Speed Surveillance System

By

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Abstract

Many accidents can be avoided if a detection mechanism can detect the speed of the incoming vehicle, and alert the controlling system. It is a universal problem which has been discussed at highest forums and practical steps are also taken in this regard so here is proposed solution to enhance the speed monitoring activity of Traffic Police Departments. The system that is going to be introduced here is easy to install and more effective which will detect the speed of the vehicle by using different techniques and methodologies to have the desired results. System will set different parameter for speed according to object availability in path and set speed criteria according to them. For measuring the speed ultrasonic sensors are used which are interfaced with ARDUINO NANO which will detect the speed of the vehicle. If the vehicle is over speeding then ultrasonic sensors will transmit a signal to the raspberry pi to get ready to capture the picture of the vehicle. The raspberry pi camera that is interfaced with RPI will take the picture of that violator and send picture to the control room by using internet and that violating vehicle's picture can be accessed at any exit point of the motorway or any highway and action will be taken accordingly.

Certificate of Correctness and Approval

It is hereby certified that the contents and form of the project report entitled "Speed Surveillance System", submitted by the syndicate of

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have been found satisfactory as per the requirement of the B.E. Degree in Electrical (Telecom) Engineering.

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DECLARATION

We hereby declare that no content of work presented in this thesis has been submitted in support of another award of qualification or degree either in this institution or anywhere else.

DEDICATED TO

Almighty Allah,

Faculty for their help

And our parents for their support

ACKNOWLEDGEMENT

Nothing happens without the will of Allah Almighty. We thank Allah Almighty for giving us knowledge and strength to accomplish this task successfully.

We would like to thank our project supervisor, Asst Prof Engr Fazal Ahmed, and our advisor, Prof Farooq Ahmed Bhatti, without their support and encouragement; it would not have been possible to complete this project.

We would like to express our special gratitude and thanks to Abdul Moiz Ahmad Pirkani for his unflinching support in truly testing times.

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Last but not least, we are very thankful to our parents, who bore with us in times of difficulty and hardship. Without their consistent support and encouragement we could not have accomplished our targets successfully.

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List of Abbreviations

TPD	Traffic Police Department
RPI	Raspberry Pi
LCD	Liquid Crystal Display
HDMI	High Definition Multimedia Interface
USB	Universal Service Bus
CSI	Camera Serial Interface
AVI	Audio Video Interleave

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Chapter 1

1.1 Introduction

1.1.1 Background

Over pace vehicles are not just a risk to travelers going in it additionally to numerous others and entire of the movement. It is an all inclusive issue which has been examined at most elevated gatherings and handy steps are additionally taken in such manner this undertaking is fundamentally to upgrade the pace observing movement of Traffic Police Departments. The inspiration driving the venture is that we will have the capacity to think about all the supplies that are being obliged to construct a tremendous undertaking. Furthermore, we will have the capacity to get the learning about diverse modules that are being used for this task. The energy to take in more and enhance the abilities makes us ready to pick this venture.

1.1.2 Problem Statement

“Preliminary Design and Prototype Development of Speed Surveillance System for Motorway and Highways to control road accidents”

1.2 Project Description

Basically in this project we have two modules one on check point and other on base station. On check point there will a speed detecting system and a camera. Speed detecting system consists of 2 pairs of ultrasonic sensors operating at 40 KHz frequency waiting for motion response and connected with ARDUNIO NANO. If a vehicle is crossing its speed limit it will consider as illegal action. The camera connected with raspberry pi at this point will switch on and capture the picture of that vehicle and send it over the email.

On base station the picture captured at the check point will be transmitted wirelessly and sent it to the base station .Once the picture has been received at the base station MATLAB code will be implemented on that picture and number plate of that vehicle will be extracted and action will be taken accordingly.

1.3 Prospective Application Area

The project will have a wide application range in traffic control and monitoring. In today's fast growing world, speed of vehicle and control on speed is much considerable issue. Quick response will result in safety of many lives. Installation of these systems will have an initial cost but after that they will work free of cost. Additionally, very less man-power will be required therefore police can reassign its resources more effectively.

These systems can be used to cover large areas. Following the basic idea of our prototype, it can be used in moving cars serving as automated collision avoidance and detection system. If we make certain advancements in our project then this system can be installed in moving cars to detect violators.

