

# A Real-time Vehicular Visible Light Communications for Smart Transportation

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**Abstract** - This paper presents the specific applications of wireless communication. Automotive wireless comm. is also called as vehicle to vehicle communication. It also explains the technology used for automotive wireless comm. Along with the various automotive applications relying on wireless communication. Our project proposes a vehicle to vehicle communication system for cooperative collision warning. One vital technical challenge viewed in this project is to achieve low latency in delivering immediate alerts in various road situations. Advanced wireless technology for vehicle to vehicle communication playing important role to reduce the number of accidents by providing early alerts. Based on a analysis application requirements, we design vehicle to vehicle communication system. This system consisting traffic control policies and methods for emergency warning broadcasting. Simulation outcomes displays that the proposed system gives less delay in delivering emergency alerts and bandwidth used efficiently in stressful road situation. The wireless data communication between two vehicles is provided by introducing wifi technology. It is implemented for low power consumption to allow battery last forever. The distance measurement is provided by ultrasonic sensors. These sensors are transmitting and receiving ultrasonic signals.

**Key Words:** ATMEGA328, sensors, Android Application.

## 1. INTRODUCTION

Traffic accidents have been taking thousands of lives each year, outnumbering any deadly diseases or natural disaster as far as India is consider, India having less than 1% of the world's vehicle, the country accounts for 6% of total road accidents across the world and 10% of total road victims. Every year in the united states road accidents account for a harsh risk to human lives from both injuries and financial perspective. Given that vehicle are designed to provide a smooth means of transportation, based on principle of reliability and safety manufacturer have long been in the process of design vehicle. However, due to reasons such as human-error, conditional error and negligence accident occur.

Today, main focus is on the technologies that can reduce road accidents. Past work in this domain includes the use of vehicle infrastructure (V2I) communication by having a centralized system in which all vehicles approaching an intersection communicate with the intersection manager. The intersection manager is the computational infrastructure installed at intersection and to make reservations for each approaching vehicle and manages all vehicles crossing the intersection [].due to high total system cost Implementing centralized module at every intersection is not possible many times. In this work, we advocate use of vehicle to vehicle(V2V) communications. V2Vcommunication systems are simple to design initially because of their dependence on wireless comm. For intelligent transportation systems various forms of wireless communication technologies have been discovered. Radio modem commit ITS UHF and VHF frequencies are mainly used for short and long range communication. By using IEEE 802.11 protocols short distance communication of 350 m can be installed. The dedicated short range communications standard being promoted by the intelligent transportation society of America and the United States Department of Transportation. Theoretically the range of these protocols can be extended using mobile ad-hoc networks or mesh networking. Longer range communications have been proposed using infrastructure networks such as Wi-MAX(IEEE 802.16), Global System for Mobile Communications(GSM) or 3G.

### 1.1 Literature Survey

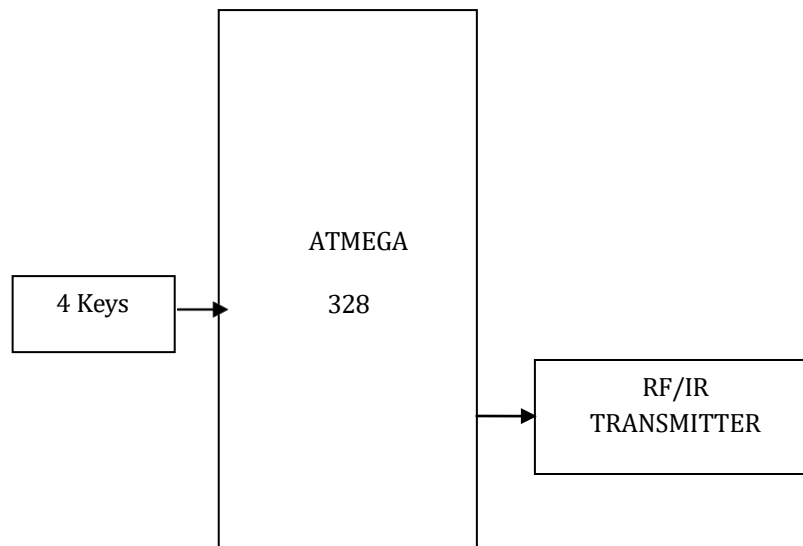
Literature surveyed some different papers to get information about the existing work which have been done Reza Azimi, Guarav Bhatia investigate the use of vehicle-to-vehicle (V2V) communications[1]. To enable the navigation of traffic intersections, to decrease collision risks, and to increase intersection throughput significantly. Specially, we design a vehicular network protocol that integrates with mobile wireless radio communication standards such as Dedicated Short Range Communications (DSRC) and Wireless Access in a Vehicular Environment (WAVE). This protocol depends on using V2V communications, GPS and other automotive sensors to safely navigate intersections and also to enable autonomous vehicle control.

