

# IoT based Vehicle Speed Monitoring and Controlling System

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**Abstract**— Millions of people lose their lives each year worldwide due to traffic violations specifically, over speeding. Immediate actions are to be taken to reduce this traffic violation. This project aims to monitor the speed of the vehicle, compare it with the predefined zonal speed limit. If it exceeds the limit, information regarding the owner's license number and vehicle number is send to control room via Blynk App and finally the speed is controlled using L293N motor driver and the driver is also alerted immediately. The distance ahead of the vehicle and the detected object is noted and if it is very close, the driver is alerted using LED.

**Index Terms**— Over speeding, Zonal speed, Blynk App and motor driver

## I. INTRODUCTION

Embedded systems play a critical role in the transportation industry by providing a means of control, communication, and monitoring of various components in vehicles and transportation systems. They also provide communication between different components of a vehicle, such as the engine, transmission, and brakes. Ref. [2] This communication allows for real-time monitoring and control of the vehicle's systems. Embedded systems are also used in transportation systems to manage traffic flow and optimize traffic signals. This helps to reduce congestion and improve the overall efficiency of the transportation system.

In this modern era, people all over the world are in constant urge to reach their destination at the earliest. Ref. [3] As a result, violation of traffic rules especially among teenagers are common now-a-days. This system is designed to reduce the accidents and hence the death rate of the people. Ref. [4] Also when any vehicles or animals are detected within a close proximity, the driver is alerted. Vehicle speed monitoring and controlling system can provide significant benefits to businesses, governments, and individuals by improving road safety, reducing fuel costs, and enhancing the overall efficiency of transportation systems.

## II. RELATED WORKS

Ref. [1] Arun Prakash, et.al 2018 in their paper "Real Time Automatic Speed Control Unit for Vehicles" proposes a system for automatic speed control of vehicles based on real-time traffic conditions. The system consists of a camera mounted on the vehicle, which captures images of the road ahead, and a microcontroller (Arduino) that processes these images to determine the appropriate speed for the vehicle. The system uses image processing techniques such as edge detection and template matching to detect road signs and other vehicles on the road. The microcontroller then adjusts the speed of the vehicle based on the traffic conditions and the speed limit of the road.

The results show that the system is capable of accurately detecting road signs and other vehicles, and can adjust the speed of the vehicle in real-time based on the traffic conditions.

Ref. [5] Mohammad Ahmar Khan, Sarfraz Fayaz Khan, 2018 in their paper “IoT based framework for Vehicle Over-speed detection” has discussed about a system for detecting vehicle over-speeding using sensors that are placed on the roads to measure the speed of vehicles passing through them and using Radar method. Location of the vehicle is tracked using GPS. The data collected by the sensors is transmitted to a cloud-based server using IoT technology

Ref. [6] Pradeep Kanavi, Chaithra K B, Chaitra K T, Bhoomika M G, Lakshmi C T, 2022, has presented a paper "Automatic Vehicle Over Speed Detection Alert and Controlling System on Highway" in which the system uses a combination of GPS and GSM technologies to monitor the speed of vehicles and notify the driver if they are over speeding. The system consists of an Arduino board, GPS module, GSM module, LCD display, and other electronic components.

Ref. [7] Rangan P.R.2017 in this paper “Vehicle Speed Sensing and Smoke Detecting System”, has proposed a system that combines vehicle speed sensing and smoke detection capabilities. The system uses a microcontroller-based circuit to monitor the speed of the vehicle and detect smoke or fire within the vehicle. The speed sensing module uses an infrared sensor to detect the speed of the vehicle and sends the data to the microcontroller for processing.

### III. PROPOSED SYSTEM MODEL

The Block diagram of proposed system model are shown in Fig.1 and Fig.2 displays the components and processes that compose the implementation of a speed monitoring and controlling system. Ref. [8] The Arduino Uno is the interface between hardware and software. It is interconnected with IR sensor, L293N motor driver, GPS module and GSM module. The IR sensor is used to find the speed of the vehicle and alerts the driver via buzzer and LCD display. The monitored data is transmitted to the control room via the GSM Module which displays the continuously monitored data. After, motor driver will control the speed. The GPS module is to track the location. The I2C module acts as an interface between the LCD display and the Arduino. The vehicle speed is consistently tracked and compared to the predefined zonal speed. If it surpasses the speed limit, the speed goes back to normal. The location and information regarding the driver will be sent to the control room.