This technology can be used to monitor traffic in multiple lanes on highways and for ticketing based on vehicle speed. Another application involves popular Formula 1 racing Cars sports. It can also be used to provide supporting evidence in contested citation cases since the citations will be accompanied by visual proof.

1.4 Scope, Objectives, Specifications and Deliverables

1.4.1 Scope and Objective

In this project we would be requiring Raspberry Pi kit. The picture captured at the check point will be transmitted wirelessly and sent to the base station .The Ultrasonic Sensors with specific frequency will be capable of detecting an inbound object's distance and speed. The sensors would be adjusted in a hidden place such that the incoming object's speed can be detected during day as well in the night time. The final outcome would include a detection module at the check point and monitoring module at the base station.

This task would further improve our comprehension of telecom frameworks. Besides, it will clean our abilities in the field of hardware, Embedded Systems and Wireless Communication.

Following are the objectives
This venture is finished, with the comprehension of the considerable number of parts which are utilized as a part of it. We have utilized Raspberry Pi B, ultrasonic sensors, ARDUINO NANO and RF transmitter and beneficiary in it. This task uncovered us everything how and where these parts can be utilized and how to deal with the issue when you are given just these segments.

1.4.2 Specifications

1. It is a framework that is ease, brilliantly implanted and is in view of unmanned pace observation framework
2. It is an unmistakable and basic installed framework to evacuate any kind of inquiries with respect to the idea.
3. It is a substitute route of rate reconnaissance when whatever else falls flat. A quick more advantageous and simple go way.
4. It gives an adaptable answer for control the street mishaps
5. A undertaking that can be extended to incorporate other basic signs

1.4.3 Deliverables

We aim to deliver a working prototype of speed surveillance system same as the traffic police department with special focus on the automation of the above mentioned system.

Chapter 2

2.1 Literature Review

2.1.1 Overview of Existing Literature

The new innovative time has enhanced the velocity reconnaissance framework and conveyed a noteworthy change to minimize the street mishaps. Movement checking frameworks have been utilized for various years to recognize vehicles disregarding different activity regulations, running from surpassing as far as possible to running red lights or stop signs. Some of these movement observing frameworks incorporate cameras designed to take a photographic picture of the violators. Infrequently, the movement observing frameworks are situated in a checking vehicle, e.g., a squad car.

In different cases, the frameworks are not situated in a vehicle, yet rather are stationary, situated near to the roadway, e.g., on the ground or lifted on a shaft. Infrequently, the frameworks are controlled by an administrator who is available amid checking. The frameworks might likewise be worked consequently, without an administrator being available. In either case, the pictures caught by the camera on film are commonly put away in a film magazine. The photographic pictures recorded on film by the camera are frequently used to frame evidentiary records for purposes of demonstrating the presence of an infringement.

2.2 Problem Formulation

Speed monitoring is one of the most important things to avoid road accidents. In order to achieve the objectives and overcome the fore mentioned problem, we will proceed in an easy and effective manner. This report describes the implementation of speed surveillance system utilizing ultrasonic sensors, high speed camera, LCD and Raspberry Pi. This system will be developed using Python for raspberry pi and C language for Arduino. The hardware part will be implemented on Raspberry Pi kit with ultrasonic sensors interfaced with it and raspberry pi camera connected with raspberry pi.

2.3 Background Study

In the later past, analysts have tried a wide cluster of innovations trying to discover enhanced strategies for observing movement conditions. This exploration in movement reconnaissance has run from investigations of customary circle identification systems to the utilization of hostile to submarine fighting innovation. AVI contains one of yet a hefty portion of the regions of ebb and flow research. A brief study of innovations investigated amid the previous decade and a half is offered underneath to give a comprehension of the level of exploration enthusiasm for activity reconnaissance advances.

The new mechanical time has enhanced the velocity observation framework and conveyed a noteworthy change to minimize the street mishaps. Movement observing frameworks have been utilized for various years to distinguish vehicles disregarding different activity regulations, running from surpassing as far as possible to running red lights or stop signs. Some of these activity observing frameworks incorporate cameras arranged to take a photographic picture of the violators. Once in a while, the activity checking frameworks are situated in an observing vehicle, e.g., a squad car. In different cases, the frameworks are not situated in a vehicle, but instead are stationary, situated near to the roadway, e.g., on the ground or hoisted on a post. Once in a while, the frameworks are controlled by an administrator who is available amid observing. The frameworks might likewise be worked naturally, without an administrator being available. In either case, the pictures caught by the camera on film are ordinarily put away in a film magazine. The photographic pictures recorded on film by the camera are frequently used to shape evidentiary records for purposes of demonstrating the presence of an infringement.

