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Advanced Automobiles Safety System using LIFI

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Abstract - *We are striving to build a system that will transmit pre-accident information to the vehicle, allowing the vehicle to avoid an accident, in this project. The designs and findings of a basic prototype of a vehicle-to-vehicle communication system based on light fidelity (Li-Fi), a unique technology developed in recent years, were investigated. One of the most effective strategies for decreasing car accidents is vehicle-to-vehicle communication. The proposed application of Li-Fi technology in this project primarily uses light-emitting diode (LED) bulbs as a mode of connectivity, with data delivered over the light spectrum as an optical wireless channel for signal propagation. In consequence, LED lighting eliminates the requirement for a complicated wireless network protocol.*

***Key Words*: Ultrasonic Sensor, Arduino, Motor, LiFi Transmitter and Receiver.**

1.INTRODUCTION

Li-Fi is a widely used and vital communication technology. Li Fi stands for light fidelity communication systems. It is an incredibly fast and low-cost wireless communication system that is the optical equivalent of Wi-Fi. The method transmits digital data that is invisible to the naked eye using light emitting diodes (LEDs). We build a prototype for vehicle-to-vehicle data transmission utilising Li-Fi technology in this project. The most efficient strategy of preventing automobile accidents has been demonstrated to be vehicle to vehicle communication. In LI-Fi technology, the LED is used as a light source for data transfer via light. Vehicle to vehicle communications, for example, is one of the earliest developments.

It was formerly used to replace or update existing wireless technology. to quickly restore high-speed connectivity (in case of disaster problem). LiFi is employed because it is an optical version of Wi-Fi that is speedy and affordable.

LiFi technology will allow us to connect to the internet using light from lamps, streetlights, or LED televisions. Not only is it less expensive, safer, and faster than wifi, but it also eliminates the need for a router. Simply point your phone or tablet at a light bulb to access the internet.

LiFi (light fidelity) is a two-way wireless technology that transmits data using LED or infrared light. Unlike wifi, which utilises radio frequency to convey an internet signal, LiFi technology uses light waves to transmit an internet signal. This is a significant improvement over today's wireless networks. It increases the bandwidth and speed of wifi, 3G, and 4G connections. These have a finite capacity and become saturated as the number of users surfing grows, causing them to crash, slow down, or even disconnect.

However, LiFi's band frequency of 200,000 GHz is 100 times faster than wifi's 5 GHz limit and can transmit significantly more data per second. When the best wifi could only manage 300 Mbit/s, a 2017 study by the University of Eindhoven used infrared light with a radius of 2.5 metres to reach a download rate of 42.8 Gbit/s.

Harald Haas, a director professor at the University of Edinburgh's LiFi Research and Development Centre, invented the technology, which could be available in our homes in a few years. It is currently being tested with LED luminaires in offices around the world, and the aerospace industry is already looking for ways to incorporate it into aeroplanes.

Other places where LiFi technology could become popular include airports, hospitals, and city streets. According to the Global Market for LiFi Technology Analysis and Forecast 2018-2028, the growth of mobile devices and the growing demand for greater bandwidth systems will drive the development of this social technology in the coming decade. According to this analysis, the global market will be worth almost $36 billion in 2028, with a compound annual growth rate of 71.2 percent over the next ten years. Up to 2028, the Asia-Pacific area will dominate global growth in LiFi technology, surpassing Europe, which held the lead in 2017.

2. RESEARCH AND DATA

With the introduction of new technologies such as 3G and 4G, we are running out of radio spectrum capacity. In comparison, because light boxes are already existent and deployed, the VLC spectrum has greater spectrum space than the radio spectrum. Efficiency: There are 14 missing cellular radio base stations, each with a 5 percent efficiency. The cooling system has consumed the majority of the energy in the base station. Because LEDs require less energy, with that Li-Fi is very efficient. Radio waves can pass through walls, allowing them to be intercepted and exploited. Light waves do not pass through solid objects. As a result, they cannot be intercepted.

Table -1:

TECHNOLOGY	SPEED	DATA DENSITY
WIRED		
Fire Wire	800 Mbps	*****
USB 3.0	5 Gbps	*****
THUNDERBOLT	2 X 10 Gbps	*****
WIRELESS (CURRENT)		
WI-FI-IEEE (802.11N)	150 Mbps	*
Bluetooth	3 Mbps	*
IrDA	4 Mbps	***
WIRELESS (FUTURE)		
Wi-Gig	2 Gbps	**
Giga-IR	1 Gbps	***
LI-FI	>10 Gbps	****

At the downlink transmitter, LI-FI employs white LED lamps. To use LEDs, a continuous current is normally provided across them. The optical output can be made to fluctuate at very high speeds by rapidly adjusting the current. In a LI-FI arrangement, this attribute is used. If the LED is turned on, we send a digital 1; if it is turned off, we send a digital 0. We can quickly convey data by rapidly turning the LEDs on and off. To build the system, we need some LEDs and a controller that can programme data into those LEDs. We can now encode the desired data and easily transfer it by altering the pace at which the LEDs flicker. We could potentially improve the system by employing an array of LEDs for simultaneous data transmission and/or a combination of red, green, and blue LEDs to change the light's frequency, each frequency encoding a distinct data channel. Theoretically speaking a system like this could could achieve speeds of up to 10Gbps.

