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Design and Simulation of a Vehicle Speed Detection and Control System Using Speed Restriction Signboards

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Abstract: Over speeding vehicles is the most serious problem in any country. For control, the government imposed speed limits for cars traveling on various roadways. We can identify vehicle speed in real-time using speed cameras, but we can't slow down the driver.
So, in this project, we connect automobiles to traffic speed cameras, which can inform drivers about their speed on a digital display and slow them down.
Keywords: Speed Detection of Vehicle, Automatic Cruise Control, Speed Signboard Adaptation, Traffic Analysis, Vehicle Speed Control System, Over speed Control System.

I. INTRODUCTION

In today's world, one of the most serious concerns about transportation is traffic and accidents. This situation is becoming worse by the day since the number of vehicles on the road is expanding at an astonishing speed each year. People are driving their cars instead of taking public transportation.
According to articles, about 1.5 lakh people die each year. [1] This serious issues cannot be under control because every person drives their car at a different speed on the road specially on highways, and it led to congestion as well as accidents.
When someone applies the brakes while driving, the cars behind them slows down as well. This chain continues until the first driver accelerates their car again. The delaying effect also produces a lot of traffic on the streets.

II. LITERATURE REVIEW

A. Seto, Youji, Inoue, Hideaki, Kobayashi, Yosuke

An adaptive automobile speed control system includes a vehicle speed sensor that distinguishes the host vehicle's vehicle speed that is accountable to adaptive vehicle speed control, which includes the vehicle speed control and the vehicle speed control system, and an inter-vehicle distance sensor that detects the inter-vehicle distance between the host vehicle and the vehicle speed control.
A man-machine interface is provided for establishing a certain vehicle speed. A desired inter-vehicle distance arithmetic processing unit estimating the desired inter-vehicle distance based on at least the speed of the host vehicle, and an associated control section inferring the desired host vehicle speed based on the speed of the host vehicle are also provided. (Seto et al., 2002)

B. Zhigang, Fan, Wu, Wencheng

A computer-implemented method for deducing the speed of a motor vehicle is disclosed in the vehicle speed detection system in this paper.
The technique may implicate the reception of a plurality of images of a motor vehicle on a lane, Determining, for each of at least two of the photographs, the point of contact where the same tire of the vehicle contacts the road surface, based in part on one or more of the vehicle's identified attributes in one or more of the plurality of images; and using the points of contact and time interval separation to calculate a speed at which the vehicle is travelling on the road.[1]

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C. Michalopoulos, P.G.

Recent worldwide innovations are briefly discussed about the use of vehicle detection for large-scale wireless data collection and implementation of advanced traffic control and management systems such as vehicle guidance/navigation. Early work on Autoscope is examined, leading to its current advantages over other emerging devices, and recent advancements are examined, such as the development of preproduction line prototypes, field testing, and comprehensive field validation and verification plans. Two major demonstration projects recently launched in Minneapolis include the above plans. The Autoscope will be used for incident detection over a portion of Interstate 394 in the first project. The second project implicates execution of the machine vision system at a signalized intersection.[2]

D. Vaughn, David

In this research paper researcher explain about GPS connectivity with vehicle which can track your vehicle speed and location this method called GPS map speed matching method. This GPS navigation device needs a database processing center, receiver, a motor computer, a video display, a speed sensor and a header sensor. This GPS navigation connect with odometer so speed of vehicle will be more accurate.

For processing facility for the database maybe local or remote. Vehicle longitude, latitude, direction and speed will be easily obtained by GPS device and until device will be there is vehicle. Device also able to control vehicle in case of over speeding whenever driver speed up their vehicle over the limit that time device will automatically get all data from vehicle like odometer reading (vehicle speed), vehicle location, maximum posted speed after calculating all data device will command vehicle to slow down. That's how we can control over speeding and make drive more safe. [3]

E. Lin, Huei-Yung, Li, Chang

This is the Camera based speed detection method also called Image based method. In this method speed cameras are used for detecting speed of vehicle. This is the best and cheap way to detect vehicle speed than usual laser or radar based detection Which are more expensive comparatively speed detection camera system. The system uses cameras to capture an image of vehicle with sensing the vehicle motion for calculation of vehicle speed.

