# VEHICLE SPEED DETECTOR

(Mini Project or Internship Assessment)

A

report on

submitted in partial fulfillment of the requirements

for the award of the degree of

**BACHELOR OF TECHNOLOGY**

by

**ARVIND KUMAR YADAV**

**(1829031019)**

Submitted to

**Dr. Hari Mohan Gaur**

**ELECTRONICS & COMMUNICATION ENGINEERING**

**ABESIT GHAZIABAD**

**Affiliated to Dr. A.P.J. Abdul Kalam Technical University, Lucknow**

**December, 2020**

# ABSTRACT

In many parts of the highway road, accidents found a major social problem. There are several reasons to why vehicle accidents. Most of accidents on the highway road cause by high speed driving. Some highway road has sign boards signifying maximum speed limit permitted while driving such as 100 km/h for the driver's safety, but some people does not follow speed limit. Therefore, the vehicles keep a constant speed within the speed limit over a particular area

In this Project, speed detection system for vehicles is proposed. This system provides very effective in detection of over speed driving. This circuit is mainly consists of Arduino UNO, two IR sensors, 1602A LCD. When a vehicle is passing between the first and second sensors, the two sensors sense the object and then microcontroller program will start counting. When it passes cross the second sensor the microcontroller will stop counting and calculate the speed as kilometer per hour. If the car's speed is over speed(100 km/h). Then, LCD displays the speed of vehicles. This system is to improve a device that detects over speeding of vehicle, gives warning using alarm and display vehicle's speed in LCD.

# DECLARATION

I hereby declare that that the work reported in the report entitled **"VEHICLE SPEED DETECTOR SYSTEM"** submitted to the Department of Electronics & Communication Engineering, **ABESIT GHAZIABAD** is an authentic record of my work. I have not submitted this work elsewhere for any other degree. I am fully responsible for the contents of my report.

ARVIND KUMAR YADAV

Department of Electronics and communication Engineering

ABES Institute of Technology

December 2020

# ACKONOWLEDGEMENT

I take this opportunity to express my sincere gratitude towards **ABES Institute of technology** and **Dr. HM Gaur** (HOD ECE) to providing this opportunity and Helping to build the Project.

# TABLE OF CONTENTS

# LIST OF FIGURES

# INTRODUCTION

In many parts of the highway road, accidents found a major social problem. There are several reasons to why vehicle accidents. Most of accidents on the highway road cause by high speed driving. Some highway road has sign boards signifying maximum speed limit permitted while driving such as 100 km/h for the driver's safety, but some people does not follow speed limit. Therefore, the vehicles keep a constant speed within the speed limit over a particular area

In this Project, speed detection system for vehicles is proposed. This system provides very effective in detection of over speed driving. This circuit is mainly consists of Arduino UNO, two IR sensors, 1602A LCD. When a vehicle is passing between the first and second sensors, the two sensors sense the object and then microcontroller program will start counting. When it passes cross the second sensor the microcontroller will stop counting and calculate the speed as kilometer per hour. If the car's speed is over speed(100 km/h). Then, LCD displays the speed of vehicles. This system is to improve a device that detects over speeding of vehicle, gives warning using alarm and display vehicle's speed in LCD.

# DESIGN AND IMPLEMENTATION OF THE SYSTEM

This system is design 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 speed of the vehicles. The system keeps 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, this sensor gets activated. From this instant forward, a timer is initiated and will continue to keep time until the vehicle reaches the second IR Sensor. Then the microcontroller starts to count the time and calculate the speed of the vehicle as km/h and this speed is displayed on a16X2 LCD Module. If the vehicle's speed is greater than the limited speed, the LCD will display " OVER SPEEDING ! "

## CONCEPT

• A timer is started inside the microcontroller whenever a low pulse is received on the first sensor.

• Timer is stopped whenever low pulse is received on second receiver.

Vehicle Speed = Distance between 2 sensors / Time taken by the timer

## COMPONENTS

### HARDWARE

1. Arduino UNO


**Fig1.1**

2. IR Sensors

**fig 1.2**

3. 16*2 LCD

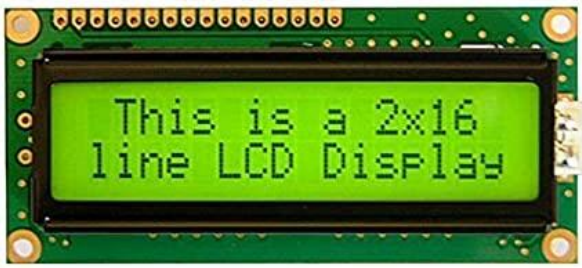



**Fig1.3**

## SOFTWARE

. PROTEUS DISGN SUIT

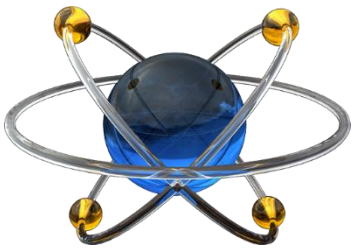


**Fig 1.4**

# Arduino UNO


- Arduino is an open-source physical computing platform.
- It is a small microcontroller board with a USB plug.
- Based on a simple i/o board and a development environment that implementsthe Processing/writing language.
- Arduino can be used to develop stand-alone interactive objects or can beconnected to software on your computer.
- Easy-to-use hardware and software.

## Description:

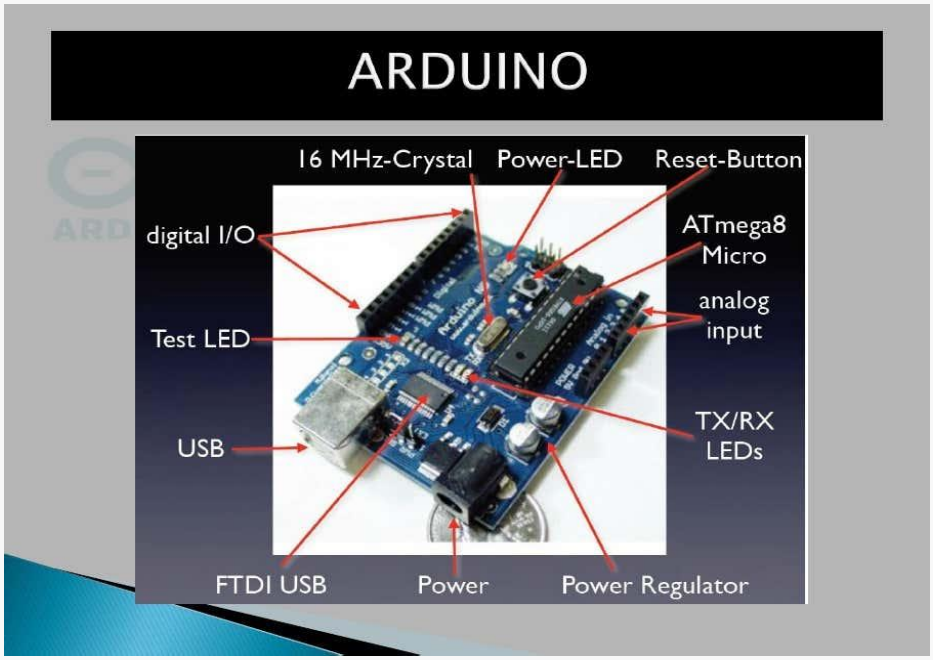



**Fig 2.1**

## Different Types Of Arduino Boards

- Arduino Uno (R3)
- Arduino Nano.
- Arduino **Micro**.
- Arduino Due.
- LilyPad Arduino Board.
- Arduino Bluetooth
- Arduino Diecimila
- RedBoard Arduino Board.

