TECHNOLOGICAL UNIVERSITY (MEIKTILA)
DEPARTMENT OF ELECTRONIC ENGINEERING

DESIGN AND IMPLEMENTATION OF CAR SPEED DETECTOR SYSTEM

BY
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GRADUATION THESIS

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A THESIS
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We certify that we have examined, and recommend to the University Steering Committee for acceptance of the graduation thesis entitled: **"DESIGN AND IMPLEMENTATION OF CAR SPEED DETECTOR SYSTEM"** submitted by **Maung Kyaw Thet Soe, Roll No. VI.EC-25 (December, 2017)** to the Department of Electronic Engineering in partial fulfilment of the requirements for the Degree of Bachelor of Engineering (Electronics).

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ABSTRACT

This thesis presents a device to detect the vehicle's speed and recording the image. The major cause to road accident is mostly caused by human speed. The speed of a moving vehicle is determined by using calculation from particular distance and time as an approach to estimate the vehicle speed. This system is designed to reduce the road accidents in development of the vehicle speed detector system by using IR sensor, Camera, 16x2 LCD, buzzer, LED and Arduino UNO. Police stations handle this system for reduction the vehicle's accidents conditions. In this system, two IR LED's transmitter and receiver sensor pairs, which are installed on the highway 27 cm apart, with the transmitter and the receiver of each pair on same side of the road. The system displays the time taken by the vehicle in crossing the distance from one pair to the other from which the speed of the vehicle is calculated. If vehicle exceeds the speed limit then LED is ON while the buzzing sound gives indication to the police stations. Camera is used for recording the vehicle's images and LCD is used for display the vehicle's speed. Arduino UNO is the heart of the system, which control all the function of the circuit.

APPENDIX

APPENDIX

PROGRAM CODE FOR CAR SPEED DETECTOR SYSTEM

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(4, 5, 6, 7, 8, 9);
float distance=27;
int first_sensor_time;
int second_sensor_time;
float second1, second2;
double speedd;
int difference;
boolean check=true;
#define buzzer 10
#define light 11
void setup() {
lcd.begin(16,2);
lcd.clear();
lcd.print("SPEED MEASURMENT");
pinMode(2, INPUT);
pinMode(3, INPUT);
pinMode(10, OUTPUT);
pinMode(11, light);
}
void loop() {
if(digitalRead(2)==0)
 {
first_sensor_time=millis();
}
 if(digitalRead(3)==0)
 {
```

```
second_sensor_time=millis();
}
if(first_sensor_time!=0 && second_sensor_time!=0)
 {
  if(first_sensor_time>second_sensor_time)
  {
    difference=first_sensor_time-second_sensor_time;
     speedd=(distance*1000)/difference;
     speedd=speedd*0.036;
  }
  else if(second_sensor_time>first_sensor_time)
  {
    difference=second_sensor_time-first_sensor_time;
   speedd=(distance*1000)/difference;
    speedd=speedd*0.036;
  }
   lcd.setCursor(2, 1);
    lcd.print(speedd);
    lcd.print(" km/h");
    delay(2000);
   first_sensor_time=0;
   second_sensor_time=0;
   if(speedd>8)
    {
   digitalWrite(buzzer, HIGH);
   digitalWrite(light, HIGH);
   delay(3000);
   digitalWrite(buzzer, LOW);
   digitalWrite(light, LOW);
 }
 else
 {
  digitalWrite(buzzer, LOW);
```

```
 digitalWrite(light, LOW);
}
}
else
{
   lcd.setCursor(0, 1);
   lcd.print(".......OK.......");
}
}
```

CHAPTER 1
INTRODUCTION

1.1. Introduction to Arduino Based Car Speed Detector

Speeding has been implicated as a major contributing factor in all fatal motor vehicle crashes. Car speed detection systems have been implemented worldwide. Current car speed detection system are handheld guns held by polices stations. The system involves IR sensors which are used to check for speeding of vehicles by placing it in the direction of moving vehicle. Road accidents occurrences have increased recently so there needs to be a system that allows detecting over speeding cars. The number of people killed and injured on our roads unacceptably high. The main reason is speed of vehicle.

Nowadays, people are driving very fast; accidents are occurring frequently, they lost their valuable life by making small mistake while driving (school zone, hills area, and highways). So, this system is used to avoid such kind of accidents and alert the drivers and to control their vehicle speed. If driving on highways, motorists are not exceeding the maximum speed limit permitted for their vehicle. The system basically comprises two IR LED's transmitter and receiver sensor pairs, which are installed on the highway 27 cm apart, with the transmitter and the receiver of each pair on same side of the road. The system displays the time taken by the vehicle in crossing the distance from one pair to the other from which the speed of the vehicle is calculated. Arduino UNO is the heart of the system, which control all the function of the circuit. It measures the speed and control the circuit through a programming. IR is used as a pair of eye that keeps watching the speed of each vehicle crossing the sensors. The 16x2 LCD display is used to display the total speed of the vehicle.

1.2. Block Diagram of Arduino Based Car Speed Detector

In the block diagram, this thesis is divided into two parts: speed detection and image recording. In this thesis, IR sensors, 16x2 LCD, camera, Arduino UNO are used. The purpose system checks rash driving by calculation the speed of the vehicles between the two set points placed on the road at a certain distance. Two IR sensors are placed apart on one side of road.

Both IR sensors are connected to the interrupt pin of Arduino and they detect the falling wave. If car moves in front of the first sensor, it gives the output signal to Arduino. Arduino detects the falling wave and now internal timer of Arduino is started. Then car moves in front of second sensor, timer is stopped. Vehicle speed is calculated by using simple distance time relationship. LCD is connected to Arduino and measured speed is shown on LCD. If vehicle exceeds the speed limit then LED is ON while the buzzing sound gives indications to the police. Camera is used to record the image and to store the image in the memory card.

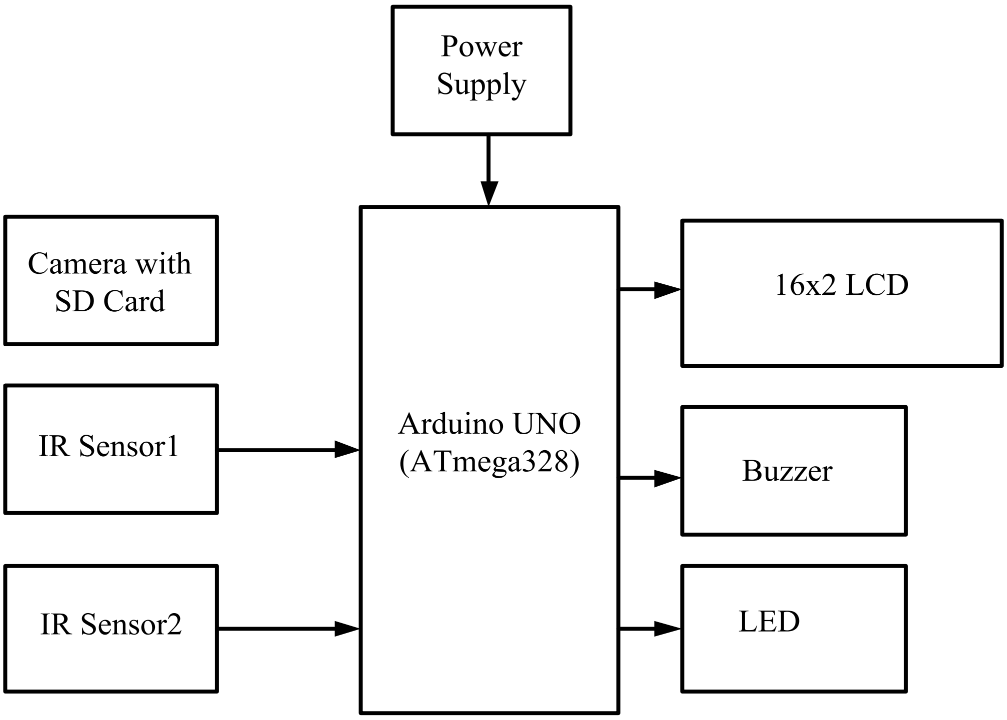

Figure 1.1. Overall Block Diagram of Arduino Based Car Speed Detector

1.3. Aim and Objectives

The main aim and objectives of this thesis are as follow:

- To study the parameters such as IR sensor, 16x2 LCD, resistor, camera, Arduino UNO used in the car speed detector
- To understand the process flow in the car speed detector circuit
- To understand the software implementation of the car speed detector circuit
- To maintain the safety of human life on the road

- To use on the road for the control of speed
- To avoid accident of vehicles at speed limit zones and rash driving of the drivers

1.4. Scope of Thesis

The goal of this thesis is to design and implement car speed detection and image recording system by using Arduino. The system is giving the output of information such as vehicle speed from IR sensor and images from camera. The system is the study of speed detection and image record system based on two IR sensors and camera. It is used on the highway for police stations.

1.5. Implementation Programs

The program to be implemented for achieving the target is as follows:

- Finding all possible and necessary data for car speed detector system
- Studying the usage and applications of the IR sensor
- Observing there technique and operation of car speed detector system
- Studying and writing C program language for the proposed system
- Designing and constructing of car speed detector

1.6. Outline of Thesis

Chapter one discusses the introduction of the thesis, block diagram, aim and objectives, scope of the thesis, implementation programs and outline of the thesis. Chapter two focuses on literature review of the car speed detector system. Mainly components of the car speed detector system are explained in chapter three. In chapter four, circuit operation and software implementation of car speed detector system are described. In chapter five, test and results of the car speed detector system are presented. And in chapter six, discussions and conclusion are mentioned.

CHAPTER 2
LITERATURE REVIEW OF THE CAR SPEED DETECTOR SYSTEM

2.1. Previous Work on Car Speed Detector System

This chapter discussed the literature review of the previous research technologies and techniques that have been employed for the design and implementation of car speed detector system. There are various methods of vehicle vibration alert based on their type and application. This chapter is also contained the theory of components, equipment and the programming language.

2.2. Detection of Over Speeding Vehicles on Highways

This thesis presents a device to detect rash driving on highways and to alert the traffic authorities in case of any violation. The entire implementation requires an IR transmitter, an IR receiver, a control circuit and a buzzer. The speed limit is set by the police use the system depending upon the traffic at the very location. The time taken by the vehicle to travel from one set point to the other is calculated by control circuit and displays that on seven segment displays. Moreover, if the vehicle crosses the speed limit, a buzzer sounds alerting the police.

The advantage of proposed over speed driving warning system is that it can handy for the highway traffic police as it is not only provide a digital display in accordance with a vehicle's speed but also sound an alarm if the vehicle exceeds the permissible speed for the highway. The proposed system is check on rash driving by calculating the speed of a vehicle using the time taken to travel between the two set points at a fixed distance. A set point consists of a pair of sensors comprising of an IR transmitter and an IR receiver, each of which are installed on either sides of the road. The speed limit is set by the police use the system depending upon the traffic at the very location. The time taken by the vehicle to travel from one set point to the other is calculated by control circuit. Based on that time, it then calculates the speed and displays that on seven segment displays. Moreover if the vehicle crosses the speed limit, a buzzer sounds alerting the police. This concept is extended in future by integrating a camera with the system which could capture the image of the number plate of the vehicle to sends that to the traffic authorities. In this section, a highway speed checker circuit has been designed to detect the rash driving using different electronic components such as timer, counter, logic gates, seven segment display and all other components. Figure 2.1 shows the typical block diagram of speed checker to detect rash driving on highways using a timer which consists of sensor module, logical module, power supply, sound detector and display module.

