Vehicle to Vehicle Communication using Li-Fi Technology

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Abstract— Car to car communication is a network-based technology proposed for vehicles which provides comfort in driving and safety to the vehicles connected with it. In this project, an application of Vehicle to Vehicle (V2V) communication which does not require any infrastructure is proposed. This methodology is more robust since this vehicle to vehicle communication method does not require any network-based architecture or protocols. Vehicle-to-vehicle communication can be used to distribute various messages of multiple actions which are generated by the vehicle by using various sensors present in the vehicle. Services such as warning about an accident, traffic jams information or messages about a rescue vehicle which is approaching. Moreover, information about the appearance of road or conditions about the weather can be also transmitted. Detailed vehicle to vehicle services such as warning on direct collision or intersection between two vehicles and its assistance with the complete information about the traffic is mentioned more detailed manner.

Key words: Li-Fi Technology, V2V Communication, ADAS system

I. INTRODUCTION

The goal of Project FUI CASA (Car Safety Apps) is to create an Android framework for developing different ADAS (Advanced Driving Assistance System) applications, as an alternative to the traditional ADAS, to promote secured and environmental-friendly driving. To do this, we work with industrial entities in France. In our ADAS system, Continental Automotive provides an infotainment platform developed for PSA Peugeot Citroen vehicles. As ADAS application is an Android smart phone application, the smat phone need to extract related information from the interface of a car like speed value, location and vehicle headlamp control etc. In this case, the stable, secure and private data transmission is the very important issue. We can classify this issue to three primary goals as follow: Connection stability: The driving vehicle has a very unstable environment. The transmission can suffer some interference perturbation. To exchange some sensitive vehicle information, we need to have a stable link. Data security: The communication between the car and the smart phone has so much sensitive information, thus to keep data security and to prevent attacker to access this information is very important. Data privacy: A vehicle infotainment platform has many tools for collecting information, and sensitive information can be accessed by an adversary. Ensuring that this information stays within the vehicle and the relevant smart phone and is accessible only to trusted parties is an essential issue toward achieving privacy.

Indeed, if we can build a data communication system to provide more stability, security and privacy between the vehicle and the smart phone, we can contribute to a more secure ADAS system. To see the green data processing and transmission of ADAS system, we need to consider the human health in the communication between the vehicle and the smart phone. When we use ADAS applications in a smart phone, the smart phone is often mounted on the vehicle window. In this case, we cannot easily retrieve the vehicle information from a wire link like USB cable, because the wire from the window to the center system can give some disturbances for driving. We can use wireless communication to replace the wire link, but the radio waves have the health threat for people. If we can find a more healthy way to communicate, we can contribute to a more green and healthy ADAS system. In Section II, the related work is presented. Then in Section III, the system design of our prototype is detailed. Section IV carries out the experiments of our prototype, especially for our visible light communication system between the car and the smart phone along with some results obtained. Finally, Section V provides some concluding remarks and relevant works for the future.

II. EXISTING SYSTEM

In this existing system, the communication of intra-vehicle and V2V to enable the safety of the vehicle is used. Namely, it extracted the vehicle information by connecting the OBD system using Pad's Bluetooth interface. And a WIFI connection enables the Pad to present a GUI for anti-collision warning, which is based on an offline map to show the real time GPS information of vehicles. Furthermore, it used the system board which supported the IEEE 802.11p/1609.X protocols to make information exchanged in vehicles. And the LTE module enables a remote server to monitor all vehicles on the road.

III. PROPOSED SYTEM

In the proposed system, the transmission of data from one vehicle to another is carry on in a very easier by Li-Fi technology by using led light. In this method, it will help us to avoid road accidents. In future the data transmission using Li-Fi technology will be promised to play a vital role in human's life. Here in this proposed method, the problem arises in wifi like the speed and the jamming are really take place when number of users increasing. But this traffic problem get reduces to a great number by using LI-Fi technology and this will proceed towards the cleaner, greener, safer and brighter future in this world without radio wave, because radio waves create a harmful effect for living thing, but Li-Fi is the optical wireless communication for data, audio and video streaming in LEDs. The ultrasonic sensor is used to measure the distance between the nearby vehicles and the vibration sensor is used to identify the accidents.