One of the weaknesses connected with putting away pictures on film is that the quantity of pictures that can be put away has a tendency to be restricted by the space in the film magazine. The framework's capacity to record infringement is accordingly constrained by the limit of the film magazine. At the point when the film magazine achieves its most extreme limit, the frameworks can no more record pictures of violators. Since it is frequently troublesome if not difficult to precisely appraise the quantity of violators at a given area, it is additionally hard to focus when the limit of the film magazine has been come to.

Another deficiency of these prior frameworks is that the administrator should frequently make incessant treks to a focal handling area to convey the film for creating and preparing. The need to make such continuous excursions can possess a lot of time. The use of time is amplified when various movement observing frameworks are situated in distinctive geographic areas at badly arranged separations from focal preparing area.

Yet another weakness of the prior frameworks is the work serious procedure of coordinating the vehicle in each photographic picture with enlisted proprietor data, keeping in mind the end goal to plan movement references or an evidentiary record. For instance, after the picture is created, the photo is inspected by a man to recognize the tag number. Next, the permit plate number is related with a posting of enrolled vehicle proprietors to focus the name of the proprietor, after which the activity reference is arranged. This is done commonly by physically inputting data identifying with the petty criminal offense, then mailing the movement reference to the enrolled proprietor. This unwieldy procedure is wasteful and brings about high expenses and uses of time. A proceeding with need in this manner exists for an activity infringement handling framework that beats one or a greater amount of the aforementioned deficiencies.

Ju and Maze performed recreations on episode recognition methodologies utilizing the FREQ8PE recreation display (1989). Their examination assessed a correlation of occurrence discovery procedures utilizing police watch versus the utilization of driver call boxes at 1 km separating. The driver call boxes shaped the foundation of the displayed road reconnaissance and control framework (FSCS). This FSCS yielded an advantage to-cost proportion of 2.69 as it produced; profits by travel-time lessening and lessened fuel utilization. These advantages were realized by diminished occurrence location time managed by the driver call boxes.

2.3.1 Sensors

Ultrasonic transmitter emitted an ultrasonic wave in one direction, and started timing when it launched. Ultrasonic spread; in the air, and would return immediately when it encountered obstacles on the way. At last, the ultrasonic receiver would stop timing when it got the reflected wave. As Ultrasonic spread speed is 340m/ s noticeable all around, taking into account the clock record t, we can compute the separation (s) between the obstruction and transmitter, specifically: s =340t / 2, which is so- called time distinction separation estimation rule

The rule of ultrasonic separation estimation utilized the known air spreading speed, measuring the time from dispatch to reflection when it experienced hindrance, and after that ascertain the separation between the transmitter and the obstruction as indicated by the time and the speed. Consequently, the standard of ultrasonic separation estimation is the same with radar.

Separation Measurement recipe is communicated as: L = C X T

Movement sensors are sorts of electronic security gadget that detects development and typically triggers an alert. Numerous sorts of movement sensors can sense movement altogether haziness, without an interloper getting to be mindful that an alert has been activated.

Ultrasonic sensors take a shot at a rule like radar or sonar which assess qualities of an objective by translating the echoes from radio or sound waves separately. Ultrasonic sensors produce high recurrence sound waves and assess the reverberation which is gotten back by the sensor. Sensors figure the time interim between sending the sign and accepting the reverberation to focus the separation to an article.

2.3.2 Wave Share Sensors

A laser sensor contains a transmitter and a receiver. In the transmitter, there is an oscillating tube can generate a shockwave in a frequency of 180 KHz. After amplified by a transistor, the shockwave is applied to the laser tube for exciting. In the receiver, there is a receiving tube, matching to the oscillating tube, can receive the reflected light. Since the laser sensor adopts modulation processing technology, the receiving tube can only receive the reflected light in a same frequency, efficiently preventing from the visible light.