This operation is done by using relative motion of the car to the camera. During the camera exposure time, the blurriness of motion in the dynamic region of image displays calculation of speed of the moving car. The results show 5% speed estimation of the real speed. [4]

F. Rad, Arash Gholami, etc...

Usually video and image processing technology (speed cameras) are used for traffic surveillance, monitoring of traffic conditions and for analysis in many cities and urban areas. In this paper a different methodology is presented for the hypothesis of vehicle speeds.

The photographs and videos are taken from the roads mounted cameras which have geometrical equation based calibrations. The results shows a difference error of 7 km/hr on running with different resolutions.[5]

G. Pornpanomchai, Chomtip, etc…

The paper is about developing a camera based speed detection system which provides reference position points and detection of speed is done by calculating the distance between the moving object and reference points. [6]

H. Rahim, H.M, etc…

In this paper, researchers have applied smart surveillance system by using PC workstation. The camera is set to 30ms to 40ms of resolution and it is limited to the camera frame rate. The factors affecting the maximum velocity are timing resolution and displacement resolution of pixels. The frame differencing technique estimates the speed of vehicle. [7]

III. OBJECTIVE

This project is majorly focused on *over speeding of vehicles, road accidents and traffic problems. The objective of this project is to slow down the vehicles using speed cameras* fixed on roads people ignore speed limit signs while driving so this technology will alert their every driver and help to maintain speed limit on every road. So eventually no. of accidents and traffic problems will reduce

A. Hardware Design

Functional Block Diagram

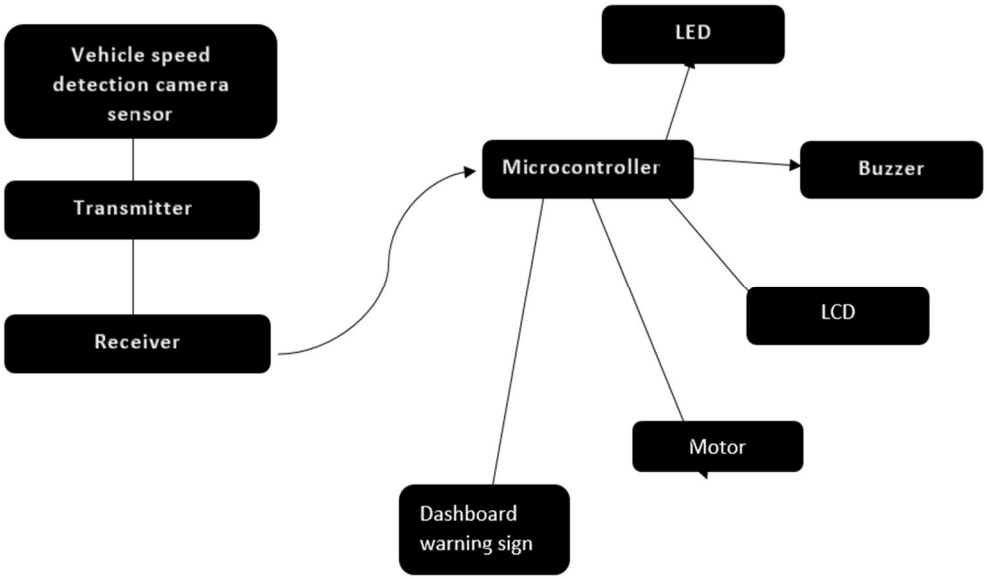


Figure 1 (Functional Block Diagram)