IV. BLOCK DIAGRAM

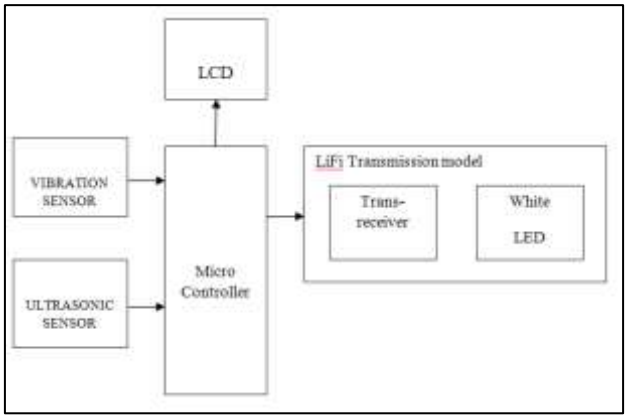

Fig. 1: Transmitter section

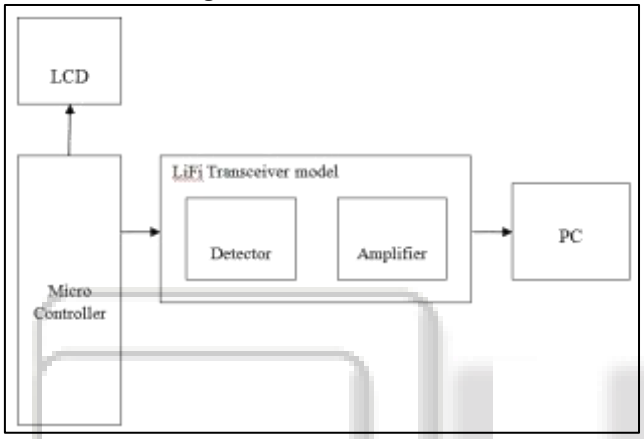

Fig. 2: Receiver section

A. Microcontroller

A microcontroller (MCU for microcontroller unit, or UC for µ-controller) is a small computer on a single integrated circuit. In modern terminology, it is similar to, but less sophisticated than, a system on a chip (SoC); an SoC may include a microcontroller as one of its components. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. Program memory in the form of ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications consisting of various discrete chips.

B. LI-FI

Li-Fi is a technology for wireless communication between devices using light to transmit data and position. In its present state only LED lamps can be used for the transmission of visible light. The term was first introduced by Harald Haas during a 2011 TED Global talk in Edinburgh. In technical terms, Li-Fi is a visible light communications system that is capable of transmitting data at high speeds over the visible light spectrum, ultraviolet and infrared radiation.

In terms of its end use the technology is similar to Wi-Fi. The key technical difference is that Wi-Fi uses radio frequency to transmit data. Using light to transmit data allows Li-Fi to offer several advantages like working across higher bandwidth, working in areas susceptible to electromagnetic interference (e.g. aircraft cabins, hospitals) and offering higher transmission speeds. The technology is actively being developed by several organizations across the globe.

C. TRANSMITTER SECTION

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. Circuit diagram for LI-FI transmitter is shown in figure 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.

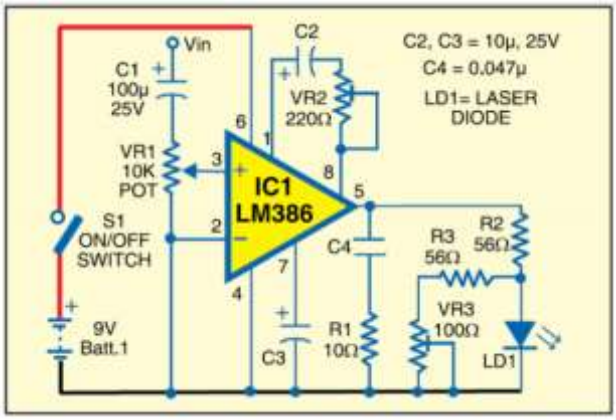

Fig. 3: Li-Fi Transmitter Circuit

D. Receiver Section

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 shown in figure 3. The solar panel is connected to the low power audio amplifier. The output of audio amplifier LM 386 is given to speaker. Now the sound generated from speaker is received by the mike connected to the analog input port of second PC.

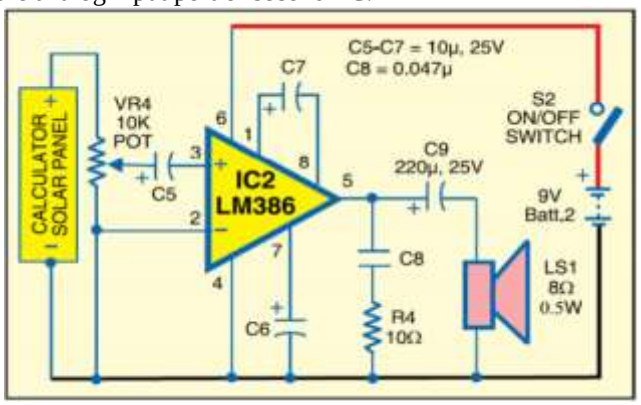

Fig. 4: Li-Fi Receiver Circuit

V. CONCLUSION

We have presented our VLC system to enabling a stable, secure and private communication between a simulated vehicle prototype and a smart phone. This approach relies on the use of a visible LED for the downlink and an IR LED for the uplink. Our VLC system has been integrated into an

ADAS application for our ADAS system. Finally, our experimental study has proved that our VLC prototype is realistic for providing a good enough quality of the data link and can run on resource constrained platforms. However, our VLC system is used inside a vehicle like indoor condition. These indoor tests in a dark room are still ideal and can't fully take into account the impact of the strong ambient light in real driving environment. Therefore, the experiments using a real vehicle is necessary to investigate the impact of weather conditions like rain and the sun light and the artificial light interference on our VLC system performances.

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