# **Project Report**

**Course Title: Digital Electronics Lab**

**Course Code:** **CSE-224**

***Submitted To***

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**Experiment Name: Vehicle Speed Checker**

**1. Introduction**

In today's fast-paced world, monitoring and regulating vehicle speed is crucial for ensuring road safety and compliance with traffic laws. Speeding is one of the leading causes of accidents, and there is a need for efficient systems to measure and control vehicle speed. The Vehicle Speed Calculator project is designed to address this need by providing a simple yet effective solution to measure vehicle speed using readily available electronic components. This project utilizes an Arduino Uno microcontroller, IR sensors, and a 16x2 LCD display to calculate and display the speed of a vehicle passing between two points.

The system works by measuring the time taken by a vehicle to travel between two IR sensors placed a known distance apart. By using the Arduino Uno to process the sensor data and calculate the speed, this project offers a practical application of digital electronics in real-world scenarios. The inclusion of a buzzer provides an auditory alert for over-speeding, making this project both informative and functional.

* Arduino Uno

The Arduino Uno is a popular microcontroller board based on the ATmega328P. It is an open-source platform used for building electronics projects. The board is equipped with digital and analog input/output (I/O) pins, making it versatile for various applications. In this project, the Arduino Uno processes the inputs from the IR sensors and controls the outputs to the LCD display and buzzer.

* I2C Protocol

I2C (Inter-Integrated Circuit) is a serial communication protocol that allows multiple devices to communicate with each other using just two wires: SDA (Serial Data) and SCL (Serial Clock). The I2C protocol is used in this project to interface the Arduino Uno with the 16x2 LCD display, simplifying the wiring and communication process.

* LCD 16x2 Display

The 16x2 LCD display is a standard liquid crystal display that can show 16 characters per line on 2 lines. It is used in this project to display the speed of the vehicle and various status messages. The LCD is connected to the Arduino Uno using the I2C interface, which reduces the number of pins required for connection.

* Breadboard

A breadboard is a solderless device used to construct electronic circuits. It allows components to be easily inserted and connected using jumper wires. In this project, the breadboard is used to connect the IR sensors, buzzer, LCD display, and Arduino Uno, enabling easy modification and testing of the circuit.

* Buzzer

The buzzer is an audio signaling device that produces a sound when activated. In this project, the buzzer is used to alert when the vehicle exceeds a predefined speed limit. It is connected to one of the digital pins on the Arduino Uno and controlled through the code to sound the alarm when necessary.

* IR Sensors

Infrared (IR) sensors are used to detect objects and measure distances. In this project, two IR sensors are placed a known distance apart to detect the passing of a vehicle. When a vehicle crosses the first sensor, the timer starts, and when it crosses the second sensor, the timer stops. The time difference is then used to calculate the speed of the vehicle.

* Connection Wires

Connection wires are used to establish electrical connections between different components on the breadboard. They provide the necessary pathways for power and signal transmission, ensuring that all components in the circuit can communicate and function correctly.

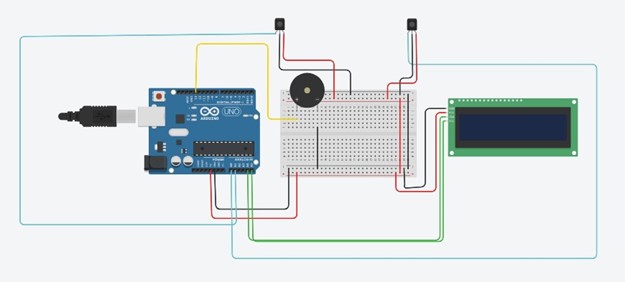
* Where Use Encoder and Decoder

Encoders and decoders are digital circuits used for encoding and decoding data, respectively. In the context of this project, the encoder could be used to convert the analog signals from the IR sensors into a digital format suitable for processing by the Arduino. The decoder would then interpret these digital signals to determine the timing information necessary for calculating the vehicle's speed.