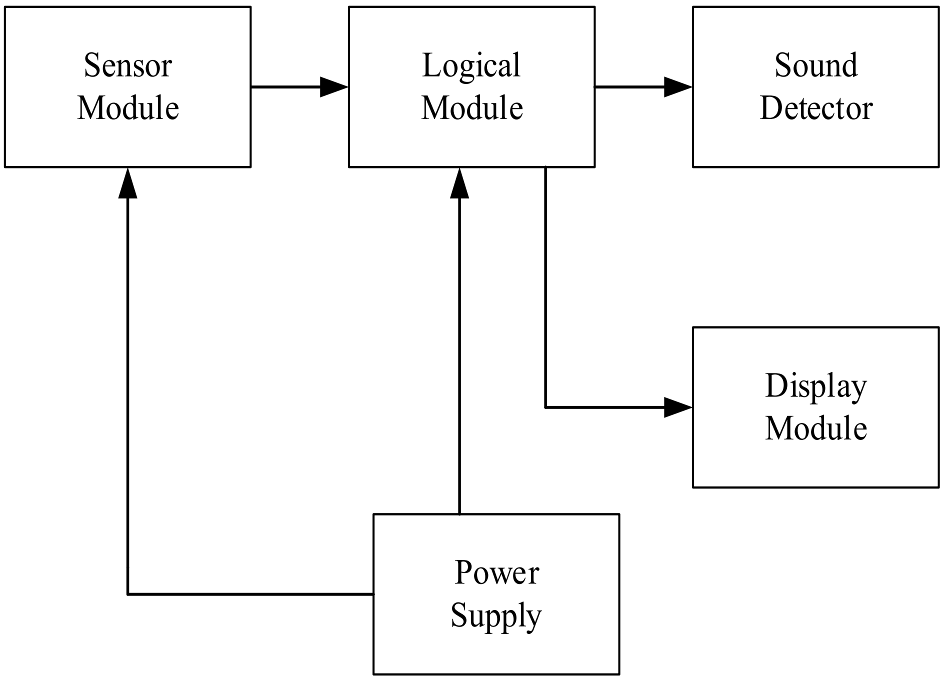

Figure 2.1. Block Diagram of Vehicle Speed Detector using Timer

In this thesis, Two IR diode transmitters (such as IR diode torches) have been installed on the other side of the highway exactly opposite to the photo diodes such that IR diode light falls directly on the photo diodes. Reset the circuit by pressing RESET switch, so the display shows ‘0000’. Using switch S1, select the speed limit (say, 60 km/h) for the highway. Vehicle crosses the first IR diode light, photo diode1 will trigger IC1. The output of IC1 goes high for the time set to cross 100 meters with the selected speed (60 km/h) and LED1 glows during for period. Vehicle crosses the second IR Diode light, the output of IC2 goes high and LED2 glows for this period. Piezo-buzzer sounds an alarm if the vehicle crosses the distance between the IR diode set-ups at more than the selected speed (lesser period than preset-period). The counter starts counting when the first IR diode beam is intercepted and stops when the second IR diode beam is intercepted. The time taken by the vehicle to cross both the IR diode beams is displayed on the 7-segment display. For 60 km/h speed setting, with timer frequency set at 100 Hz, if the display count is less than ‘600’ it means that the vehicle has crossed the speed limit (and simultaneously the buzzer sounds). The installation of lasers and LDRs is shown in Figure 2.2 below. The system displays the time taken by the vehicle in crossing this 100 m distance from one pair to the other with a resolution of 0.01 second from which is calculated the speed of the vehicle from as follows:

Speed (km/h) = Distance/ Time Equation (2.1)

= 0.1 km/ (Reading x 0.01) x3600

or, Reading (on display) = 36000/ Speed.

As per the above equation for a speed of 40 km/h the display read 900 (or 9 second), and for a speed 60 km/h the display read 600 (or 6 seconds).

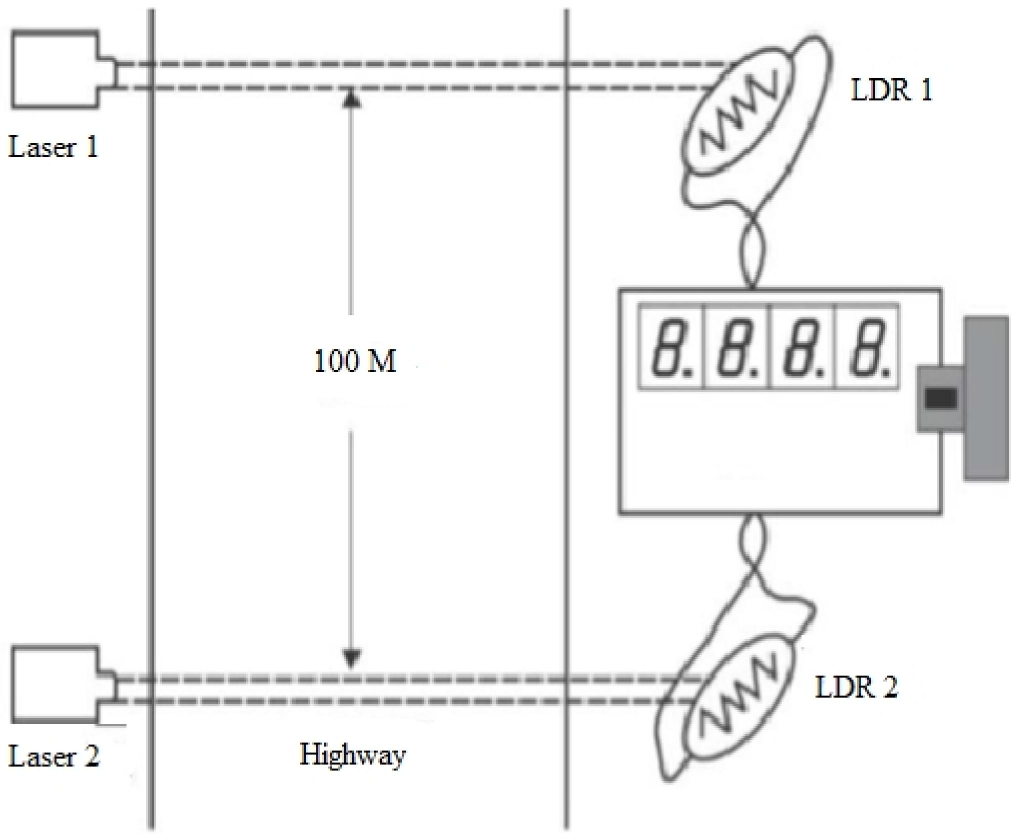

Figure 2.2. Installation of Lasers and LDRs

This proposed system proved that low power consumption, low project cost, flexibility and high reliability. Table 2.1 shows result analysis of over speeding vehicles on highways [15Mon].

Table 2.1. Depicting Final Results of Over Speeding Detection on National Highway

Vehicle	Speed 1 40 Km/h	Speed 2 60 Km/h	T 1 (s)	T 2 (s)	Buzzer Sound
Car	---	70	---	5.14	Yes
Bus	35	---	10.3	---	No
Van	---	54	---	6.67	No
Truck	77	---	4.68	---	Yes
SUV	---	90	---	4.00	Yes
Tempo	40	---	9.00	---	Yes

2.3. Speed Warning System Using Solar Power

This thesis presented to design, develop and monitoring vehicle's speed with solar power. The major cause to road accident is mostly caused by human speed. Police authorities have enforced the speed limits of the vehicle to control the road accidents. This system is designed to reduce the road accidents in development of speed warning system by using solar power energy. Solar is used to provide the energy to the system in terms of optimizing the operational cost and reducing the energy wastage. It requires a battery to store energy that automatically recharged from solar panel. Three light indicators which are green, yellow and red based on the speed level of vehicles are used in this system. The indicator shows the condition of the speed warning system, whether in slow, fast and very fast conditions.

This system uses two ultrasonic sensors for speed measurement which requires Arduino Mega to process the data measured by ultrasonic sensor. The LCD is used to display the speed measurement measured by sensors. This sensor determines the speed measurement due to the major factors of road accident so that people are able to recognize their speed along a highway depending on the light indicator. This system is functioned as warning system to alert the people about their speed in the highway. In the development of this thesis, 12 V solar panel is used to supply the system in terms of saving environment and energy wastage. Electricity is produced from the light intensity of the sun through the solar panel. It contributes to the decrease of harmful greenhouse gas emission. The hardware development of solar powered speed warning system is shown in Figure 2.3. The purpose of this system is to focus in development of speed warning system by using solar power energy.

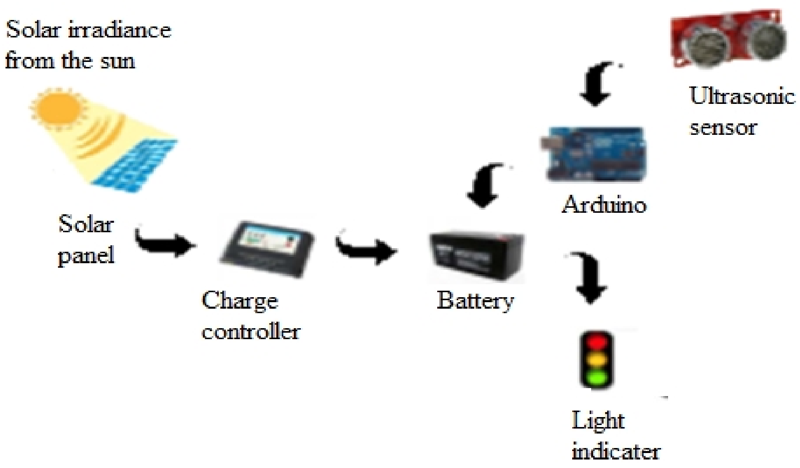

Figure 2.3. Hardware Development of Solar Powered Speed Warning System

Figure 2.4 shows the component arrangement on the roadside. This thesis is designed to be used in green energy environment. The sensor is located 4 m from the light indicator to alert user about their vehicle speed. Then, light indicator is turned ON based on the speed of the vehicle. This system requires two ultrasonic sensors to measure the speed based on equation of distance over time.

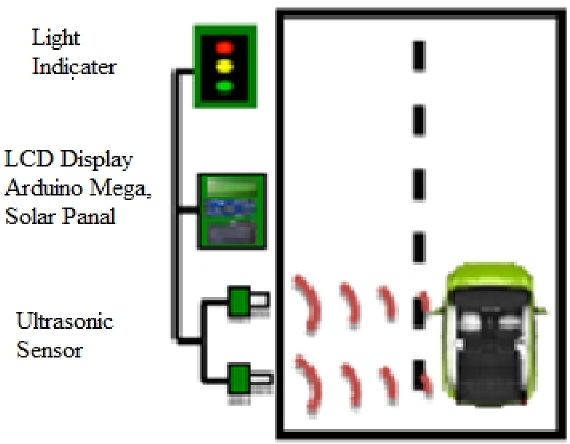

Figure 2.4.The Illustration of the Component Arrangement

To develop and design of speed warning system using various sensors to reduce the human intervention in the processes. This system used a solar panel, battery, charge controller, ultrasonic sensor and light indicators. Figure 2.5 described connection of the component for solar powered speed warning system.

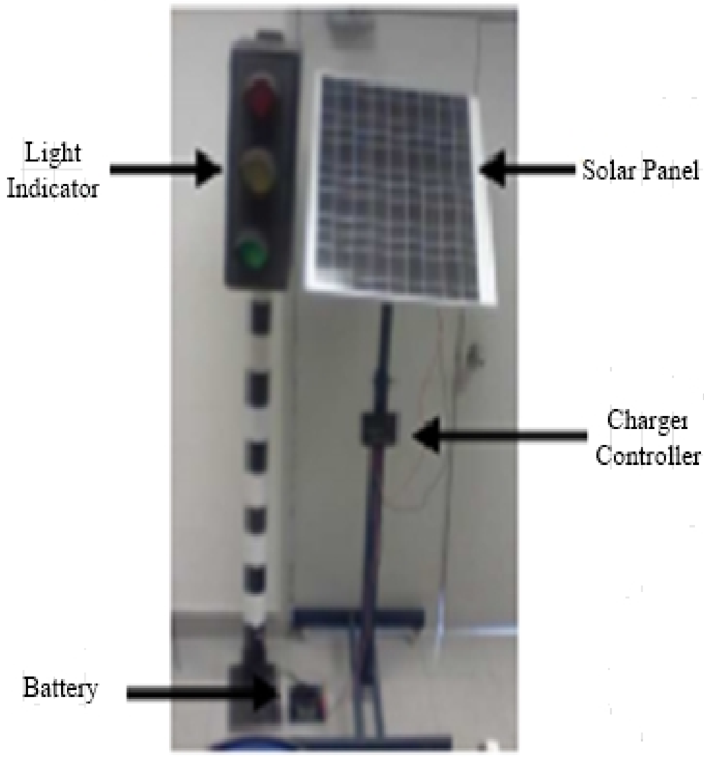

Figure 2.5. Connection of the Component for Solar Powered Speed Warning System

In this system, the testing performance is conducted to determine the effective speed used by the available instrument sensor. Particularly, there are three conditions regarding on the measuring speed. Table 2.2 depicts testing performance condition for the status of light indicator, the time taken and condition based on the speed detected by the system. The first condition is when the status of light indicator shows green indicator to represent the ‘slowest’ condition. The time taken is above 0.072 s, then, the speed captured is below 50 km/h. Next, the time taken to detect the speed is between 0.072 s and 0.036 s, whereby the speed limit detected is between 50 km/h and 100 km/h represent ‘fast’ condition. Thus, the status of the light indicator displays the yellow indicator. For last conditions, the light indicator appears in red indicator when the speed limit is above 100 km/h. Then, the time taken to detect the speed is 0.036 indicates ‘very fast’ conditions. The range of speed is programmed by using the Arduino Mega compiler depending on location such as highway, school and urban area. The capability to detect the speed is proven if the speed is fulfilled in this condition.

