P.E.S. COLLEGE OF ENGINEERING, MANDYA 571401

(An Autonomous & Govt. Aided Institution, Affiliated to VTU, Belagavi)

A Project Report on

"*AN IOT BASED VEHICLE SPEED DETECTION SYSTEM USING IR SENSOR*"

Submitted in partial fulfilment for the award of the degree of

BACHELOR OF ENGINEERING

in

INFORMATION SCIENCE & ENGINEERING

Submitted by

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P.E.S. COLLEGE OF ENGINEERING, MANDYA

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Department of Information Science & Engineering

CERTIFICATE

This is to certify that, **Mr. Manoj Gowda B K, (4PS20IS019)** have been successfully completed the Project work (P18ISL67) entitled **"An IoT based Vehicle Speed Detection System Using IR sensor"** in partial fulfilment for the award of Bachelor of Engineering in Information Science and Engineering of P.E.S. College of Engineering, Mandya (An Autonomous Institution, Affiliated to VTU, Belagavi) during the academic year 2021-2022. It is certified that, all corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the departmental library. The Project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the Degree in Bachelor of Engineering.

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ABSTRACT

The vehicle speed detection system using infrared (IR) sensors is an essential component of modern traffic management and road safety. This project aims to develop an efficient and cost-effective solution for accurately measuring the speed of vehicles on roadways. The proposed system employs IR sensors strategically placed at specific intervals along the road to detect passing vehicles and calculate their speed based on the time taken to traverse the distance between sensors.

The hardware setup consists of IR sensors, a microcontroller (Arduino Uno), a display unit (LCD screen), and a power supply. IR sensors are utilized to detect vehicles as they pass over them, triggering the microcontroller to record the timestamps of vehicle entry and exit for each sensor pair. The microcontroller calculates the time difference and, subsequently, the speed of the vehicle. The measured speed is then displayed on the LCDscreen for easy visualization.

Keywords: Vehicle speed detection, IR sensors, Arduino, Traffic management, Road safety, Real-time monitoring.

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INTRODUCTION

In the rapidly evolving world of the Internet of Things (IoT), numerous applications have emerged to enhance our daily lives. One such application is vehicle speed detection, which plays a vital role in ensuring road safety and efficient traffic management. With the advancements in sensor technology, specifically infrared (IR) sensors, accurate and reliable speed detection systems can be implemented in smart transportation systems.

Traditional methods of monitoring vehicle speeds, such as radar and laser-based systems, havebeen widely used but are often expensive, bulky, and require complex installations. In contrast,IR sensors offer a cost-effective and versatile solution for speed detection in IoT-based applications. By utilizing the principles of infrared light reflection and interruption, these sensors can measure the speed of moving vehicles with high precision and minimal setup requirements.

This project aims to explore the potential of IR sensors in vehicle speed detection within an IoT framework. By leveraging the power of IoT connectivity, the system can collect real-timedata from multiple IR sensors installed along roadways and relay it to a central server. The gathered information can then be analyzed, providing valuable insights into traffic flow patterns, congestion hotspots, and average vehicle speeds.

The implementation of a vehicle speed detection system using IR sensors in IoT has several benefits. Firstly, it enables the automation of data collection, reducing the need for manual monitoring and increasing operational efficiency. Secondly, the system can aid law enforcement agencies in detecting speeding vehicles, enabling them to take appropriatemeasures to ensure road safety. Additionally, traffic management authorities can utilize the collected data to optimize traffic signal timings, plan infrastructure improvements, and reducecongestion.

This project will explore the fundamental concepts and technologies involved in implementing a vehicle speed detection system using IR sensors in an IoT environment. We will discuss the working principle of IR sensors, the integration of IoT connectivity, data collection and analysis techniques, and potential applications of the system in real-world scenarios. Through this research, we aim to contribute to the development of smarter transportation systems that enhance road safety, reduce traffic congestion, and improve overall efficiency

LITERATURE SURVEY

Vishal Pande et.al [1] has proposed a framework for autonomous speed control of over speeding vehicle using Radio Frequency to design a controller to control vehicles speed and display to monitor the zones which can run on an embedded system platform.

