Collision Detection System for Smart Cars

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Abstract - *The rapid growth over the past decade has led to an increase in the use of automobiles. Due to this rapid growth, large accidents are caused by collisions between vehicles, so many accidents have occurred despite the safety regulations that have been complied with. The methodology proposed here aims to increase human safety by reducing the number of accidents by preventing collisions between vehicles. There are many factors that can lead to death, including sudden loss of concentration in drivers, failure to brake, drowsiness and stability problems. This unanticipated scenario can only be mitigated through vehicle-to-vehicle communication, which can be achieved with various short range communication systems to prevent accidents, but the most effective way is to use visible light for vehicle-to-vehicle communication. In this proposed system, the LED transmits light from the transmitter and captures it from the receiver, then the embedded system calculates the optimal distance and makes an appropriate decision. This visible light communication is achieved using a technology called Light Fidelity (Li-Fi), which is used to avoid collisions between vehicles, and the main goal of the system is to provide a cost effective solution with higher data rates to help reduce accidents. will be This project provides an alternative to the traditional accident prevention system by analyzing not only the heart rate of the driver, but also the degree of drowsiness, the distance between vehicles, the vibration level of the vehicle, as these parameters play an important role in the cause of the accident. . Here, LiFi helps to interpret and prevent accidents by overcoming the shortcomings of wireless transmission used for vehicle-to-vehicle communication because light can travel at much higher speeds*

Key Words*: *Li-Fi Lighting Fidelity

1.INTRODUCTION

The vehicle-to-vehicle communication feature is a feature that has been widely studied in recent years due to its many advantages, and several solutions have been proposed in this direction. The possibility of direct vehicle-to-vehicle communication improves traffic safety, as the vehicle can be adjusted within milliseconds based on the environment. Therefore, the driver has already been warned of the accident by giving the information, and can save the driver from a big accident. Among the solutions proposed so far, WIFI communication is widely used because it is a mature technology and has proven to be extremely reliable. However, WIFI-based technology has some drawbacks. This new technology offers some additional benefits by overcoming some of the above major shortcomings and providing smart safety features to prevent vehicle collisions. Li-Fi technology (Light Fidelity) is based on visible light communication and uses only light beams to send wireless internet data at very high speeds. LIFI has a large light wave current and can be turned on and off quickly, so the response time is less than 1 microsecond and is invisible to the human eye. LIFI is very efficient, high bandwidth and safe.

1.1 RELATED WORK

Batreddy Venkata Sai Jahnavi [1] proposed a system to avoid accidents by communicating between vehicles by light rays. They have made use machine learning technologies to develop the Anti-Fatigue Decision Tree, Anti-Fatigue Detection and Enhanced Collision Avoidance Systems to accurately evaluate the current situation of the drivers and vehicles, and make timely response.

Chinnapparaj [2] in his paper has made an approach to the accident prevention system using Li-Fi by adding an alcohol detector in his module which added security by preventing drunk driving accidents. ultrasonic sensor to find the position of the opposite vehicle, motor and alarm unit in the receiver. then it will alert the opposite side driver so that he could take precautionary measures and thereby prevent accidents.

P.Kingston Stanley [3] in his paper he proposed advanced navigation system which detects and avoids autonomous vehicles to safely navigate through the path. They used HSV algorithm is used for image processing technique to detect the obstacles.

2. SYSTEM DESIGN

They created a collision detection system for a smart automobile combining Li-Fi and an ultrasonic sensor on the Arduino platform in the current system. The ultrasonic sensor, Arduino processor, and Li-Fi circuit are all part of this design. Ultrasonic sensors are used to detect the distance between cars, and Arduino interprets the data and makes decisions based on it. The biggest disadvantage is that it only identifies the shortest distance. As a result, we went forward by including new features such as a sound alert system, driver sleepiness detection, vehicle vibration, and driver pulse rate. The vehicle's speed has been lowered based on the information gathered.

The main goal of our project is to avoid road accidents. Using Li-Fi, the data transfer rate is 10 GHz/s. It is more cost effective and useful than Wi-Fi. The main advantage of using Li-Fi instead of Wi-Fi is that the bandwidth becomes 1000 times larger than Wi-Fi which is the bandwidth of radio waves. The security of transmitted data is more secure and enhanced because light waves cannot be intercepted or misused. Here, the ultrasonic sensor detects obstacles along the car's transport path, and it blocks the gap between the obstacle and the car and transmits it through Li-Fi. With this Heart Rate setting, the driver's level of vibration and sleepiness will be detected and the information transmitted to the other end is received by a Li-Fi receiver located on the other car, where the binary signal is transmitted under electronic form by the photosensitive detector that can be perceived by the human eye.