Table 2.2. Testing Performance Condition

Speed (Km/h)	Time	Status light indicator	Condition
100km/h And above	0.036 and below	Red	Very fast
Between 50km/h and 100km/h	Between 0.072s and 0.036s	Yellow	Fast
50km/h and below	0.072s and above	Green	Slow

This system is used to help the police stations for speed control. The main purpose of Arduino in this system is used to control the whole system. The performance, flexibility and reliability are based on the investment. The entire system has shown more reliable, time saving and user friendly [15Sha].

2.4. RFID Based Intelligent Vehicle Speed Controller Using Active Traffic Signal

This system proposed for reduction of the number of accidents and mitigation of their consequences is a big concern for traffic authorities, the automotive industry and transport research groups. These systems are somewhat available in commercial vehicles today, and future trends indicate that higher safety is achieved by automatic driving controls and a growing number of sensors both on the road infrastructure and the vehicle itself. In this system, it present a new infrastructure to vehicles 12V communication and control system for intelligent speed control, which is based upon Radio Frequency Identification (RFID) technology for identification of traffic signals on the road, and high accuracy vehicle speed measurement with a hall effect based sensor. A fuzzy logic controller, based on sensor fusion of the information provided by the 12 V infrastructure, allow the efficient adaptation of the speed of the vehicle to the circumstances of the road. The performance of the system is checked empirically, with promising results.

The key idea offered by this system is to use RFID technology to tag the warning signals placed in the dangerous portions of the road. While artificial vision-based recognition of traffic signals might fail if visibility is poor insufficient light, difficult weather conditions or blocking of the line of sight by preceding vehicles, RF signals might still be transmitted reliably. Placement of RFID tags on the road lanes has been proposed in order to provide accurate vehicle localization in tunnels or downtown areas where GPS positioning might be unreliable. RFID tagging of cars is offered as an alternative to traffic data collection by inductive loops placed under the road surface.

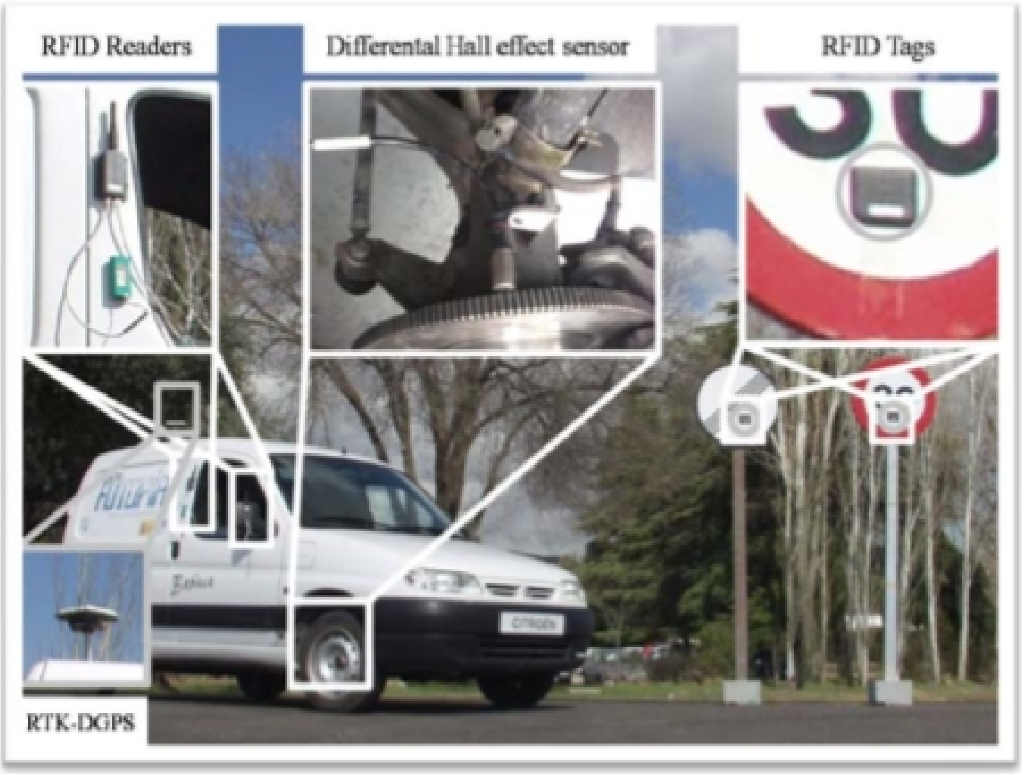

Figure 2.6. Sensors Installed in the Vehicle

In this section, it describe the sensors which have been installed in the vehicle shows in Figure 2.6 and the infrastructure in order to achieve intelligent speed control. The sensors subsystems are: an RFID based system for traffic signal detection tags and the placement of the detector readers in the vehicle, a differential hall effect sensor placed in the vehicle's wheels for high accuracy speed measurement and a

Differential Global Positioning System (DGPS) to locate the vehicle and to set the sampling frequency of our control loop. The physical arrangement of these sensors in the vehicle and the infrastructure is shown in Figure 2.6. An RFID system consists in a set of emitters or tags which, periodically or upon interrogation, transmit a short digital radiofrequency message containing an identification code (unique to each tag) as well as some data stored in the tag's memory. These data is obtained remotely by a computer equipped with an RFID reader. Besides the tag ID, which confirms the presence of the tag within the detecting range of the reader, the RFID reader measures the received signal strength of the RF signal, which is an indicator of the range from tag to reader. The main advantage of RFID systems with respect to other RF technologies, which is used for infrastructure to vehicle 12 V communications is its low cost and minimum infrastructure maintenance, which results in a high scalability and easy deployment of the infrastructure. The kind of active RFID tags used in this research are cheap , is easily attached to the traffic signals.

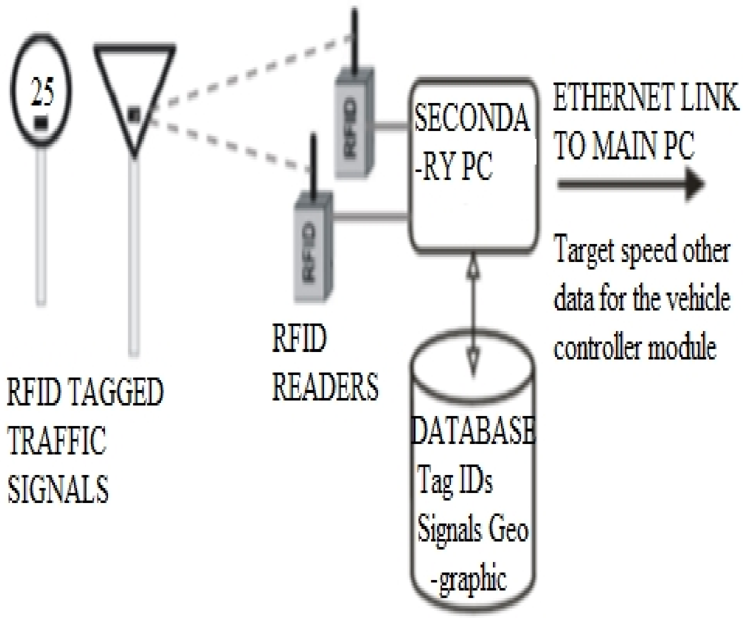

Figure 2.7. Working Principle of the RFID Subsystem

The working principle of the RFID subsystem onboard the vehicle is shown in Figure 2.7. Ordinary traffic signals equipped with RFID tags transmit their identification code and are detected by the RFID readers onboard the vehicle. The information is transmitted to the Personal Computer (PC), which determines the correspondence between tag IDs to traffic signals in a database which is also contain geographic information about the area where the signals are situated. This secondary PC communicates the new target speed as well as other relevant data for the control of the vehicle to the main PC through an Ethernet connection.

The proposed architecture for cruise control is shown in Figure 2.8 and comprises two parts: placement of RFID sensors (tags) in the road's traffic signals, and the on-board systems in the vehicle, which describe in this section.

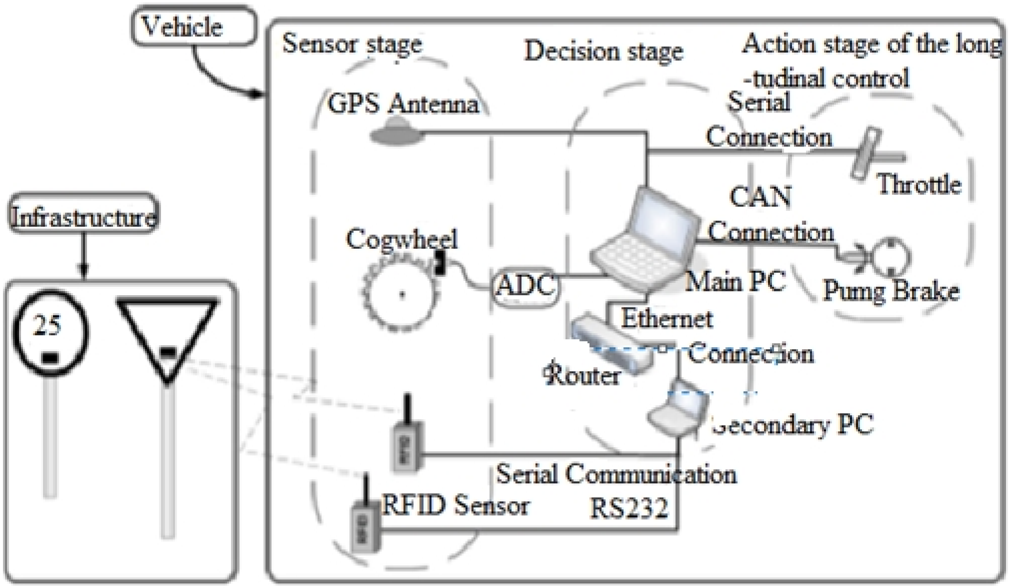

Figure 2.8. Control Scheme Onboard the Vehicle and its Interaction with the Infrastructure

This system presents an architecture for automatic adaptation of the longitudinal speed control of a vehicle to the circumstances of the road which is help to decrease one of the major causes of fatalities: the excessive or inadequate vehicle speed. It approach is based on a combination of three different sensor technologies: RFID tagging of traffic signals to convey their information to the car, hall effect sensors located in the vehicle's wheels for high accuracy measurement of the speed of the car, and Differential Global Positioning Systems (DGPS) for precise positioning of the vehicle and control loop time. Sensor fusion is applied to the information received by these subsystems, and used to adjust the longitudinal speed of the vehicle with a fuzzy controller [10Jos].

CHAPTER 3
COMPONENTS OF THE CAR SPEED DETECTOR SYSTEM

3.1. Required Components

The required components of the proposed system are:

- Arduino UNO
- IR Sensor
- Camera with SD card
- 16x2 LCD
- Buzzer
- LED

3.2. Introduction to Arduino

Arduino is an open source platform used for building electronics. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or Integrated Development Environment (IDE) that runs on computer, used to write and upload computer code to the physical board. The Arduino board also consists of on board voltage regulator and crystal oscillator. They also consist of two serial adaptors using which the Arduino board can be programmed using USB connection. The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino is not need a separate piece of hardware (called a programmer) in order to load new code onto the board can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++ programming, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the microcontroller into a more accessible package.