Chapter 3

3.1 Detailed Design

1. RTOS is installed and run.
2. Raspberry pi camera with proper device drivers is integrated with Raspberry Pi board.
3. Ultrasonic sensors are interfaced with Arduino.
4. Speed detection algorithms are implemented.
5. Camera is interfaced with Raspberry Pi.
6. Arduino and sensors are interfaced with raspberry pi
7. Raspberry Pi is interfaced with Laptop/PC to receive and transmit command and feedback of the algorithm.

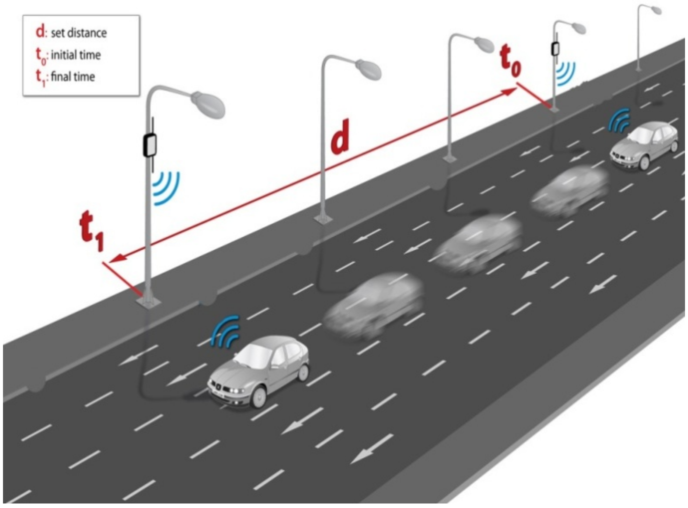


Figure 1: A Traffic Scenario

Fundamentally in this task we have two modules one on check point and other on base station. On check point there will a rate distinguishing framework and a camera. Pace identifying framework comprises of 2 sets of ultrasonic sensors working at 40 KHz recurrence sitting tight for movement reaction and associated with ARDUNIO NANO. In the event that a vehicle is intersection its speed farthest point it will consider as unlawful activity. The camera joined with raspberry pi as of right now will switch on and catch the photo of that vehicle and send it over the email.

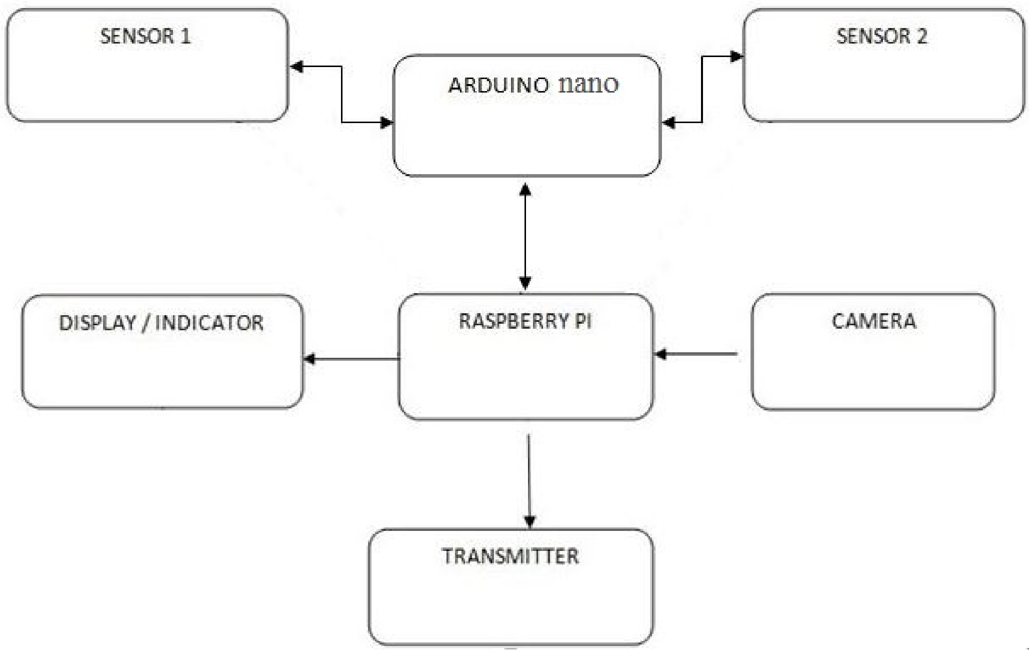


Figure 2: Check Point Block Diagram

On base station the picture captured at the check point will be transmitted wirelessly and sent it to the base station .Once the picture has been received at the base station MATLAB code will be implemented on that picture and number plate of that vehicle will be extracted and action will be taken accordingly.