3. STUDIES AND FINDINGS

As LI-FI sends data via visible light, the data must be modulated into a signal that can be transferred. Light pulses make up these signals. The following are some of the most popular modulation techniques used in LI-FI:

(a) OFDM: OFDM refers orthogonal frequency division multiplexing. OFDM is a digital multi-carrier modulation system based on frequency division multiplexing (FDM). Data is sent on numerous parallel data streams or channels using a large number of closely spaced orthogonal sub-carrier signals. Each sub-carrier is modulated at a low symbol rate using a typical modulation method (such as quadrature amplitude modulation or phaseshift keying), resulting in overall data rates comparable to single-carrier modulation schemes in the same bandwidth.

(b) OOK: The simplest kind of amplitude-shift keying (ASK) modulation, on-off keying (OOK), expresses digital data as the presence or absence of a carrier wave. A binary one represents the presence of a carrier for a given duration, while a binary zero represents its absence for the same length. Some more advanced techniques change the durations to convey extra information. It's identical to line code with unipolar encoding. It is simple to generate and decode, but it is limited in terms of lighting management and data throughput.

(c) PWM: PWM (pulse-width modulation) is a signal encoding technique that converts a message into a pulsing signal. Even though this modulation technique can be used to encode data for transmission, it is most commonly employed to manage the power provided to electrical equipment, particularly inertial loads like propellers. PWM encodes data into the duration of the pulses and transmits it. Each pulse can carry more than one bit of information.

(d) PPM: PPM (pulse-position modulation) is a type of signal modulation in which M message bits are encoded by sending a single pulse with one of several possible time-shifts. This is done every T seconds, resulting in a bit rate of bits per second being delivered. It's most useful in optical communications networks, when there's little or no multipath interference.

(e) SIM-OFDM: Modulation of Sub-carrier Index OFDM is a two-dimensional amplitude/phase modulation technology that includes Amplitude Shift Keying (ASK) and Quadrature Amplitude Modulation (QAM). The sub-carrier index is used by SIM to send data to the receiver. Unlike typical OFDM, the SIM-OFDM approach divides the serial bit stream into two equal-length bit sub-streams.

COMPARISON OF LI-FI AND WI-FI TECHNOLOGIES

	LI-FI	WI-FI
SPEED	1-3.5 Gbps	54-250 Mbps
RANGE	10 meters	20-100 meters
IEEE STANDARD	802.15.7	802.11b
SPECTRUM RANGE	10000 times than WI-FI	Radio spectrum range
NETWORK TOPOLOGY	Point-to-Point	Point-to-Multi Point
DATA TRANSFER MEDIUM	Use light as a carrier	Use radio spectrum
FREQUENCY BAND	100 times of THz	2.4 GHz

Fig -1: Comparision of LiFi and Wifi.

4. SYSTEM DESCRIPTION

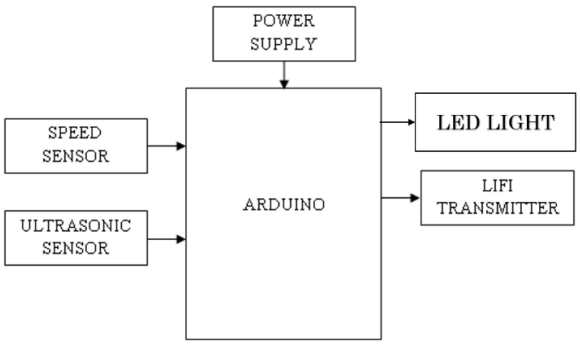

Fig -1: Transmitter Section

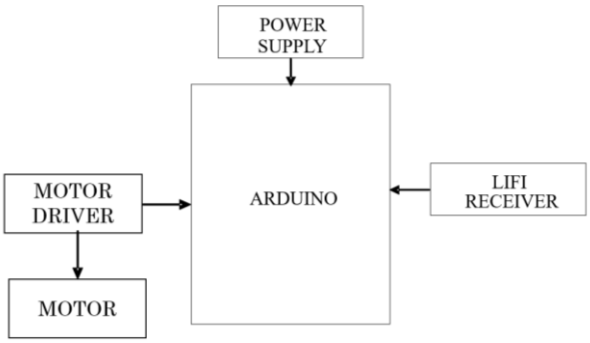

Fig -2: Receiver Section

The above figure **1** and **2** shows the working of the how the Li-Fi is used in the project to make the vehicle stop from accidents. Firstly, the Ultrasonic sensor is senses if there are any cars are closed, if it is detected with the help of Arduino the motor driver is turned on and the speed of the motor is reduced. If any crisis not detected the ultrasonic sensor keeps on checking for the cars to be detected in the range using Li-Fi.