Monika Jain [2] presented a device to detect the rash driving and alerts the traffic authorities in case of any violation. This frame of reference intends to design a system aimed at early detection and alerts vehicles driving patterns which is related to rash driving. The speed limit is by the police at very location who uses the system depending on the traffic. This device reports, displays and data base system for over speed violation management.

Amarnarayan et.al [4] developed speed estimation system that alerts drivers about driving conditions, robust and reliable and helps to avoid joining traffic jams is an important problemthat has attracted lots of attention recently.

SOFTWARE AND HARDWARE SPECIFICATIONS

SOFTWARE COMPONENTS:

1. Arduino ID

HARDWARE COMPONENTS:

1. Bread Board
2. Arduino uno
3. Male/female jumper wires
4. IR proximity sensor
5. USB-A to USB-mini cable
6. LED-RGB defused common cathode
7. 16X2 LCD Display Module

IMPLEMENTATION

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 speedof 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 LED will blink. Then LCD will be displayed "Over Speed Detected!!". Block diagram of this system is shown in Figure 1.

Steps to operate the speed detection project:

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

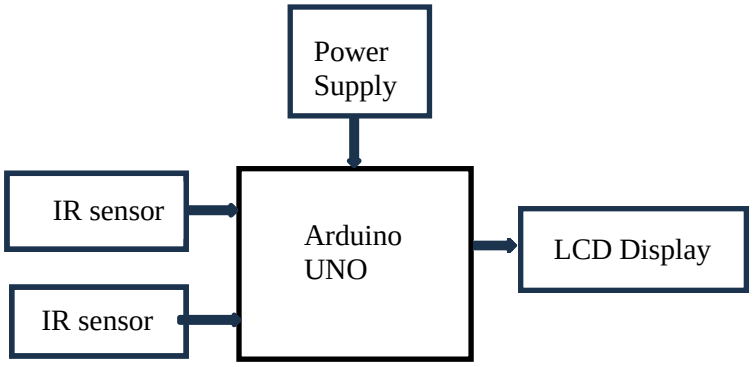

Fig:1 Block Diagram of the System

CIRCUIT DESIGN FOR SPEED DETECTION SYSTEM :

Figure 2 shows the overall circuit diagram of speed detection system using IR sensor. When avehicle passes through the first sensor, the infrared rays cross the vehicle that the sensor has detected. The IR sensor 1 is connected to the pin A0 of the Arduino. In similar manner, IR sensor 2 is connected to the pin A1 of the Arduino. Both sensors are connected to Ground and5V respectively.

16x2 LCD is used to display the speed of the vehicle. DB 7 to DB 4 of the LCD Pin areconnected to the I/O pin 2 to 5 of the Arduino. The RS and E pins of LCD are connected topins 7 and 6 of Arduino respectively. LCD indicates “no vehicle detected” before and after thecar passes. If the speed is over 50 km/hour, LCD displays “Over Speed!!”. Microcontrollercalculates 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