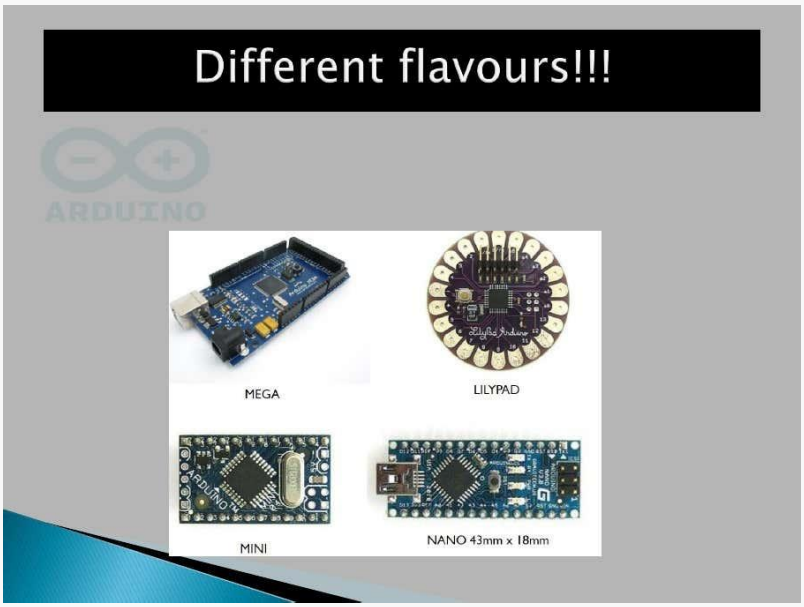



**Fig 2.2**

## Shield:

- Printed circuit boards that sit atop an arduino
- Plug into the normally supplied pin-headers of arduino.
- These are expansions to the base Arduino.
- For example:Arduino Ethernet shield,Xbee Shield,Touch Shield etc


**Fig 2.3**

## Power Supply:

- Should be between 9V and 12V DC.
- Must be rated for a minimum of 250mA current output.
- Must have a 2.1mm power plug on the Arduino end.
- The plug must be “centre positive”,that is,the middle pin of the plug has to be the + connection

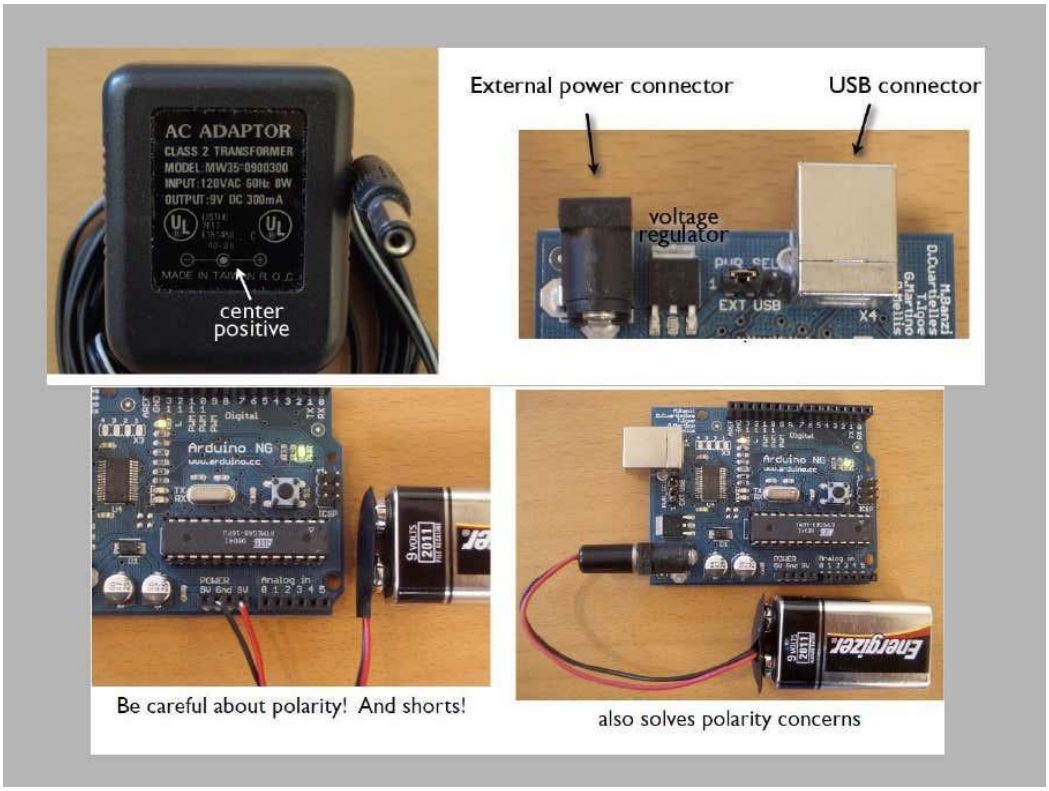



**Fig 2.4**

## Arduino Software:

- Arduino boards can be controlledUsing an implementation of Wiring,Which is a version of Processingdeveloped specifically for electronicI/O.
- Arduino looks like Processing,butis actually built in C,so there are afew differences to look out for.

## The Arduino IDE:

- The arduino is programmed in C language.
- The language is very simple and provides many abstractionfor simplicity of reading and writing powerfull applications.
- It provides a serial monitor to see the serial data from the USBvirtual COM port.
- Allows one click compiling,verification and burning of code onto the arduino.