TRANSMITTER BLOCK

The transmitter module includes ultrasonic, strobe, vibration and heart rate sensors as well as a Li-Fi transmitter and motor. An LCD screen is added to display the data obtained from the sensors. At first, when a vehicle is approaching, the ultrasonic sensor detects the distance to the opposite vehicle and updates the data to the ARDUINO UNO which is used for further processing. Drowsy driver is detected through blink sensor and heart rate sensor detects heart rate and eyelid blink rate. The presets for the driver's drowsiness are compared with the data received from the sensors and the arduino performs the necessary actions according to the user

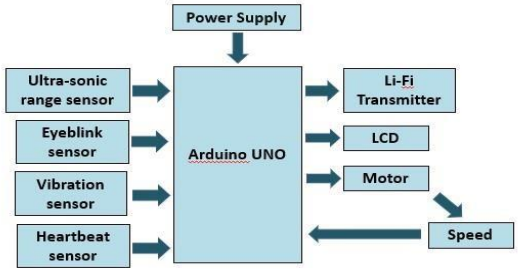

Fig -1: Transmitter Block

defined code, then by the Li-Fi transmitter, the light rays will be transmitted to the vehicle on the opposite side of the edge. For user understanding, the system includes an LCD display. In addition, a motor is added to this system to measure speed and provide the same input to the Arduino, thereby alerting the driver or taking the necessary action.

RECEIVER BLOCK

The receiver block contains the Li-Fi receiver used to receive the light beam from the Li-Fi transmitter of the opposite vehicle.

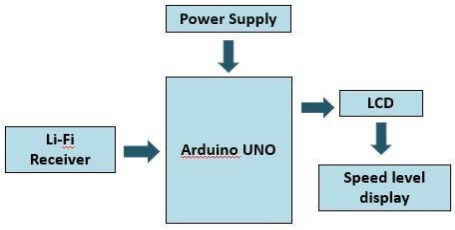

Fig -2: Receiver Block

The beam detected by Li-fi is converted to data via the Arduino microcontroller and displayed to the driver via the LCD display. This allows the driver while driving to easily know if a collision is imminent. This allows the driver to take precautionary measures. We designed the circuit using proteus tool suite by interfacing ARDUINO UNO with ultrasonic sensor, Eye blink sensor, Vibration sensor and pulse sensor , LCD, with Li-Fi transmitter to transmit the data which read by the sensors. And at Receiver side we designed by interfacing ARDUINO UNO with Li-Fi receiver along with LCD to display the status of the front end. In this design tool we used photo detector library in receiver block along with each sensors in transmitter in this design. In case of this tool when the motor runs the speed is displayed, in case eye blink sensor we used switch if switch is off the output will be high shows the drowsiness detected, if ultrasonic sensor displays the distance . Here we dumped hex file generated use ARDUINO IDE and we load the hex file into the board in proteus tool suite.

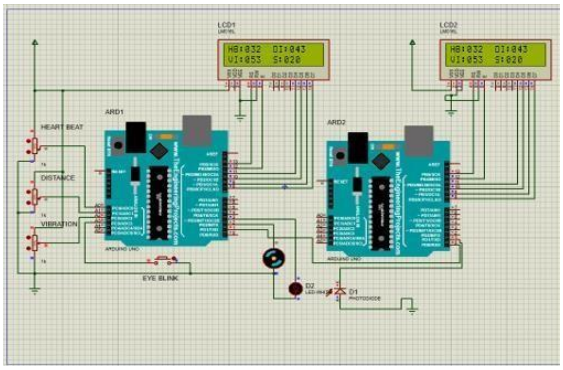

Fig -3: simulated output

As explained the figure shows the reading of the Distance, Heartbeat, Vibration level and Speed based on the speed of motor the speed level varies which will display on the LCD. The Proteus simulation program provides the simulated circuit design. Our primary control unit is Arduino here. It first fetches and finally executes through LIFI after it receives data from the respective sensors.