IV. WORKING BLOG DIAGRAM

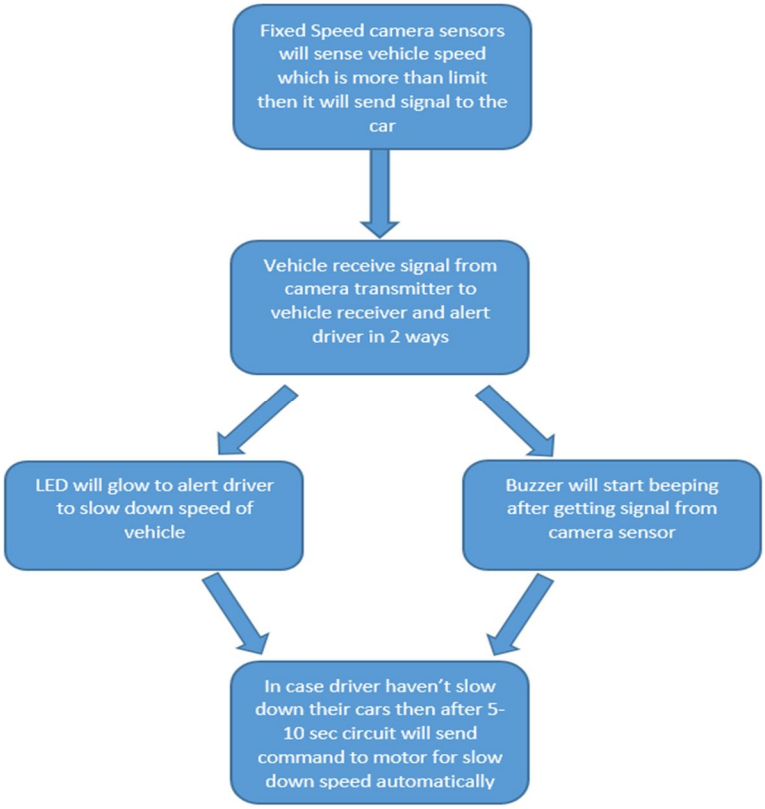


Figure 2 (Working of model in Blog Diagram)

A. Circuit Diagram

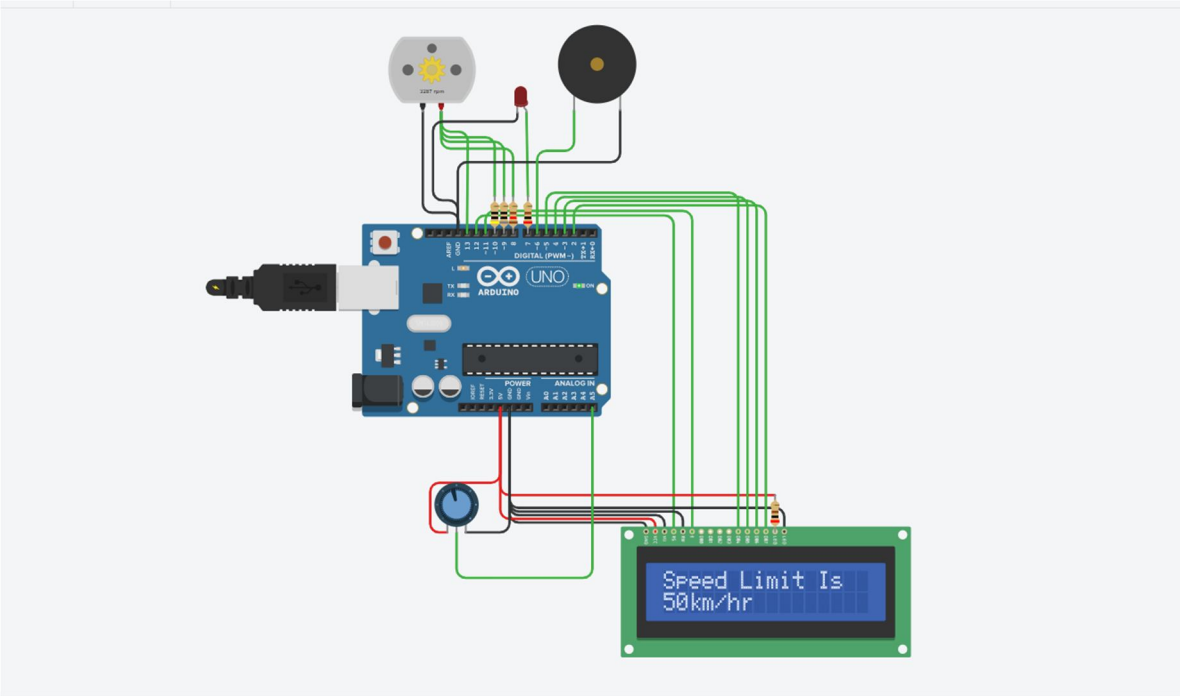


Figure 3 (Circuit diagram)

B. Technical Specification of Sensors and Actuators

1) Speed Cameras



Figure 4 (Speed Cameras)[2]



Figure 5 (Position of Speed Camera)

2) Motor

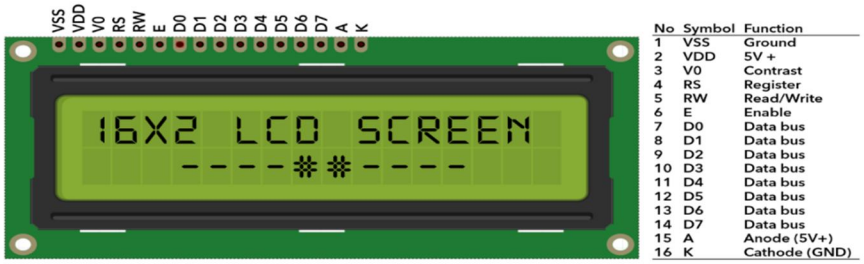


Figure 6 (EV Motors)