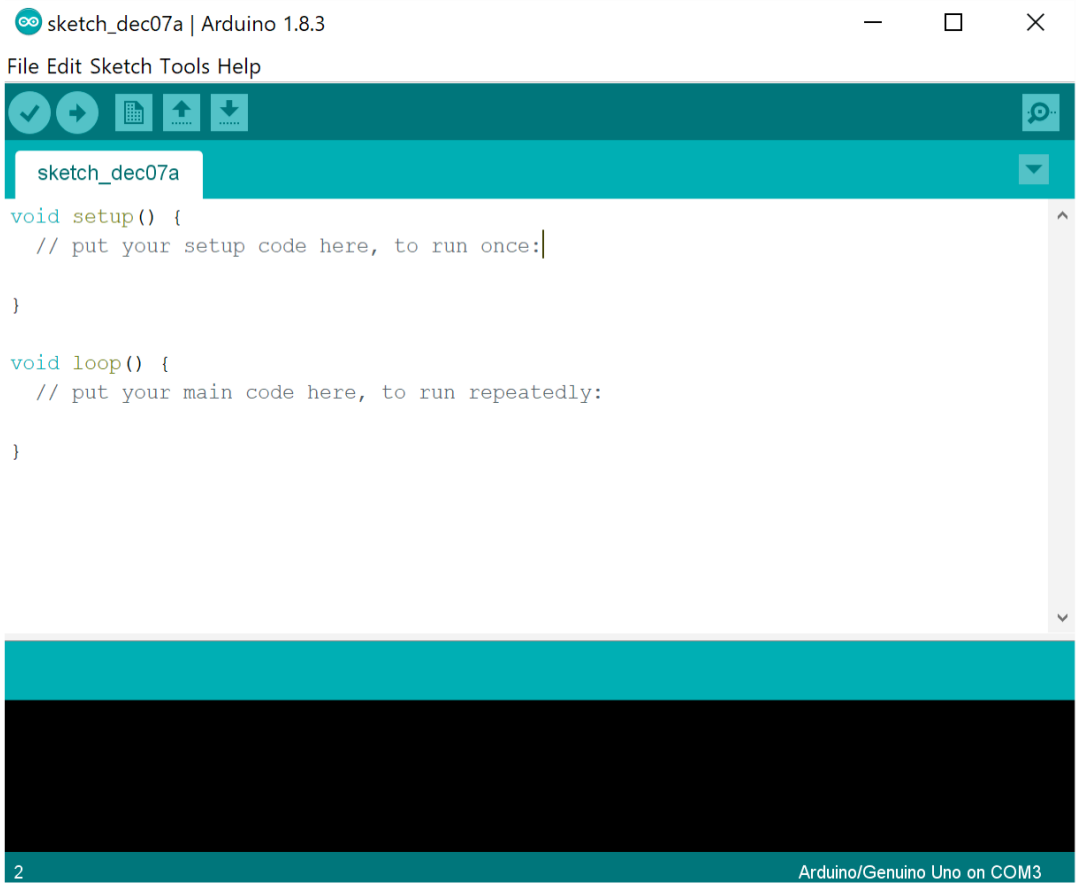



**Fig 2.5**

## Arduino Programming language v/s processing:

Arduino has two reserved functions:

1. void setup()
2. void loop()

There is no pop-up display window,hence void draw() is not special.Loop() can be considered to do the same thing as draw() for the arduino.

There are three types of variable in Arduino:

i. char
ii. int

iii.
long
Arduino has a few reserved constants,which donot need to be defined:
1.
HIGH//5 volts
2.
LOW//0 volts
3.
INPUT//pin is input
4.
OUTPUT//pin is output

- Conditional statements are the same as in Processing.
- Functions can be defined the same as in Processing

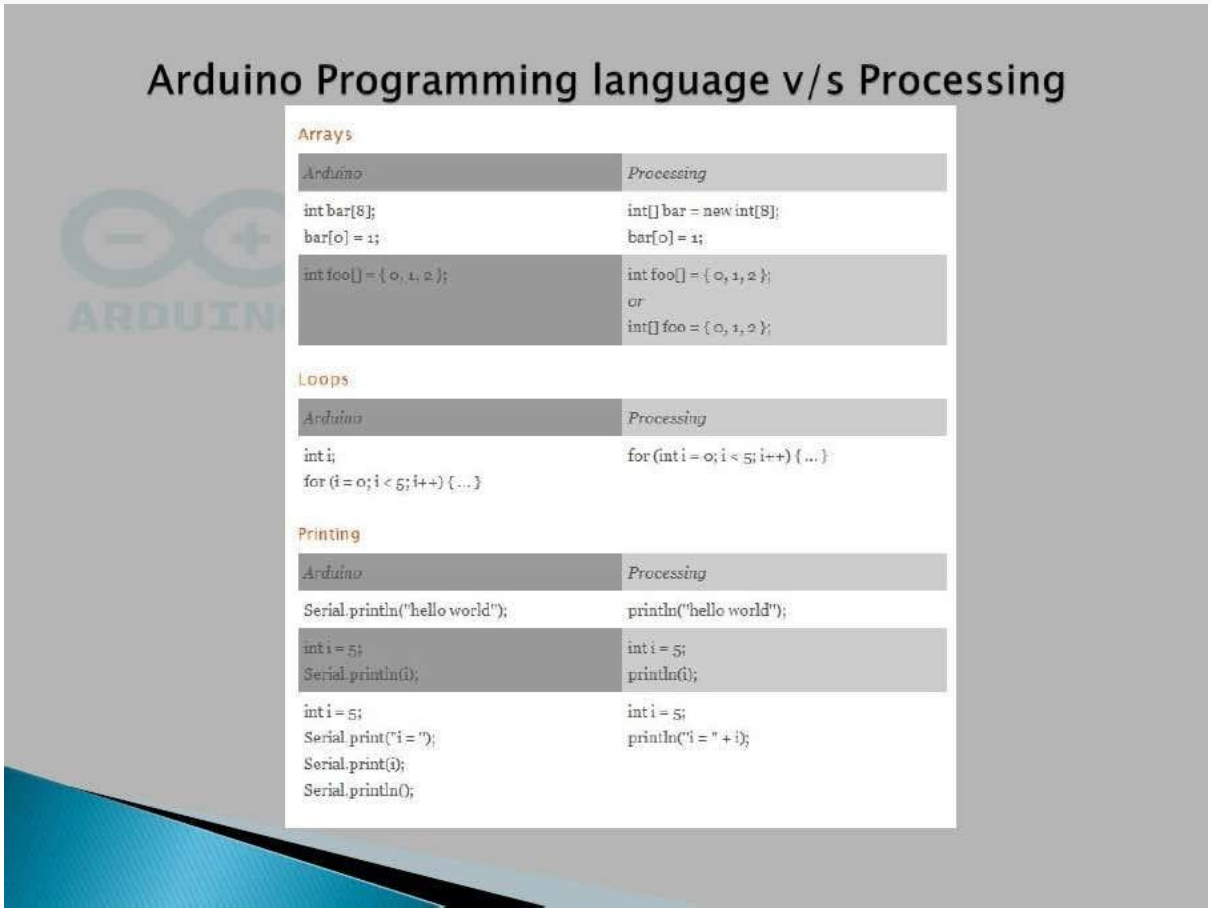



**Fig 2.6**

## Steps in Arduino Programming:

- Open the IDE
- Write code and logic
- Click the verify/compile button to check your program for errors
- Attach the arduino via USB to the PC

- Install drivers if first time
- Setup serial port being used.
- Setup board which we need to program.
- Click upload code to send code to arduino.

## Why Arduino?

- It is Open Source,both in terms of *Hardware* And *Software*.
- It is cheap (about $20 the cost of going out for pizza)
- USB connectivity (MacBooks don't have serial ports)
- More powerful than a BASIC stamp (it costs around $180)
- Simple and easy to use by someone without formal electronicstraining.Editing and rewriting is often easier than writing from scratch.That's where the BeagleBoard falls short."It has virtually no example application that you can just copy and hack to learn from".
- We know simple is attractive.
-

## IR Sensor

IR sensor is an electronic device which measures infrared radiations and helps to detect obstacles and the motion in our surrounding. It mainly consists of a transmitter led and a receiver photodiode and detects infrared radiations having a wavelength from 700nm to 1mm emitted by the objects. When a specific positive voltage is applied across the transmitter led it transmits the IR rays. If these rays fall on some object then that object reflects back the IR rays which are received by the receiver diode. The receiver diode generates a voltage across its terminals which depend on the intensity of light reflected by the object. Generally, IR receiver led is darker whereas transmitter is transparent in color.

