# SPEED DETECTING SYSTEM

A course project report submitted in partial fulfillment of the requirement

of

## SMART SYSTEM DESIGN

by


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# ABSTRACT

The main aim of this project presents the implementation of a speed detector of vehicle. This framework is intended to help and give help to satisfy the needs of monitoring traffic conditions. Additionally, the idea of speed detector will improve the safety of public. The main application of this is to avoiding number of accidental deaths on highways causing by over speeding of vehicles. Speed Limit violation detection system will be working as a violation warning for those vehicles which crosses the maximum allowed speed on that route. This system is designed to check the speed of vehicle, ease of use, and cost-effective design and implementation. Our main idea is to develop a system to provide people a living environment with security, comfort, environmental protection, and intelligence. We introduced a technology which will not only save our money and time but will prove to be beneficial and effective for the economy.

# CONTENTS

# CHAPTER 1
# INTRODUCTION

## ABOUT PROJECT

You might have heard the slogans like “Over Speeding kills”, “Drive slowly”, etc. on the roads. Over speeding is a threat to the lives of the people as it can take the life of the driver, people sitting in the vehicle or people on the roads. Therefore there must be strict rules and regulations for driving the vehicle at certain speed limits on certain roads. For this to be done traffic police must have some instrument which can help them to detect the speed of the vehicle so in case of over speeding of any vehicle they can charge the fine or take necessary actions against the driver.

Facing the invention of the automobile, many nations enacted speed limit laws, and appropriate measures to enforce them. In a cause-wise split, maximum number of road crashes and deaths were caused by over-speeding, which accounted for 67.3 per cent or 1,01,699 deaths, 71 per cent of crashes and 72.4 per cent of injuries. The first Locomotive Act, passed in 1861, set a speed limit of 10 miles per hour (16 km/h) in uninhabited areas, and 5 miles per hour (8.0 km/h) within towns.

So we brought you a project which can help you to detect the speed of the vehicles easily and automatically. This project is just a prototype and can be implemented on a large scale.

## OBJECTIVES

- The objective of this project is to implement a low cost and reliable automation system that can be used to detect the speed of the vehicles.
- This project will help you to detect the speed of a moving car easily without any human intervention by simply placing it somewhere on the road.
- This project can be used in traffic logger, traffic counter and many more traffic-related applications.
- Speed detectors reduce speeding and save lives. Detectors are a very effective way of persuading drivers not to speed, and thereby reducing the number of people killed and seriously injured.
- This project is just a prototype and can be implemented on a large scale.

# CHAPTER 2

# PROJECT DESCRIPTION

## BLOCK DIAGRAM OF THE PROJECT

As shown in the below diagram it mainly consists of an Arduino, two IR sensors, LCD, buzzer and LED. The two sensors are speed detecting sensors. These sensors are connected to Arduino. Whenever the IR sensor detects a vehicle or an object moving then immediately it sends the information to Arduino, then Arduino displays the speed of the vehicle on the LCD. If the vehicle is in over speed then the Arduino displays "Over Speed" on the LCD and the LED starts glowing and also the buzzer sounds else "Normal Speed" is displayed on LCD. The block diagram of the project is shown in fig. 2.1

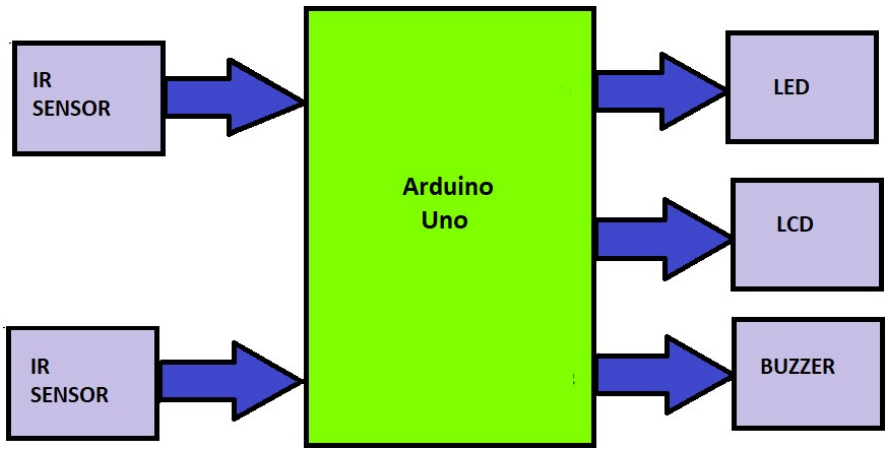


Fig.2.1 Block Diagram

## HARDWARE DESCRIPTION

### Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button as we can see in the figure 2.2.It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2HWB line to ground, making it easier to put into DFU mode. Revision 3 of the board has the following new features: 1.0 pin out: added

SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which operate with 5V and with the Arduino Due that operate with 3.3V. The second one is a not connected pin that is reserved for future purposes. Stronger RESET circuit. At mega 16U2 replace the 8U2. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

| | |
|---|---|
| Microcontroller | ATmega328 |
| Operating Voltage | 5V |
| Input Voltage (recommended) | 7-12V |
| Input Voltage (limits) | 6-20V |
| Digital I/O Pins | 14 (of which 6 provide PWM output) |
| Analog Input Pins | 6 |
| DC Current per I/O Pin | 40 mA |
| DC Current for 3.3V Pin | 50 mA |
| Flash Memory | 32 KB of which 0.5 KB used by bootloader |
| SRAM | 2 KB (ATmega328) |
| EEPROM | 1 KB (ATmega328) |

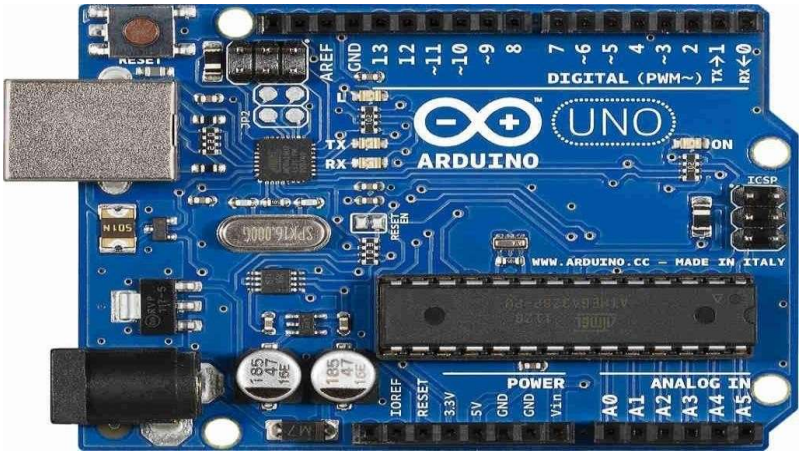


Fig. 2.2 Arduino Uno

**Applications:**

- Xoscillo, an open-source oscilloscope
- Arduinome, a MIDI controller device that mimics the Monome

- OBDuino, a trip computer that uses the on-board diagnostics interface found in most modern cars
- Gameduino, an Arduino shield to create retro 2D video games
- Arduino Phone, a do-it-yourself cell phone
- Water quality testing platform
- Automatic titration system based on Arduino and stepper motor
- Low cost data glove for virtual reality applications
- Impedance sensor system to detect bovine milk adulteration
- Homemade CNC using Arduino and DC motors with close loop control by Homo faciens
- DC motor control using Arduino and H-Bridge

## IR Sensor (HW-201)

The sensor module adaptable to ambient light, having a pair of infrared emitting and receiving tubes, transmitting tubes emit infrared certain frequency, when the direction of an obstacle is detected (reflection surface), the infrared reflected is received by the reception tube, After a comparator circuit processing, the green light is on, but the signal output interface output digital signal (a low-level signal), the effective distance range of 2 ~ 30cm, the working voltage of 3.3V- 5V.The picture of the HW-201(IR Sensor) is shown in the fig2.3. Detection range of the sensor can be obtained by adjusting potentiometer, with little interference, easy to assemble, easy to use features, can be widely used in robot obstacle avoidance, avoidance car, line count, and black and white line tracking and many other occasions. When the module detects an obstacle in front of the signal, the green indicator lights on the board level, while the OUT port sustained low signal output, the module detects the distance 2 ~ 30cm, detection angle 35 °, the distance can detect potential is adjusted clockwise adjustment potentiometer, detects the distance increases; counter clockwise adjustment potentiometer, reducing detection distance. The sensor active infrared reflection detection, target reflectivity and therefore the shape is critical detection distance. Where the minimum detection distance black, white, maximum, small objects away from a small area, a large area from the Grand. The sensor module output port OUT port can be directly connected to the microcontroller IO can also be directly drive a 5V relay; Connection: VCC-VCC; GND-GND; OUT-IO. The module can be 3-5V DC power supply. When the power is turned on the red power indicator lights. With the screw holes 3mm, easy fixed installation.