Figure 7 (Brushless Motor)

3) LCD Screen 16×2: A 16×2 LCD display is commonly uses in various circuits and device. This LCD is can display you 16 characters per line and there are 2 such lines this display is work in form of matrix view it will show you digit and numbers in 5*12pixel matrix. It is normally used for seven segmental display. This LCD is working on the light Modulation it is a technique which can share and receive signals in form of light, and it is energy saving display which can work on very low energy because liquid crystal display are reflectors so they are work on low electricity.



No	Symbol	Function
1	VSS	Ground
2	VDD	5V +
3	V0	Contrast
4	RS	Register
5	RW	Read/Write
6	E	Enable
7	D0	Data bus
8	D1	Data bus
9	D2	Data bus
10	D3	Data bus
11	D4	Data bus
12	D5	Data bus
13	D6	Data bus
14	D7	Data bus
15	A	Anode (5V+)
16	K	Cathode (GND)

Figure 8 (LCD Screen)

4) Potentiometer as an Accelerator of Vehicle

The Potentiometer which is used in above circuit is used as a speed controller module (Accelerator) it will shows vehicle speed. By rotating knob of the potentiometer we can control speed of vehicle which will be project on LCD.



Figure 9 (Potentiometer)

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5) *LED Bulb and Buzzer:* LED bulb and buzzer are used to alert driver about speed limit. When speed camera sensor sense and analyze speed of vehicle. If vehicle speed will be greater than road speed limit then LED will glow on dashboard and buzzer will start beeping to alert driver.

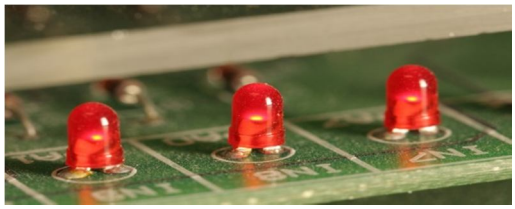


Figure 10 (Red LED Bulbs)



Figure 11 (Buzzer)

C. Coding for Proposed Circuit

Text 1 (Arduino Uno R3)

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(12,11,5,4,3,2);
int value;
int angle;
void setup()
{
pinMode(6, OUTPUT);
pinMode(7, OUTPUT);
pinMode(8, OUTPUT);
pinMode(9, OUTPUT);
pinMode(10, OUTPUT);
pinMode(13, OUTPUT);
pinMode(A5, INPUT);
Serial.begin(9600);
lcd.begin(16,2);
}

void loop()
{
   value = analogRead(A5);
  angle = map(value, 0, 1023, 0, 180);
  if (angle < 90 && angle > 70)
{
 lcd.clear();
 lcd.setCursor(0, 0);
 lcd.print("Warning!");
 lcd.setCursor(0, 1);
 lcd.print("Overspeeding");
 delay(100);
 digitalWrite(7, HIGH);
 delay(1000);
 digitalWrite(7, LOW);
 delay(1000);
 digitalWrite(8, HIGH);
  }

  else if (angle < 70 && angle >= 0)
{
  lcd.clear();
```

Serial Monitor

Figure 12 Arduino Coding I

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```
Text                                                    1 (Arduino Uno R3)
39    lcd.clear();
40     lcd.setCursor(0, 0);
41   lcd.print("Warning!");
42   lcd.setCursor(0, 1);
43   lcd.print("Overspeeding");
44   delay(2000);
45   lcd.clear();
46   delay(300);
47   lcd.setCursor(0,1);
48   lcd.print("Reducing Speed");
49   digitalWrite(7, HIGH);
50   delay(200);
51   digitalWrite(6, HIGH);
52   delay(1000);
53   digitalWrite(13,LOW);
54   digitalWrite(10, HIGH);
55   delay(400);
56   digitalWrite(10,LOW);
57   digitalWrite(9,HIGH);
58   delay(400);
59   digitalWrite(9,LOW);
60   digitalWrite(8,HIGH);
61   delay(5000);
62    }
63    else
64    {lcd.setCursor(0, 0);
65 lcd.print("Speed Limit Is");
66 lcd.setCursor(0, 1);
67 lcd.print("50km/hr");
68 delay(1000);
69 lcd.clear();
70 digitalWrite(13, HIGH);
71      digitalWrite(6, LOW);
72      digitalWrite(7, LOW);
73      digitalWrite(8, LOW);
74      digitalWrite(9, LOW);
75      digitalWrite(10, LOW);
77
78    }
79    Serial.println(angle);
80    }
Serial Monitor
```

