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AVOIDANCE OF COLLISION BETWEEN VEHICLES THROUGH LI-FI BASED COMMUNICATION SYSTEM

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***Abstract:** Due to collision between vehicles there are large number of accidents taking place all over the world. Survey reports show that about 1.2 million people died in road accidents the previous year. World Health Organisation(WHO)reports suggest that people and vehicle safety is important. To reduce number of accidents that are taking place an idea is being proposed using visible light communication. In this technique, visible light is used for communication of data between vehicles. Most of the accidents occurred due to lack of communication between vehicles. This drawback can be overcome using visible light communication known as light fidelity(Li-Fi). This is a cost effective process for reducing the accident with high data rate.*

Keywords: Light Fidelity, Vehicle to Vehicle Communication, Collision.

1. INTRODUCTION

Vehicle to Vehicle (V2V) communication is one of the important technology for supporting automotive services. These services require high data rate transmission. To satisfy the high data rate requirement, the V2V communication has adopted millimetre-wave. In mm Wave V2V communication there is high possibility of inter-vehicular line of sight blockage caused by dynamic topology. To overcome the blockage effect, a self organised V2V association strategy is proposed. When blockage interrupt data transmission, a new data packet queue is triggered leaving unfinished data packet dropped.

The change of technology is being utilized for the comfort and time saving of the human being. In wireless communication the technology is movingupwards by inventing Li-Fi technology. Since the high intensity LED lights are present in the ars already, these lights are being utilized as the Li-Fi transmitters. By adding the cheap circutry, using Li-Fi technology the collision can be avoided in the vehicles.

2. RELATED WORKS

Kim et al. has analyzed the outdoor environmental condition faced in vehicle to vehicle communications using Visible light communication [9]. Head light and rear light used for the transmitter and photo diode saturation used for light signal receiver. The total distance is 20 m range is covered in the daytime outdoor environmental conditions. Outdoor communication problems faced during observation such as sun light noise, photo diode saturation; increase the range of communication in the daytime. So transmitter and receiver are implemented with filter design, error correct and improve the strength of signal.

Bhateley et al. worked at the Smart Vehicular Communication [10]. Headlights are used as a transmitter and photo diode used as a receiver. The high data rate transmission range achieved up to 0.45 m in indoor. But for the outdoor it is difficult to control the environmental conditions so they have used the PWM and OFDM modulation techniques but other technique like Direct Sequence Spread Spectrum (DSSS) can also be used to increase the transmission range up to 40 m.

Santos et al. have designed Visible light communication protocol applied on V2V (Vehicle to Vehicle) network [11]. The VLC uses the white LED at low cost. LED has less required energy so replaced with tail and headlights and reduces the thermal damage, LED is preferred as the high illumination light because of its high bandwidth and immunity to interference from electromagnetic source. The Manchester Coding technique is used for transmission because it is secure and efficient. The distance between vehicles was 20 cm.

Ergul et al. presented the VLC and its challenges [12]. VLC has huge bandwidth therefore it has high data carrying capacity thousand times of greater than the range of radio frequencies. He mentioned that the system is effective to carrying data rate up to 300Mbps within the range of 25ft.Takai et al. [6] has developed LED based Optical wireless communication (OWC) and CMOS image sensor in automotive field. For particular application to avoid the collision and highly suitable for transmitter because very high speed data rate and light source is simple bulb and fluorescent lamp also used in automotive fields. At receivers, cameras have also been integrated. Some ideas using image sensors for a high-speed optical signal reception have already been reported. The frame rate used in image sensors is approximately 30 frames per second (fps). If its frame rate is 30 fps, then the data rate in each pixel must be limited 15 bit per second (bps) or less than Nyquist frequency requirement.

