A LIFI BASED DATA TRANSMISSION FOR ANTI COLLISION SYSTEM

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Abstract- A new way of data transmission between two vehicles using light fidelity technology is proposed in this paper. A best way of avoiding accidents can be achieved by the communication between the vehicles. This system can be simplified by using LED bulbs for data transmission. The previously used data transmission technology can be overcome by the newly proposed LIFI technology. The major objective of this system is to achieve reliable communication between the vehicle using a transmitter and a receiver. The communication methods and the operations are presented in detail.

Index terms: Light fidelity, Light emitting diode, wireless communication, and visible light communication

I. INTRODUCTION

LIFI is a new way of communication which uses light as a medium of transmission. LIFI refers to light fidelity. It is also a faster and effective way of communication than a WI-FI. Light fidelity works by using light emitting diode for data transmission [1]. In this paper a new design of data transmission based on light fidelity is shown.LIFI uses visible light as a medium hence it can be called as an optical version of WI-FI. This technology has data speed at the rate of terabits which is much faster compared to WI-FI. Spread spectrum technique is used as a vehicle to vehicle communication previously [4].

The major drawback of this technique is it requires driver's attention for control of speed. But in the proposed system the motor connected to the Controller senses the speed between the vehicles and automatically stops the vehicle.

Automation can be achieved as the distance between the vehicles reduces then the controller reacts and the motor speed is reduced. Intelligent transport system (ITS) using visible light communication with a transmitter and a receiver is given in [6]. But the speed of this system is limited. The proposed technique modes of operation, its principles are presented in detail.

II. Communication without WIFI Or GPS

GPS or WI-FI is not required for vehicle communication. Apart from these WIFI and GPS a programmable interface controller is used. It sends a 40 KHz pulse of sound which is not heard by humans. The microcontroller is used to detect the echo. The distance between the vehicles is calculated using the time difference between the transmitter and receiver. If the time required for transmitting and receiving is more than the speed will be increased. If the time reduces then the controller reacts by applying the braking system. Figure1 illustrates the normal wireless communication that occurs between two vehicles.

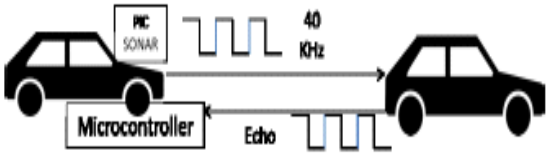

Figure 1: Communication using Sonar

III. Communication System Using LIFI

Communication between Vehicle to Vehicle and Ranging System has been proposed by using Spread Spectrum Technique and LIFI technique. Fig 2 shows the block diagram of the propose system. Based on the input the sender sends the message to the microcontroller. The controller converts the message signal to ASCII. Then it is given to NPN switching circuit. The switching circuit is used to boost the signal. The message is reverted using a NPN switching device. A syska LED is used to transmit the obtained ASCII message in LED spectrum.

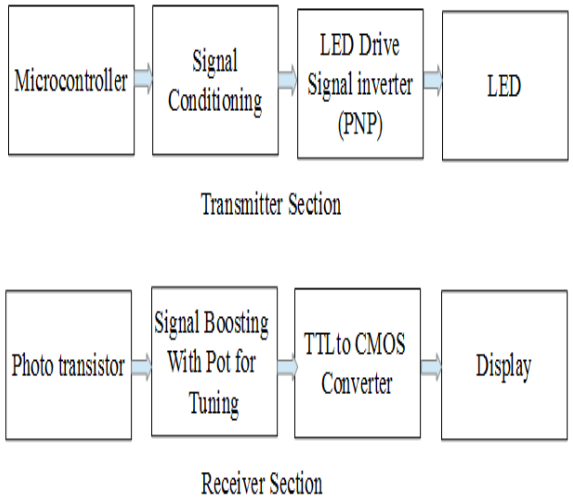

Figure 2: Communication System Using LIFI

On the receiver side a phototransistor is used to receive the message. For sensing the data a impedance matching circuit is used. Transistor- transistor logic is used to convert ASCII message to normal message. The basic function is described with an example. The speed of the vehicle is read using speed sensor. It is then converted to DC and given to the microcontroller. The controller processes the data such as comparing the speed. The processed data is given to LED driver and transmitted.

IV. Components Description

4.1 Buzzer

A buzzer is an electronic device which is used as signaling device, in automobiles and household appliances. It consists of a various switches, sensors. They are connected to a control unit. The control unit illuminates a light on the appropriate control panel or sounds a warning in the form of a buzzing sound. In current trend, to obtain high pitched sound ceramic-based piezoelectric

sounder is equipped. Usually these were hooked up to driver circuits which varies the pitch of the sound. A Piezo buzzer is made from two conductors that are separated by Piezo crystals. When a voltage is applied to these crystals, they push on one conductor and pull on the other. The result of this push and pull is a sound wave. The process can also be reversed to use as a guitar pickup. When a sound wave is passed, they create an electric signal that is passed on to an audio amplifier. Table 1 shows the various features of Buzzer.