Figure 13 Arduino Coding II

V. RESULTS AND DISCUSSION

1) It will show speed limit is 50km/hr on LCD at initial until the potentiometer is in between 91-180 degree. Motor can run on different speed under 50Km/hr.

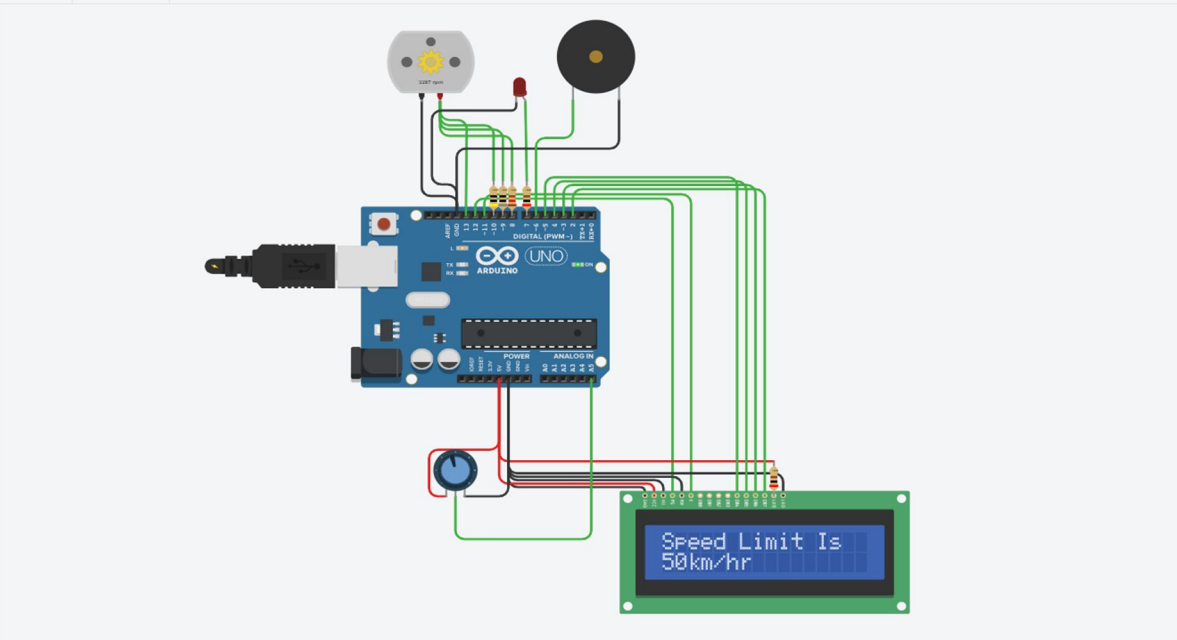


Figure 14

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2) When potentiometer is at 90° means vehicle is at 50km/hr speed at this moment circuit will automatically send warning message on LCD about over speeding.

