iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** V **Month of publication:** May 2020

DOI: http://doi.org/10.22214/ijraset.2020.5253

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

Vehicle Speed Detection System using IR Sensor

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Abstract: ***The objective of this paper is speed detection system for vehicle on the highway road. An accident occurs due to rash driving on highways is on the rise and people are losing their lives because of others mistakes. It is necessary to solve these kinds of problems through electronics circuit. This paper describes the over speed for vehicles. This system will come handy for highway traffic police as it will not only provide a digital display in accordance with a vehicle's speed but also sounds an alarm if the vehicle exceeds the limit speed for the highway.***
Keywords: Speed detection, IR Sensor, Buzzer, Arduino UNO, LCD Display.

I. INTRODUCTION

Growth in population has led to the growth in technology. People uses car on large number and number of accidents taking place, is increasing day-by-day. Road accidents are certainly the most frequent happening cases and overall, the cause of the most damage. Most of accidents on the highway road are caused by the high speed driving. Therefore, the vehicles should keep a constant speed within the speed limit over a particular area.

In this paper, we intend to design a system aimed at early detection and alert of dangerous vehicles driving patterns which reduces the accident. This system provides very effective detection of over speed driving. This circuit is mainly consisting of Arduino UNO, two IR sensors, 16x2 LCD and buzzer. Two IR sensors are kept apart on one side of road. When any vehicles cross the sensors, the internal timer in Arduino counts the time between activation of sensor. Now speed is measured by using simple formula of distance time relationship. If the Vehicle's speed indicates over speeding condition i.e. 50 km/h, the buzzer will be triggered and the LED will blink. Then, LCD displays the speed of vehicles. This system is to develop a device that detects over speeding of vehicles, gives warning using alarm and display vehicle's speed in LCD.

II. COMPONENTS

The proposed system consists of two major components i.e. hardware and software.

A. Transmission Section

There is a transmitter and receiver depends on the direction of the vehicle that is present in particular specification on these Infra Red (IR) sensors they act as both transmitter and receiver. The main aim of this is to calculate the speed of the vehicle or human being.

B. Power Supply

The board requires a 5 Volts power to make it work, the sensors and all other hardware devices works in this much of power.

C. Arduino Uno

The Arduino is having 28 pins for making the input and output from the Arduino board. These pins are very much helpful for some useful work for example it can be used to take some sensor values from the sensors and make the decision based on the programming we have done on it. The board is having an ATMEGA microcontroller which is like a heart of the board.

Figure 1. Arduino UNO

D. LCD 16X2

The below figure is a simple LCD display device which is available in the market its 16X2 display where one can able to view the 16 characters in each line and having a maximum of 2 lines. LCD's comes in thinner and lighter when compared to LED and cathode ray tube. It has major application in the field of science and engineering on electronic devices. LCD's provides excellent contrasts. LCD consists of some microwatts for display in comparison to some mill watts for LEDs.

1) Consists of 5 × 8 and 5 × 10 dot matrix
2) Power operation is low: 2.7 to 5.5V
3) Greater range of LCD power: 3.0 to 11V
4) LCD operated waveform (One line frequency AC waveform)
5) Resembles to high speed Microprocessor unit bus interface with 2 MHz (when VCC = 5V)
6) MPU interface of 4-bit or 8-bit
7) 80× 8 - bits display RAM (Maximum 80 characters.)
8) Minimum power consumption.

E. IR Sensor

Infrared Obstacle Sensor Module has built in IR transmitter and IR receiver that sends out IR energy and looks for reflected IR energy to detect the presence of any obstacle in front of the sensor module. Whenever an object passes between the sensors, light reflects from the object and falls on the phototransistor. An operational amplifier IC is used and the phototransistor is connected to it. When object come in front of sensor, it sends a logical HIGH signal to Arduino.

Some IR Sensors has option to produce both Analog and Digital Outputs but the module which is used in this system has only digital output i.e. if object is detected the output is HIGH and if no object found the output will be LOW.