Arduino boards are generally based on microcontrollers from Atmel Corporation like 8, 16 or 32 bit AVR architecture based on the microcontroller. Microcontrollers are small computing purpose. A microcontroller consists of the microchips on a circuit board with Read and Write capabilities, memory, inputs and outputs. The Arduino hardware and software was designed for artists, designers, hobbyists, hackers, newbies and anyone interested in creating interactive objects or environments. Arduino can drive motors, LEDs, buttons, speakers, GPS units, GSM units, camera, LCDs and other components. It's been used to make robots, home automation gadgets, automotive system, for sensing and controlling lights, motors locks and other thesis. There are many types of Arduino boards available in the markets but all the boards have one thing in common; they is programmed using the Arduino IDE. The reasons for different types of boards are different power supply requirements, connectivity options, their applications, etc. The recommended voltage for most Arduino models is between 6 V and 12 V.

3.2.1. Types of Arduino Boards

There are many types of Arduino boards available in the market but all the boards have one thing in common: they is programmed using the Arduino IDE. They come in different shapes and sizes, with different processing power, digital IO and other capabilities. There are many types of Arduino available to use for thesis, such as:

- Arduino UNO
- Arduino DUEMILANOVE
- Arduino ESPLORA
- Arduino NANO
- Arduino PRO
- Arduino ROBOT
- Arduino YUN

Each has its own advantages and disadvantages. According to the thesis, user can choose the appropriate board. For this thesis, the car speed detector system is built with Arduino UNO.

3.2.2. Introduction to Arduino UNO

Arduino UNO is a single board microcontroller meant to make the application more accessible which are interactive objects and its surroundings. Arduino UNO is the basic and inexpensive Arduino board and is the most popular of all Arduino boards with a markets share of over 50 %. The hardware features with an open source hardware board designed around an 8 bit Atmel AVR microcontroller or a 32 bit Atmel ARM. It has 14 digital input and output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and button. The Arduino UNO board is a microcontroller based on ATmega328. This contains all the required support needed for microcontroller. In order to get started, they are simply connected with a USB cable or with an AC to DC adapter or battery. Current models consists a USB interface.

UNO means one in Italian and is named to mark the upcoming reference versions of Arduino, moving forward. The UNO is the latest in a serious of USB Arduino boards and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards. Figure 3.1 shows Arduino UNO board.

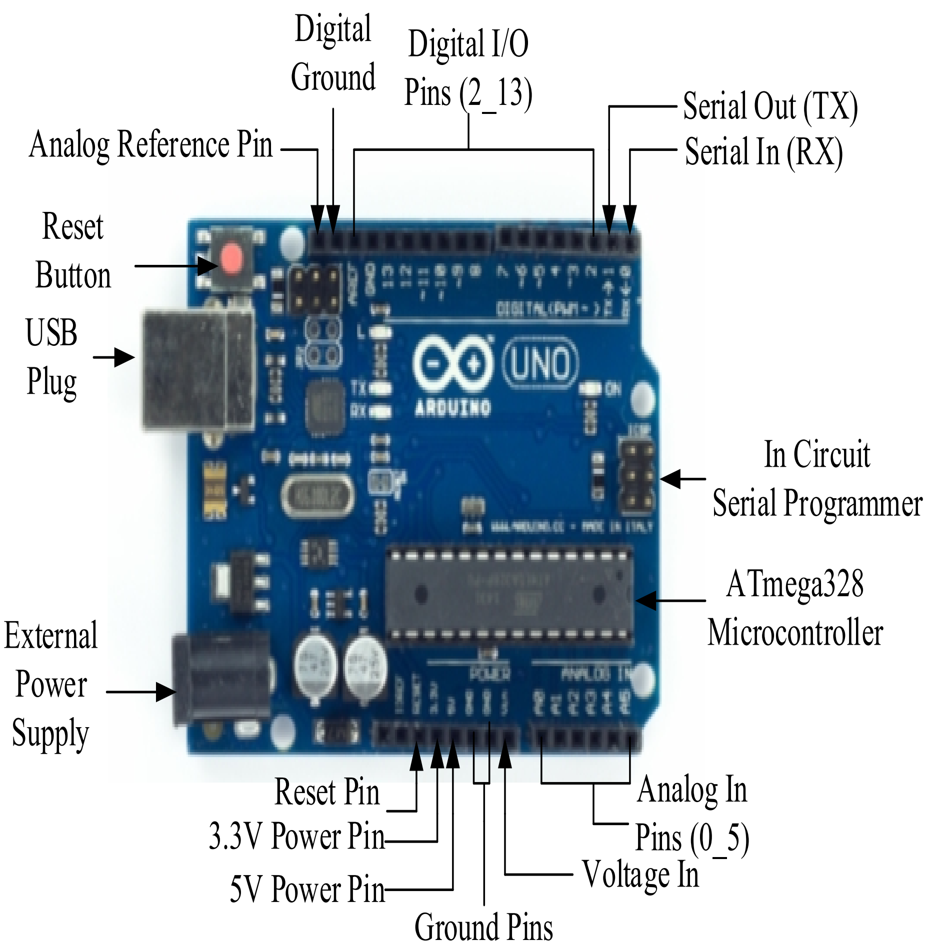

Figure 3.1. Arduino UNO Board

Table 3.1. Pin Specifications of Arduino UNO

Pin category	Pin Name	Details
Power	Vin, 3.3 V, 5V, GND	Vin: Input voltage to Arduino when using an external power source. 5V: Regulated power supply used to power microcontroller and other components of the board. 3.3 V: 3.3 V supply generated by on board voltage regulator. Maximum current draw is 50mA. GND: Ground pins.
Reset	Reset	Resets the microcontroller.
Analog pins	A0-A5	Used to provide analog input in the range of 0-5V
Input/ output pins	Digital Pins 0-13	Can be used as input or output pins.
Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8 bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MOSI) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

3.2.2.1. Features of Arduino UNO board

- Microcontroller: ATmega328
- Operating Voltage: 5 V
- Input Voltage (recommended): 7 V to 12 V
- Input Voltage (limits): 6 V to 20 V
- 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 3.3 V Pin: 50 mA
- Flash Memory: 32 kB of which 0.5 kB used by bootloader
- SRAM: 2 kB (ATmega328)
- EEPROM: 1 kB (ATmega328)
- Clock Speed: 16 MHz

3.2.2.2. Power

The Arduino UNO is powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power is come either from an AC to DC adapter (wall wart) or battery. The adapter is connected by plugging a 2.1 mm center positive plug into the board's power jack. Leads from a battery are inserted in the GND and VIN pin headers of the Power connector.

The board is operating on an external supply of 6 V to 20 V. If it is supplied with less than 7 V, however, the 5 V pin is supply less than five volts and the board is unstable. If it is used more than 12 V, the voltage regulator may overheat and damage the board. The recommended range is 7 V to 12 V.

The power pins are as follows:

- VIN: The input voltage to the Arduino board when it's using an external power source (as opposed to 5 V from the USB). It is supply voltage through this pin or if supplying voltage via the power jack, access it through this pin.
- 5 V: the regulated power supply used to power the microcontroller and other components on the board. This is come either from VIN via an on board regulator, or is supplied by USB or another regulated 5 V supply.
- 3V3: A 3.3 V supply generated by the on-board regulator. Maximum current draw is 50 mA.

- GND: Ground pins.

3.2.2.3. Memory

The Atmega328 has 32 kB of flash memory for storing code (of which 0.5 kB is used for the boot loader); it has also 2 kB of SRAM and 1 kB of EEPROM (which is read and written with the EEPROM library).

3.2.2.4. Input and output

Each of the 14 digital pins on the UNO is used as an input or output, using pinMode( ), digitalWrite( ) and digitalRead( ) functions. They operate at 5 V. Each pin is provide or receive a maximum of 40 mA and has an internal pull up resistor (disconnected by default) of 20 kΩ to 50 kΩ. In addition some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX).Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB to TTL Serial chip.
- External interrupts: 2 and 3. These pins are configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach interrupt() function for details.
- PWM: 3, 5, 6, 9, 10, and 11. Provide 8 bit PWM output with analog Write( ) function.
- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, although provided by the underlying hardware, is not currently included in the Ardunio language.
- LED: 13. There is a built in LED connected to digital pin 13. When the pin is HIGH value, the LED is ON, when the pin is LOW, it is OFF.

The UNO has 6 analog inputs, each of which provides 10 bits of resolution (i.e., 1024 different values). By default they measure from ground to 5 V, though it is possible to change the upper end of their range using the Analog Reference (AREF) pin and the analog reference( ) function. Additionally, some pins have specialized functionality:

- I2C: 4 (SDA) and 5 (SCL). Support I2C (TWI) communication using the wire library.

There are a couple of other pins on the board:

- AREF: Reference voltage for the analog inputs. Used with analog reference( ).
- Reset: Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

3.2.2.5. Programming

A program is a set of instructions written in a language understandable by the computer to perform a particular function on the computer. Programming is the implementation of logic to facilitate specified computing operations and functionality. It is the process of taking an algorithm and encoding it into a notation, a programming language, so that it is executed by a computer. Although many programming languages and many different types of computers exeunt, the important first step is the need to have the solution. Without an algorithm there is no program.

A program is a sequence of symbols that specifies a computation. A programming language is a set of rules that specify which sequences of symbols constitute a program, and what computation the program describes. Programming languages allow people to give instructions to a computer with commands that both the computer and the programmer is understand. Different programming languages use different commands and different rules for entering those commands. A programming language is an artificial language designed to communicate instructions to a machine, particularly a computer. Programming languages can be used to create programs that control the behavior of a machine and/or to express algorithms. Any programming language is composed of a set of predefined words that are combined according to predefined rules (syntax) to generate a computer program.

3.2.2.6. Automatic (Software) reset

UNO is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines Data Terminal Ready (DTR) of the ATmega8u2 is connected to the reset line of the ATmega328 via a 100 NANOfarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow us to upload codes by simply pressing the upload button in the Arduino environments. This means that the bootloader have a shorter timeout, as the lowering of DTR is well coordinated with the start of the upload.

This setup has other implications. When the UNO is connected to either a computer running operation system (OS) and Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the UNO. While it is programmed to ignore malformed data (i.e., anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

The UNO contains a trace that is cut to disable the auto reset. The pads on either side of the trace is soldered together to re-enable it. It's labeled "Reset-En'. It is able to disable the auto reset by connecting a 110 Ω resistor from 5 V to the reset line [18Ano].

3.3. Infrared Sensor

An infrared sensor is an electronic device that detects IR radiation falling on it. Sensor keeps transmitting infrared light and when any object comes near, it is detected by the sensor by monitoring the reflected light from the object. Proximity sensors used in touchscreen phones and edge avoiding robots, contrast sensors used in line following robots and obstruction counters and sensors used for counting goods and in burglar alarms are some applications involving IR sensors.

Infrared sensors are passive or active. Passive infrared sensors are basically infrared detectors. Passive infrared sensors do not use any infrared source and detects energy emitted by obstacles in the field of view. They are of two types: quantum and thermal. Thermal infrared sensors use infrared energy as the source of heat and are independent of wavelength. Thermocouples, piezoelectric detectors and bolometers are the common types of thermal infrared detectors.

Quantum type infrared detectors offer higher detection performance and are faster than thermal type infrared detectors. The photosensitivity of quantum type detectors is wavelength dependent. Quantum type detectors are further classified into two types: intrinsic and extrinsic types. Intrinsic type quantum detectors are photoconductive cells and photovoltaic cells.

Active infrared sensors consist of two elements: infrared source and infrared detector. Infrared sources include an LED or infrared laser diode. Infrared detectors include photodiodes or phototransistors. The energy emitted by the infrared source is reflected by an object and falls on the infrared detector [15Ano].

An IR sensor consists of two parts, the emitter circuit and the receiver circuit. This is collectively known as a photocoupler or an optcoupler. The emitter is an IR LED and the detector is an IR photodiode. The IR photodiode is sensitive to the IR light emitted by an IR LED. The photodiode's resistance and output voltage change in proportion to the IR light received. This is the underlying working principle of the IR sensor.