Debasis dad, Rajiv Misra [2] proposed An Inter vehicular communication systems has the potential to comfort of travel everyday increase the safety efficiency and comfort of travel I VANETS.

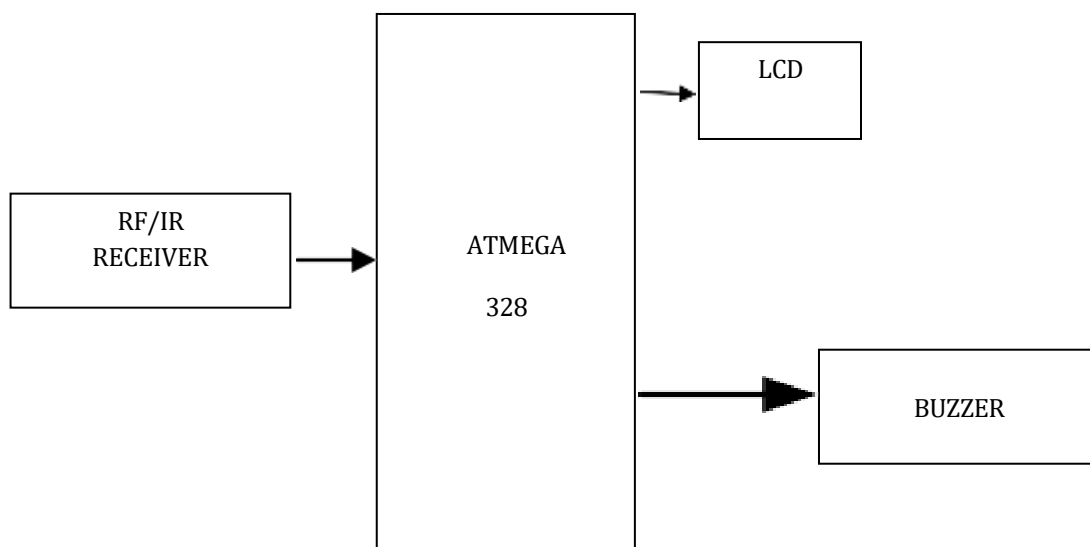
In this project we proposing an efficient V2V communication protocol to avoid collision in VANETS.

Abdulsalam, Raya Al Hajri [3] presented initial designs and results of a small-scale prototype of a vehicle to vehicle communication system using Radio frequency (RF) technology, a new technology that was implemented in the recent few years, which still needs more transparency on its sustainability for outdoor vehicular networks. The most effective solution is vehicle to vehicle communication in order to lessen vehicle accidents. The proposed use of RF technology in this paper contains mainly light-emitting diode (LED) bulbs as means of connectivity by transmitting data through light spectrum as an optical wireless medium for signal propagation. The need of complex wireless networks and protocols is eliminate by an LED. Several case studies imitating the vehicle to vehicle communication are implemented in this work. Both numerical simulations using Proteus package.