III. DESIGN AND IMPLEMENTATION OF THE SYSTEM

This system is designed to detect an over speeding vehicle by computing the speed of the passing vehicle using the time taken to travel between two sensors at a fixed distance. In this system, IR Sensors are the main part of circuit design that detects the Vehicle's speed. This system detects the time taken by the speed of the vehicle in crossing the fixed distance from two sensors. When the vehicle passes through the first IR sensor, the sensor gets activated. From this instant, a timer is initiated and will continue to detect time until the vehicle reaches the second IR Sensor. Then the microcontroller starts to count the time and calculate the speed of the vehicle in km/h and this speed is displayed on a 16X2 LCD Module. If the vehicle's speed is greater than the speed limit, the buzzer will be triggered and LED will blink. Then LCD will be displayed "Over Speed Detected!!". Block diagram of this system is shown in Figure 2.

A. How to operate Arduino Car Speed Detector Project?

1) Make all the necessary connections with respect to the circuit diagram and upload the code to Arduino.
2) Place the two IR Sensors on the edge of the breadboard so that the distance between them is approximately 10 centimeters.
3) Simulate a car movement in front of the sensors either by using your hands or a toy car.
4) Arduino calculates the speed and displays the result on the 16×2 LCD.

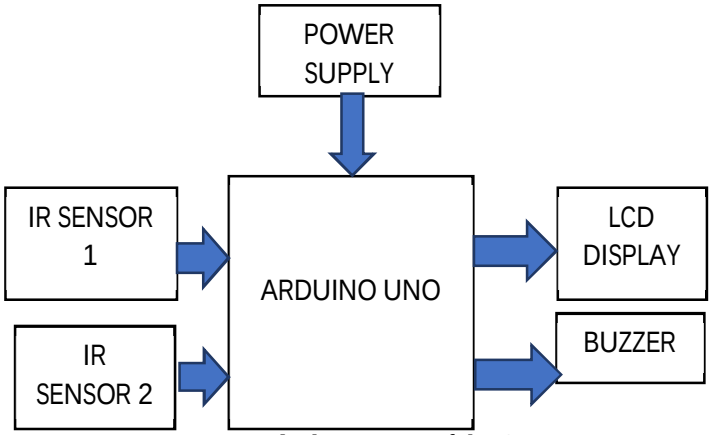

Figure 2. Block Diagram of the System

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IV. CIRCUIT DESIGN FOR SPEED DETECTION SYSTEM

Figure 3 shows the overall circuit diagram of speed detection system using IR sensor. When a vehicle passes through the first sensor, the infrared rays cross the vehicle that the sensor has detected. The LED 1 for sensor 1 is connected to the pin 13 of the Arduino and the output of IR sensor 1 is connected to the pin 8 of the Arduino. In similar manner, 2nd sensor's infrared ray touches the object and reflects to the sensor which the sensor has sensed the object. The LED 2 for sensor 2 is connected to the pin 12 of the Arduino and the output of IR Sensor 2 is connected to the pin 9 of the Arduino. 16x2 LCD is used to display the speed of the vehicle. DB 7 to DB 4 of the LCD Pin are connected to the I/O pin 2 to 5 of the Arduino. The RS and E pins of LCD are connected to pins 7 and 6 of Arduino respectively. LCD indicates "no vehicle detected" before and after the car passes. If the speed is over 50 km/hour, the buzzer will be alarmed and LED will start blinking and LCD displays "Over Speed!!". Microcontroller calculates the vehicle's speed in km/hr. The Vehicle's speed is calculated by this equation:

Speed = Distance/Time

This equation is used to calculate the time taken between the two sensors:

Time = (t2-t1) milliseconds

In this part, the power supply circuit used 12V step down transformer. Regulator LM 7805 is used to convert 12V to DC 5V. The ground pin of the power supply is connected to the GND pin of the Arduino and the power supply DC 5V is connected to the VIN pin of the Arduino.

