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Embedded Vehicle Speed Control and Over-Speed Violation Using IoT

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Abstract: ***In our daily life we come across so many road accidents resulting in affecting humans and animals due to different reasons like over-speeding and neglecting alerts. This study aims to overcome that problem by using sensors, GSM Modem, GPS Module, gear motor and Arduino UNO. Vehicles motion is detected by IR sensors and their speed is calculated, if the speed of the vehicle is more than the speed limit an alert will be sent. If the speed of the vehicle is still the same alert is sent to nearby officials and the speed of the vehicle is automatically reduced.***

Keywords: Internet of Things (IoT), Arduino UNO

I. INTRODUCTION

A microprocessor or other specialized embedded technology is integrated inside the vehicle to control the speed of the vehicle. Based on preset restrictions, this microprocessor is in charge of tracking and managing the car's speed. Accurate speed tracking is achieved by the system through the use of sensors, real-time data processing, and GPS technology. By joining the embedded electronics in cars to a centralized network, the Internet of Things is enabled. The network enables smooth communication between automobiles, traffic control centers, and pertinent authorities. The transmission of real-time data made possible by IoT integration permits dynamic modifications to speed limits according to variables including traffic density, road conditions, and construction zones.

The detection of over-speed violations is one of this system's primary features. Vehicles send in real-time speed data to a central monitoring system over the Internet of Things network. This method assesses how fast the car is going in relation to the posted speed limits at the specified place. The system sends out an alert in the event of a speeding infringement, informing the driver and the appropriate authorities. Using IoT to provide embedded vehicle speed control and over-speed violation detection has various advantages. First off, it greatly improves road safety by reducing the number of accidents brought on by speeding. Secondly, it facilitates effective traffic control, which lessens traffic jams and raises the general effectiveness of transportation. Because it is simple for authorities to identify and punish drivers who break speed restrictions, the system also encourages accountability.

II. FIGURES

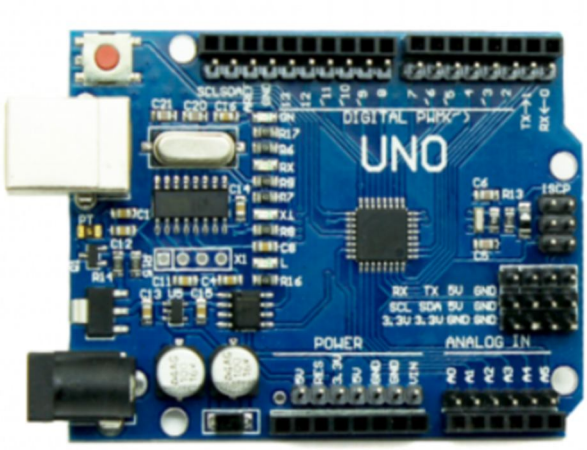


Figure 1. Arduino UNO R3

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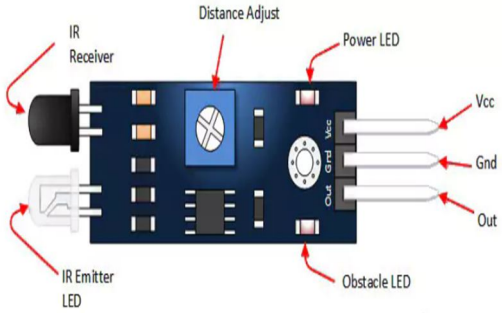