The type of incidence can be direct incidence or indirect incidence. In direct incidence, the IR LED is placed in front of a photodiode with no obstacle in between. In indirect incidence, both the diodes are placed side by side with an opaque object in front of the sensor. The light from the IR LED hits the opaque surface and reflects back to the photodiode.

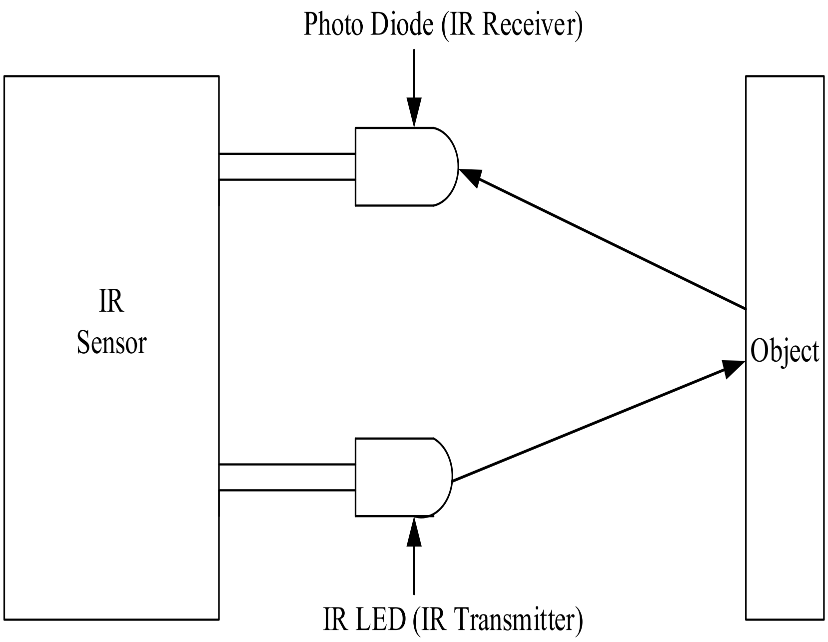

Figure 3.2. Functional Block Diagram of IR Sensor

3.3.1. Functions of IR LED and Photodiode

An IR LED also known as IR transmitter is a special purpose LED that transmits infrared rays in the range of 760 nm wavelength. Such LEDs are usually made of gallium arsenide or aluminum gallium arsenide. They, along with IR receivers, are commonly used as sensors. The appearance is same as a common LED. Since the human eye cannot see the infrared radiation, it is not possible for a person to identify whether the IR LED is working or not, unlike a common LED. To overcome this problem, the camera on a cell phone is used. The camera shows the IR rays being emanated from the IR LED in a circuit.

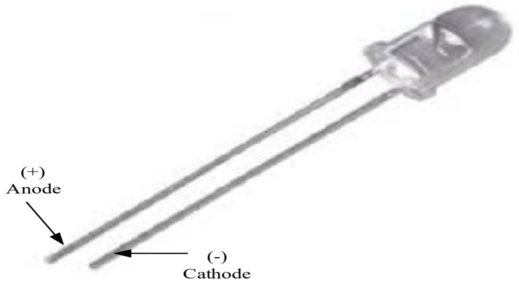

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Figure 3.3. IR LED

A photodiode is a type of photo detector capable of converting light into either current or voltage, depending upon the mode of operation. The common, traditional solar cell used to generate electric solar power is a large area photodiode. Photodiodes are similar to regular semiconductor diodes expect that they may be either exposed to detect vacuum UV or X rays or package with a window or optical fiber connection allow light to reach the sensitive part of the device. Many diodes designed for use specifically as a photodiodes use a PIN junction rather than a P-N junction, to increase the speed of response [17Ano].

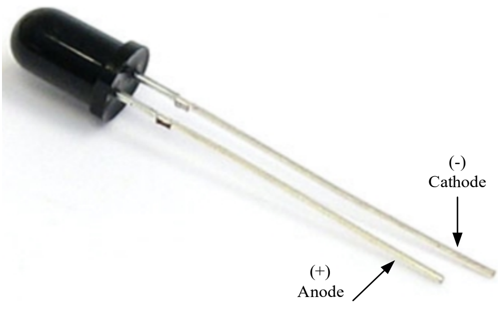

Figure 3.4. Photodiode

3.3.2. IR Sensor Module

Infrared obstacle sensor module has built in IR transmitter and IR receiver that sends out IR energy and looks for reflected IR energy to detect presence of obstacle in front of the sensor module. This sensor is known variously as the keyes, keyes IR or key studio KY-032. Infrared obstacle sensors usually come in two types; with 3 and 4 pins. The 3 pin version does not have the ability to be disabled. The sensor uses a four pin connector, the pins are labeled: EN (Enable), out (Output), + (Power) and GND (Ground). At the heart of the sensor is an NE555 chip configured to generate a 38 kHz square wave. The 38 kHz signal is used to illuminate an Infrared (IR) LED. Light reflected from the LED is detected by an IR receiver module. The receiver module incorporates an external, optical, 950 nm IR filter and an internal, electronic, 38 kHz band-pass filter that make the module receptive only to IR light pulsing at that frequency.

There are two potentiometers and one jumper on the board. The potentiometer R5 is used to adjust how sensitive the sensor is and to adjust the distance from the objects at which the sensor detects it. The potentiometers R6 is used to fine tune the signal to exactly 38 kHz. The receiver module also includes Automatic Gain Control (AGC) that is suppressing a continuous signal of any frequency, including 38 kHz. It is absolutely necessary to use the 'Enable' pin for proper operation of the device. If the Enable function is used correctly, the device is achieving its maximum sensitivity [16Ano].

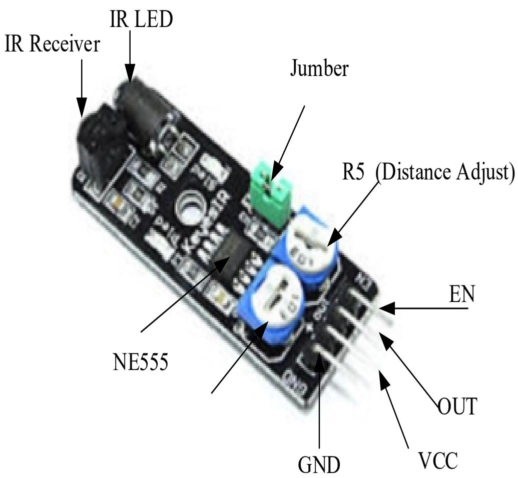

Figure 3.5. IR Sensor Module

3.4. Camera

A camera is an optical instrument for recording or capturing images, which stored locally, transmitted to another location or both. The images may be individual still photographs or sequences of images constituting videos or movies. The camera is a remote sensing device as it senses subjects without any contact. The word camera comes from camera obscura, which means dark chamber and is the Latin name of the original device for projecting an image of external reality onto a flat surface. The modem camera evolved from the camera obscure and continued to change through many generation of photographic technology, including Daguerre types, callow types, dry plates, film and digital cameras. The functioning of the camera is very similar to the functioning of the human eye.

3.4.1. Function of Camera

A camera works with the light of the visible spectrum or with other portions of the electromagnetic spectrum. A still camera is an optical device which creates a single image of an object or scene and records it on an electronic sensor or photographic film. All cameras use the same basic design: light enters an enclosed box through a converging or convex lens and an image is recorded on a light sensitive medium (mainly a transition metal-halide). A shutter mechanism controls the length of time that light can enter the camera. Most photographic cameras have functions that allow a person to view the scene to be recorded, allow for a desired part of the scene to be in focus, and to control the exposure so that it is not too bright or too dim. A display, often a Liquid Crystal Display (LCD), permits the user to view the scene to be recorded and settings such as International Organization of Standardization (ISO) speed, exposure and shutter speed.

A movie camera or a video camera operates similarly to a still camera, expect it records a series of static images in rapid succession, commonly at a rate of 24 frames per second. When the images are combined and displayed in order, the illusion of motion is achieved [15Ano].

3.4.2. Features of SQ11 Mini Camera

- Working Voltage: 5 V
- Memory: up to 32 GB
- Detection distance: 5 m to 10 m
- Night vision distance: 3 m to 5 m
- Wide view angle: 120° wide angle
- Operation temperature: -10°C and – 50°C

- Video resolution: 1080P
- Camera Pixel: 1.2MP

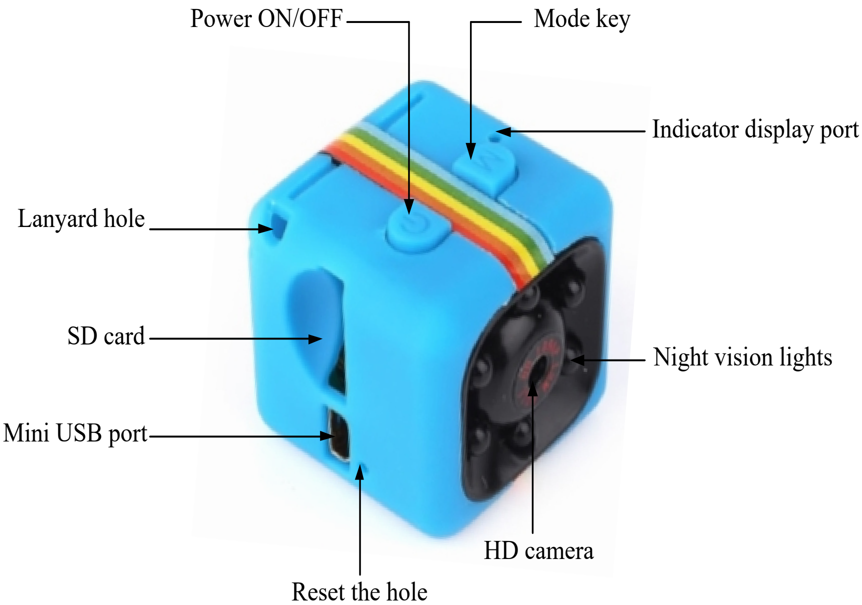

Figure 3.6. SQ11 Mini Camera [17Ano]

3.5. Liquid Crystal Display (LCD)

Liquid Crystal Display (LCD) is the technology used for displays in notebook and other smaller computers. Like Light Emitting Diode (LED) and gas plasma technologies, LCDs allow displays to be much thinner than Cathode Ray Tube (CRT) technology. LCDs consume much less power than LED and gas display displays because they work on the principle of blocking light rather than emitting it.

An LCD is made with either a passive matrix or an active matrix display grid. The active matrix LCD is also known as a Thin Film Transistor (TFT) display. The passive matrix LCD has a grid of conductors with pixels located at each intersection in the grid. A current is sent across two conductors on the grid to control the light for any pixel. An active matrix has a transistor located at each pixel intersection, requiring less current to control the luminance of a pixel. For this reason, the current in an active matrix display is switched ON and OFF more frequently, improving the screen refresh time.

Some passive matrix LCD's have dual scanning, meaning that they scan the grid twice with current in the same time that it took for one scan in the original technology. However, active matrix is still a superior technology.

The principle behind the LCD’s is that when an electrical current is applied to the liquid crystal molecule, the molecule tends to untwist. This causes the angle of light which is passing through the molecule of the polarized glass and also cause a change in the angle of the top polarizing filter. As a result a little light is allowed to pass the polarized glass through a particular area of the LCD. Thus that particular area will become dark compared to other. The LCD works on the principle of blocking light. While constructing the LCD’s, a reflected mirror is arranged at the back. An electrode plane is made of indium tin oxide which is kept on top and a polarized glass with a polarizing film is also added on the bottom of the device. The complete region of the LCD has to be enclosed by a common electrode and above it should be the liquid crystal matter. Next comes to the second piece of glass with an electrode in the form of the rectangle on the bottom and, on top, another polarizing film. It must be considered that both the pieces are kept at right angles. If there is no current, the light passes through the front of the LCD it is reflected by the mirror and bounced back. As the electrode is connected to a battery the current from it will cause the liquid crystals between the common plane electrode and the electrode shaped like a rectangle to untwist. Thus the light is blocked from passing through. That particular rectangular area appears blank.