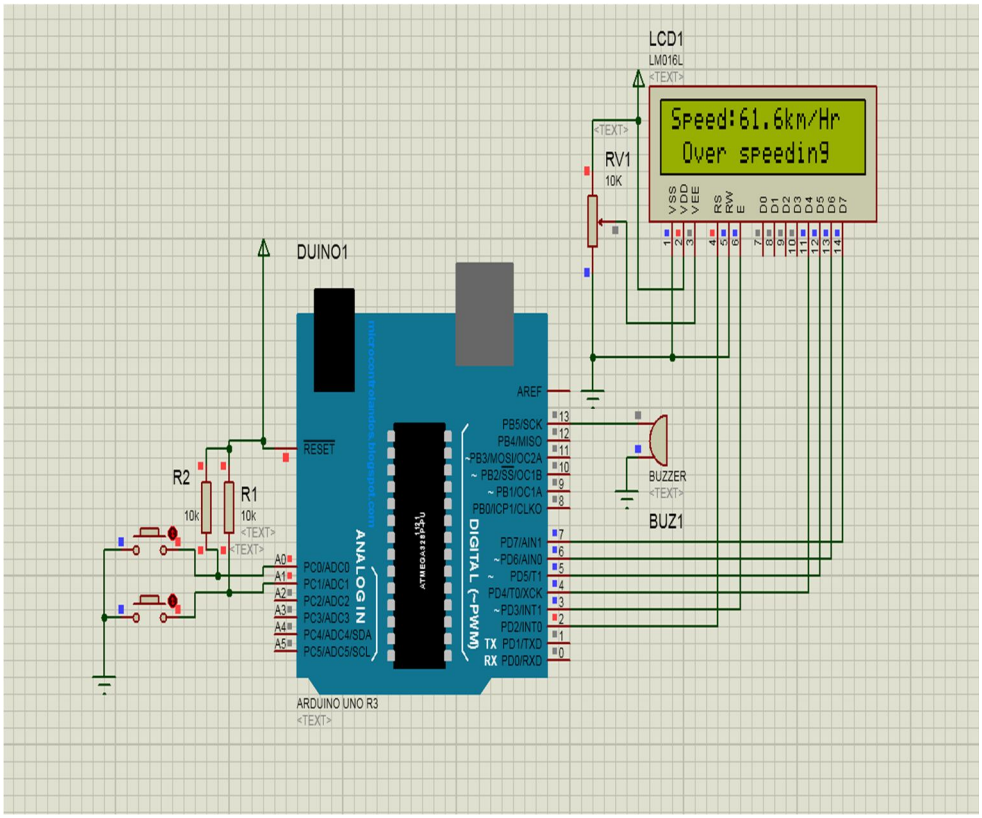

Figure 3. Circuit Design of Speed Detection System

V. OVERALL FLOWCHART OF THE SYSTEM

Figure 4 shows the flow chart of the system. First, initialize the input/output pins of the device which activate IR sensor 1 and the vehicle is detected. If the sensor senses the vehicle, the program starts to count and LED 1 is turned ON. If the vehicle is not sensed, LCD displays "No Vehicle Detected" and LED is turn off. After that, IR sensor 2 senses the vehicle and stops the program counting and starts to calculate the speed of the vehicle. Microcontroller counts start time and stop time, and time interval will get from start time and stop time and vehicle speed. And then, the calculated speed is compared with the limited speed i.e. 50km/hr. When the calculated speed is greater than limited speed, alarm is triggered, turning the buzzer which displays over-speed condition. If the vehicle is not sensed, LCD displays "No Vehicles detected" and LEDs turns off.

