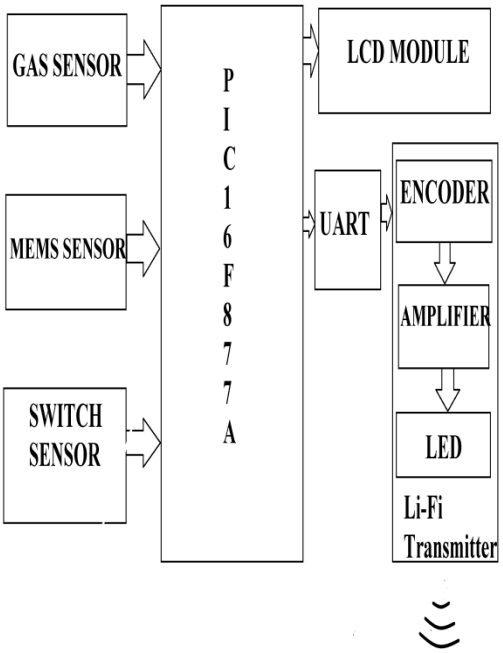

Fig no:1.1 Transmitter

RECEIVER:

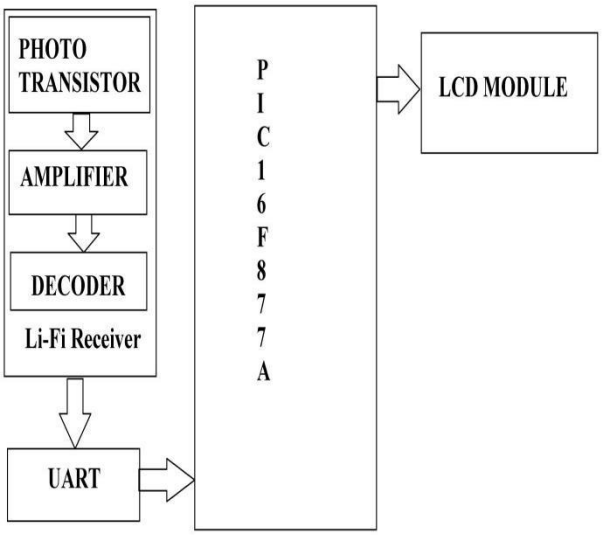

Fig no:1.2 Receiver

V. COMPONENTS

PIC: The pic controller are used because the malfunction in pic is very less and the performance is very high when compared to other micro-controllers. The power consumption is also less and the performance are fast because of using RSIC architecture.

Fig no:1.3 PIC

GAS SENSOR:A gas sensor is a device which detects the presence or concentration of gases in the atmosphere. In Li-Fi it is used to measure the alcoholic level of the driver in the car and gives alert if the alcoholic level is above the threshold value.

Fig no:1.4 Gas sensor

MEMS SENSOR: It stands for micro electro -mechanical system that is used to measure the physical parameters such as acceleration, temperature, and pressure. the electronic components are connected to the output of the sensors, preform signal processing and provides wireless communication.

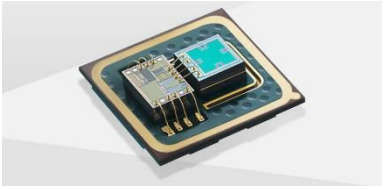

Fig no:1.5 MEMS sensor

SWITCH: The sensor is a combination of movement and light sensor which manages the to produce signals when the passengers does not wear their seat belts and display on the LCD module.

Fig no:1.6 switch sensor

LCD MODULE: The LCD module present in the vehicle displays the output that is received from the Pic microcontroller.

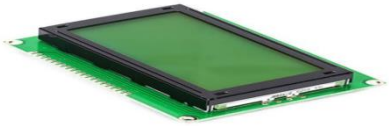

Fig no:1.7 LCD display

UART: it's a computer hardware device for asynchronous serial communication in which data format and transmission speed are configurable. It sends data in bits one by one, from least significant bit to the most significant bit with high transmission speed.

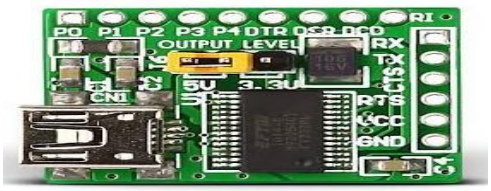

Fig no:1.8 UART

LI-FI TRANSMITTER: It consist of the encoder is a combi national circuit that converts the binary information to in the

form of a 2^N into N output lines and then the amplifier amplifies (boost up) the signal and the signal is sent through the LED.

LI-FI RECEIVER: The signal sent is the received by photo transistor which capture the light signal and sends it to the amplifier that is followed by the amplifier and the decoder were the n input signals are converted into the 2^N output binary information.

VI.VERIFICATION AND RESULT

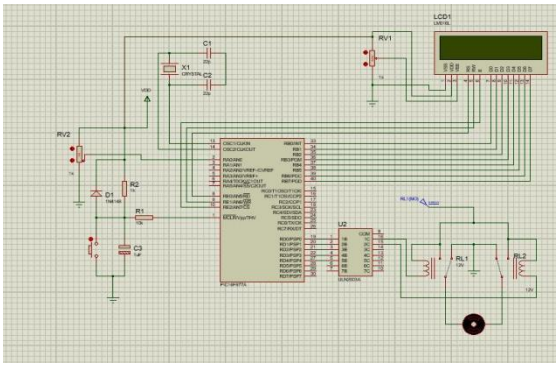

Fig no:1.9 circuit schematic of VLC communication

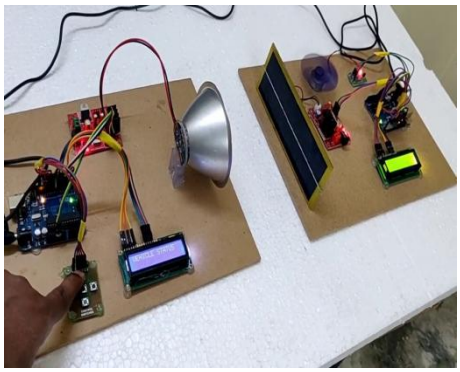

Fig no:1.10 Prototype of VLC Communication

VII. CONCLUSION AND FUTURE SCOPE

Li-Fi is one of the very efficient versions of Wi-Fi which uses light for data communication by using visible light waves for data transmission and reception.Using Li-Fi technology the transmission of data form vehicle to vehicle is made easier and speed is also increased using light as the medium to avoid jamming of data which is today's problems the Li-Fi technology plays a vital role for the efficient wireless communication .Li-fi is used in many real time applications due to its low cost consumption, high data rate, secured path of transmission, safe to human eyes and high power efficiency. In future the system can be developed as a product to help the communication much easier.

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