3.5.1. Advantages of LCD:

- LCD is consumes less amount of power compared to CRT and LED
- LCD are consist of some microwatts for display in comparison to some mill
- Watts for LED’s
- LCDs are of low cost
- Provides excellent contrast
- LCDs are thinner and lighter when compared to cathode ray tube and LED

3.5.2. Disadvantages of LCD:

- Require additional light sources
- Range of temperature is limited for operation
- Low reliability
- Speed is very low
- LCD is need an AC drive

3.5.3. Applications of LCD

Liquid crystal technology has major applications in the field of science and engineering as well on electronic devices.

- Liquid crystal thermometer
- Optical imaging
- The liquid crystal display technique is also applicable in visualization of the radio frequency waves in the waveguide
- Used in the medical applications

3.5.4. 16x2 LCD

LCD screen is an electronic display module and find a wide range of application. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons are being: LCD are economical; easily programmable; have no limitation of displaying special and even custom characters, animations and so on. Some of the most common LCDs connected to the controllers are 16x1, 16x2 and 20x2 displays. This means 16 characters per line by 1 line and 20 characters per line by 2 lines, respectively. A 16x2 LCD it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, command and data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. One of the most common devices attached to a controller is an LCD display. 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 [16Tar].

3.5.5. Specification of 16x2 LCD Display

- Pin1 (VSS): Ground pin of the LCD module.
- Pin2 (VCC): Power of LCD module (+5 V supply is given to this pin).
- Pin3 (VEE): Contrast adjustment pin. This is done by connection the ends of a 10 k potentiometer to +5 V and ground and then connecting the slider pin to the VEE pin. The voltage at the VEE pin defines the contrast. The normal setting is between 0.4 and 0.9.

- Pin4 (RS) Register select pin: The JHD162A has two registers namely command register and data register. Logic HIGH at RS pin selects data registers and logic LOW at RS pin selects command register.
- Pin5 (Read and Write): Read and Write modes. This pin is used for selecting between Read and Write modes. Logic HIGH at this pin activates Read mode and logic LOW at this pin activates Write mode.
- Pin6 (E): This pin is meant for enabling the LCD module. A HIGH to LOW signal at this pin will enable the module.
- Pin (DB0) to Pin14 (DB7): These are data pins. The commands and data are fed to the LCD module though these pins.
- Pin15: Anode of the black light LED. When operated on 5 V, a 560 Ω resistor should be connected in series to this pin. In Arduino based projects the back light LED can be powered from the 3.3 V source on the Arduino board.
- Pin16: Cathode of the black light LED.

Figure 3.7. Pin Diagram of 16x2 LCD Display

3.5.6. Features of 16x2 LCD

- Operating voltage is 4.7 V to 5.3 V
- Current consumption is 1 mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers
- Consists of two rows and each row can print 16 characters
- Each character is built by a 5×8 pixel box
- 1/16 duty cycle
- Built in controller
- Working on both 8 bit and 4 bit mode

- It is also display any custom generated characters
- Available in green and blue backlight

CHAPTER 4
SOFTWARE IMPLEMENTATION AND OPERATION OF CAR SPEED DETECTOR SYSTEM

4.1. Circuit Operation of Car Speed Detector System

This circuit is constructed with three main sections. The first section is IR sensors which are the input section. The second one is LCD which is the output section. And the last one is the microcontroller Arduino UNO. Two IR sensors are placed together apart on one side of the road. The system basically comprises two IR LED's transmitter and receiver sensor pairs, which are installed on the highway 27 cm apart, with the transmitter and the receiver of each pair on same side of the road. Using the timer, select the speed limit 8 km/h for the restriction area. The system displays the time taken by the vehicle in crossing the distance from one pair to the other from which the speed of the vehicle is calculated. Arduino UNO is the heart of the system, which control all the function of the circuit.

If the vehicle is arrived to the first IR sensor, the first sensor senses this coming vehicle. The first IR sensor gets signal. This signal sends to the microcontroller. Arduino detects the falling waves and now internal timer of Arduino is started. Then the vehicle is crossing in front of the second sensor, timer is stopped. Both IR sensors are connected to the interrupt pin of Arduino, and they detect the falling wave. The microcontroller is programmed by using C programming that calculates the time duration between two sensors, corresponding gives the speed. Now vehicle's speed is calculated by using simple time distance relationship. This system speed is calculated in cm/s. And then, speed cm/s convert speed km/h by using the formula. LCD is connected to the Arduino and measured speed is show on LCD display. If the vehicle exceeds the speed limit then the LED gets ON while the buzzing sound gives indication to the polices that the vehicle is crossing the speed limits. The camera is used to capture the video recording of that vehicle between the both IR sensors. Camera includes the SD card for storage the video recording.

4.1.1. Circuit Diagram of Car Speed Detector System

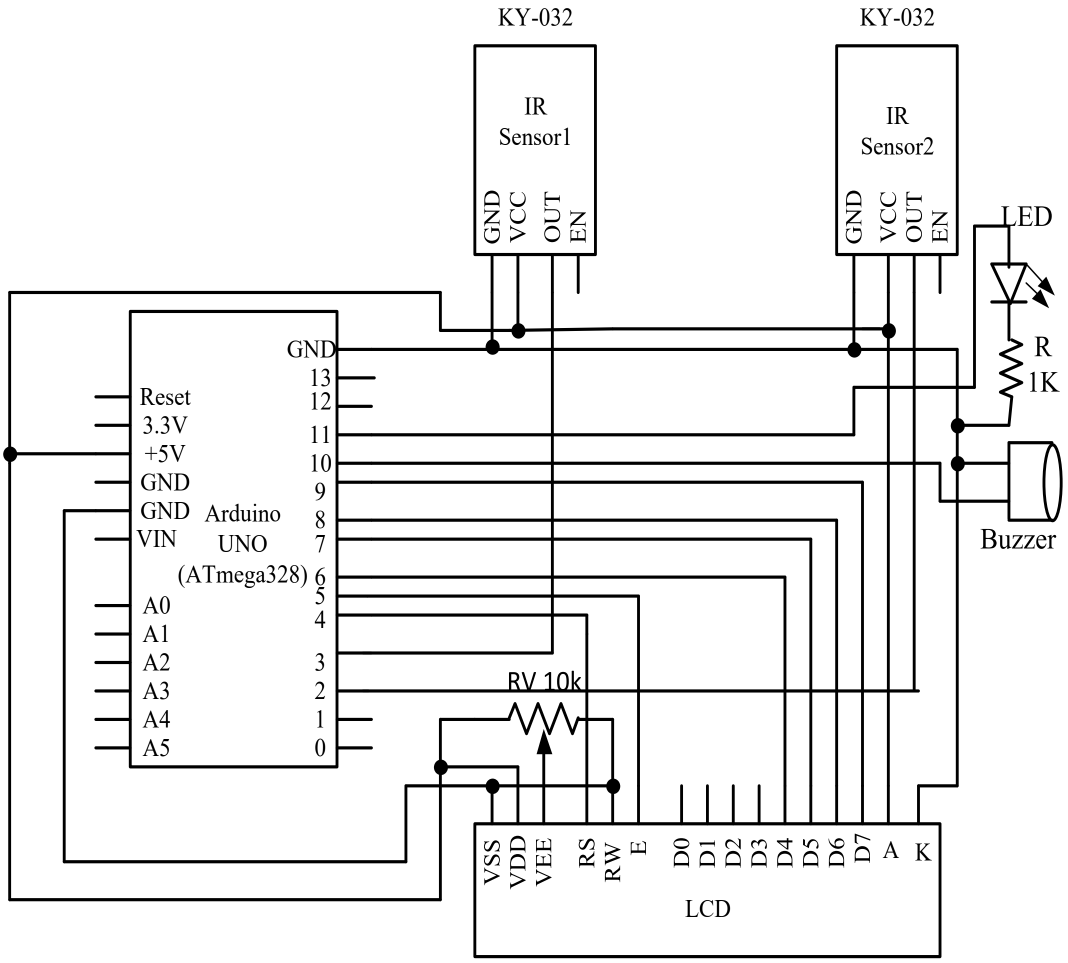

Figure 4.1. Circuit Diagram of Car Speed Detector System

Table 4.1. Pin Connection of Car Speed Detector System

Pin Name	Arduino UNO's Pin
OUT1	D3
OUT2	D2
VCC	+5V (IR sensor1 VCC pin and IR sensor2 VCC pin)
GND	GND (IR sensor1 GND pin and IR sensor2 GND pin)
D4	D6
D5	D7
D6	D8
D7	D9

E	D5
RS	D4
VCC	+5V (LCD VDD’s VCC pin)
VSS, RW	GND
LEDA	+5V
LEDK	GND
Buzzer	D10
LED	D11
VCC	+5V (Buzzer’s VCC pin and LED’s VCC pin)
GND	GND (Buzzer’s GND pin and LED’s GND pin)

4.2. Car Speed Detector Process

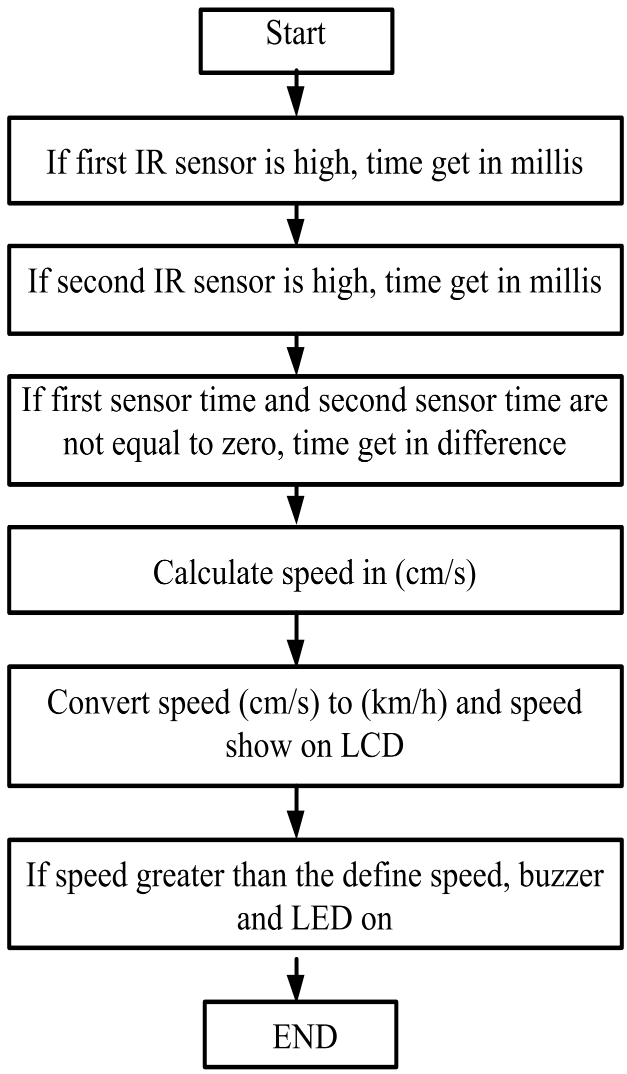

Figure 4.2. Car Speed Detector Process

Figure 4.2 show car speed detector process. In this process, two IR sensors are used to detect the vehicle for getting time between the two IR sensors. If first IR sensor is arrived the vehicle, it get time in millisec. And then, if second IR sensor is also arrived the vehicle, it get time in millisec. Checking first sensor time and second sensor time are not equal to zero. If first sensor time and second sensor time are not equal to zero and if first sensor time greater than the second sensor time, first sensor time subtract the second sensor time in the difference. If second sensor time greater than the first sensor time, second sensor time subtract first sensor time in difference. And then, speed is calculated in the distance and time relationship formula. After it, speed (cm/s) convert to speed (km/h). Speed (km/h) printed on LCD. If speed greater than the define speed, buzzer and LED ON. This process is ending.

4.3. Speed Measurement of Car Speed Detector System

This system comprises two IR sensor pairs, which are installed apart on one side of the road. The system displays the time taken by the vehicle in crossing this 10 cm distance from one pair to the other with delay time is 200 millisec from which the speed of the vehicle is calculated as follows;

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \qquad \text{Equation (4.1)}$$

Distance = 10 cm

Delay Time = 200 millisec

= 200×10^{-3} sec

Speed (cm/s) = $(10 \times 1000)/200$

= 50 cm/s

Speed (km/h) = Speed (cm/s) $\times$ 0.036

= 1.8 km/h

The speed of the vehicle is 1.8 km/h. In this saturation, the buzzer and LED are not alarmed.

