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Automobile Collision Avoidance System Using Li-Fi Communication

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ABSTRACT: The 21st century is defined as the era of technological development. With drastic increase in population, automation is becoming the need of the hour in order to make life more comfortable and easy. Due to the advancement and development in the field of automation and embedded system, the notion of smart car has become very popular. Smart cars are modernizing trends in the traditional automobile industry. Companies across the globe have been investing a huge amount of resources on the production and design of smart cars. Every technological development needs to overcome certain obstacles, and hence, in this paper, a design of a collision detection system for smart car using light fidelity (Li-Fi) and ultrasonic sensor on the Arduino platform is proposed. This design consists of an ultrasonic sensor, an Arduino processor, and a Li-Fi circuit. The ultrasonic is used for measurement of distance between vehicles, and Arduino processes the data and makes decisions accordingly. Data transmission between vehicles is ensued using a Li-Fi transmitter circuit and a Li-Fi receiver circuit. The transmitter circuit is mounted on the tail lights of the leading car and the receiver circuit is mounted on the front side of the car that follows. Using visible light communication, the transmitter circuit transmits the calculated speed and the information is received by the receiver circuit of the second car. On the basis of the information received, the speed of the second car is changed in order to avoid collision.

KEYWORDS : Li-Fi Technology, Arduino Microcontroller, Vehicle to vehicle Communication, Visible light Communication.

I. INTRODUCTION

There are around 1.4 million cell pole radio waves base stations set, with more than 5 billion cell phones. Cell phones transmit over 600TB of information on a normal reason for consistently. Presently a days remote correspondence utilize radio waves. Yet, radio waves have an issue of effectiveness, accessibility, security and limit. Range is significant necessity for remote correspondence. With headway in innovation and increment in number of clients, existing radio wave range neglects to address the issue and consequently, the limit issue. To determine all the issues, we have concocted the idea of transmitting information remotely through light utilizing LEDs called as Li-Fi which is a most recent innovation that utilizes LED lights which helps in the transmission of information considerably more quicker, and adaptable due to the sturdiness, effectiveness and high life time attributes that makes Li-Fi idea a superior one. Driven lights are these days generally utilized for individual and authority purposes for their radiant viability improvement. Obvious light correspondence (VLC) is another method for remote correspondence utilizing noticeable light. Common transmitters utilized for noticeable light correspondence are obvious light LEDs and recipients are photodiodes and picture sensors. Being a profoundly populated nation like India and parcel of traffic issues, there is constantly an issue of manual traffic control at whatever point an emergency vehicle shows up along a specific course which isn't powerful. 2 The proposed system aims in using lifi for transmission of data through led light between two vehicles which helps in reducing road accident and promotes safe driving. The Automobile Collision Avoidance Using Li-Fi Communication Project is a research project aimed at developing a communication system that can prevent accidents on the road by providing real-time information to drivers about potential collisions. The project makes use of Li-Fi technology, which uses light waves to transmit data, to facilitate communication between vehicles. The primary objective of the project is to improve road safety by developing a communication system that can alert drivers to potential collisions before they occur. The system will achieve this by using Li-Fi technology to send information between vehicles, such as speed, direction, and proximity. By analyzing this information, the system will be able to predict potential collisions and warn drivers in advance, allowing them to take appropriate action to avoid an accident. The project also aims to address some of the limitations of traditional communication systems, such as radio frequency communication, which can be subject to interference and other issues.