5.Ultrasonic Sensor

An ultrasonic sensor is a device that uses ultrasonic sound waves to detect the distance between a target item and converts the sound into an electrical signal. Ultrasonic waves travel at a faster rate than sound waves (i.e., noise that people can be able to hear).

A transmitter and a receiver are the two main components of ultrasonic sensors.

Ultrasonic sensors are typically employed as a complement to other sensors. Car parking technology and collision safety systems both use them. Ultrasonic sensors are also used in manufacturing technologies and robotic detecting systems. Ultrasonic sensors are less sensitive to smoke, gas, and other particles that pass through the air than infrared (IR) sensors in neighbouring sensory systems (although body parts are still affected by fluid-like substances)

Although some sensors have a separate audio emitter and receiver, they can also be combined into a single package device with an ultrasonic switching feature between the signal output and receiver end. This sort of sensor can be packaged in a smaller packaging than a variety of products, making it ideal for applications where space is limited.

Fig -3: Ultrasonic Sensor

6.ARDUINO UNO

Arduino Uno is a microcontroller board based on the ATmega328P. The Arduino UNO has 14 digital input/output pins, six analogue inputs, a 16 MHz quartz crystal, a USB connection, a power jug, an ICSP header, and a reset button. All you have to do is plug it into a computer via USB or power it with an AC-to-DC adapter or battery to get started with a microcontroller.

Technical Information

- Microchip ATmega328P mini controller
- 5 volts active electricity
- Voltage range: 7 to 20 volts
- Digital Anchors I/O: 14 (6 of which can provide PWM output)
- Six PWM anchors (PIN #3, 5, 6, 9, 10, and 11)
- UART: 1
- I2C: 1
- SPI: 1
- PINs for Analysis Input: 6
- 20 mA DC current for each I/O pin
- 3.3V DC Current

• Flash Memory: 32 KB, with 0.5 KB utilised as a bootloader

• SRAM: 2 KB • EEPROM: 1 KB

• Clock speed: 16 MHz

• Height: 68.6 mm

• Diameter: 53.4 mm

• Weight: 25 g

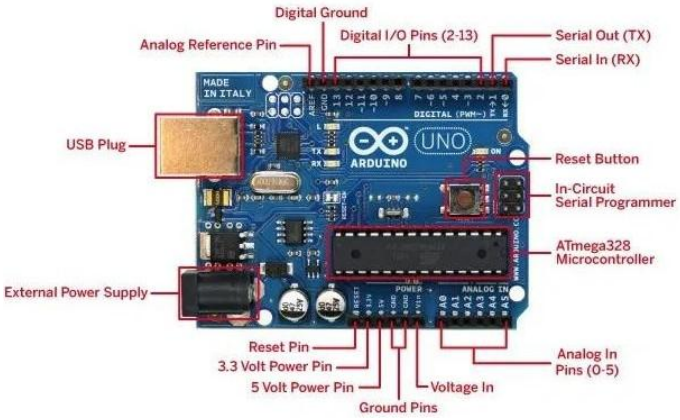

Fig -4: Arduino Uno

Programming Arduino UNO with Arduino IDE

The Arduino development board can be easily programmed using the Arduino IDE. It will take at least 2-3 minutes to programme the Arduino UNO with the IDE.

7.EXPERIMENTAL SETUP

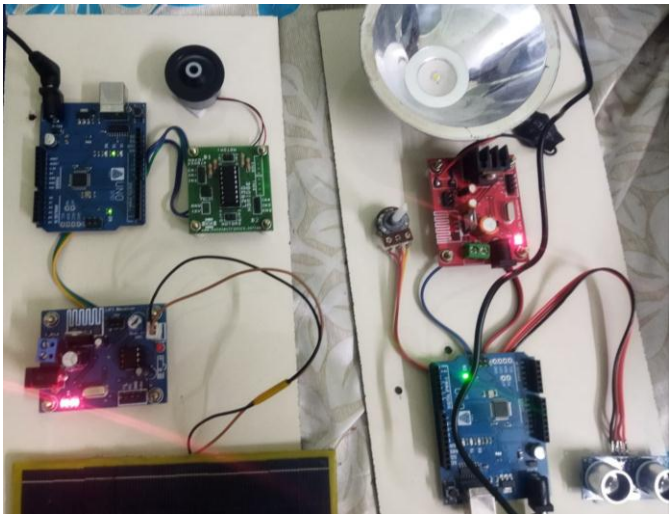

Fig -5: Basic Prototype

8.CONCLUSION

We are striving to build a system that will transmit pre-accident information to the vehicle, allowing the vehicle to avoid an accident, in this project. The designs and findings of a basic prototype of a vehicle-to-vehicle communication system based on light fidelity (Li-Fi), a unique technology developed in recent years, were investigated. One of the most effective strategies for decreasing car accidents is vehicle-to-vehicle communication. The proposed application of Li-Fi technology in this project primarily uses light-emitting diode (LED) bulbs as a mode of connectivity, with data delivered over the light spectrum as an optical wireless channel for signal propagation. In consequence, LED lighting eliminates the requirement for a complicated wireless network protocol.

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