### 1.2 Block Diagram and discription



**Fig -1:** Block diagram of proposed Transmitter system



**Fig -2:** Block diagram of proposed Receiver system

1)

**RF/IR SENSOR:**

Here we are connecting an IR base obstacle sensor. The 50 ohm resistor is used for current limiting. The current through the LED is  $5v/50\text{ ohm} = 100\text{mA}$ , which is high for a LED but to the increase the range of an obstacle sensor we are using a lower range resistor (50 ohm). In reverse bias the IR receiver is connected on the receiver side. So when the light falls on the IR receiver, the anode voltage goes on increasing and when the anode voltage exceeds than the cathode voltage then the LED enters into forward bias mode and start conducting.

**LCD:**

LCD can used to check the output of different modules interfaced with the microcontroller. Thus LCD plays a vital role to see the output and debug the system modules wise in case of system failure in order to rectify the problem. Here we have used 16\*2 LCD which indicates 16 columns and 2 rows. So, we can 16 characters in each line. So, total 32 characters we can display on 16\*2 display.

**Power Supply:**

It provides supply to the circuit. We use 12v power supply in our project. It is used to provide DC voltage to the components on board. 3.3V for lpc2138 and 4.2v for Wi-Fi module is apply from power supply. 5V is required for relay applied from power supply.

**ATMEGA328:**

The LPC 2138 microcontroller is based on a 16 or 32 bits ATMEGA328 TDMIS CPU with real time emulation and embedded support, that combile the microcontroller with the 32 kB, 64kB, 128kB, 256kB and 512kB of embedded high speed flash memory. A 128 bit wide memory interface and unique acceralator architecture enable 32 bit code execution at maximum clock rate. For critical code size application the alternative 16 bits thumb mode reduces code by more than 30% with minimal performance penalty. Due to their tiny size and low power consumption, this microcontrollers are ideal for applications.

**Table -1:** Comparison with existing technique

Sr. No	Author names	Paper	Advantages	Disadvantages
1	Reza Azimi, Gaurav Bhatia,	IEEE 2016 Vehicular networks for collision avoidance.	It improves flexibility and collision avoidance. Pedestrian and Bike safety.	The protocols evalute do not take into controller model for the cars. Low scalability.
2	Debasis Dad, Rajiv Misra	IJARCCCE 2014 Efficient vehicle to vehicle communication	Fast speed internet which will change the automobile on board system from an effective widget.	Complex algorithm. Costly.
3	Abdul Salam, Raya Al Hajri	IJEEE 2015, vehicle to vehicle communication	In this system the use of LED eliminates the need of complex wireless network with the help of RF technology.	Expensive, harder to understand.

## 2. SYSTEM MODEL

The schematic block diagram of the proposed V2V VLC link is shown in Fig. 1. The Tx side is composed of a LED array (4x5 matrix 5mm white LEDs), a raspberry pi 3b+ as the LED driver, a keypad for the user interface (i.e., to select the information to be transmitted) and an on off keying data stream for intensity modulation of the LED. The intensity modulated light is transmitted through the free space channel. The Rx is composed of a PD and a raspberry pi 3b+ for signal processing and detection. A Raspberry pi 6.7" touch screen display and a speaker are used for the decoded message to be represented in both text and audio formats, respectively. For the line of sight (LOS) link, the received signal is given as [13]:  $y(t) = \mathcal{R}x(t) \otimes h(t) + n(t)$ , (1) where  $y(t)$  represents the received signal current,  $\mathcal{R}$  is the PD's responsivity and  $x(t)$ ,  $h(t)$  and  $n(t)$  represents the transmitted optical pulse, the impulse response and the additive white Gaussian noise, respectively. Note, the main noise is the ambient light induced shot noise. The channel DC gain for the LOS link can be expressed as [13]:  $H(0) = \{ A_p (m + 1) 2\pi L_s^2 \cos m(\phi) g(\psi) T_s(\psi) \cos(\psi), 0 \leq \psi \leq \psi_c, 0, \psi > \psi_c \}$ , (2) where  $A_p$  the active area of the PD is,  $L_s$  is the link span and  $m$  represents the Lambertian order of emission of the Tx.  $\psi$ ,  $\phi$ ,  $T_s(\psi)$ ,  $g(\psi)$  and  $\psi_c$  represents the angles of incidence, irradiance, the gains of an optical filter, concentrator and the width of the field of vision at the Rx respectively. The optical concentrator  $g(\psi)$  can be given as follows [13]:  $g(\psi) = \{ n^2 \sin^2 \Psi_c, 0 \leq \Psi \leq \Psi_c, 0, 0 \geq \Psi_c \}$ , (3) For the line of sight (LOS) link, the received signal is given as [13] The received optical power in terms of the transmit optical power  $P_t$  is given as [13]:  $P_r = H(0)P_t + n(t)$ . (4)