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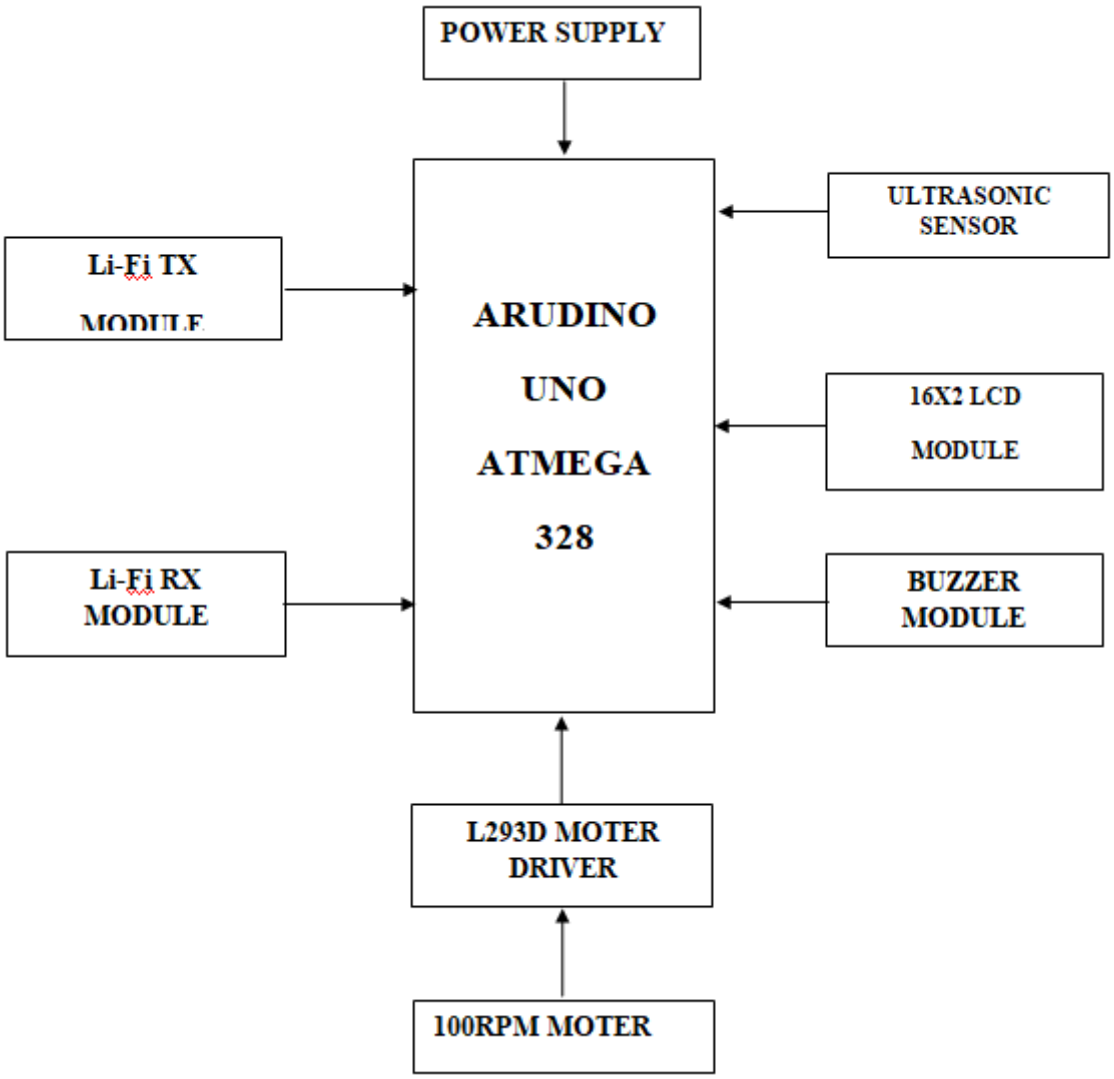
II. USES OF Li – Fi COMMUNICATION TECHONOLOGY

The idea of Li-Fi was first given by Harald Haas from University ofEdinburgh, UK, in his TED Global talks on Visible Light Communications.According to him Visible Light Communication is very simple, if the LED ison, the transmitted data is digit 1, if it is off, the transmitted data is digit0. TheLEDs can be switched on and off very quickly, which gives better opportunityfor transmitting data. So the requirement in LEDs and a controller that code data into those LEDs. Fig:1.1 Block diagram of Li-Fi communication systemDepending on the data to be encoded or transmitted, the LED flicker rate is varied. Enhancements to be made in this method are like using combinations of red, green and blue LEDs or using parallel data transmission