**2. Apparatus**

* Arduino Uno: Microcontroller board for processing inputs and controlling outputs.
* I2C 16x2 LCD Display: Display unit for showing speed and status messages.
* Breadboard: Platform for connecting electronic components.
* Buzzer: Audio device for over-speeding alerts.
* 2 IR Sensors: Sensors for detecting vehicle passage.
* Connection Wires: Wires for making electrical connections.

**3. Circuit Diagram:**

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*Fig-1: Implement the Circuit for Vehicle Speed Detector*

**4.** **Mathematical Calculation**

To calculate the speed of the vehicle, we use the basic formula for speed:

Speed = Distance / Time​

Where:

* Distance: The distance between the two IR sensors. In this project, we assume this distance to be 10 meters.
* Time: The time taken by the vehicle to travel from the first sensor to the second sensor. This time is measured in seconds.

Since speed is typically expressed in kilometers per hour (km/h), we need to convert the distance from meters to kilometers and the time from seconds to hours:

Speed (km/h) =(Distance (m) / 1000) ÷ (Time (s) / 3600)

Simplifying, we get:

Speed (km/h) = (Distance (m) × 3600 / Time (s) × 1000) = (Distance (m) / Time (s))×3.6

Therefore, the speed calculation in this project is performed by multiplying the distance (in meters) by 3.6 and dividing by the time (in seconds).

**5. Procedure**

1. At first we have to collect our necessary components like Arduino Uno, IR sensors, LCD display, and buzzer on the breadboard.
2. Then we connected all the elements according to our circuit diagram
3. At first we connect the first IR sensor's VCC (power) pin to the 5V pin on the Arduino.
4. Then we connect the first IR sensor's GND (ground) pin to the GND pin on the Arduino.
5. After that we connect the first IR sensor's OUT (signal) pin to analog pin A0 on the Arduino. Repeat the above steps for the second IR sensor, connecting its OUT pin to analog pin A1 on the Arduino.
6. Then we connect the positive pin of the buzzer to digital pin 13 on the Arduino.
7. After that we connect the negative pin of the buzzer to the GND pin on the Arduino.
8. After the completing our buzzer and IR sensor setup then we connected our LCD Display setup
9. At first we Connect the SDA pin of the LCD display to the SDA pin (A4) on the Arduino.
10. Then we connect the SCL pin of the LCD display to the SCL pin (A5) on the Arduino.
11. Then we connect the VCC pin of the LCD display to the 5V pin on the Arduino.
12. And last er connect the GND pin of the LCD display to the GND pin on the Arduino.
13. We use jumper wires to connect the 5V and GND pins on the Arduino to the power and ground rails on the breadboard. Ensure all components share a common ground and power supply.
14. Then we connect the Arduino to a power source using a USB cable or an external power supply.
15. After completing all the connection we place a vehicle on the track so that it will pass through both IR sensors.
16. Then we observe the speed displayed on the LCD screen as the vehicle passes the sensors.
17. If the vehicle speed exceeds 50 km/h, the buzzer will sound to indicate over-speeding.

**6. Result & Discussion**

The Vehicle Speed Calculator effectively measures and displays the speed of a vehicle passing between the two IR sensors. The calculated speed is shown on the LCD, and the system alerts with a buzzer if the vehicle is speeding. The project successfully demonstrates the integration of sensors, microcontrollers, and display units to create a functional speed measurement system.

**Results:**

* The system accurately calculates and displays the speed of vehicles.
* The buzzer provides an immediate alert for over-speeding, enhancing safety.
* The use of an LCD display with I2C interface simplifies the connection and improves the readability of the output.

**Discussion:**

1. This project demonstrates the practical use of digital electronics and microcontroller programming to develop a real-world solution for measuring vehicle speed.
2. Utilizing common components such as the Arduino Uno, IR sensors, and an LCD display makes the project accessible and straightforward to replicate.
3. The simplicity and availability of the components involved ensure that the project can be easily duplicated by others.
4. Potential future improvements could include more precise distance measurement and data logging capabilities for recording speed data.
5. Further development could involve integrating the system with other traffic management solutions to create a more comprehensive speed monitoring system.