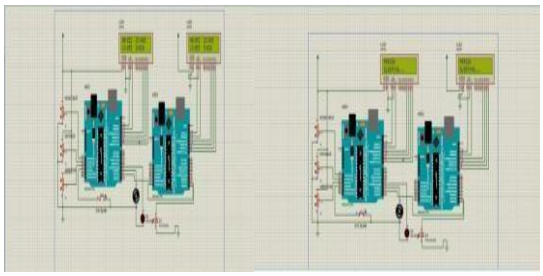

Fig -4: simulated output

After design using proteus tool suite we moved to interface Arduino with the sensors shown in the above circuit.

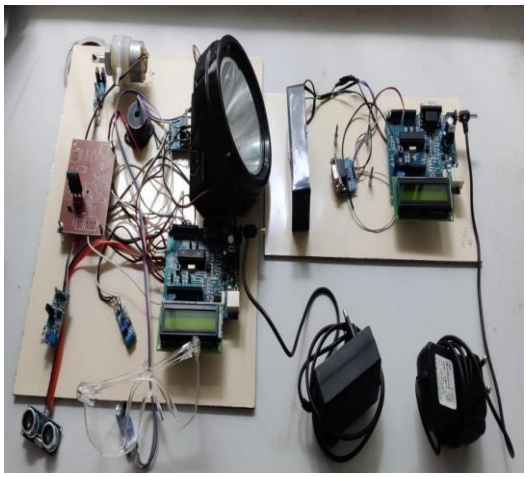

Fig -5: Prototype of design

In this ARDUINO UNO is interfaced with LCD with pin(13,12,11,10,9,8) and we interfaced the IR eyeblink sensor 4th pin , vibration sensor 2nd pin, motor 3rd pin. In this circuit along with the sensors we used IR speed control sensor to measure the speed of motor along with that MOSFET is used to boost up the speed of motor. Same in receiver side LCD is connected with same pin in another board along with that we used Li-Fi receiver. And we dumped the program into the board by connecting USB port to the board which is generated using ARDUINO IDE.

HARDWARE OUTPUT

Fig -8: Transmitter and receiver block LCD display

EYE BLINK SENSOR

Sensors are used to detect driver drowsiness and can alert the driver with a buzzer and display a message on the screen.

Fig -9: Transmitter and receiver block LCD display

ULTRASONIC AND HEARTBEAT SENSOR

This ultrasonic sensor detects the minimum distance to another vehicle and if the distance is minimum, the system will automatically notify you via LIFI to slow down the engine.

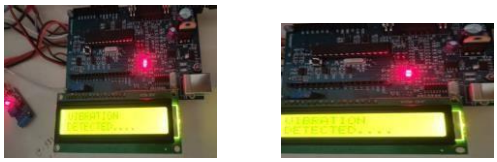

Fig -10: Transmitter and receiver block LCD display

VIBRATION SENSOR

A vibration sensor measures the amount and frequency of vibration in a car and provides information via Li-Fi to other vehicle.

Table -1: comparision Li-Fi vz Wi-Fi

Parameters	**Li-Fi**	**Wi-Fi**
IEEE Standards	IEEE 802.15.7	IEEE 802.11N
Frequency Band	Light does not require frequency	2.4 GHZ
Costs	Cheap	Expensive
Data Transmission Medium	Light	Radio Spectrum
Network Topology	Point-to-Point	Point-to-Point
Speed	1-3.5Gbps	54-250Mbps
Range	Based on LED	20-100 meters
Security	High	Medium

Power energy	Available	Less available
Reliability	High	Medium
Data Transfer	Greater than 1Gbps	Mbps

We used Li-Fi as there are more advantages than Wi-Fi which is compared in the above table.

CONCLUSIONS

Vehicle-to-vehicle communication plays an important role in accident prevention and detection, as vehicleto-vehicle collisions can only be avoided by proper communication between vehicles on the road. The system introduced a LiFi based system to monitor the driver's physical parameters and the distance between vehicles to reduce the risk of accidents. This system saves the lives of many by overcoming all the shortcomings of previously implemented systems, technically identifying the cause of the accident and preventing the accident by alerting the driver. , Provides an improved safety mechanism. Data transfer speeds are high and are not interpreted by the human eye, making them more efficient and cheaper.

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