## Working Principle

The working principle of an infrared sensor is similar to the object detection sensor. This sensor includes an IR LED & an IR Photodiode, so by combining these two can be formed as a photo-coupler otherwise optocoupler. The physics laws used in this sensor are planks radiation, Stephan Boltzmann & weins displacement.

IR LED is one kind of transmitter that emits IR radiations. This LED looks similar to a standard LED and the radiation which is generated by this is not visible to the human eye. Infrared receivers mainly detect the radiation using an infrared transmitter. These infrared receivers are available in photodiodes form. IR Photodiodes are dissimilar as compared with usual photodiodes because they detect simply IR radiation. Different kinds of infrared receivers mainly exist depending on the voltage, wavelength, package, etc.

Once it is used as the combination of an IR transmitter & receiver, then the receiver's wavelength must equal the transmitter. Here, the transmitter is IR LED whereas the receiver is IR photodiode. The infrared photodiode is responsive to the infrared light that is generated through an infrared LED. The resistance of photo-diode & the change in output voltage is in proportion to the infrared light obtained. This is the IR sensor's fundamental working principle.

Once the infrared transmitter generates emission, then it arrives at the object & some of the emission will reflect back toward the infrared receiver. The sensor output can be decided by the IR receiver depending on the intensity of the response.

## Types of Infrared Sensor

Infrared sensors are classified into two types like active IR sensor and passive IR sensor.

### Active IR Sensor

This active infrared sensor includes both the transmitter as well as the receiver. In most of the applications, the light-emitting diode is used as a source. LED is used as a non-imaging infrared sensor whereas the laser diode is used as an imaging infrared sensor.

These sensors work through energy radiation, received & detected through radiation. Further, it can be processed by using the signal processor to fetch the necessary information. The best examples of this active infrared sensor are reflectance and break beam sensor.

### Passive IR Sensor

The passive infrared sensor includes detectors only but they don't include a transmitter. These sensors use an object like a transmitter or IR source. This object

emits energy and detects through infrared receivers. After that, a signal processor is used to understand the signal to obtain the required information.

The best examples of this sensor are pyroelectric detector, bolometer, thermocouple-thermopile, etc. These sensors are classified into two types like thermal IR sensor and quantum IR sensor. The thermal IR sensor doesn't depend on wavelength. The energy source used by these sensors is heated. Thermal detectors are slow with their response and detection time. The quantum IR sensor depends on the wavelength and these sensors include high response and detection time. These sensors need regular cooling for specific measurements.

## IR Sensor Circuit Diagram

An infrared sensor circuit is one of the basic and popular sensor modules in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real-time. This circuit comprises the following components

- LM358 IC 2 IR transmitter and receiver pair
- Resistors of the range of kilo-ohms.
- Variable resistors.
- LED (Light Emitting Diode).

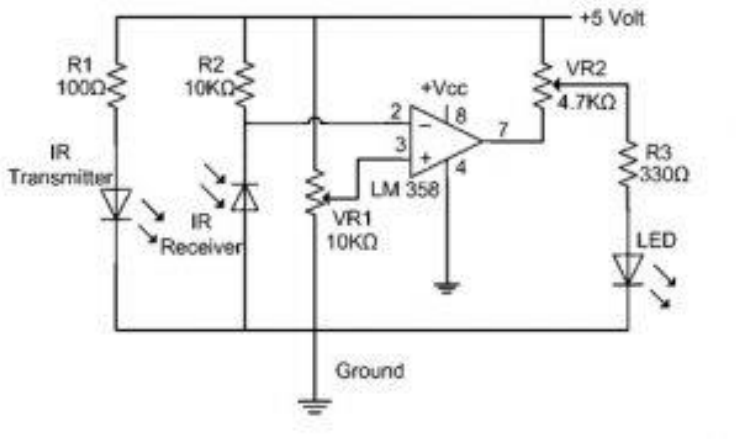



**Fig 3.1**

In this project, the transmitter section includes an IR sensor, which transmits continuous IR rays to be received by an IR receiver module. An IR output terminal of the receiver varies depending upon its receiving of IR rays. Since this variation cannot be analyzed as such, therefore this output can be fed to a comparator circuit. Here an operational amplifier (op-amp) of LM 339 is used as a comparator circuit.
When the IR receiver does not receive a signal, the potential at the inverting input goes higher than that non-inverting input of the comparator IC (LM339). Thus the output of the comparator goes low, but the LED does not glow. When the IR receiver module receives a signal to the potential at the inverting input goes low. Thus the output of the comparator (LM 339) goes high and the LED starts glowing.

Resistor R1 (100 ), R2 (10k ), and R3 (330) are used to ensure that a minimum of 10 mA current passes through the IR LED Devices like Photodiode and normal LEDs respectively. Resistor VR2 (preset=5k ) is used to adjust the output terminals. Resistor VR1 (preset=10k ) is used to set the sensitivity of the circuit Diagram. Read more about IR sensors.

## IR Sensor Circuit using Transistor

The circuit diagram of the IR sensor using transistors namely obstacle detection using two transistors is shown below. This circuit is mainly used for obstacle detection using an IR LED. So, this circuit can be built with two transistors like NPN and PNP. For NPN, BC547 transistor is used whereas, for PNP, BC557 transistor is used. The pinout of these transistors is the same.

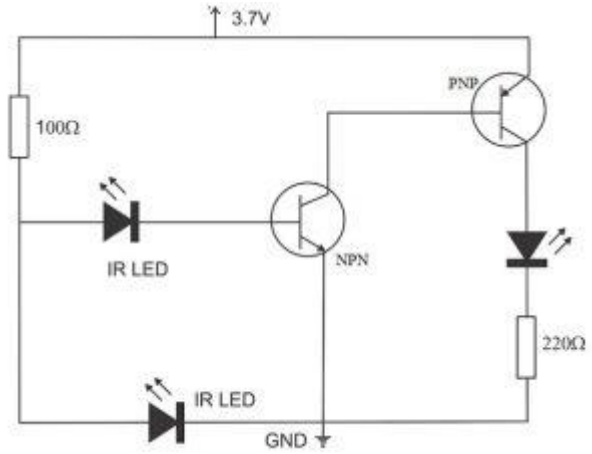



**Fig 3.2**

In the above circuit, one infrared LED is always switched on whereas the other infrared LED is allied to the PNP transistor's base terminal because this IR LED acts as the detector. The required components of this IR sensor circuit include resistors 100 ohms & 200 ohms, BC547 & BC557 transistors, LED, IR LEDs-2. The step by step procedure of **how to make the IR sensor circuit** includes the following steps.

- Connect the components as per the circuit diagram using required components
- Connect one infrared LED to the BC547 transistor's base terminal
- Connect an infrared LED to the base terminal of the same transistor.
- Connect the 100Ω resistor toward the residual pins of the infrared LEDs.
- Connect the base terminal of the PNP transistor toward the collector terminal of the NPN transistor.
- Connect the LED & 220Ω resistor as per the connection in the circuit diagram.
- Once the connection of the circuit is done then gives the power supply to the circuit for testing.