Fig 2. IR Sensor

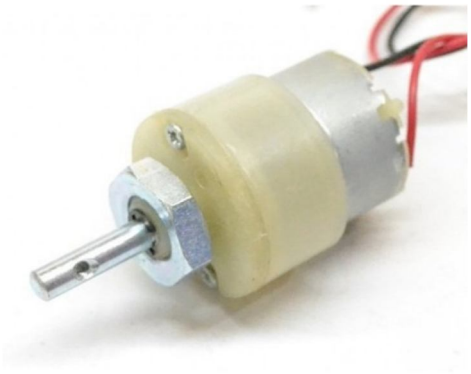


Figure 3. Geared DC Motor



Figure 4. LCD Display

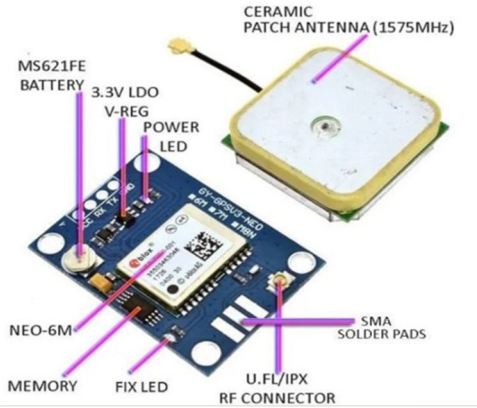


Figure 5. NEO 6M GPS Module



Figure 6. GSM Modem

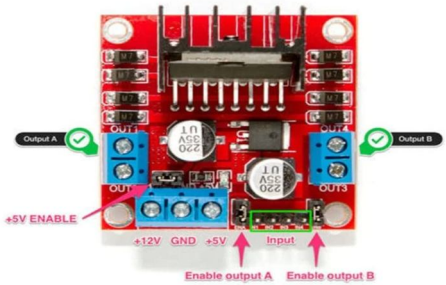
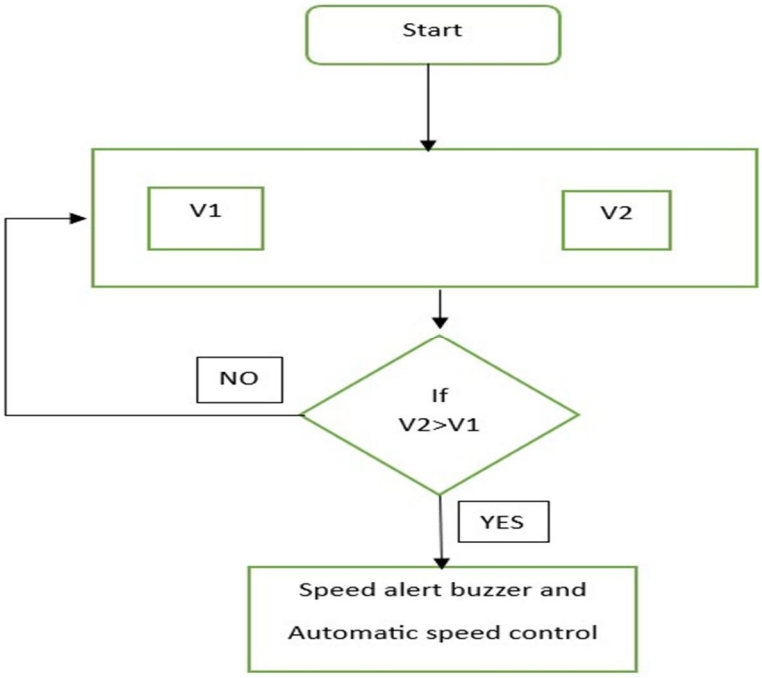


Figure 7. Motor Drive Board

III. FLOW CHART



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In the above figure,
V1 = Speed limit or threshold speed
V2 = Speed of the vehicle
If speed of the vehicle V2 is greater than the threshold speed V1, an alert message is sent to the vehicle owner. If not it will return to checking the speed of the vehicle again and continues to do so.

IV. PROPOSED WORK

The proposed system consists of seven main components, which are:

1) Arduino UNO R3
2) IR sensor
3) Geared DC motor
4) LCD display
5) Motor driver board
6) NEO 6M GPS module
7) GSM modem

Initially a power supply of 12V is given to Arduino UNO which consists of a regulator that converts the 12V supply to 5V. All six remaining components are connected to Arduino UNO. Two IR sensors are placed having a certain distance between them and that distance is noted in the code which is later used to calculate the speed of the vehicle. When an object is moving infront of an IR sensor its motion can be detected due to the radiations emitted by the IR sensor. A timer is initiated when an object is detected from the first sensor.
After some time, second IR sensor detects the same object and the timer is ended. The time taken to travel from first sensor to second sensor is noted which is used to calculate the speed of the object or vehicle by simple mathematical formula, speed = distance/time.
In real life vehicle speed detection can be done by speed guns which are very effective. These speed guns measure the speed of the objects by observing the change in frequency. Speed guns emits radiations with certain frequency. Those radiations after hitting an object returns with a slight change in frequency if the object is constant. But if the object is moving the frequency may increase or decrease. This concept is called doppler shift.
A threshold speed is set in the code to determine whether the vehicle travelling at a normal speed or overspeed. If the speed of the vehicle is greater than the threshold speed, it is over speed. If the speed of the vehicle is less than the threshold speed, it is normal speed.
After detecting the speed of the vehicle the speed of the vehicle is displayed on the LCD display as shown in the figure 8 and figure 9. If the vehicle speed is more than the threshold speed an alert message is sent to the vehicle owner. If the speed of the vehicle is still the same an alert message is sent to nearby police station which consists of location of the vehicle and the speed of the vehicle is automatically reduced.