Table 1: Features of Buzzer

Rated Frequency	3,100Hz
Operating Voltage	3 - 20Vdc
Current Consumption	14mA at 12Vdc
Sound Pressure Level (30cm)	73dB at 12Vdc
King State Buzzer	KPE-200
Dimensions	22.5mm diameter, 19mm High, 29mm Between mounting holes

4.2 LCD Display

A liquid crystal display is combination of two states of matter, the solid and the liquid. LCD produces a visible image with the help of the liquid crystal. An LCD is either made up of an active matrix display grid or a passive display grid. Active matrix display is used in modern smart phones and the passive display grid designs were used in some of older designs. The LCD does not produce any illumination of its own .Figure 3 shows the pin diagram of an LCD display.

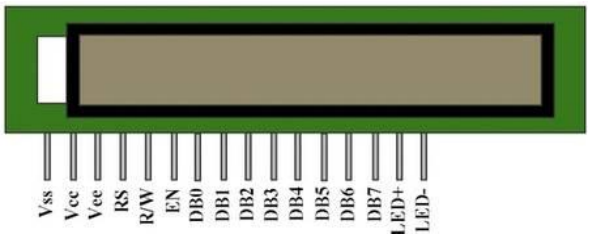

Figure 3: Pin diagram of LCD

The working principle of the LCD is that when an electrical current is applied to the liquid crystal molecule, the molecule tends to untwist. This causes the angle of light which is passing through the molecule of the polarized glass and cause a change in the angle of the top polarizing filter. As a result, a little light is allowed to pass the polarized glass through a particular area of the LCD. Thus, that particular area will become dark compared to other. The LCD works on the principle of blocking light. While constructing the LCD's, a reflected mirror is arranged at the back. An electrode plane is made of indium-tin oxide which is kept on top and a polarized glass with a polarizing film is also added on the bottom of the device. The complete region of the LCD must be enclosed by a common electrode and above it should be the liquid crystal matter.

4.3 Light Emitting Diode (LED)

A light-emitting diode (LED) is an electronic light source. The first LED was built in the 1920s by Oleg Losev, a radio technician who noticed that diodes used in radio receivers emitted light when current was passed through them. The LED was introduced as a practical electronic component in 1962.A light emitting diode (LED) is known to be one of the best optoelectronic devices out of the lot.

The device can emit a narrow bandwidth of visible or invisible light when its internal diode junction attains a forward electric current or voltage. The visible lights that an LED emits are usually orange, red, yellow, or green. The invisible light includes the infrared light. The biggest advantage of this device is its high power to light conversion efficiency. The response time of the LED is also known to be very fast in the range of 0.1 microseconds when compared with 100 milliseconds for a tungsten lamp. Due to these advantages, the device wide applications as visual indicators and as light displays**.**

4.4 IR (Infra-Red) Sensor

Infra-red sensors are the most often used sensor by amateur robotics. IR are mainly used in making of robots for robotic events like white/black line follower, a wall follower, obstacle avoidance, micro mouse, an advanced flavor of line follower like red line follower, etc., Infra-red

sensors are in the form of diodes with 2 terminals. You can buy a pair of such diode (one transmitter and one receiver) at a very low cost.

4.5 Motor Driver IC

Motor driver IC is an integrated circuit that is used to control motors to work in an autonomous manner. It can be used as an interface between microcontroller and a motor. Most commonly used motor driver IC are L293 series. Some of these L293 series of motor driver IC include L293D, L293NE etc. In addition to its use for interfacing motor with microcontroller, motor driver IC also has another need. Microcontroller requires only low voltages to operate and relatively small amount of current, but motor relatively need a large amount of voltage and current for its operation. This current cannot be supplied to the motor from microcontroller directly .Thus motor driver IC can be used for this purpose to provide high current to motor. L293D is the motor driver IC that has been used here for receiving signal from the microcontroller and transmits this signal to drive the motor.