## Advantages

The **advantages of IR sensor** include the following:

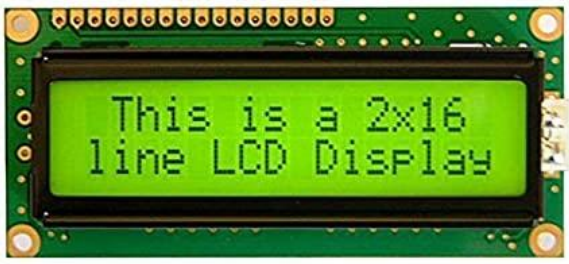
- It uses less power
- The detection of motion is possible in the presence or absence of light approximately with equal reliability.
- They do not need contact with the object for detection
- There is no data leakage because of the ray direction
- These sensors are not affected by oxidation & corrosion
- Noise immunity is very strong

# Disadvantages

The **disadvantages of IR sensor** include the following

- Line of sight is required
- Range is limited
- These can be affected by fog, rain, dust, etc
- Less data transmission rate

## 16 x 2 LED




CD modules are very commonly used in most embedded projects, the reason being its cheap price, availability and programmer friendly. Most of us would have come across these displays in our day to day life , Computers, calculators, television sets, mobile phones, digital watches use some kind of display to display the time.

16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. but the most used one is the 16×2 LCD.

An LCD is an electronic display module that uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 translates o a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix.

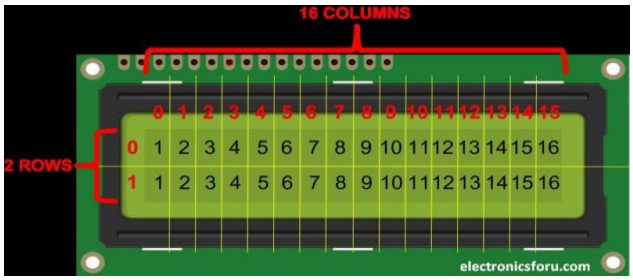



**Fig 4.1**

## 16X2 LCD pinout diagram:

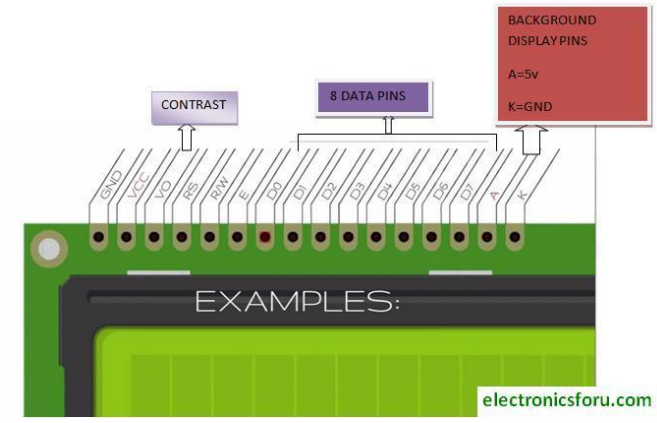



**Fig 4.2**

# RS (Register select)

A 16X2 LCD has two registers, namely, command and data. The register select is used to switch from one register to other. RS=0 for command register, whereas RS=1 for data register.

**Command Register:** The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task. Examples like:

- initializing it
- clearing its screen
- setting the cursor position
- controlling display etc.

Processing for commands happens in the command register.

**Data Register:** The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. When we send data to LCD it goes to the data register and is processed there. When RS=1, data register is selected.

## Interfacing a 16X2 LCD with Arduino

LCD modules form a very important in many Arduino based embedded system designs to improve the user interface of the system. Interfacing with Arduino gives the programmer more freedom to customise the code easily. Any Arduino board, a 16X2 LCD display, jumper wires and a breadboard are sufficient enough to build the circuit. The interfacing of Arduino to LCD display below.

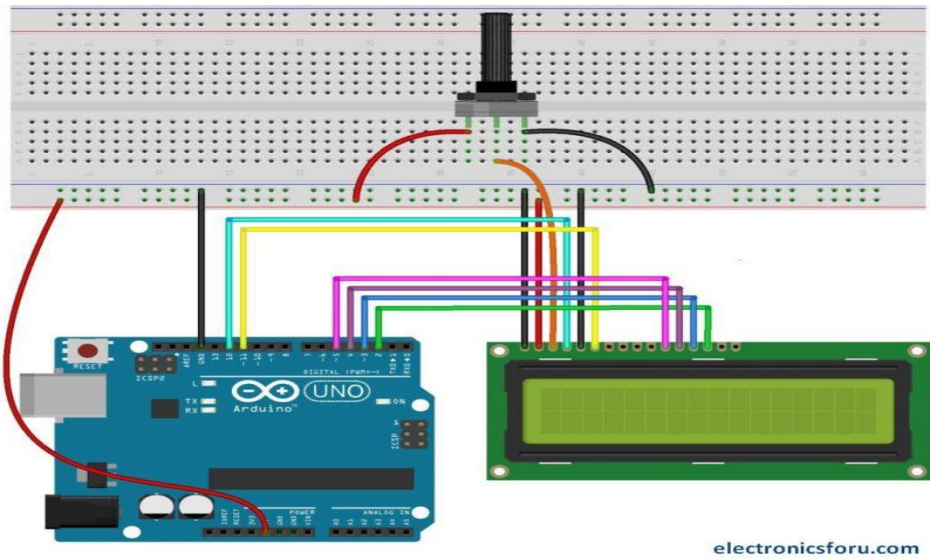



**Fig 4.3**

## Display the LED Brightness on a 16×2 LCD

The combination of an LCD and Arduino yields several projects, the most simple one being LCD to display the LED brightness. All we need for this circuit is an LCD, Arduino, breadboard, a resistor, potentiometer, LED and some jumper cables. The circuit connections are below.

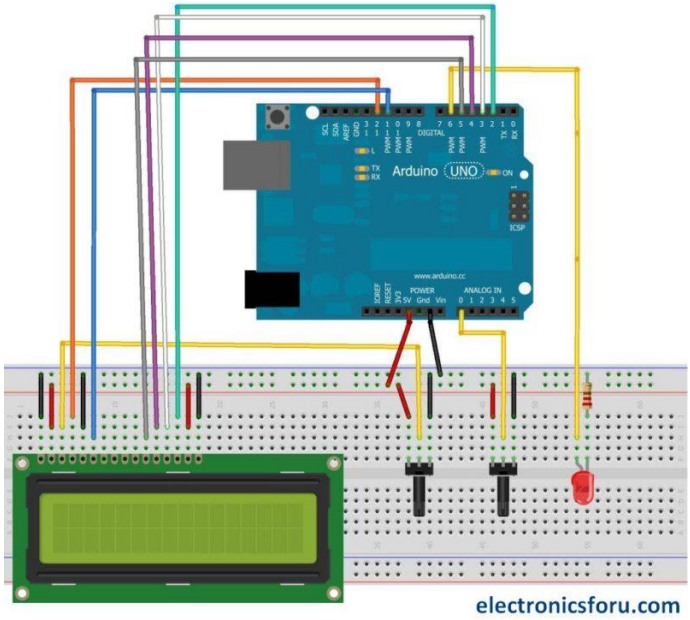
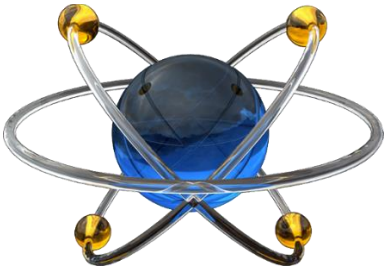


**Fig 4.5**

# PROTEUS



The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.