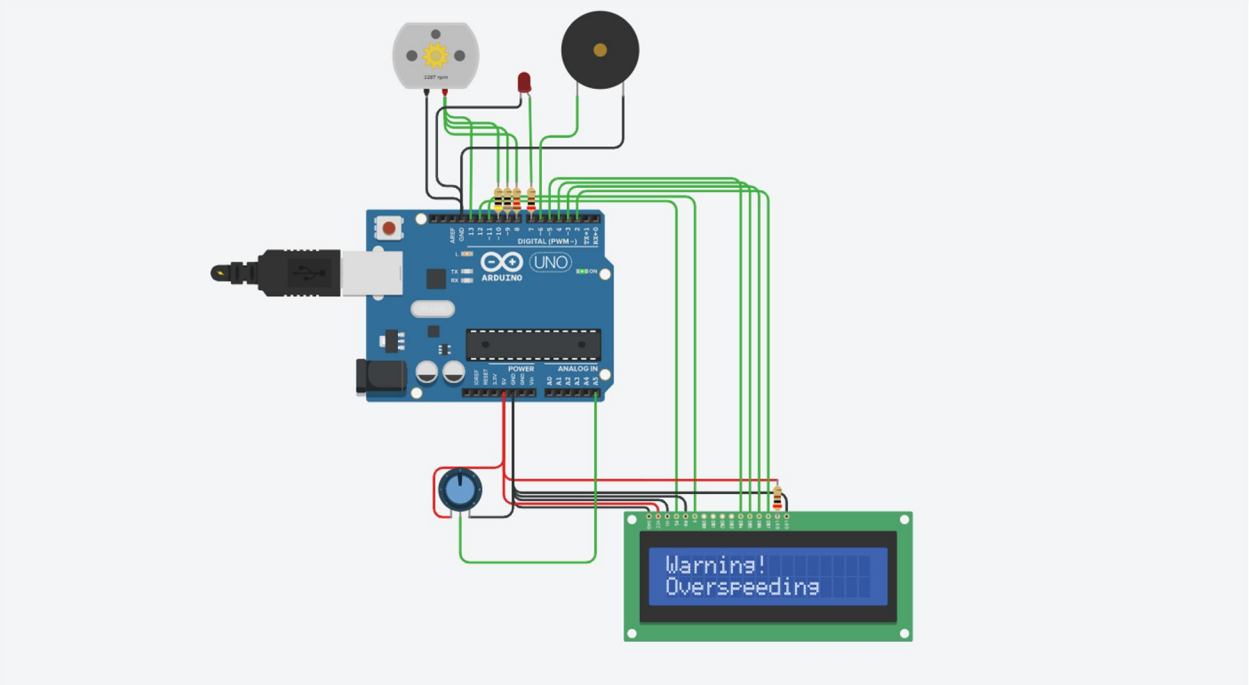


Figure 15

3) If potentiometer will increase 89-0°, buzzer will automatically start beeping and warning light will glow on vehicle dashboard to alert driver even LCD will show warning message on display to **reduce speed** of vehicle or in next 10 seconds motor (power train) of vehicle will automatic reduce speed under and start following speed limit of road.