V. RESULTS

All things considered, putting an embedded vehicle speed control and over-speed violation system using the Internet of Things into practice involves careful planning, integrating hardware and software components, adhering to safety regulations, and extensively testing to guarantee efficacy and dependability.
Road safety and regulatory compliance have improved significantly as a result of the IoT-based embedded vehicle speed control and over-speed violation system. The system was able to monitor vehicle speed in real-time by combining complex software algorithms with hardware components such microcontrollers, speed sensors, actuators, and communication modules. Instant alerts and notifications in the event of over-speed infractions were made possible by the system's flawless connection between vehicles and remote monitoring stations, which was made possible by the utilization of IoT connectivity. During field testing, the system's accuracy and dependability in a range of driving scenarios were proven, and drivers benefited from timely alerts and useful feedback to continue driving safely.

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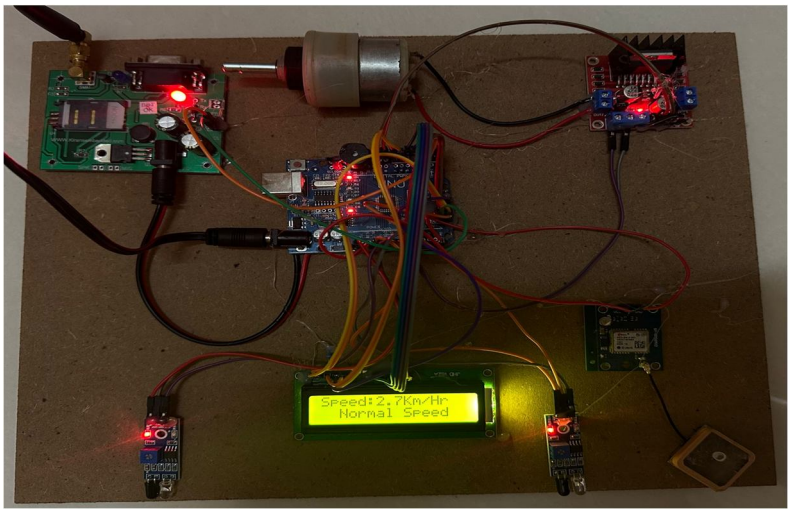


Figure 8. Display showing the speed of the vehicle

The figure above indicates that the vehicle is going with a normal speed of 2.7km/hr. Since this speed is normal, there is no need to send an alert to the vehicle owner.

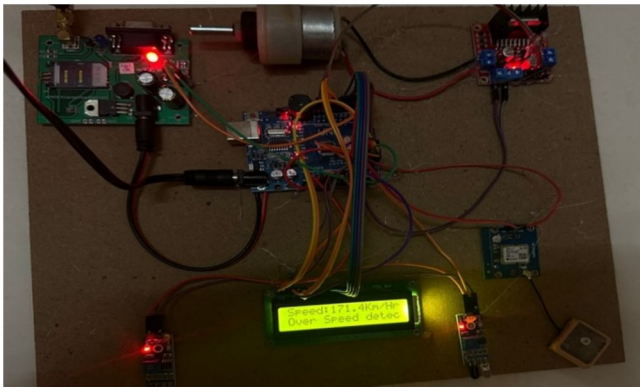


Figure 9. Display showing the speed of the vehicle

Figure 9 indicates that the vehicle is going with an over speed of 171.4km/hr. Since this speed is high an alert message is sent to the vehicle owner as shown in the below figure