The distance between two sensors is 27 cm and delay time is 30 millisec from which the speed of the vehicle is calculated as follows;

Distance = 27 cm

Delay Time = 30 millisec

= 30×10^{-3} sec

Speed (cm/s) = $(27 \times 1000)/30$

= 900 cm/s

Speed (km/h) = Speed (cm/s) $\times$ 0.036

= 32.4 km/h

The speed of the vehicle is 32.4 km/h. In this saturation, the buzzer and LED are alarmed to the police station.

The distance between two sensors is 30 cm and delay time is 15 millisec from which the speed of the vehicle is calculated as follows;

Distance = 30 cm

Delay Time = 15 millisec

$=15 \times 10^{-3}$ sec

Speed (cm/s) = $(30 \times 1000)/15$

= 2000 cm/s

Speed (km/h) = Speed (cm/s) $\times$ 0.036

= 72 km/h

The speed of the vehicle is 72 km/h. In this situation, the buzzer and LED are alarmed to the police station.

4.4. Software Implementation for IR Sensor

The software programming language for the IR sensor is very simple. The setup function will follow the declaration of IR pins are input by using to set pinMode.

```
pinMode(2, INPUT);
pinMode(3, INPUT);
```

The loop function includes the code to be executed continuously reading the IR pins. Firstly, check the first IR sensor for the arrival of the vehicle. If the vehicle is arrived the time1 get in millisec. Moreover, check the second IR sensor for the arrival of the vehicle. If the vehicle is arrived the time 2 gets in millisec.

```
if (digitalRead(2)==0)
first_sensor_time=millis();
if (digitalRead(3)==0)
second_sensor_time=millis();
```

4.4.1. Code Explanation of Car Speed Detector Sketch

At the beginning of the code a header file is declared by name LiquidCrystal.h which is used for the LCD display. In the next line pins of LCD are declared in the function "Liquid Crystal Display (LCD) (4, 5, 6, 7, 8, 9)", number in the bracket shows the pins of Arduino pins that are connected to the LCD. In the line 3 and 2 two integers are declared by the name sensor1 and sensor2, these are pins of Arduino that are connected to the IR sensors. After it 4 integers are declared by the name first sensor time, second sensor time, difference and float second1, second2. Where the first sensor time is the measured time if sensor1 is activated and the second sensor time is the measured time if sensor2 is activated. The difference is the difference of first sensor time and second sensor time, which is equivalent to time taken by car to go from sensor1 to sensor2 or sensor2 to sensor1. The float is declared by name second1 and second2 that is measured the time from the sensors. Now double is declared by name speed that is measured speed of the running car. And then, in the line 10 and 11 two integers are declared by the name of buzzer and LED, these are pins of Arduino that are connected to the buzzer and LED.

In the void setup( ) function, LCD is being by using lcd.begin(16,2) function. LCD is cleared by using the lcd.clear( ) function and SPEED MEASUREMENT is printed on LCD by using function "lcd.print". After it 4 integers are declared by the name pinMode(2, INPUT), pinMode(3, INPUT), pinMode(buzzer, OUTPUT)and pinMode(light, OUTPUT). First IR sensor is declared input by using the pinMode(3, INPUT) function and second IR sensor is declared input by using the pinMode(2, INPUT) function. Buzzer is declared output by using the pinMode(buzzer, OUTPUT) function and LED is declared output by using the pinMode(light, OUTPUT) function.

In the void loop( ) function, "if", "else if" and "else conditions" are used for checking. Firstly, checking first IR sensor is high by using "if" condition and if first IR sensor is high get time in millisec. Checking second IR sensor is high by using "if" condition and if second IR sensor is high get time in millisec. Secondly, checking first sensor time and second sensor time are not equal to zero by using "if" condition. If first sensor time and second sensor time are not equal to zero, checking first sensor time greater than the second sensor time by using "if" condition. If first sensor time greater than second sensor time, first sensor time subtract the second sensor time in the difference and calculate the speed in the distance and time relationship formula. Speed convert (cm/s) to (km/h). Checking second sensor time greater than the first sensor time by using "else if" condition. If second sensor time greater than the first sensor time, second sensor time subtract the first sensor time in the difference. Speed is printed on LCD by using lcd.print function. Checking speed greater than the defined speed by using “if” condition. If speed greater than the define speed, buzzer and LED are high. If speed less than the define speed by using “else” condition, buzzer and LED are low. If first sensor time and second sensor time are equal to zero by using “else” condition, OK is printed on LCD by using lcd.print function.

4.5. Algorithm

The algorithm used in the flowchart.

Step1: Start.

Step2: Set liquid crystal display (LCD) that means measured speed is shown on LCD.

Step3: Set the two IR sensors for sensing the vehicle.

Step4: Check the first IR sensor for the arrival of the vehicle. If the vehicle is arrived go to step5 otherwise step4.

Step5: Get the first IR sensor time in millis.

Step6: Check the second IR sensor for the arrival of the vehicle. If the vehicle is arrived go to step7 otherwise step6.

Step7: Get the second IR sensor time in millis.

Step8: Check the first IR sensor time and the second IR sensor time are not equal to zero. If the IR sensors times are not equal to zero go to step9 otherwise print “OK” on LCD and step4.

Step9: Check the time1 greater than the time2. If the time1 greater than the time2 go to step10, step12 and step13 otherwise step11.

Step10: Subtraction the time1 and the time2.

Step11: Subtraction the time2 and the time1.

Step12: Calculate the speed of the vehicles in cm/s.

Step13: Convert the speed of the vehicle from cm/s to km/h.

Step14: Check the speed of the vehicle greater than 8 km/h. If the speed of the vehicle greater than the 8 km/h go to step15 otherwise step16.

Step15: Print speed value on LCD and Buzzer and LED ON for 3 seconds.

Step16: Print speed value on LCD for 3 seconds.

Step17: Go to step4.

Step18: Exit.

4.5.1. Flowchart of Car Speed Detector System

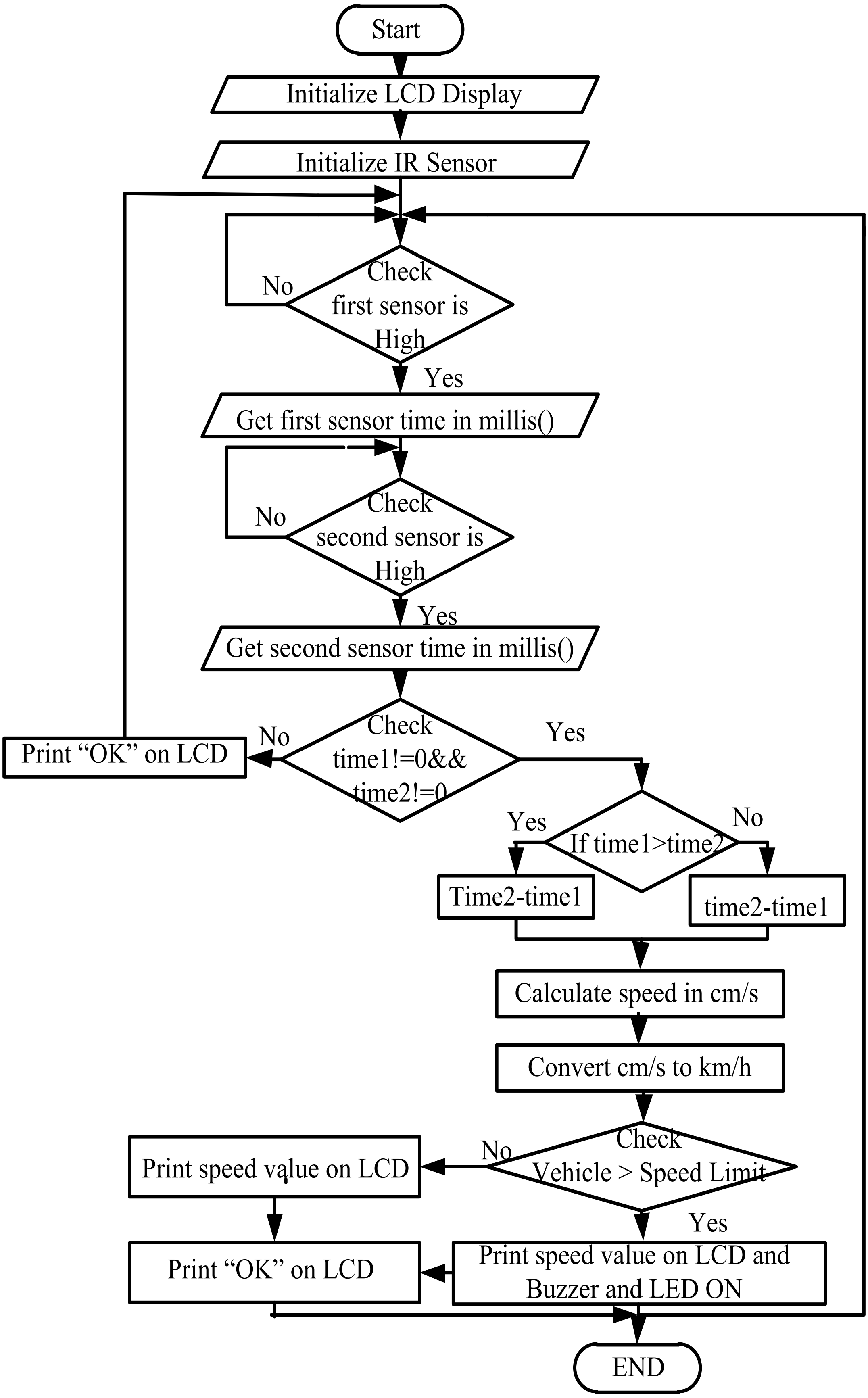

Figure 4.3. Flowchart of Car Speed Detector System

List of components shown on table 4.2.

Table 4.2. List of Components

Component	Number
Arduino UNO	1
IR Sensor	2
SQ11 Mini Camera	1
16x2 LCD	1
Buzzer	1
LED	1

CHAPTER 5

TEST AND RESULTS OF CAR SPEED DETECTOR SYSTEM

5.1. Test and Results of the System

In this system, IR sensor very depends on surrounding light intensity because of sensing distance. If this system is placed in different place such as different surrounding light for example indoor and outdoor, IR sensor's detection distance changes. So, this system is needed to place outdoor of light getting place for getting long sensing distance.

5.2. Results for IR Sensor Based Car Speed Detector System

If the vehicle is not crossing the two IR sensor, the operation is performed according to the code on LCD was displaying "SPEED MEASUREMENT OK". In this system, two IR sensors are crossing the vehicle and then the vehicle's speed is shown on LCD and if the vehicle crosses the speed limit and then buzzer and LED sound alerting the police.

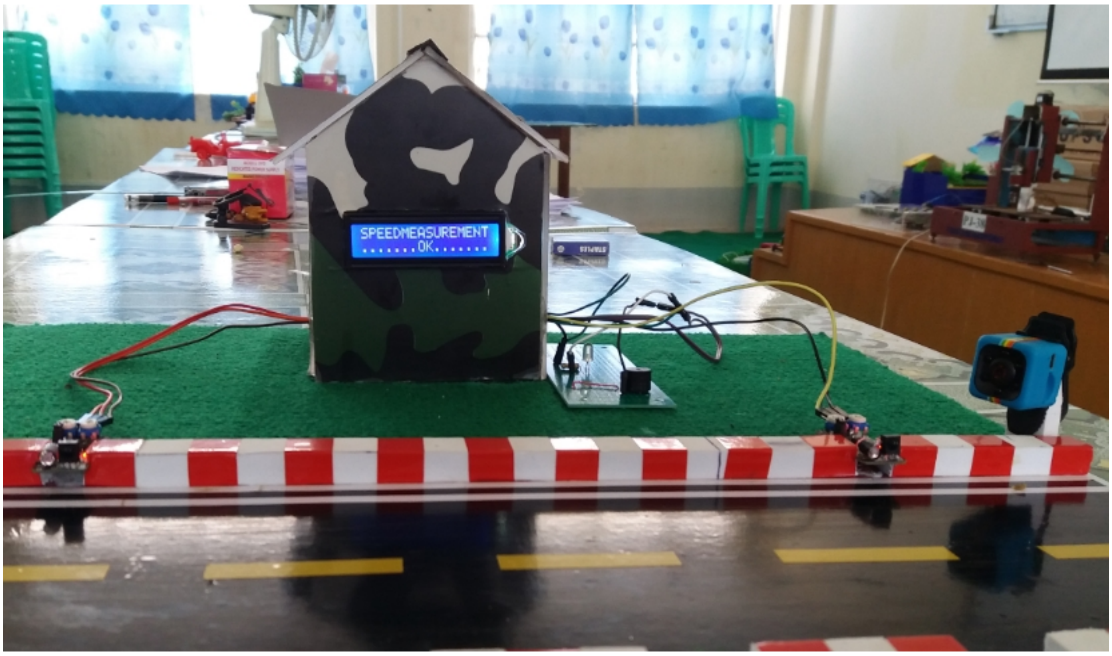

Figure 5.1. Results for the Active System

In this result, the vehicle crosses the speed limit and then buzzer and LED sound alerting and this speed is shown on LCD.