BLOCK DIAGRAM



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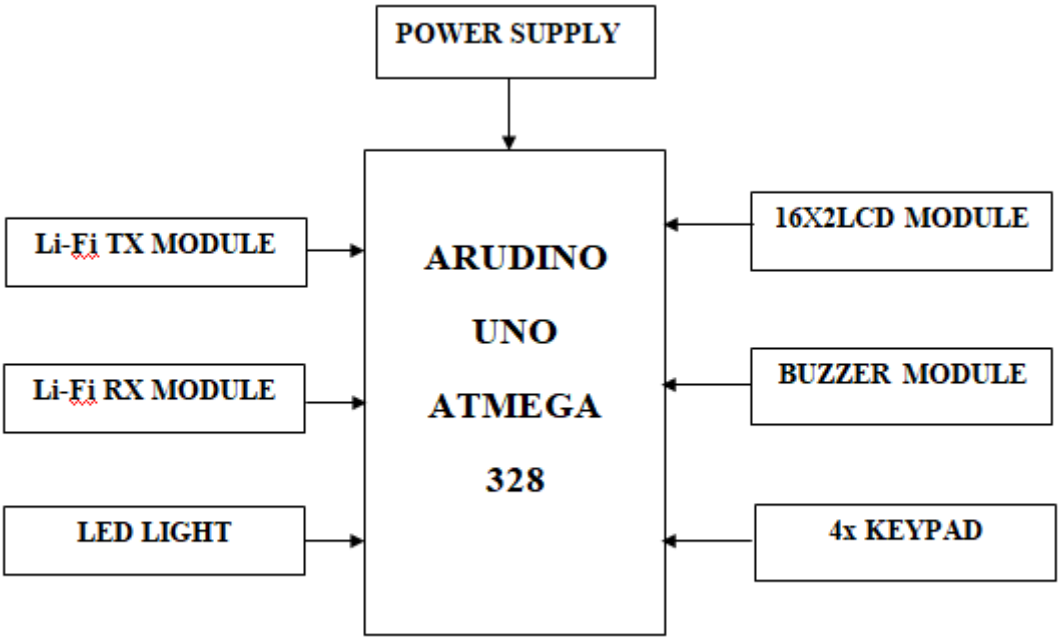
TRANSMITTER SECTION

The transmitter system which consists of an LED array unit and a controller including a PC. The vehicle internal data which consists of a vehicle ID,LED ID, vehicle speed, operating states of various devices (brake, head lights, and left and right blinkers) and many details. The controller collects various information for packetizing and encoding it before transmitting it .The encoded technique used is Manchester coding [6] for the LED to mitigate the optical noise mixtures. No feedback or optical filtering is required in this process. Other benefit of the Manchester coding is that it can provide signal synchronization and which 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 lights capable of being modulated at Asian Journal of Applied Science and Technology. This module is equipped with Li-Fi Transmitter module, Ultra-Sonic Range sensor and microcontroller Board which in turn helps the leading car C1 to transmit the information to following car C2 to detect and avoid collision. The block diagram of transmitter section and its real time module is shown in Figs. while the work flow diagram of transmitter section is shown in Fig. When a following car C2 approaches the leading car C1, the range sensor installed in Car C1 gets initialized and measure the distance between two cars. If the measured distance between two cars is less than the threshold distance then the LCD display attached to the transmitter section will appear the indication



RECIVER SECTION

A 12.5-mm lens is connected to receiver side and the AOV is 22 (H) deg. 16 (V) deg. Since optical filters are not used on the lens, a receivable light wavelength range is from the visible to NIR light. The personal computer sets different parameters to the camera receiver and has application software which is to display received data, flag images, and gray images. A block diagram of a camera receiver system which includes a PC. In the receiver system, the gray image signals and the flag image signals which are outputted from the OCI are constructed on the frame memories, and each image which can be completed in a period of up to 16.6 ms (at up to 60 fps). In this system, the gray image is used for displaying purposes. The completed flag image is send to the LED detector, and LED regions are detected by using a typical connected parameters labeling method in a period of up to 16.6 ms. Optical signals received by the activated CPx are digitized by the 80-MSPS ADC and equalized by a 33-tap FIR filter. Consequently, the receiver system selects a fixed target and receives optical signals one-by-one. For example, when the data of A(x1, y1) is successfullybeing received, the camera receiver which selects B(x2,y2) as the next target as shown in Fig. When the data which is