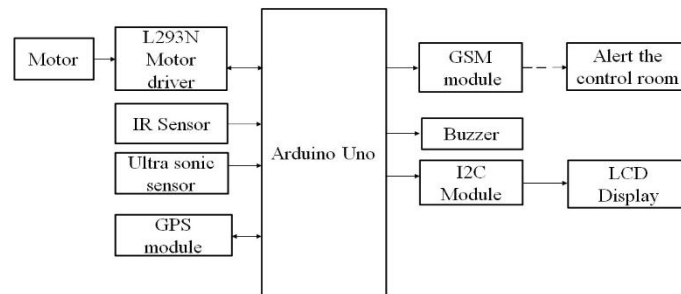


Figure 1. Block diagram of proposed system model

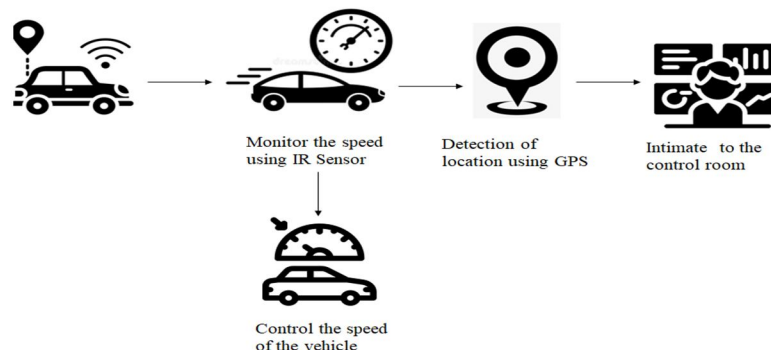


Figure 2. Proposed System Model

#### IV. WORKING PRINCIPLE

The Arduino is set up in the IDE and the required libraries are installed for the respective modules. When the wheel rotates the same point on it repeatedly, it returns to the original position after one revolution. The time lag between the two positions, i.e. completing a single rotation and taking the reciprocal of it, gives RPS, RPM is obtained by multiplying it by sixty. An IR sensor is used to measure the time difference. To establish a reference point, white paint is employed. It also reflects light, increasing IR sensitivity. When white paint is placed in front of the sensor, it produces a high output. The millis() command is used to measure time in milliseconds, which can accurately measure time lapse at high speeds.

The (number of interrupts /time in millisecond)\*60000 will give the revolutions per minute (rpm).

##### A. rpm to km/hr conversion

$$k = d \times r \times 0.001885 \quad (1)$$

where,

d- diameter of wheel in cm

k- km/hr value

r- rpm value calculated by IR sensor

Considering the diameter of the wheel as 8 cm

$$k = 0.01508 \times r \quad (2)$$

k (km/hr value) will be compared with the pre-defined value. The information about driver and location will be sent to higher officials whenever the vehicle exceeds the that value. Also the speed will be reduced to normal speed within the speed limit.

Ref. [9] An ultrasonic sensor is a device that uses sound waves with frequencies above the range of human hearing to detect objects and measure distances. It works by emitting a high-frequency sound wave from a transducer, which then travels through the air and reflects off any object in its path. The sensor then receives the reflected sound wave and measures the time it takes for the wave to return. This time measurement can be used to calculate the distance between the sensor and the object.

$$distance = duration * 0.034 / 2 \quad (3)$$

#### IV. RESULTS AND DISCUSSION

Each time when the wheel completes a revolution it is detected by the IR Sensor. Speed of the wheel is calculated based on the equation (2). Fig 3 and 4 shows the over speeding message and speed of the vehicle if it exceeds the 60 km/hr by displaying it in the LCD display. Fig 5 and 6 shows the reduced speed in the LCD Display.



Figure. 3 LCD Output of over speeding



Figure. 4 LCD Output of over speeding

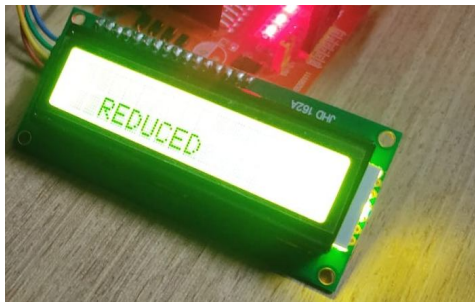


Figure. 5 LCD Output of reduced speed



Figure. 6 LCD Output of reduced speed

Fig 7 shows the output of the serial monitor which contains the latitude and longitude of the location of the vehicle detected by GPS.

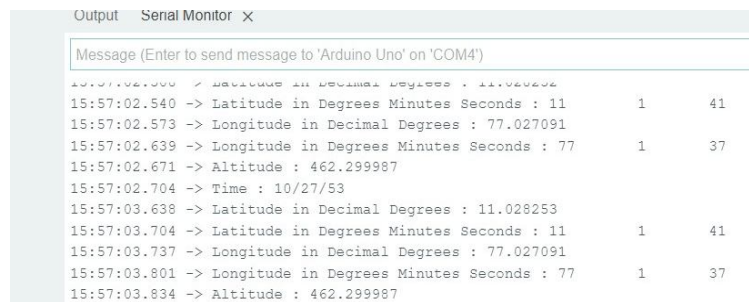


Figure. 7 GPS Output in IDE

Fig.8 shows the serial monitor output of ultrasonic sensor when the object is detected and it display the measured distances.