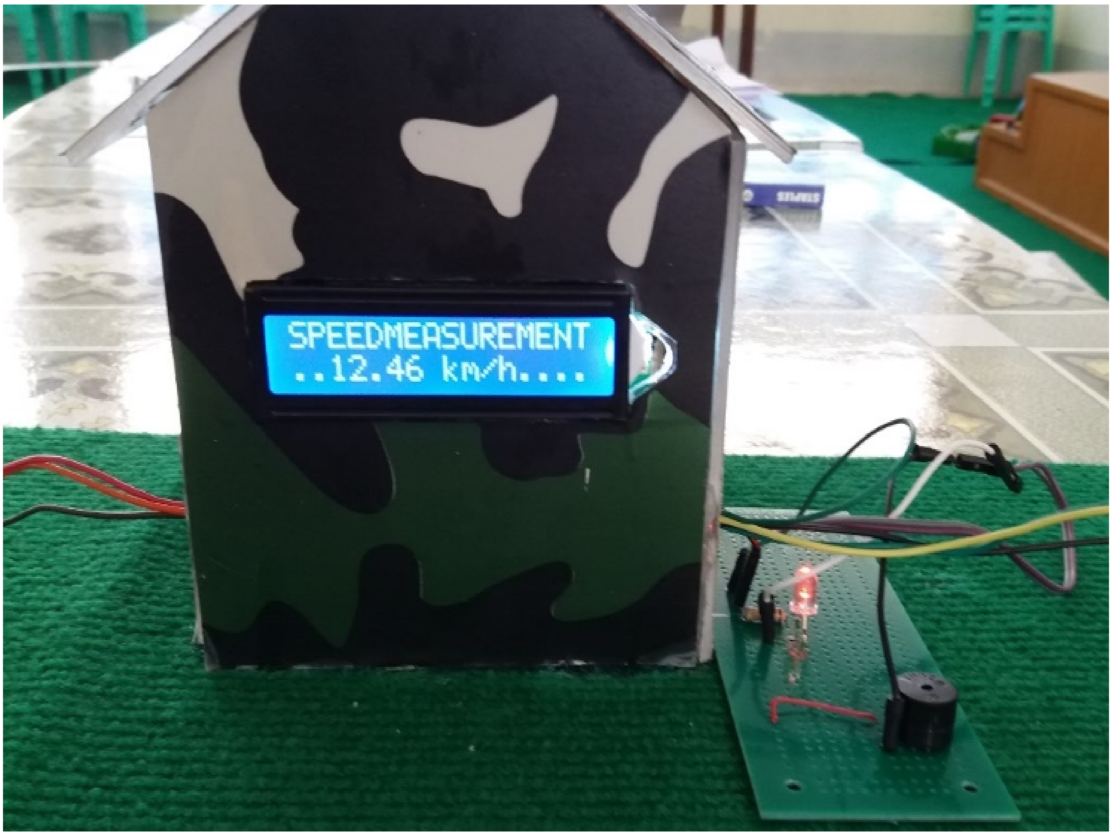

Figure 5.2. Vehicle's Over Speed Print on LCD

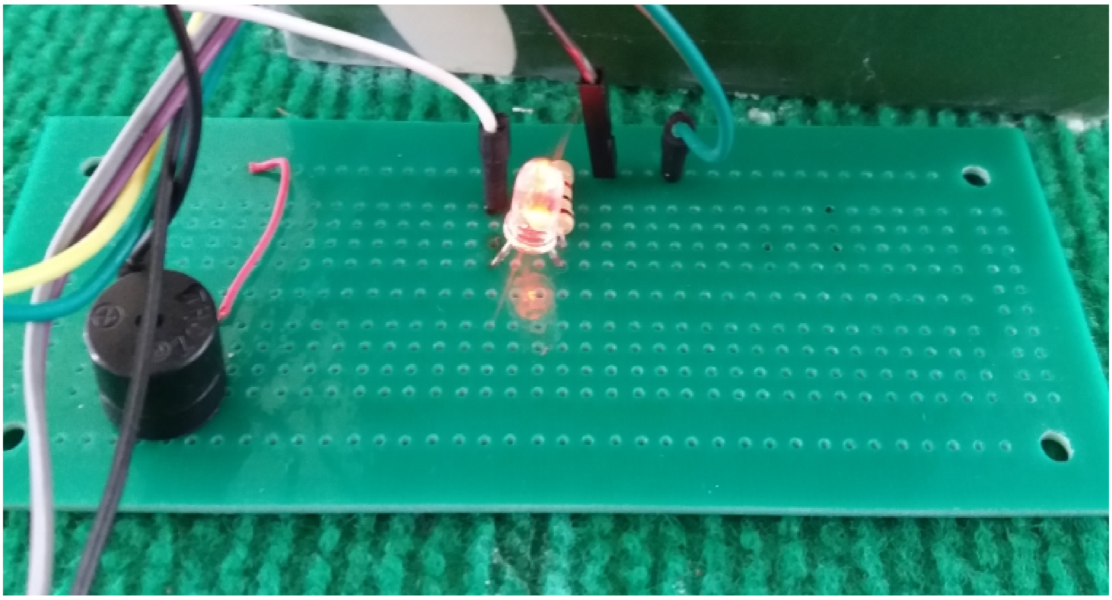

Figure 5.3. Results for Buzzer and LED

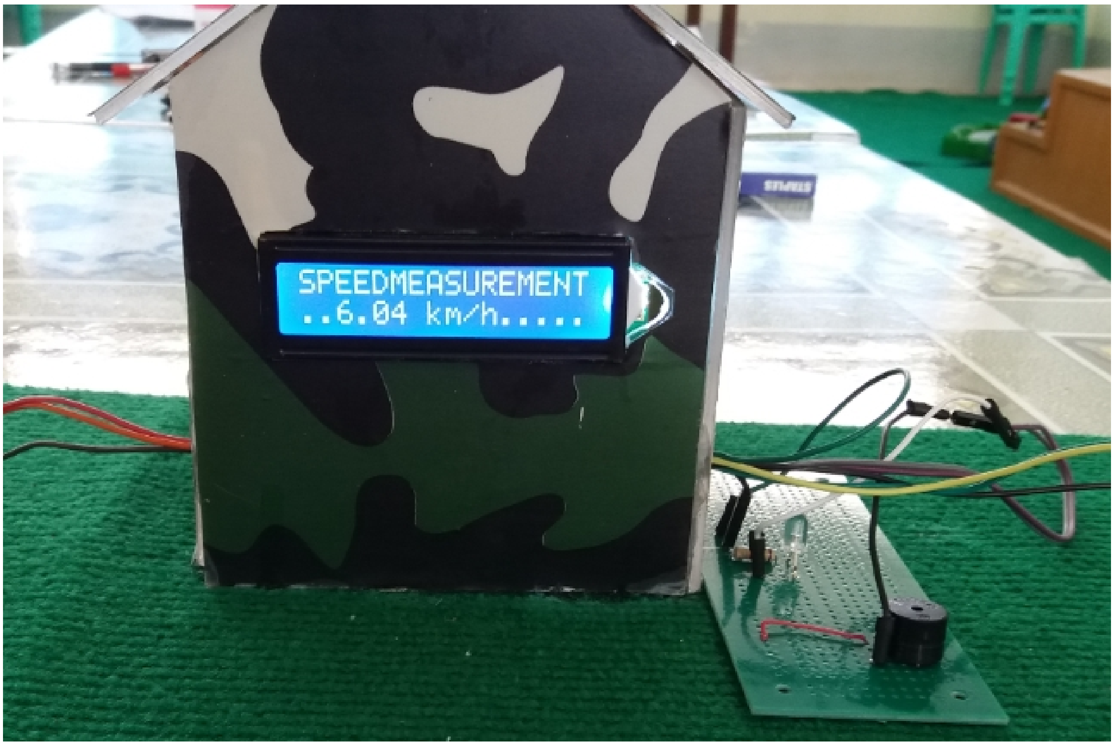

Figure 5.4. Vehicle's Normal Speed Print on LCD

CHAPTER 6
DISCUSSIONS AND CONCLUSION

6.1. Discussions and Conclusion

This thesis is presented car speed detector system, which is detected using two IR sensors in order to detect the speed of the vehicle. So, this proposed system check on rash driving by calculating the speed of a vehicle using the time taken to travel between the two set points at a fixed distance. The police perform their duties while sitting in control room and provide their service with more ease and accuracy.

The aim and objectives of the system has been covered during the system implementation. Proposed design fulfills the aim and objectives of the system and implemented for detection the vehicle speed. The proposed system requires installing the hardware system beside of the roads for detecting the vehicle speed and notifying it to police stations. Hardware and software required for this thesis is also being research thoroughly. All the hardware has been tested before implementation and C# programming language have been learned during this thesis. Code had been written in C language for controlling the overall system which was uploaded to microcontroller. While driving on highways, drivers are not exceed the maximum speed limit permitted for their vehicles. In particular, the system relies on the microcontroller to detect the vehicle speed. Car speed detector system involves three parts. In the first portion, two IR sensors are used for detection the speed of the vehicle by using simple time distance relationship. In the second portion, if vehicle crosses the speed limit and then buzzer and LED sound alerting the police stations. Camera is capturing the video recording of the vehicle in the third portion.

The advantage of this proposed car speed detector system is that it comes handy for the highway traffic police as it is provide a digital display in accordance with a vehicle’s speed and it is also sound an alarm if the vehicle exceeds the permissible speed for the highway. By applying the idea of this thesis the police stations is easily detect the vehicle’s speed.

6.2. Further Extension

Some of the future scope that can applicable on this car speed detector system. Advanced technology can be used to detect the vehicle speed. This system can be improved with the light indicator, if the vehicle are crossing the minimum speed then the light indicator is green, the middle speed then light indicator is yellow and the over speed then the light indicator is red. This system can be used to help for police stations. An RFID based intelligent vehicle speed controller using active traffic signals. Microcontroller, PIC, ultrasonic sensor and speed camera can be used to improve the performance of the system. This system can be taken as basic where all above scope can be improved with the help of the advanced technology.

LIST OF ABBREVIATIONS

Abbreviations	**Description**
AREF	Analog Reference
AVR	Advanced Virtual RISC
CRT	Cathode Ray Tube
DGPS	Differential Global Positioning System
DTR	Data Terminal Ready
GPS	Global Positioning System
GSM	Global System for Mobile Communication
ICSP	In Circuit Serial Programming
IDE	Integrated Development Environment
IR	Infrared
ISO	International Standards Organization
KY	Keyes
LCD	Liquid Crystal Display
LDR	Light Development Resistor
LED	Light Emitting Diode
MISO	Master In Slave Out
MOSI	Master Out Slave In
OS	Operation System
PC	Personal Computer
PIC	Peripheral Interface Controller
PWM	Pulse Width Modulation
RF	Radio Frequency
RFID	Radio Frequency Identification
SD	Secure Digital
SDA	SPI Data
SPI	Serial Peripheral Interface
SS	Slave Select

TTL	Transistor Transistor Logic
TFT	Thin Film Transistor
TWI	Two Wire Interface
USB	Universal Serial Bus

LIST OF FIGURES

LIST OF SYMBOLS

Symbols	Description	Unit
D	Distance	m
T	Time	s

LIST OF TABLES

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