## 3. Data communication flow chart

The flow chart of the proposed V2V-based VLC system is shown in Fig.3. Note that, pre-defined messages have been configured for the different buttons of the keypad. In the source vehicle (i.e., the transmitting vehicle) when the user presses a key, the raspberry pi first detects the key pressed and then transmits the data in the binary format (i.e., the American standard code for information interchange (ASCII)). For example, as shown in Fig.8, when keys 1 and 2 are pressed the binary equivalent in the ASCII format is transmitted via the LEDs by serial communications and the received signal is processed and decoded by the raspberry pi. To reduce the BER, we have introduced multiple transmissions by sending the data three times, at the cost of reduced throughput. However, throughput is not an issue in V2V communications, since the transmission data rates are very low (i.e., < 1 kbps in most cases). At the Rx, the regenerated electrical signal at the output of the optical Rx is applied to the Raspberry pi for signal processing and detection (based on the majority decision scheme). Note that, pre-defined text and audio messages have also been mapped to different keypad numbers; consequently, the user in the target (destination) vehicle can both see and hear the transmitted information. Fig. 3. Flow chart for the V2V based VLC system

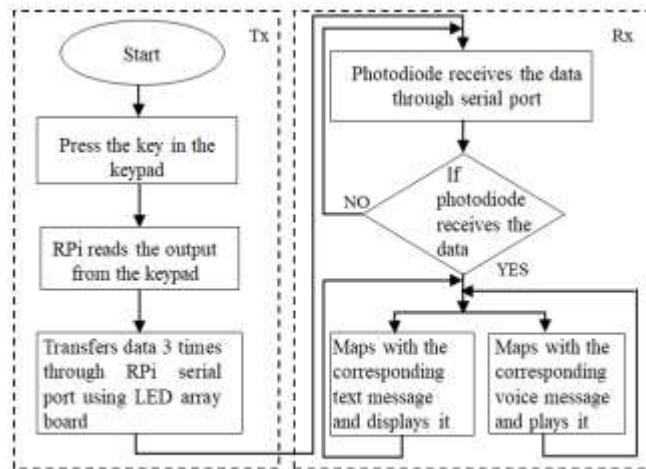


Fig. 3. Flow chart for the V2V based VLC system

#### 4.CONCLUSION

The substantial fraction of automotive collision occurs on highways. Furthermore highways are often traffic bottlenecks contributing to significant trip delays. In this paper our goal to design vehicle to vehicle management protocols using only vehicle to vehicle communications to addressed these two core issues of safety throughput. It reduces amount of road collision and deaths of drivers.



Fig.4. Prototype for V2V VLC system

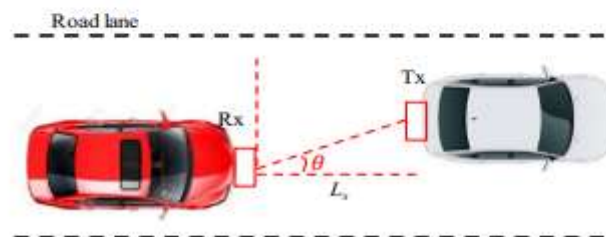


Fig.5. V2V system in driving scenario

Also we are design accident avoidance system using Ultrasonic and IR sensors. Also we have design lane drift system in which driver is not allowed to change lane without giving indicators. Using this system there is no need of honking and it will also decrease noise pollution. The use of wireless communication can be easily intercepted by hackers who want to take everything you have.V2V communications could one day lead to people not having to drive and could help with those who make the dumb decision to drink then drive. This prevents them from hurting innocent people and would definitely be something worth investing it.

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