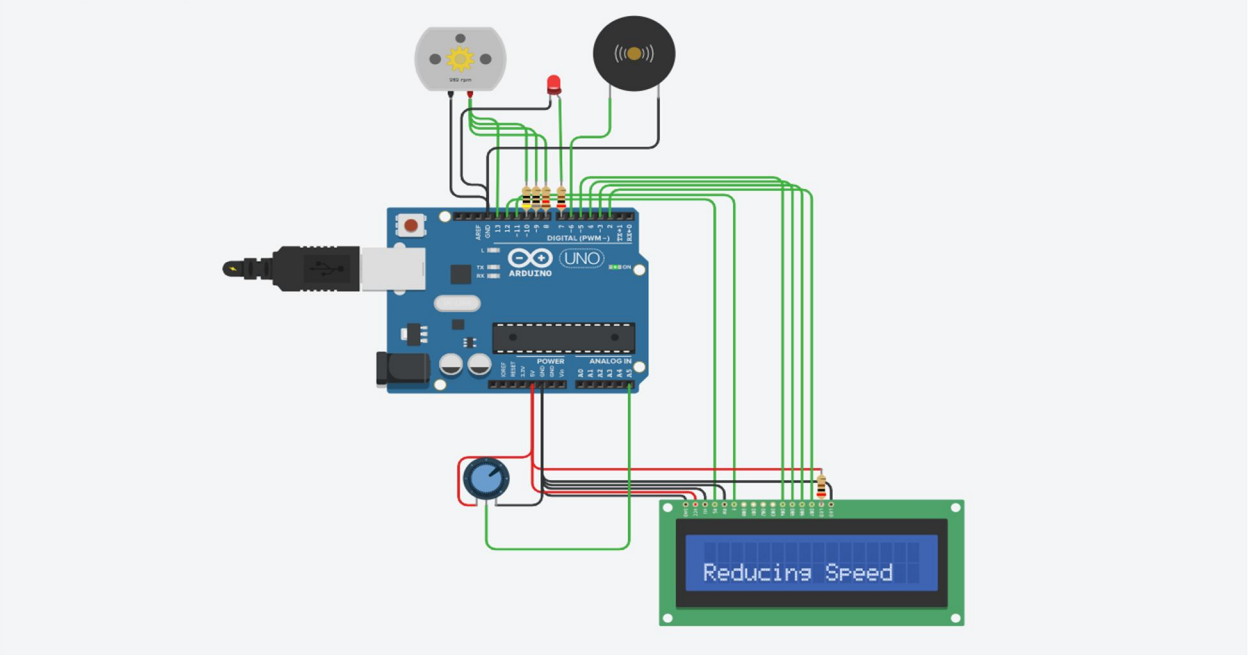


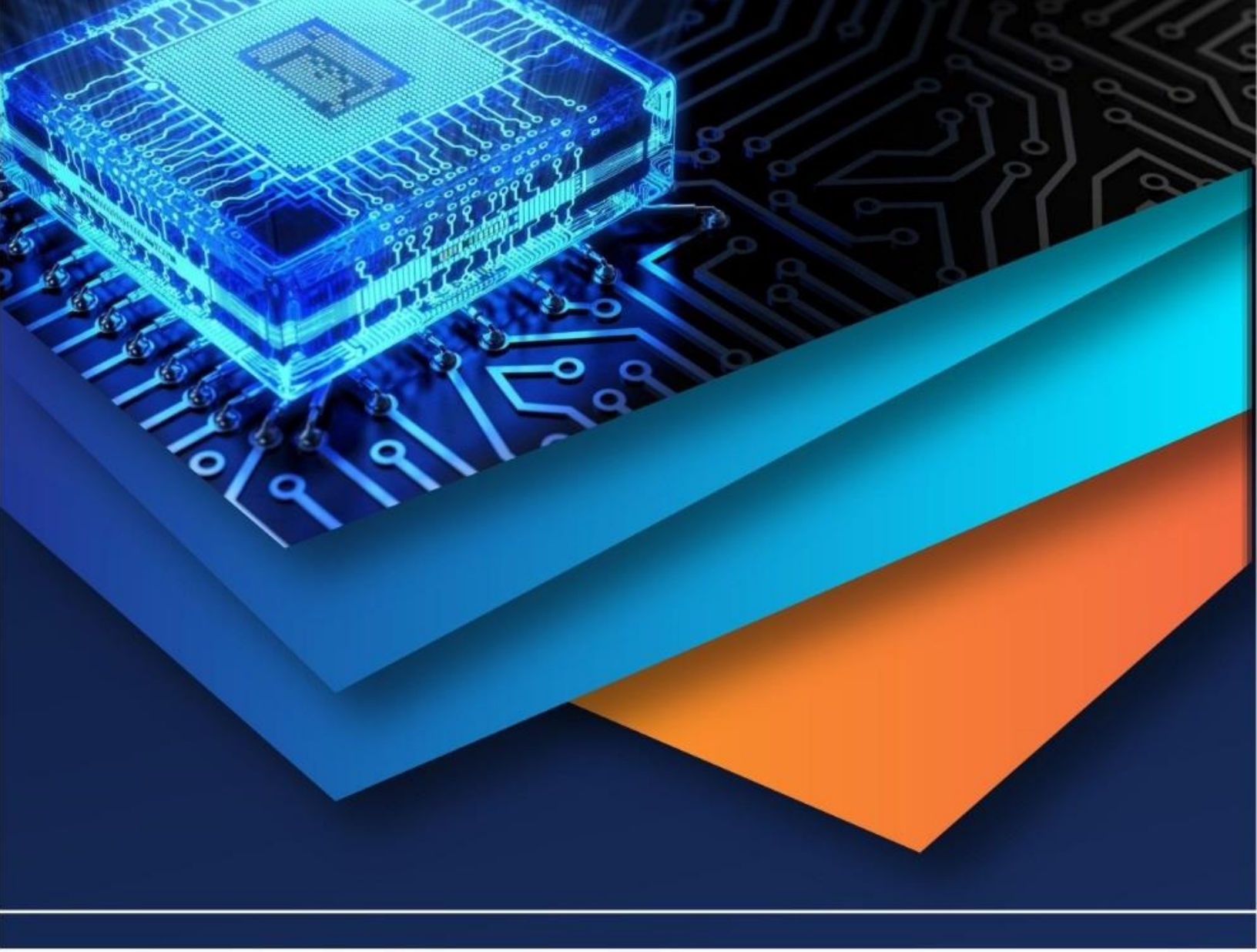
Figure 16

This circuit will help to fulfill our aim and objective of project. With the help of this we can control all vehicle speeds so traffic problem will reduce automatically and chances of accident will also decrease.

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