3. PROBLEM AND MODULE DESCRIPTION

The problem faced by the drivers are that they are not able to communicate with other vehicles. The driver of a vehicle may get distracted or get drowsy when driving the vehicle. The driver may also not predict what the other vehicle's driver is intended to do. To solve this problem, this system is being proposed. This proposed system consists of the ultrasonic sensor which calculates the distance of the object in front of the vehicle and alerts the driver. The Eye-blink sensor is used for monitoring the eye-blink of the driver. If the sensitivity of the driver's eyes is less, then it is assumed that the driver has slept. The buzzer sound is continuously given until the driver's eye-blink becomes normal. This avoids the collision between vehicles.

Module Description

Module 1: Safety Indication

IR sensor is used for detecting if the driver has put on the seat belt. IR sensor is placed in the seat belt holder. If any object cuts the IR sensor, it indicate that the seat belt is put on. If the driver has not put on the seat belt, the vehicle cannot be started. If a driver put on the seat belt, the IR sensor detect then it sends the message to the controller so, vehicle get started as shown in fig:1.1.

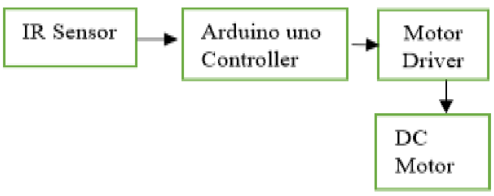

Fig:1.1 Safety Indication

The vehicle get slow down when the IR sensor detects then the vehicle speed is controlled by the DC Motor.

As the vehicle does not start, it sends the warning message to the driver. The warning message is given to the driver by using APR speaker. The APR speaker Alert the driver by giving the voice to put on the seat belt. In the APR Speaker, the audio is recorded predefined.

The buzzer sound is also given to alert the driver. The vehicle can be started as soon as the seat belt has been put on.

Fig:1.2 IR Sensor

IR sensor is electronic device, it can sense the aspects of the surrounding is shown in fig1.2. IR sensor measure the object's heat as well as detect the motion. It can measure only infrared radiations which is detect by IR sensor. These radiations are invisible to the eyes.

Module 2: Drowsiness Detection

The Eye-blink Sensor is used to monitor the driver's eye-blink. The Eye-blink sensor is provided by using the glass to the driver as shown in fig1.3.

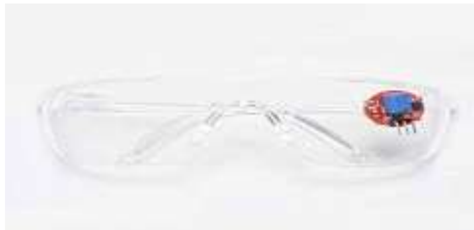

Fig:1.3 Eye-Blink Sensor

If the driver's eye-blink is normal, the driver does not get any alert message. If the driver does not blink his eyes or if the sensitivity of driver's eyes is less, then it indicates that the driver is drowsy.

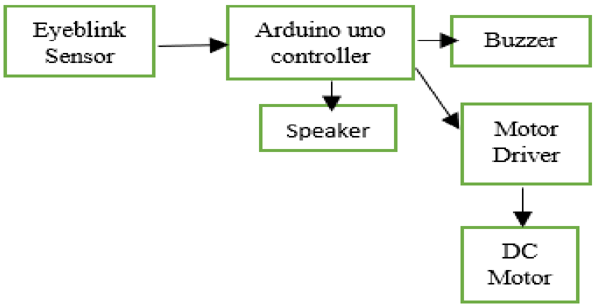

Fig:1.4 Drowsiness Detection

The drowsiness of the driver detected by the eyeblink sensor, this message is send to the controller. Through the speaker the driver get alert and the vehicle get slowed down by the DC Motor as shown in fig:1.4.

The buzzer sound is given continuously until the driver eye-blink becomes normal. When the driver is drowsy the vehicle's speed is automatically slowed down.