**Proteus Design Suite** (designed by **Labcenter Electronics Ltd.**) is a software tool set, mainly used for creating schematics, simulating Electronics & Embedded Circuits and designing PCB Layouts.

## Why we use Proteus?

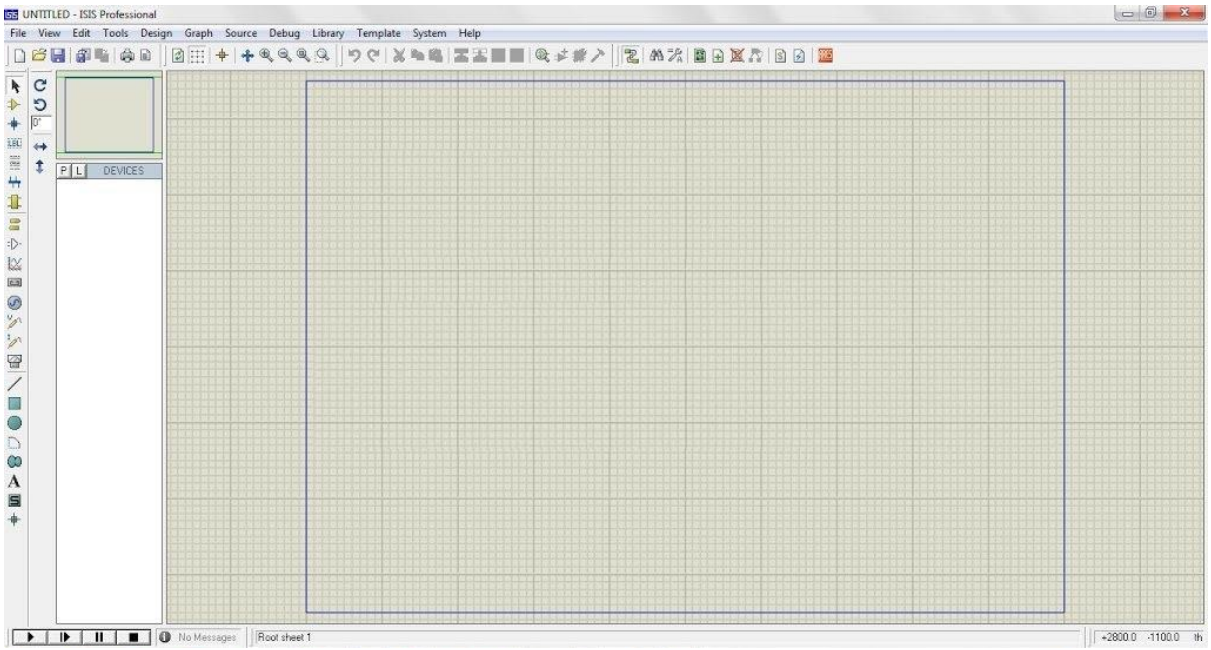



**Fig 5.1**

In Embedded projects, we need to design a programming code for Microcontrollers and for designing such codes you have to perform a lot of testing, which involves uploading code to Microcontroller. So, in such projects, Proteus is a great relief. Let's say, you have to print some strings on 20x4 LCD, then its quite annoying to burn the Microcontroller several times for typographical errors. Instead, design a circuit in Proteus and test your code in the simulation and once you are sure that you are getting perfect output then burn your PIC Microcontroller and test it on real hardware. Quite easy and handy. In the coming classes, I will show you how to burn code in Microcontrollers in Proteus.

**PRODUCT MODULE** :

- Schematic Capture
- Microcontroller Simulation
- PCB Design
- 3D Verification

## Schematic Capture:

Schematic capture in the Proteus Design Suite is used for both the simulation of designs and as the design phase of a PCB layout project. It is therefore a core component and is included with all product configurations.

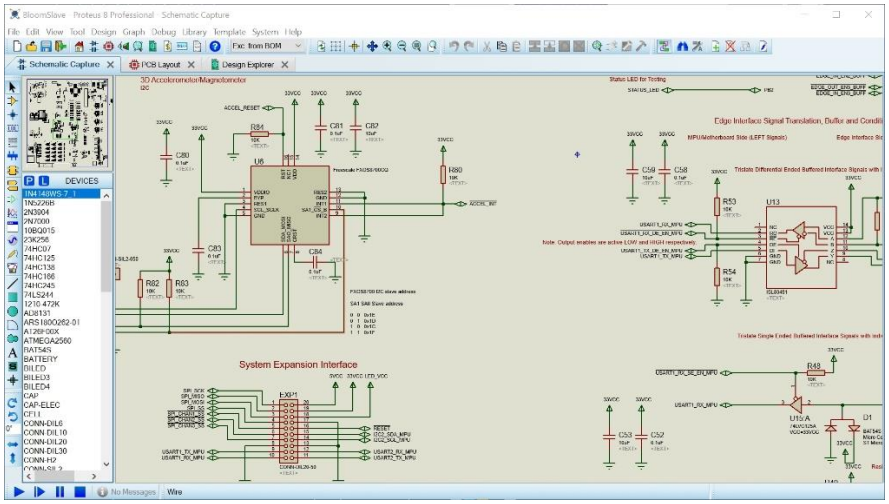



**Fig 5.2**

## Microcontroller Simulation:

The micro-controller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic. It is then co-simulated along with any analog and digital electronics connected to it. This enables its use in a broad spectrum of project prototyping in areas such as motor control, temperature control and user interface design.

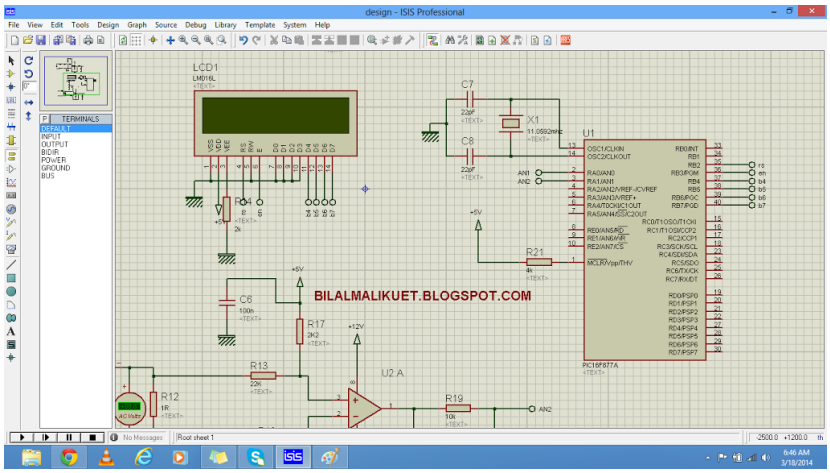



**Fig 5.3**

## PCB Design:

The PCB Layout module is automatically given connectivity information in the form of a netlist from the schematic capture module. It applies this information, together with the user specified design rules and various design automation tools, to assist with error free board design. PCB's of up to 16 copper layers can be produced with design size limited by product configuration.