The IR sensor module consists mainly of the IR Transmitter and Receiver, Op-amp, Variable Resistor (Trimmer pot), output LED along with few resistors.

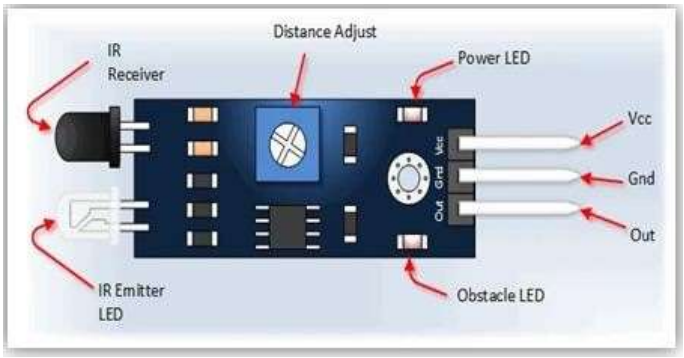


Fig.2.3 HW-201(IR Sensor)

- **IR LED Transmitter**

IR LED emits light, in the range of Infrared frequency. IR light is invisible to us as its wavelength (700nm – 1mm) is much higher than the visible light range. IR LEDs have light emitting angle of approx. 20-60 degree and range of approx. few centimeters to several feet, It depends upon the type of IR transmitter and the manufacturer. Some transmitters have the range in kilometers. IR LED white or transparent in color, so it can give out amount of maximum light.

- **Photodiode Receiver**

Photodiode acts as the IR receiver as its conducts when light falls on it. Photodiode is a semiconductor which has a P-N junction, operated in Reverse Bias, means it start conducting the current in reverse direction when Light falls on it, and the amount of current flow is proportional to the amount of Light. This property makes it useful for IR detection. Photodiode looks like a LED, with a black colour coating on its outer side, Black colour absorbs the highest amount of light.

- **LM358 Operational amplifier**

LM385 is an Operational Amplifier (Op-Amp) is used as voltage comparator in the IR sensor. the comparator will compare the threshold voltage set using the preset (pin2) and the photodiode's series resistor voltage (pin3). When Opamp's output is high the LED at the Opamp output terminal turns ON (Indicating the detection of Object).

- **Variable Resistor**

The variable resistor used here is a preset. It is used to calibrate the distance range at which object should be detected.

## Module Interface Description:

**1.** VCC : 3.3V-5V external voltage (can be directly connected to 5v and 3.3v MCU )

**2.** GND : GND External

**3.** OUT : small board digital output interface (0 and 1)

## Features:

- 5v-DC Operating voltage
- I/O pins are 5V and 3.3V complaint
- Range upto 20cm
- Adjustable senseing range
- Built-in Ambient Light Sensor
- 20 mA supplying voltage
- Mounting hole
- 35 Degree Detection Angle
- LM393 comparator Selection Output
- Easy to use

## Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. The buzzer we used in our project is shown in below fig2.4.

Fig.2.4 Buzzer

**Types of buzzers:**

1. **Electromechanical**

Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current, causing the contacts to buzz. Often these units were anchored to a wall or

ceiling to use it as a sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made.

2. **Mechanical**

   A joy buzzer is an example of a purely mechanical buzzer. They require drivers.

3. **Piezoelectric**

   A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.

**Applications:**

While technological advancements have caused buzzers to be impractical and undesirable, there are still instances in which buzzers and similar circuits may be used. Present day applications include:

- Novelty uses
- Judging panels
- Educational purposes
- Annunciated panels
- Electronic metronomes like microwave ovens and other household appliances
- Game show lock-out device and Sporting events such as basketball game

## Liquid Crystal Display (LCD):

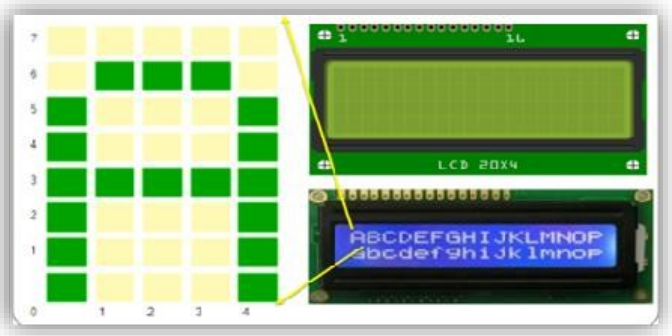


Fig. 2.5 20x4 & 16x2 LCDs

**Description:**

The term LCD stands for Liquid Crystal Display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for

displaying custom characters, special and even animations, etc. LCD is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smart phones, televisions, computer monitors and instrument panels.