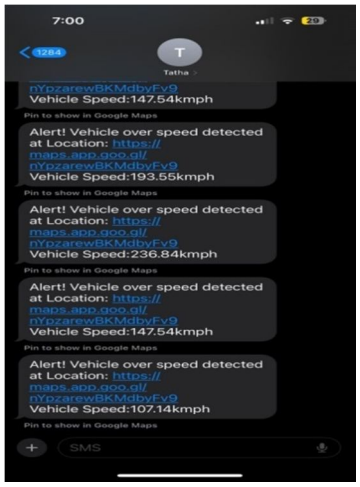


Figure 10. Picture showing the alert messages sent to the vehicle owner

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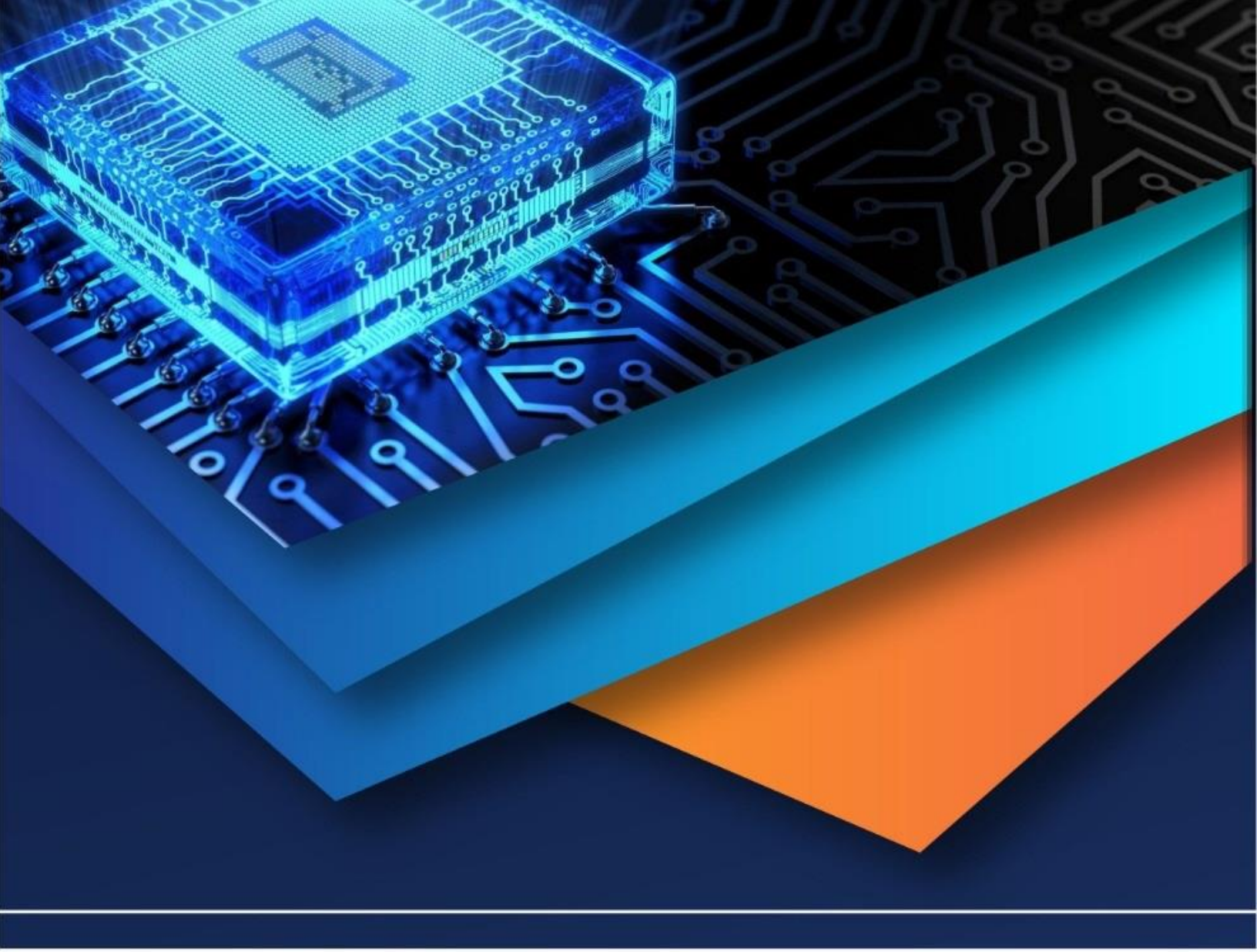
VI. CONCLUSION

To sum up, the use of IoT for embedded vehicle speed control and overspeed violation alerts represents a major improvement in road safety and traffic law enforcement. We can effectively monitor and manage the speed of vehicles by incorporating IoT technology, which lowers the danger of accidents and ensures that speed regulations are followed. This system is able to identify instances of over-speeding and rapidly notify the driver and appropriate authorities through real-time data transfer and analysis. This preemptive technique helps to more effectively enforce traffic laws in addition to averting possible collisions. Additionally, the integration of IoT makes it possible to gather important data on driving behaviors and trends, which can be used for additional analysis and the improvement of transportation policies and road infrastructure.

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