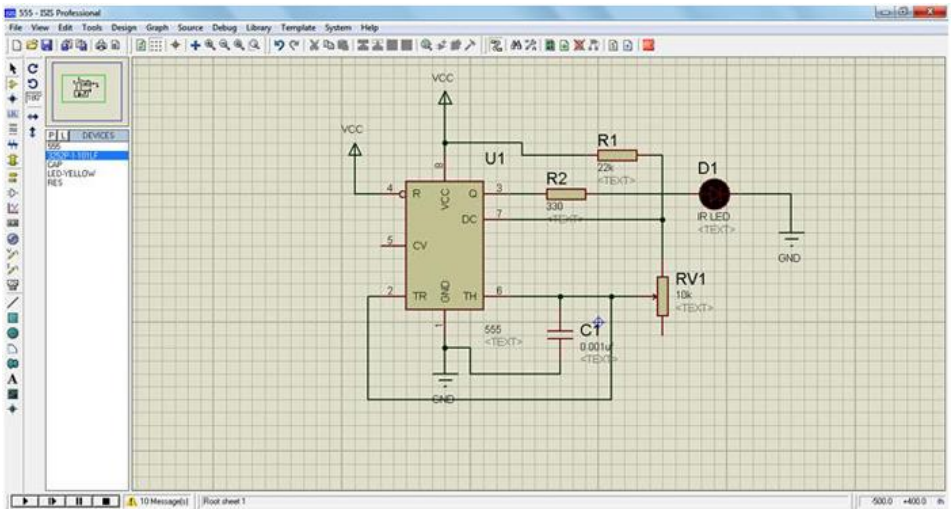



**Fig 5.4**

### 3D Verification

The 3D Viewer module allows the board under development to be viewed in 3D together with a semi-transparent height plane that represents the boards enclosure. STEP output can then be used to transfer to mechanical CAD software such as Solidworks or Autodesk for accurate mounting and positioning of the board.

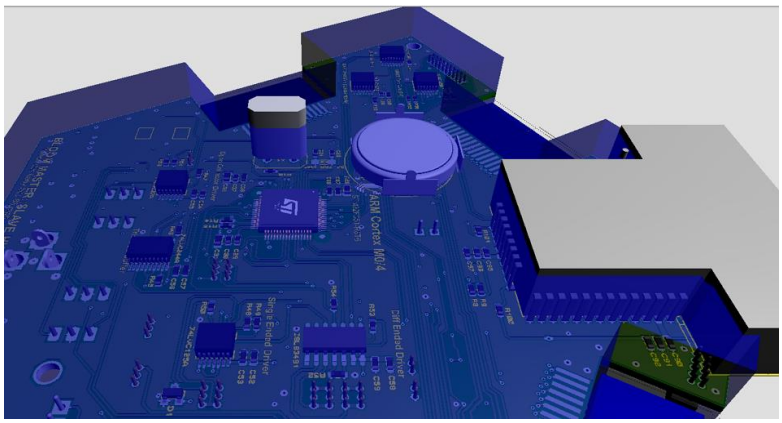


**Fig 5.5**

## BLOCK DIAGRAM

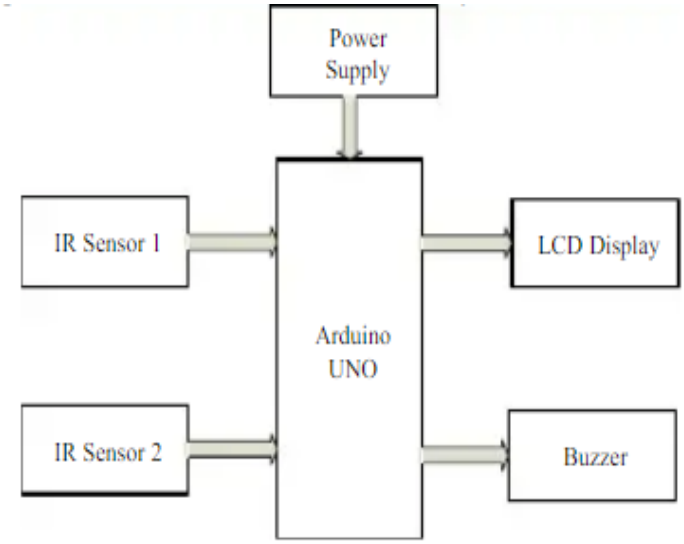



**Fig 6.1**

# CIRCUIT DIAGRAM

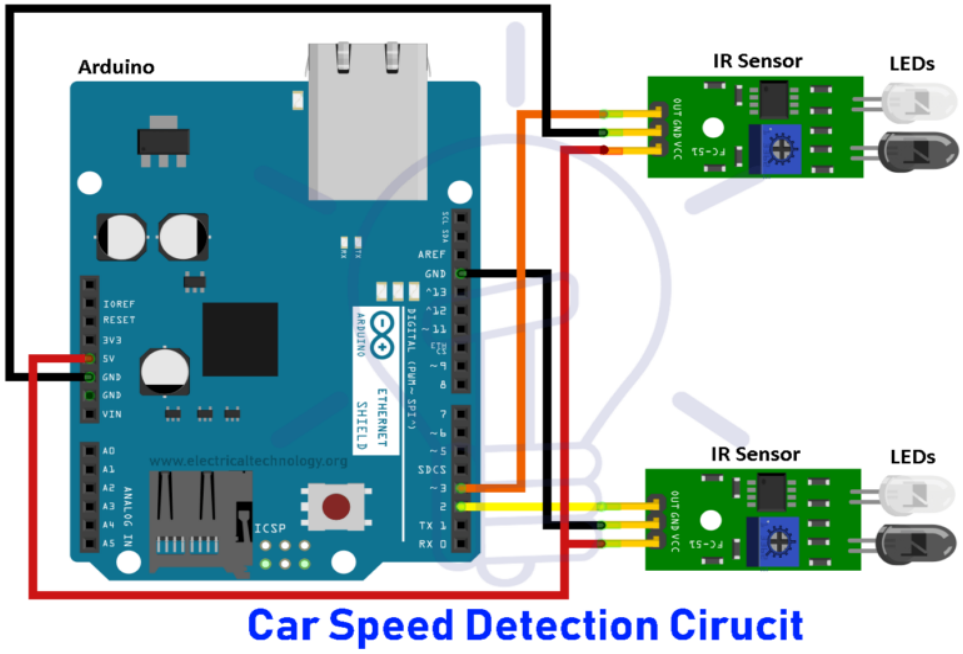



**Fig 7.1**

Circuit diagram contain Arduino along with 2 IR sensor and jumper wires for the connection.