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received at the final target end is completed, the camera receiver which selects the first targeted image again. This loop operation is continuously repeated until the next target positions are got from the next flag image. When the next target positions are attained, each new target is labeled again by the same routine repeatedly. If a preamble of a packet is not obtained and captured from a selected target during arbitrary set times, that target will be skipped to the next labeled are skipped in a given time. Design the Li-Fi communication receiver section.

COMPONENTS USED

ARDUINO BOARDS

Arduino is an open-source electronics platform of both hardware and software. Arduino UNO and Arduino ATMEGA 328 are the two microcontrollers used in our project. The former is used in the transmitter section and the latter is used in receiver section. These Arduino boards are programmed via Universal Serial Bus(USB) Arduino ATmega2560 consists of 16 analog and 54 digital input output pins, operates at 5V and has a memory of about 8kb so entire coding can be stored in it. Arduino UNO is a microcontroller board based on ATmega 328. It consists of 20 digital input output pins and operates at 12V for maximum. The Arduino boards are used because they are handy, cost efficient and highly reliable.

Li-Fi TRANSMITTER

is a custom-design front-end for visible light communications (VLC). It has a wide bandwith (25 MHz) to support even the most demanding video streaming applications. The transmitter has a powerful 5000K 186 lumen LED with an interchangeable lens mechanism. First transmitter will be connected to the Arduino board. Then Arduino board will send the data to transmitter, the transmitter will convert the data into binary and make it ready to transfer the data, now the data will be transferred using LED bulb. If the binary number is 0, then the led will not blink if binary number is 1 the LED will blink. The LED bulb will turn on and off so fast that the human eye cannot see . This is one of the method to transfer the data using Li- Fi.

Li-Fi RECIVER

is a custom-design front-end for visible light communications (VLC). It has a wide bandwith (20 MHz) to support even the most demanding video streaming applications. The receiver features a photodetector with a field-of-view of 170° enabling a robust performance in non line-of-sight conditions. The Photovoltaic cell will receive the light from the LED then the photovoltaic cell will send that to the receiver .The receiver will convert that binary data into actual data then send that data to the arduino board.

SENSORS

In our project, three sensors namely ultrasonic sensor, crash sensor and gas sensor are used. The HC-SR04 Ultrasonic sensor is a senor which operates at 5V. It measures a distance of about 80 cm accurately. So accidents can be prevented even at a short distance.

MOTOR DRIVER

The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. They are designed to drive inductive loads such 0as relays, solenoids, dc and bipolar stepping motors, as well as other highcurrent/high-voltage loads in positive-supply applications.

DC MOTER

This 12 Volt DC Motor – 100 RPM can be used in all-terrain robots and a variety of robotic applications. These motors have a 3 mm threaded drill hole in the middle of the shaft thus making it simple to connect it to the wheels or any other mechanical assembly.

BUZZER ALARM

An Active Buzzer Alarm Module for Arduino is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Just like what you are viewing now, it is 3.3V-5V DC Electronic Part Active Buzzer Module. Using top quality material, it is durable in use.

LCD DISPLAY 37

This 16X2 LCD Display Module is used to interface with any kind of microcontroller target boards like 8051, AVR, Arduino and any other processors. The module comes with 4-bit data and 3-bit control pins. The LCD Contrast can be varied with the potentiometer provided on board.

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4X KEYPAD

This is 4x keypad. It has 4 buttons, and since every key has its own wire line, no matrix code is required - just treat these like every day switches. It was interfaced with 8 bit Microcontroller. High Low Data Logic. Inputs connected to Burg Stick. It is also a Power indicator.