Figure. 8 Ultrasonic Output in IDE

The ultrasonic sensor detects the objects and measure the distance by sending ultrasonic rays towards the object. Whenever a closer object is detected, the ray will be echoed and distance is calculated for back and forth and it will be divided by two to get the distance. LED is used as an indicator to the driver. Fig.9 and 10 represents the output respectively. As the distance between the ultrasonic sensor is more than 10cm, LED is in off state.

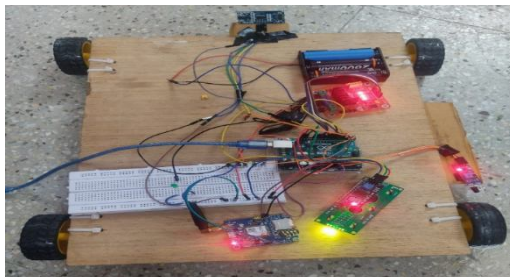


Figure .9 Ultrasonic Sensor when object is not detected

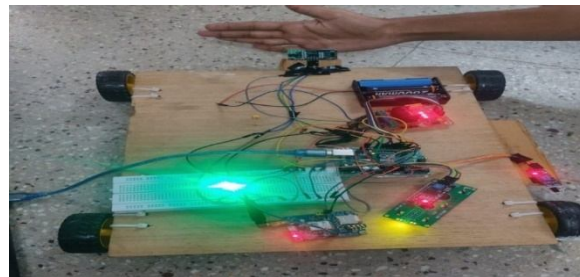


Figure.10 Hardware output of Ultrasonic Sensor

Fig 11 shows the over speeding message in the Blynk App in the Mobile phone and their official website. When an object is detected close to the ultrasonic sensor, ie within 10cm, LED is turned on.



Figure.11 Over Speeding message in Blynk website

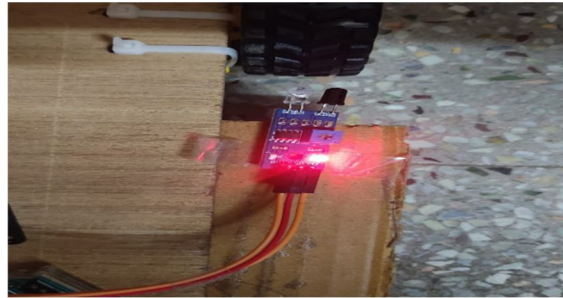


Figure.12 IR Sensor output before detection

Fig 12 and 13 shows the demonstration for the detection of wheel in order to determine the speed of the vehicle. As, IR sensor is incapable of detecting black color, it is not detected by the sensor.

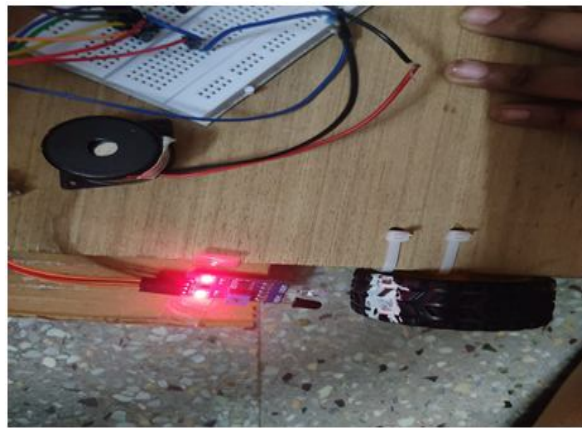


Figure.13 IR Sensor output after detection

## V. CONCLUSION

This project has proposed a system which determined the vehicle speed continuously and when the vehicle speed cross the predefined zonal speed, the driver is alerted via buzzer and the speed is brought back within the limit automatically. Also, this violation is intimated to the control room along with the vehicle's location, driver's details like number plate details, license number using GSM .When the vehicle comes closer to other vehicles or any animals, the driver is alerted. A vehicle speed monitoring and controlling system is a useful tool for ensuring road safety and preventing accidents. By monitoring the speed of vehicles and controlling their speed in real-time, this system can help to reduce the incidence of speeding, which is a major cause of accidents on the road .This system has the potential to improve road safety, reduce accidents, and save lives. It is an important technology that should be implemented on a wider scale to make our roads safer for everyone. Ref. [10] This project can be further expanded by alerting the driver before there is a deficit in the fuel level or if the engine temperature exceeds beyond the limit. Also, details of several drivers can be collected in a database and the message can be sent to the control room from the database.

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