## SIMULATION CIRCUIT

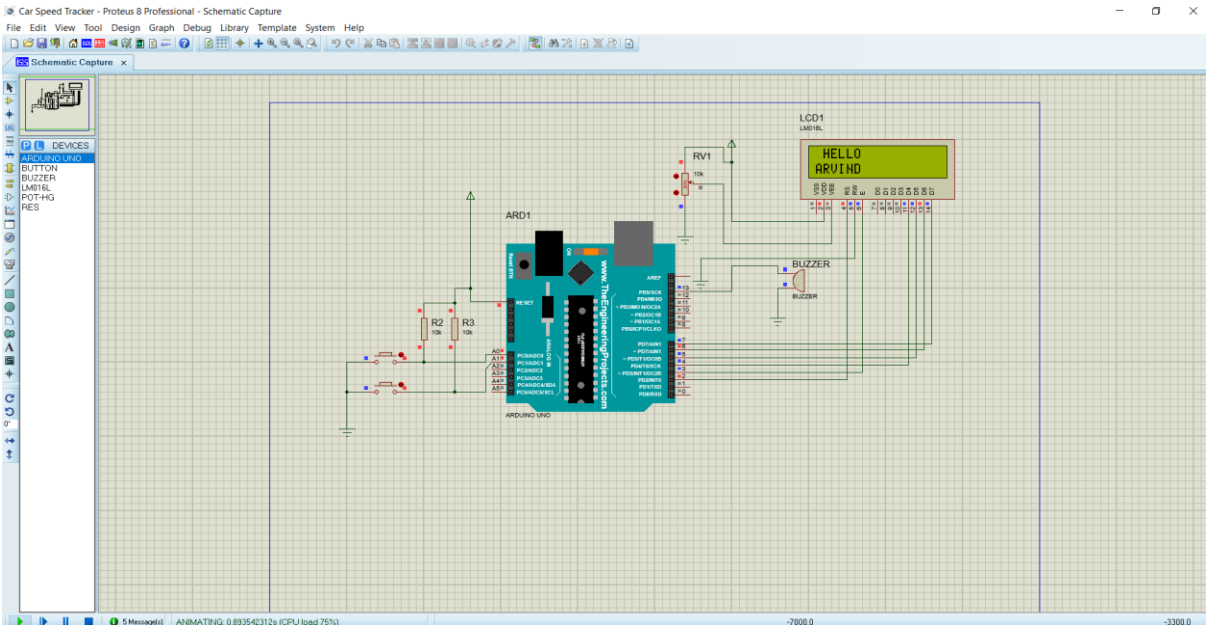



**Fig 8.1**

## Source Code

```
#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 = 5.0;

float speed;
```

```
int ir_s1 = A0;
int ir_s2 = A1;
int buzzer = 13;
void setup(){
  pinMode(ir_s1, INPUT);
  pinMode(ir_s2, INPUT);
  pinMode(buzzer, OUTPUT);

  lcd.begin(16,2);
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print(“HELLO ");
  lcd.setCursor(0,1);
  lcd.print("ARVIND");
  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;     //convert millisecond to second
 speed=(distance/Time); //v=d/t
 speed=speed*3600;   //multiply by seconds per hr
 speed=speed/1000; //division by meters per Km
}
if(speed==0){
lcd.setCursor(0, 1);
if(flag1==0 && flag2==0){
lcd.print("No car  detected");
}
 else
{
lcd.print("waiting to reach other end");}
}
else
{
   lcd.clear();
   lcd.setCursor(0, 0);
```

```
    lcd.print("Speed:");
    lcd.print(speed,1);
    lcd.print("Km/Hr  ");
    lcd.setCursor(0, 1);

 if(speed > 15)
{
lcd.print("  Over Speeding  "); digitalWrite(buzzer, HIGH);
}
else
{
lcd.print("  Normal Speed   ");
}
    delay(3000);
    digitalWrite(buzzer, LOW);
    speed = 0;
    flag1 = 0;
    flag2 = 0;
 }
}
```

# OUTPUT

Here the LCD will be ON and print weither the vehicle is detected or not . If detected then will show the speed of the vehicle. If the speed is less than 15km/Hr then print “Normal Speed “ , if speed is greater than 15km/Hr then will print “Over speeding” .

# ADVANTAGE

1 . The circuit is also running on +5V which is easier to generate.

2. They reduce the risk of accidents.

3. It is easy to implement.

4. It reduces the man-effort.

# DISADVANTAGE

1. Sometimes the circuit got failure and causes various problems.
2. Infrared detectors are extremely expensive, which limits their use in many sectors

# SCOPE

**1. Road safety:** The timely checking of the over speeding vehicle will reduce high percentage of road accidents.

**2. Automation in law enforcement:** The system being completely automatic, reduces the number of traffic police officers needed to deploy in the real field for checking speeding vehicles.

With very few enhancements in the proposed system new features can be easily incorporated such as:

• **Vehicle security**: The lost out cases of the vehicle are increasing day by day, the stolen vehicle can be easily detected by comparing with the registered entry of stolen vehicles.

• **Parking:** The vehicles can be easily registered using automatic system with this

system in the parking lounge or similar purpose complexes.

• **Visitor management:** This system can be effectively used to assist visitor management systems in recognizing guest vehicles.

# LITERATURE REVIEW

Many projects addressing similar problems have been done in international level. One such approach has been discussed in the research paper by Leo Cetinski and David Dawson. Use of speed gun for speed detection and LPR software for vehicle recognition has been explained in the paper. A number of different approaches have been used by many researchers to detect speed of moving vehicle. One of the most popular ways of speed detection is based on LASER crossing. Two LASER lights placed on the path of a moving vehicle can be used to determine the speed by measuring the time difference between the crossings.

However this approach is now less frequently used for speed detection after the advent of Doppler radar guns. Speed detection using Doppler sensor is based on the principle of Doppler Effect. Commercially available speed guns are based on this approach of speed detection and provide high degree of accuracy.

The history of automatic vehicle number detection dates back to mid 1970s. In 1976, the Police Scientific Development Branch in the UK first invented this system. Systems were working by 1979, and contracts were let to produce industrial systems, first at EMI Electronics, and then at Computer Recognition Systems (CRS) in Wokingham, UK. Early trial systems were deployed on the A1 road and at the Dartford Tunnel. However it did not become widely used until new developments in cheaper and easier to use software was pioneered during the 1990s.

The issue of Number Plate Detection is still not solved completely because the accuracy in Number Plate digitization achieved so far is not satisfiable. Different approaches for LPR have been developed but the research still continues for the best result. Initial approaches were based on boundary line properties. Gradient filters were used to enrich boundary lines. Algorithm such as Hough transform was then used to detect boundary lines.two sets of lines parallel to each other were then considered as boundary of the plate.

# CONCLUSION

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 base on distance between the sensor and speed which can be easily changed and modified using microcontroller. In this Project, the speed limit is specified with 15 km/hr. 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 delay due to the far distance which is installed from one to other. If more accuracy of the speed and time is required, more number of sensors has to be used. The overspeed detection system can be further advanced by using GSM module and CCTV camera in the circuit. If any vehicle has crossed the maximum limited speed then this camera will be triggered to take a picture of the vehicle. Employing the over speed detection system offer not only several advantages for traffic but also safety to road users