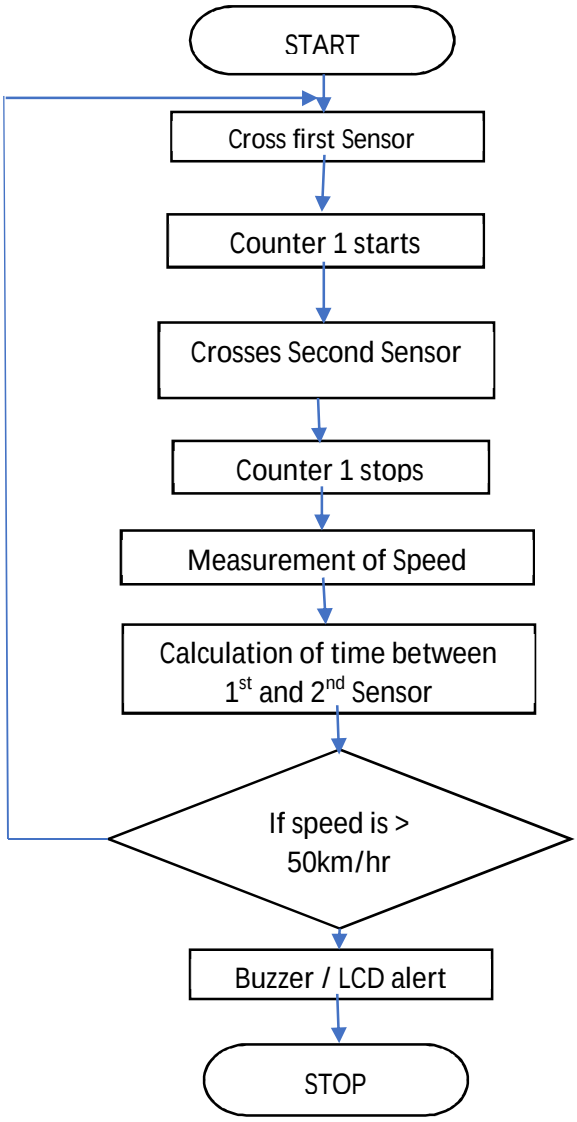

Figure 4. Flowchart of the system

VI. ANALYSIS AND RESULT OF SPEED DETECTION SYSTEM

The testing result of the speed detection system is shown below. Hardware implementation of overall speed detection system for vehicles is in figure 5.

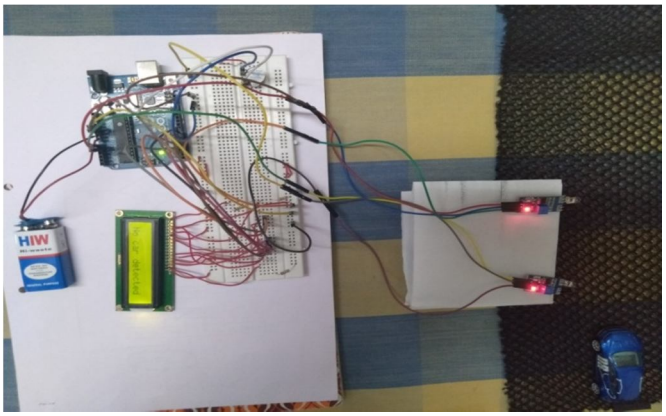

Figure 5. Implementation of Over Speed Detection System

When the vehicle passes through the sensor 1 and sensor 2, LCD displays the speed of the vehicle. The time taken between two sensors is displayed on LCD. When the speed of the vehicle is not greater than the speed limit i.e. 50km/h, the LCD display the condition for under limited speed as shown in figure 6.

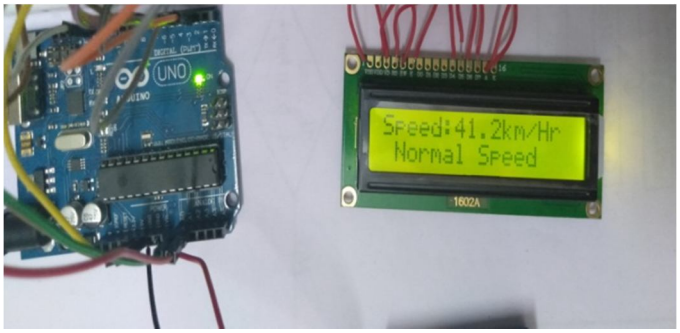

Figure 6. LCD Display for Under Limited Speed

In this section, over speed condition is shown on the LCD display. Figure 7 shows the vehicle speed 53.3 km/h and then it will also show a warning message.

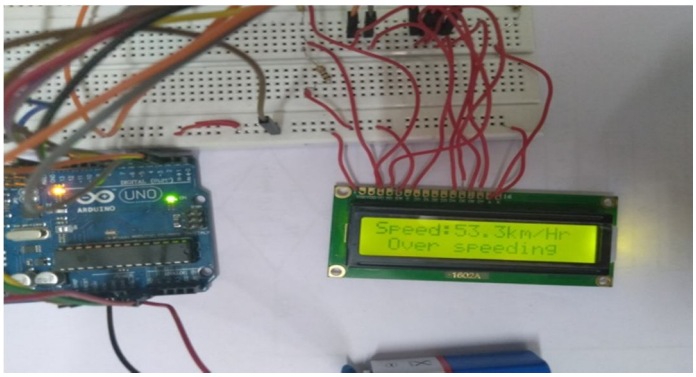

Figure 7. LCD Display of Over Speed (53.3 km/h)

VII. FUTURE SCOPE AND CONCLUSION

Design and construction of speed detection system for vehicles was designed in this paper. This design is based on Arduino microcontroller. The timing condition for the vehicle detection system must be set, based on distance between the sensor and speed which can be easily changed and modified using microcontroller. In this paper, the speed limit is specified as 50 km/h. The calculation of vehicle's speed and the time taken by it to cross between the sensors is an approximate value. And the speed sensing from sensors is also delayed due to large distance between the sensors. If more accuracy of the speed and time is required,a greaternumber of sensors must be used. The over speed detection system can be further advanced by using GSM module and CCTV camera in the circuit. If any vehicle has crossed the speed limit, then this camera will be triggered to take a picture of the vehicle. Employing this over speed detection system, offers several advantages for traffic control department and also safety of commuters.