CONVERTER MODULE

This DC-DC STEP UP BOOST POWER CONVERTER MODULE. It can be set up as a boost, flyback, SEPIC, or inverting converter, depending on your needs. It ensures reliable performance over a wide range of supply and output voltages

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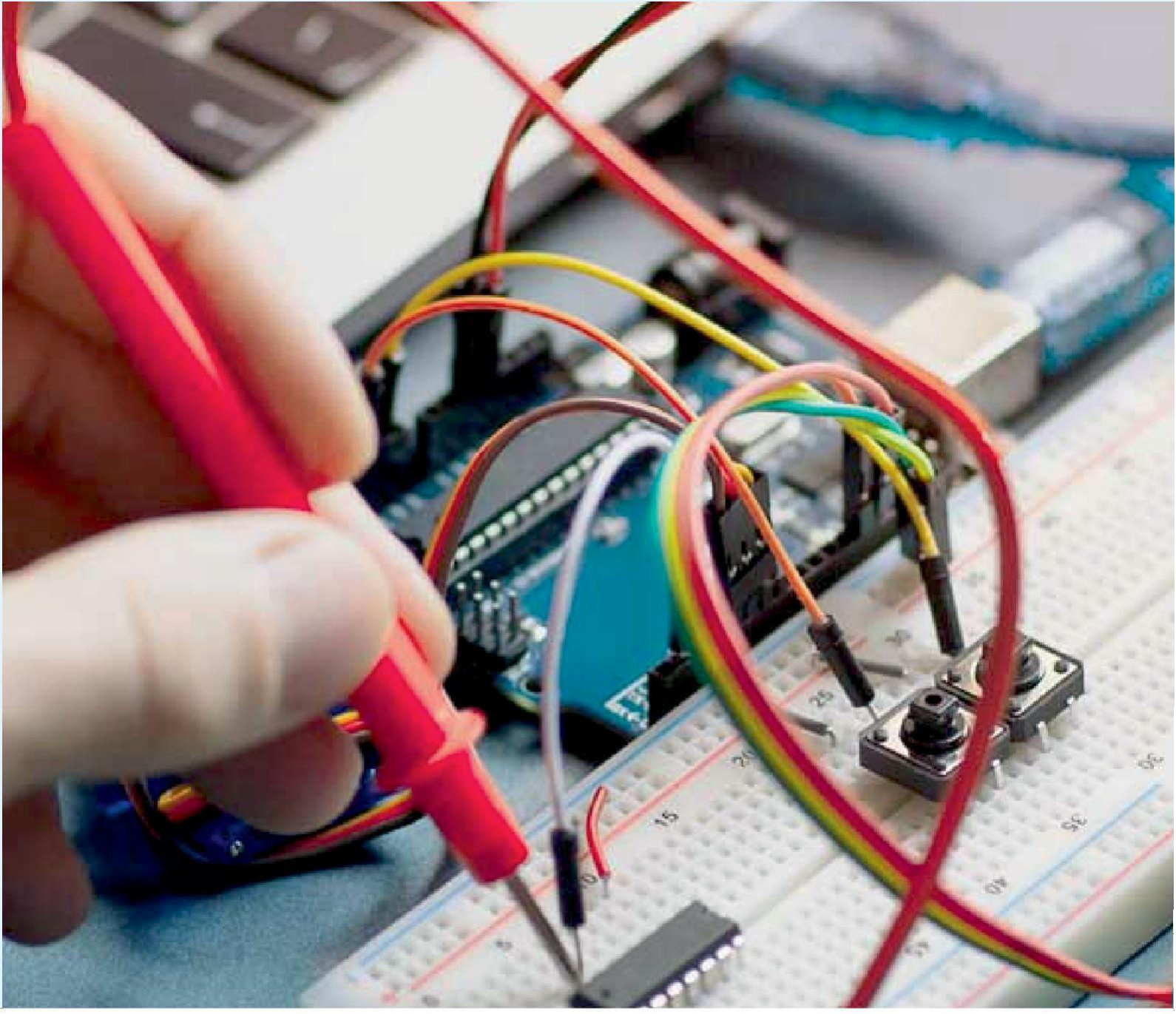

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