LCD is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizer. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. From fig.2.5 we can notice types of flat-panel displays.

The liquid crystal display screen works on the principle of blocking light rather than emitting light. LCDs require a backlight as they do not emit light by themselves. Hence they require backlight. We always use devices which are made up of LCD's displays which are replacing the use of cathode ray tube. The Pin diagram of LCD 16x2 is shown in fig2.6.

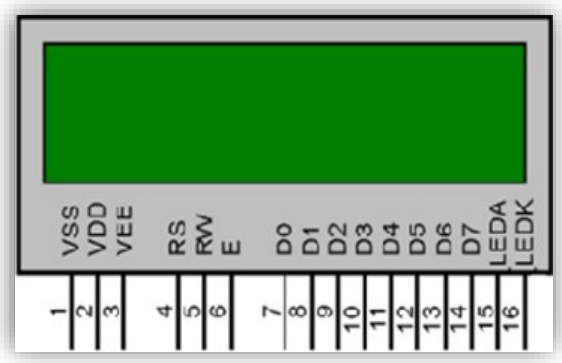


Fig.2.6 16x2 LCD Pin Diagram

- **Pin1 (Ground/Source Pin)**: This is GND pin of display, used to connect the GND terminal of the micro controller unit or power source.
- **Pin2 (VCC/VDD/Source Pin):** This is the voltage supply pin of the display, used to connect the supply pin of the power source.
- **Pin3 (VO/VEE/Control Pin):** This pin regulates the difference of the display, used to connect a changeable POT that can supply 0 to 5V.
- **Pin4 (Register Select/Control Pin):** This pin toggles among command or data register, used to connect a microcontroller unit pin and obtains either 0 or 1(0 = data mode and 1 = command mode).
- **Pin5 (Read/Write/Control Pin):** This pin toggles the display among the read or writes operation, and it is connected to a microcontroller unit pin to get either 0 or 1 (0 = Write Operation and 1 = Read Operation).
- **Pin 6 (Enable/Control Pin):** This pin should be held high to execute Read/Write process, and it is connected to the microcontroller unit & constantly held high.
- **Pins 7-14 (Data Pins):** These pins are used to send data to the display. These pins are connected in two-wire modes like 4-wire mode and 8-wire mode. In 4-wire mode, only four pins are connected to the microcontroller unit like 0 to 3, whereas in 8-wire mode, 8-pins are connected to microcontroller unit like 0 to 7.

- **Pin15 (+ve pin of the LED):** This pin is connected to +5V.
- **Pin16 (-ve pin of the LED):** This pin is connected to GND.

## SOFTWARE DESCRIPTION

The software used here is ARDUINO SOFTWARE:

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

**Writing Sketches:**

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

**NB:**

Versions of the Arduino Software (IDE) prior to 1.0 saved sketches with the extension pde. It is possible to open these files with version 1.0, you will be prompted to save the sketch with the ino extension on save.

***Verify***

Checks your code for errors compiling it.

***Upload***

Compiles your code and uploads it to the configured board. See uploading below for details.

**Note:** If you are using an external programmer with your board, you can hold down the "shift" key on your computer when using this icon. The text will change to "Upload using Programmer"

***New***

Creates a new sketch.

***Open***

Presents a menu of all the sketches in your sketchbook. Clicking one will open it within the current window overwriting its content.

**Note:** due to a bug in Java, this menu doesn't scroll; if you need to open a sketch late in the list, use the File | Sketchbook menu instead.

***Save***

Saves your sketch.

***Serial Monitor***

Opens the serial monitor.

Additional commands are found within the five menus: File, Edit, Sketch, Tools, and help.