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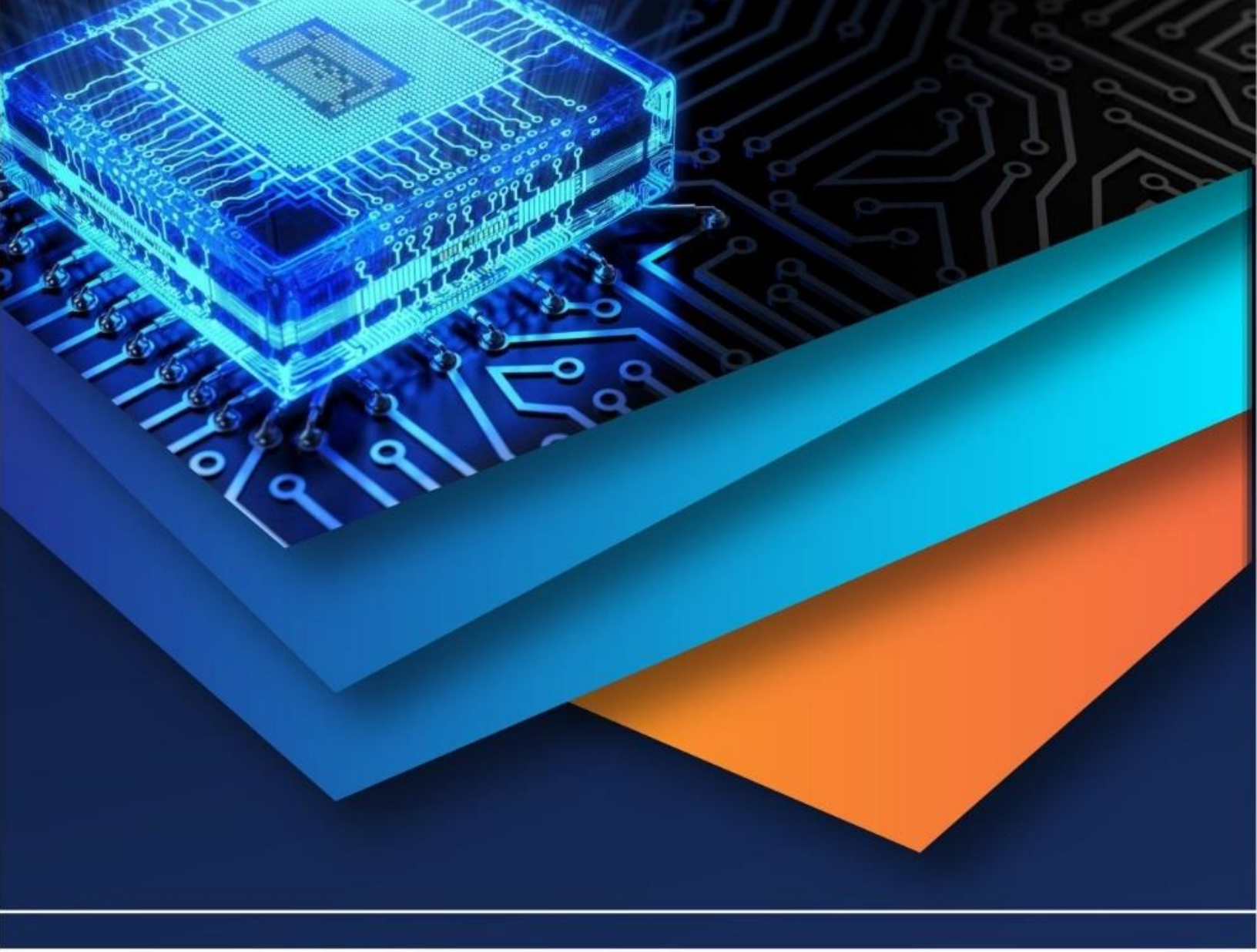

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