1m/s = Km/1000 x 3600/hr =

3.6Km/hr1m/s = 3.6Km/hr

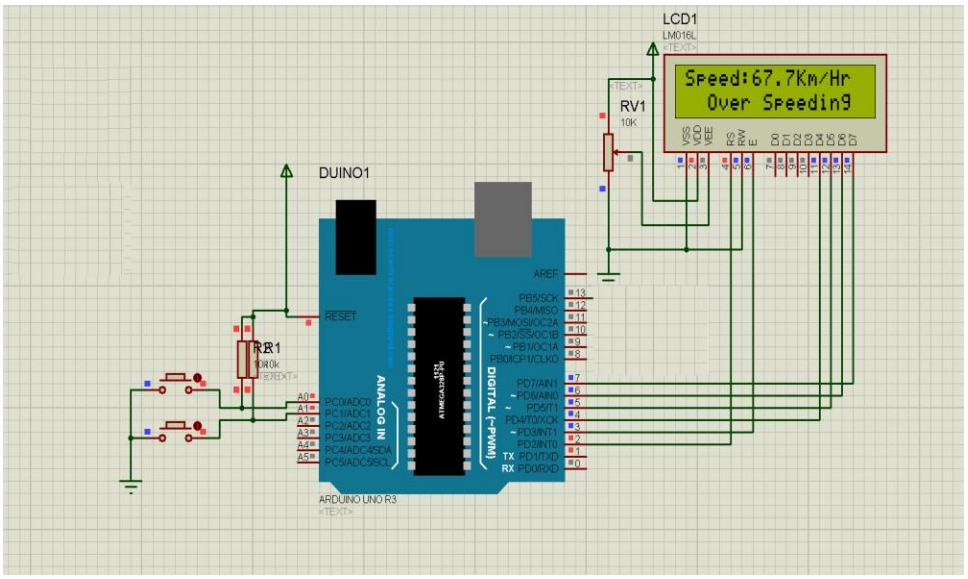

Fig 2: Circuit Design of Speed Detection System

OVERALL FLOWCHART OF THE SYSTEM :

Figure 3 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. If the vehicle is not sensed, LCD displays "No Vehicle Detected". 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, LCD display displays over-speed condition. If the vehicle is not sensed, LCD displays "No Vehicles detected.

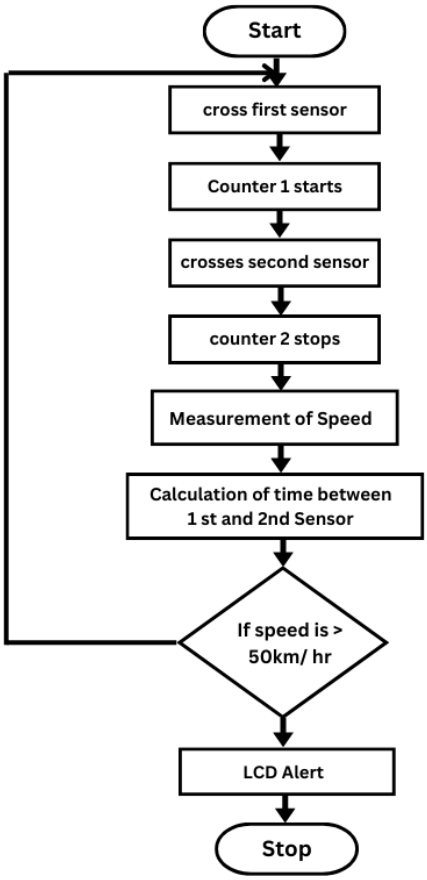

Fig 3: Flowchart of the System

RESULTS AND ANALYSIS

The testing result of the speed detection system is shown below. Hardware implementation ofoverall speed detection system for vehicles is in figure 4.

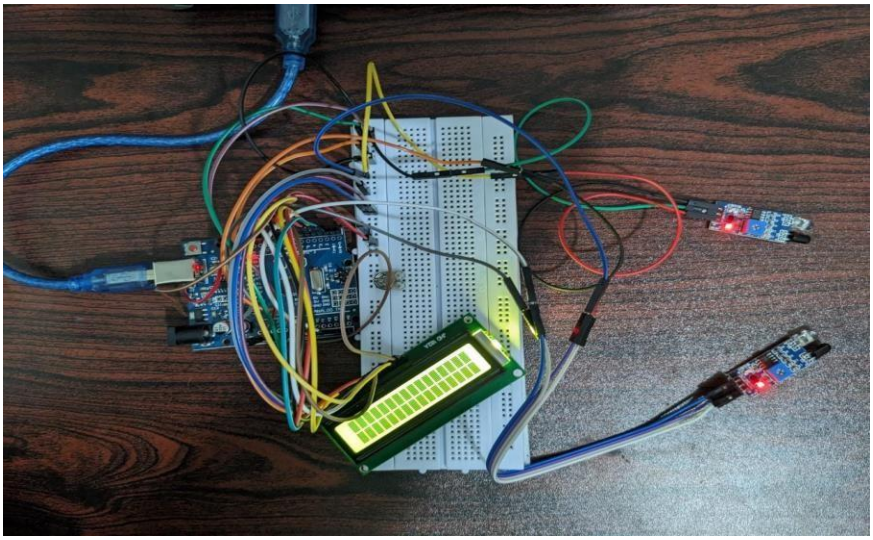

Fig 4: Implementation of Over Speed Detection System

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 underlimited speed as shown in figure 5.