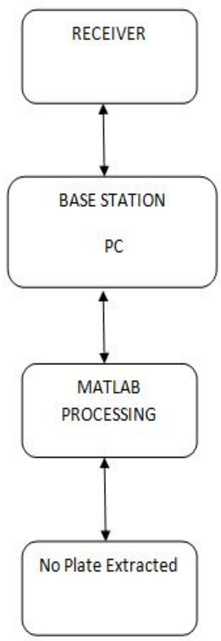


Figure 3: Base Station Block Diagram

3.2 Modules Description and Design

3.2.1 Raspberry Pi

Raspberry Pi is like a wonder in the world of students, hobbyists and the professionals who want to learn and try to convert their ideas into reality. Moreover, it is its easy interfacing with the devices that are essential for our project. It has 2 USB ports which can be used to attach a mouse, Keyboard, Camera or any other devise that has a USB connector for interfacing. It also have audio and video jacks through which we can attach an audio device or a television or other video devices. New High definition LCDs and TVs have HDMI interfaces which is also not an issue for Raspberry Pi board as it also has an HDMI output interface from where we can connect it with HD televisions or LCDs.

SPECIFICATIONS

1. 700 MHz ARM1176JZF-S core CPU
2. 512 MB RAM
3. 2 x USB2.0 Ports
4. Video Out via Composite (PAL and NTSC), HDMI or Raw LCD (DSI)
5. Audio Out via 3.5mm Jack or Audio over HDMI
6. Storage: SD/MMC/SDIO
7. 10/100 Ethernet (RJ45)
8. Easy to Understand
9. +5V
10. Ground
11. Many Categories Available with High Processing Speed
12. Power Requirements: 5V @ 700 mA via Micro USB or GPIO Header
13. Supports Debian GNU/Linux, Fedora, Arch Linux, RISC OS and More!

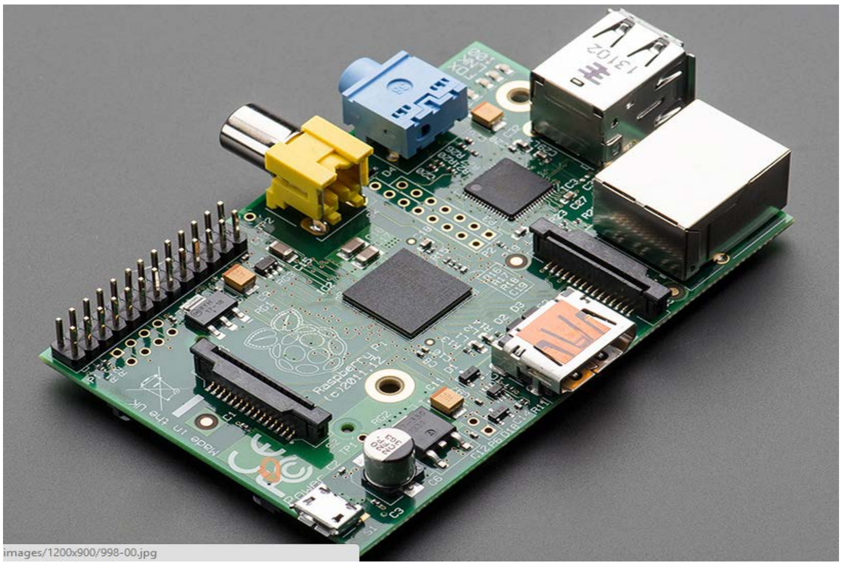


Figure 4: Raspberry Pi Board

Raspberry pi is not a standalone system and it is not a complete plug and play package it requires following things at least.