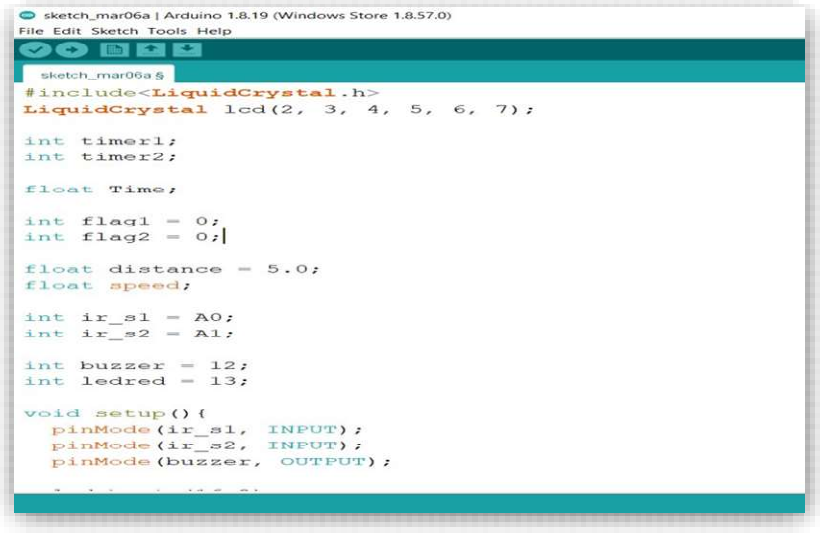


Fig.2.7 Software IDE

## Programming on Arduino Uno

In order for the Arduino-Uno board to be able to interact with the application used in this project certain program (code) needs to be uploaded to the Arduino-Uno.

Arduino Company provides user friendly software which allows writing any code for any function wanted to be performed by the Arduino-Uno and upload it to the board.Refer to appendix A for the full source code of the Arduino-Uno board.

# CHAPTER 3

# CIRCUIT DIAGRAM AND DESCRIPTION

## Working

We have used 2 IR sensors. Whenever a vehicle passes through the 2 IR sensors, it detects and sends the information to arduino. Then the arduino receives it, calculates the speed and shows the speed on the LCD. When the vehicle crosses the speed limit of >50 km/hr , then the buzzer gives the sound and red LED glows and "over speeding" is shown on the LCD along with speed . When there is no vehicle passing by "No Car Detected" is shown on the LCD. When the vehicle is moving in normal speed of <50 km/hr, then "Normal Speeding" is shown on the LCD along with speed. As the working of speed detector using Arduino is as shown in fig.3.1

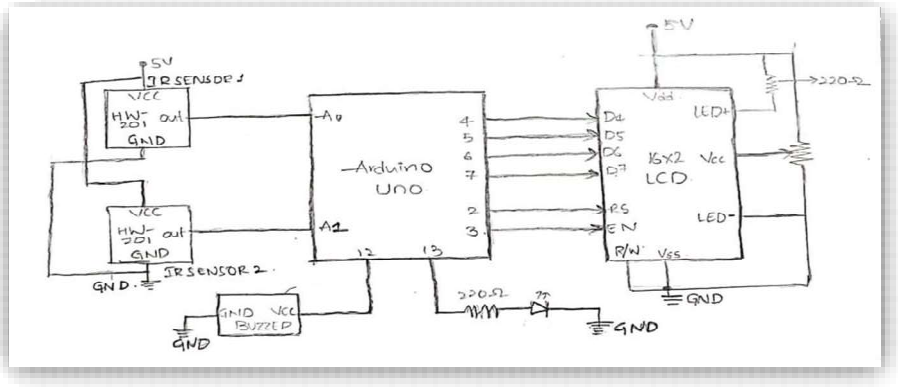


Fig.3.1 Schematic diagram

## RESULTS

The experimental result is as shown in below fig. 3.2

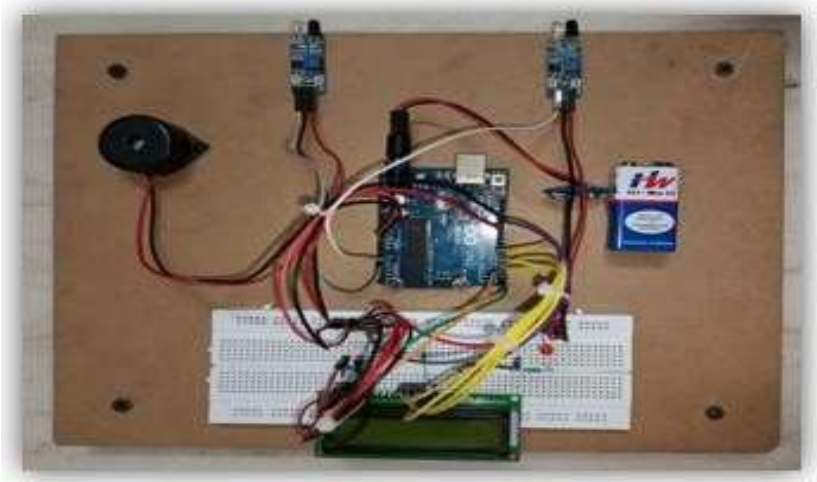

Fig .3.2 Experimental result

## Experimental result:

Managed to successfully apply the SPEED DETECTOR OF VEHICLE USING ARDUINO and it was user friendly and cost effective. it is cost effective as in it will cost exactly as the project requires (optimum price).