4.6 PWM (Pulse Width Modulation) For Controlling Motor Speed:

PWM is a method for binary signals generation, which has 2 signal periods (high and low). The width of each pulse varies between 0 and the period . The main principle is control of power by varying the duty cycle. Here the conduction time to the load is controlled. The PWM makes possible the use of microcontroller to drive the motor which is shown in fig. 4

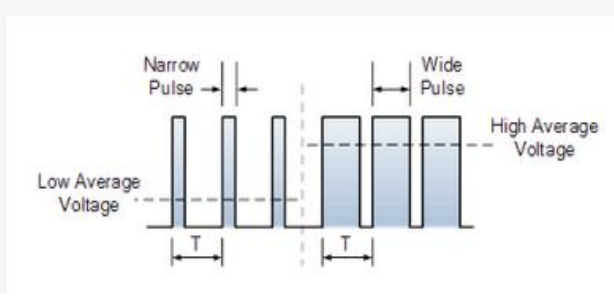

Figure 4: Pulse Width Modulation

The use of pulse width modulation to control a small motor has the advantage in that the power loss in the switching transistor is small because the transistor is either fully “ON” or fully “OFF”. As a result the switching transistor has a much reduced power dissipation giving it a linear type of control which results in better speed stability.

V. Methodology

The system has a transmitter and a receiver in each vehicle in both rear and front sides of the vehicle. The speed of the first vehicle is transmitted to the second vehicle and if the speed exceeds, a notice of slowdown is displayed in the LCD display.

Similarly, if the vehicles have the chance of collision, driver will be alerted with a chance of crash. The motor in the receiver controls the speed of the vehicle in accordance to the distance calculated between the vehicles. Similarly, when an alert of crash is displayed, the vehicle stops automatically preventing the accident.

The complete system constitutes of Transmitter and Receiver in which we are using LED for transmitting data with the help of LED driving circuit and led detector as receiver for capturing the data which is further processed for obtaining the transmitted data.

5.1 Transmitter Section

The transmitter block is shown in Fig 5 .It consists of an LED array unit and a controller including a PC. The vehicle internal data consists of a vehicle ID, LED ID, vehicle speed, operating states of various devices (brake, head lights, and left and right blinkers). The controller collects various data for packetizing and encodes it before transmission. Manchester coding is the encoding technique used here

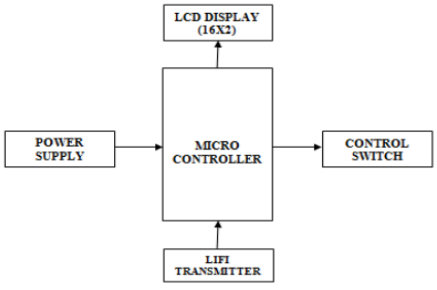

Figure 5: Transmitter Section

It helps the LED to mitigate the optical noise. No feedback or optical filtering is required. Other benefit of the Manchester coding is that it can provide signal synchronization and improve the clock recovery. The LED array unit has LED drivers and few LEDs, and its optical power is up to

4 W. In this system, 870-nm near infrared LEDs is used tentatively, which are capable of being modulated at high speed (fc: 55 MHz). The modulation technique preferred is ON-OFF keying.

Table 2: Transmitter Details

Modulation Method	On –Off Keying (OOK)
Encoding Method	Manchester coding (MC)
Data rate	10 Mbps to 20Mbps Peak Emission
Wavelength	870 nm
Optical output power	4W
Measured cut off frequency	55 Hz

The table 2 presented below has the details about the modulating and encoding methods and describes the features of transmission section**.**

5.3. Receiver Section

Receiving data implemented through the led light detector with universal baud rate. This LIFI receiver gets the data from the nearer vehicles. Vehicle speed and distance will have calculated by the transmitting data. When receiving, data matching the threshold data mean vehicle speed control automatically and monitoring the current parameter through this system. Fig 6 shows the receiver block of the system.

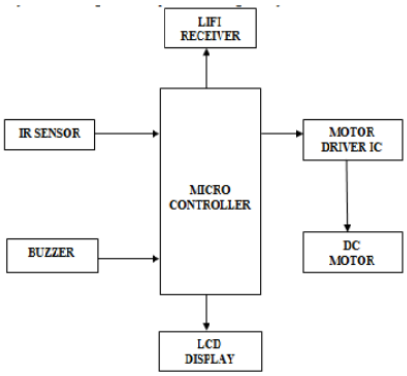

Figure 6: Receiver Section

Speed control of DC motor need to be very precise in application where required speed is correcting signal representing and to operate motor at constant speed, so we use PWM method to fulfill all requirements to speed control of DC motor. PWM based speed control system consists of electronic components (integrated circuits, Sensors etc.) To control the speed of DC motor using Pulse Width Modulation (PWM) method. Microcontroller ATmega8 is used to generate PWM. Here we use DC motor (30rpm) and it controlled through the PWM technique.

Camera→ controller→motor

VI. Results

In this section, the output and results of the proposed system were discussed. ATmega8 has many features like that of ATmega32. But it has reduced number of features and capabilities, yet it has enough features to work with. Atmega8 is cheaper than ATmega32. In that case, one feature you won't be able to realize is the JTAG interface. But rest of the features are available in this IC .ATmega8 is the microcontroller used in the hardware kit of this work. Two vehicles are considered where in each vehicle a microcontroller, LCD display is provided.