Module 3: Object Distance Calculation and Data Transmission

The ultrasonic sensor detects the object in front of the vehicle, so the vehicle will stop. The ultrasonic sensor sends the message to the controller if the object in the front vehicle is less than or equal to 5m

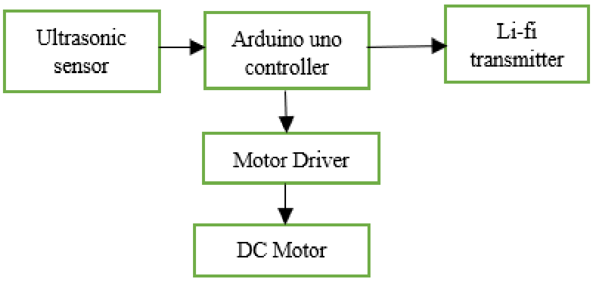

Fig:1.5 Object Distance Calculation and Data Transmission

The controller inform to the motor driver, so that the vehicle is stopped. DC Motor specifies the speed of the vehicle as shown in Fig:1.5. The Li-Fi transmitter sends the information to the back vehicle that the front vehicle get stopped.

Fig: 1.6 Ultrasonic Sensor

The ultrasonic sensor measures the distance between the object and front vehicle by using the sonar technology. By using this sensor shown in fig1.6, the vehicle collision is reduced.

Module 4: Toggle and Stop Indication

The Toggle switch is connected to the controller for transferring the data about front vehicle's left or right indicator.This data is also send through li-fi transmitter.

The light from the Li-Fi Transmitter falls on the Li-Fi Receiver of the vehicle at the back, the driver is given an alert by using the APR Speaker as shown in fig:1.7.

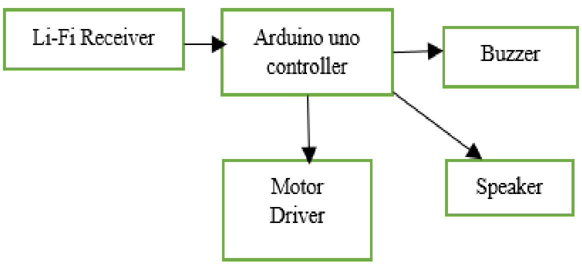

Fig: 1.7 Toggle and Stop Indication

The APR Speaker tells the driver that the vehicle in the front has stopped and also gives the buzzer sound. The buzzer is shown in fig1.8.

Fig:1.8 Buzzer

It automatically slow down the motor of the vehicle at the back. As the vehicle is slowed down, the vehicle is stopped from collision at the front as shown in fig 1.9.

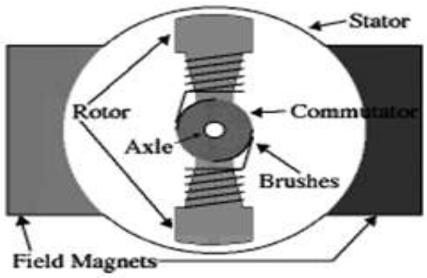

Fig: 1.9 DC Motor

The data is passed from the Li-Fi Transmitter to the Li-Fi Receiver as soon as the light falls on it. The vehicle at the back is only slowed down and the control is still given to the driver, so he can overtake the vehicle at the front is he wishes. The system is shown as transmitter and receiver in fig1.10 & fig1.11.

Algorithm:

Steps:

1. The vehicle can be started only when the seat belt is worn.

2. The Ultrasonic sensor in the vehicle measures the distance of the object in the front.

3. If the distance of the object is less than 10m, the vehicle is stopped.

4. The data that the vehicle has stopped is sent through the Li-Fi Transmitter to the vehicle at the back.

5. As soon as the data is received by the Li-Fi receiver, the vehicle is slowed down and the driver is alerted.

6. The data from the Li-Fi transmitter is received by the Li-Fi receiver, if the range is within 50m.

4. SYSTEM ARCHITECTURE

TRANSMITTER

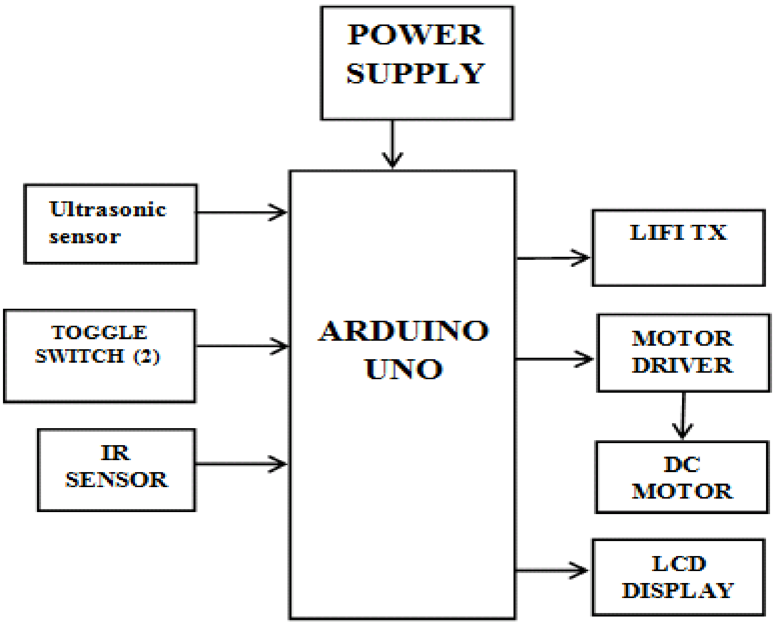

Fig:1.10 Transmitter

RECEIVER

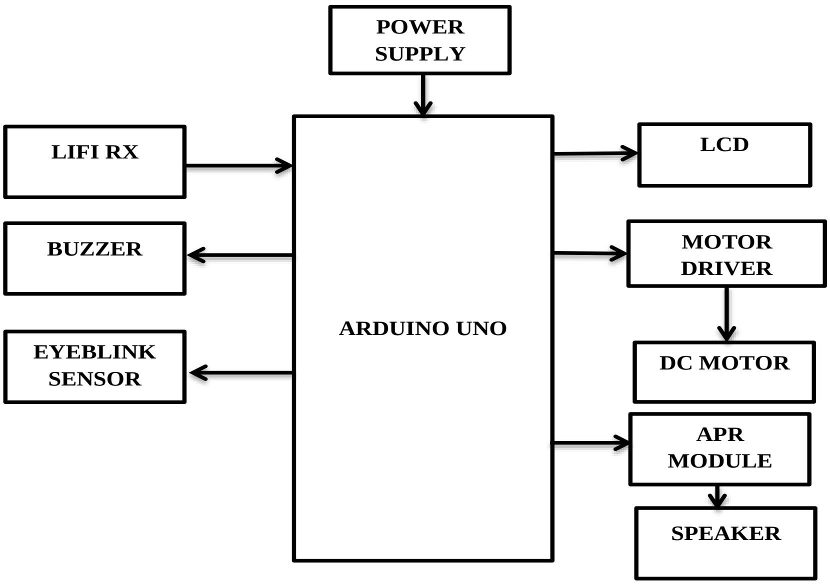

Fig: 1.11 Receiver

5. RESULTS AND DISCUSSION

The resulting system is used for avoiding collision between vehicles and the driver is also monitored for his drowsiness.

The system monitors the sensitivity of the driver's eyes, whether it is sensitive or not.

This proposed system will be very useful for accident avoidance in vehicles due to carelessness and the driver is also monitored if he is awake or not using the eye-blink sensor.

6. CONCLUSION AND FUTURE ENHANCEMENT

Using this system, the vehicle-to-vehicle (V2V) communication is proposed to monitor the motion of distant vehicles.

By using this system, the vehicle collision can be detected and thus road accidents will be reduced. The road accidents will be reduced because the driver's drowsiness can be detected.

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