## ADVANTAGES

- Reduces number of Road Accidents.
- Provides safe Journey.
- Avoiding Traffic Collisions.
- Effective method to record Vehicle Speed.
- Does not need any Human interception.

## DISADVANTAGES

- Equipment and installation cost.
- Human errors.
- Reliability.
- System compatibility.

# CHAPTER 4
# CONCLUSION

## CONCLUSION

The vehicle over speeding detection system reduces the number of road accidents and provides a safe journey by controlling the speed of vehicles in turn avoiding traffic collisions. Thus, the work of the traffic police authorities is minimized and they can control the rash driving of cars efficiently and accurately with ease by just sitting in the control room. In future, this concept can be further extended by integrating a camera with this system that will capture the picture of the over speeding vehicle's number plate and send it to the police authority for further process.

In this project, we can easily detect the speed of vehicles/human by utilizing Arduino and IR sensors so that it alerts the over speed of vehicles/human. This project is mainly used as sport check, to control over speed near prohibited areas. The system accumulates information of vehicle/human speed (moving objects) by displaying on LCD display and if over speed occurs it alerts by giving buzzer. The designed detection system continuously monitors the speed of the approaching vehicle.

It minimizes the difficulties of traffic department and make ease to control the rash driving / over speed vehicles on highways. So that, the police can provide their service with more ease and accuracy while sitting in control room.

## FUTURE SCOPE

In future, this system can be extended by integrating a camera which could capture the image of the number plate of the vehicle and sends to the traffic authorities or the corresponding vehicle owner.

The CCTV Camera can be installed on highways along with speed detector. If any vehicle has violates the maximum speed limit then this implementation of CCTV will be triggered to take a picture of the vehicle.

Major benefit is adding voice announcement system. By adding this in system, it will notify the driver that vehicle has crossed the over speed conditions.

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# APPENDIX

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(2, 3, 4, 5, 6, 7);

int timer1;
int timer2;

float Time;

int flag1 = 0;
int flag2 = 0;

float distance = 10.0;
float speed;

int ir_s1 = A0;
int ir_s2 = A1;

int buzzer = 12;
int ledred=13;

void setup(){
  pinMode(ir_s1, INPUT);
  pinMode(ir_s2, INPUT);
  pinMode(buzzer, OUTPUT);
  pinMode(ledred, OUTPUT);

  lcd.begin(16,2);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print(" SSD PROJECT ");
  lcd.setCursor(0,1);
  lcd.print("BATCH-2");
  delay(2000);
  lcd.clear();
}

void loop() {
if(digitalRead (ir_s1) == LOW && flag1==0){timer1 = millis(); flag1=1;}

if(digitalRead (ir_s2) == LOW && flag2==0){timer2 = millis(); flag2=1;}

if (flag1==1 && flag2==1){
 if(timer1 > timer2){Time = timer1 - timer2;}
else if(timer2 > timer1){Time = timer2 - timer1;}
Time=Time/1000; speed=(distance/Time);
speed=speed*3600;
 speed=speed/1000;
}
```

```
if(speed==0)
{
      lcd.setCursor(0, 1);
      if(flag1==0 && flag2==0)
{
      lcd.print("No car  detected");
}
 else
{
      lcd.print("Searching...    ");
}
}
else
{
   lcd.clear();
   lcd.setCursor(0, 0);
   lcd.print("Speed:");
   lcd.print(speed,1);
   lcd.print("Km/Hr ");
   lcd.setCursor(0, 1);
if(speed > 50)
{
       lcd.print(" Over Speeding ");
       digitalWrite(buzzer, HIGH);
       digitalWrite(ledred, HIGH);
}
  else
{
       lcd.print("  Normal Speed  ");
}
       delay(3000);
       digitalWrite(buzzer, LOW);
       digitalWrite(ledred, LOW);
       speed = 0;
       flag1 = 0;
       flag2 = 0;
 }
}
```