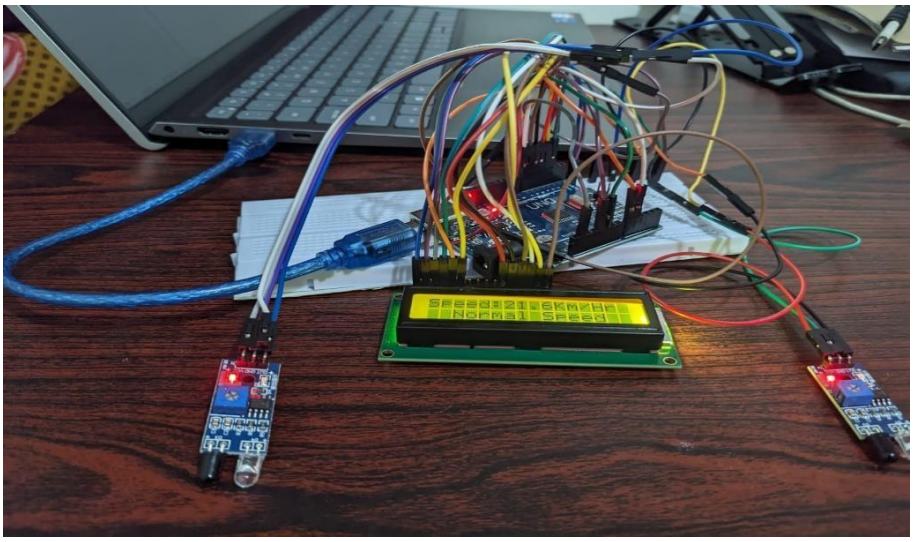

Fig 5: LCD Display for Under Limited Speed

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

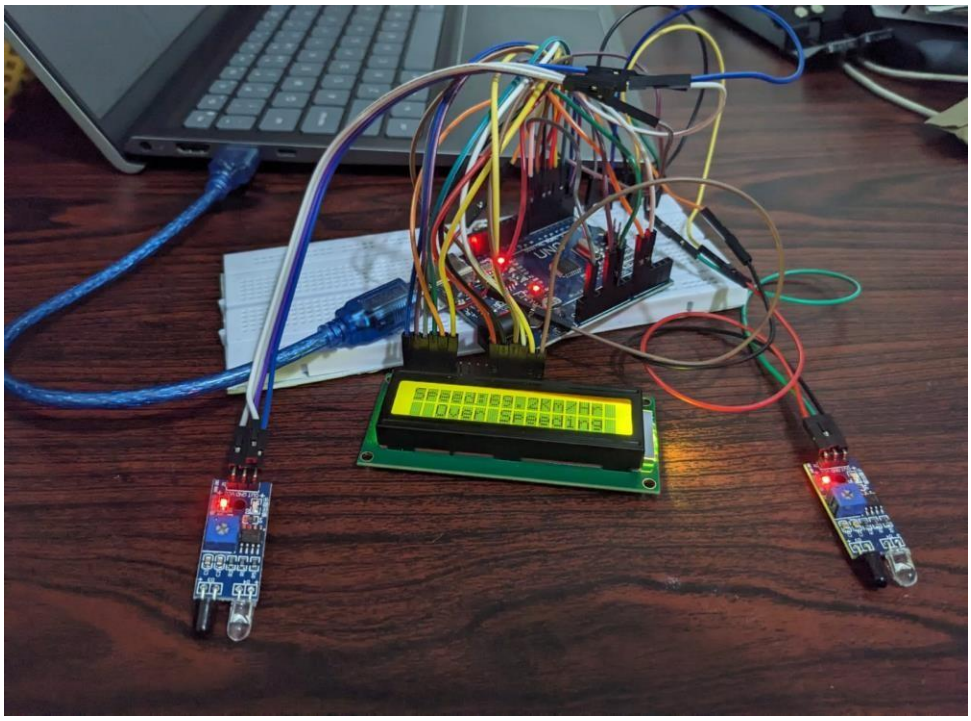

Fig 6: LCD Display of Over Speed (69.2 km/h)

CONCLUSION AND FUTURE ENHANCEMENT

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 greater number 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 andalso safety of commuters.

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