When the accelerator is varied with different speeds, this corresponding speed variation is displayed in a vehicle. LIFI transmitter being attached to the microcontroller transmits information of speed about first vehicle to second vehicle through LIFI receiver. Thus, the speed information of the first vehicle is known by the user of second vehicle.

The results are obtained by considering two different speeds in first vehicle that can be known by the second vehicle through LIFI transmitter and receiver. The simulation circuit is being illustrated in figure 7.

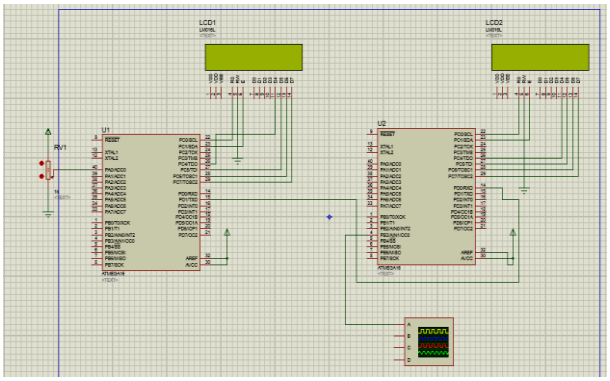

Figure 7: Simulation Circuit

Various information about the speed of the first vehicle is being transmitted to second vehicle. This is represented in figure 8.

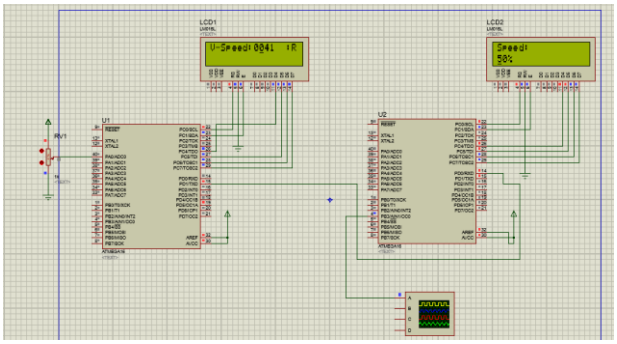

Figure 8: Speed Information Transmitting Between Vehicles

The PWM signal output is thus obtained in digital oscilloscope for different speeds. The digital oscilloscope output for random high and low speed is obtained by varying the accelerator with different speed levels .

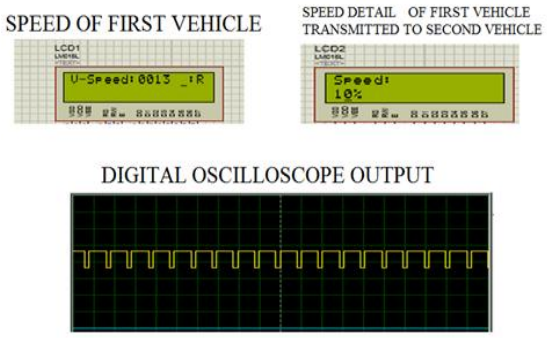

Figure 9: Digital Oscilloscope Output for low speed in first vehicle

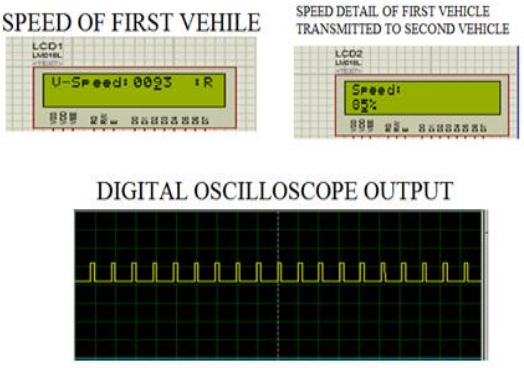

Figure 10: Digital Oscilloscope Output for high speed in first vehicle

The comparison between the PWM signals that are obtained using the simulation circuit is obtained in digital oscilloscope .the "ON" and "OFF" time variation in the output signal can be used in the control of the DC motor. This is illustrated in Figure 9 and Figure 10.

VII. Conclusion

This paper proposed a new technique of communication between vehicles which is reliable and simple compared to existing ones and also cost efficient. The main aim is to reduce accidents and to provide safer transportation which we have implemented in this system. LIFI technology makes vehicles to communicate with each other and prevents the accidents by applying the braking system. The simulation results show the interface of vehicle to vehicle communication. Thus, the visible light communication was established which transmits data at the rate of terabytes and the hardware components gives the necessary results.

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