1 A LCD/TV.
2. HDMI cable for display on LCDs.
3. Keyboard and for interfacing.
4. Ethernet cable to connect internet.
5. Micro SD card (8GB).
6. Charger of 5v and current rating more than 700mA

3.2.2 HC-SR04 Ultrasonic Range Sensors

The HC-SR04 Ultrasonic Range finder is very simple to use, however the signal it outputs needs to be converted from 5V to 3.3V so as not to damage our Raspberry Pi. Sound consists of oscillating waves through a medium with the pitch being determined by the closeness of those waves to each other, defined as the frequency.

Only some of the sound spectrum is audible to the human ear, defined as the "Acoustic" range. Ultrasonic sensors are designed to sense object proximity or range using ultrasound reflection, similar to radar, to calculate the time it takes to reflect ultrasound waves between the sensor and a solid object. Ultrasound is mainly used because it's inaudible to the human ear and is relatively accurate within short distances.

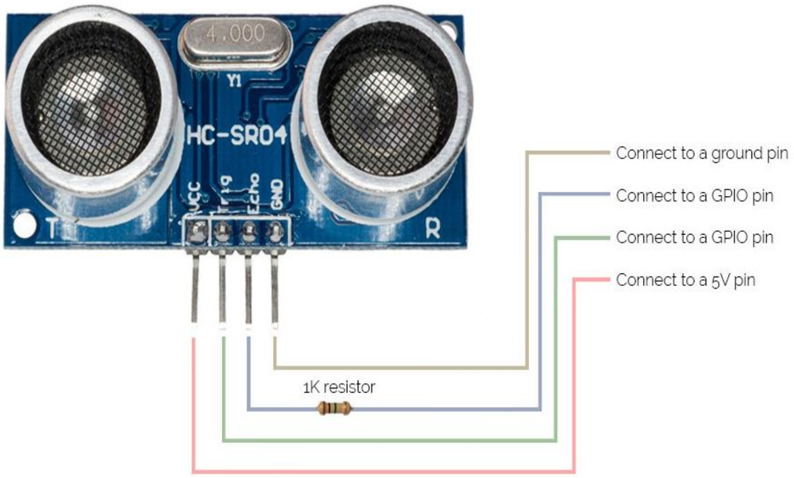


Figure 5: HC-SR04 Ultrasonic Transducer

A basic ultrasonic sensor consists of one or more ultrasonic transmitters basically speakers, a receiver, and a control circuit. The transmitters emit a high frequency ultrasonic sound, which bounce off any nearby solid objects. Some of that ultrasonic noise is reflected and detected by the receiver on the sensor. That return signal is then processed by the control circuit to calculate the time difference between the signal being transmitted and received. This time can subsequently be used, along with some clever math, to calculate the distance between the sensor and the reflecting object.

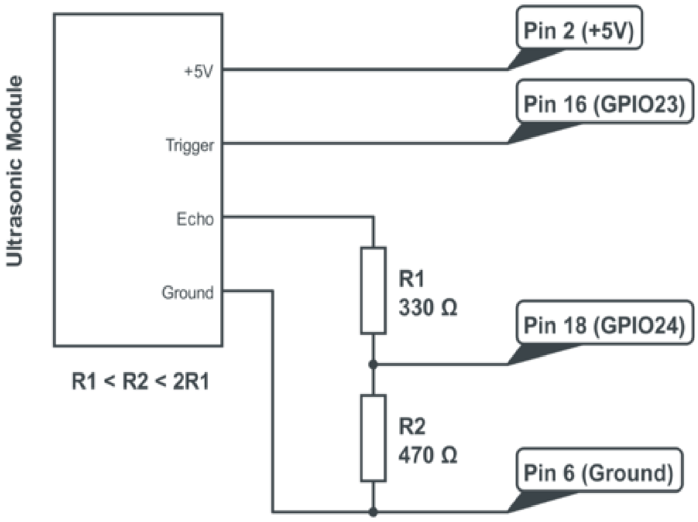


Figure 6: Ultrasonic Module Circuit

Specifications

1. Power Supply :+5V DC
2. Effectual Angle: <15°
3. Ranging Distance : 2cm – 400 cm/1" - 13ft
4. Measuring Angle: 30 degree
5. Trigger Input Pulse width: 10uS
6. Dimension: 45mm x 20mm x 15mm

3.2.3. Ultrasonic Distance Measurement

With the time it takes for the signal to travel to an object and back again, we can calculate the speed using the following formula.

SPEED= DISTANCE/TIME

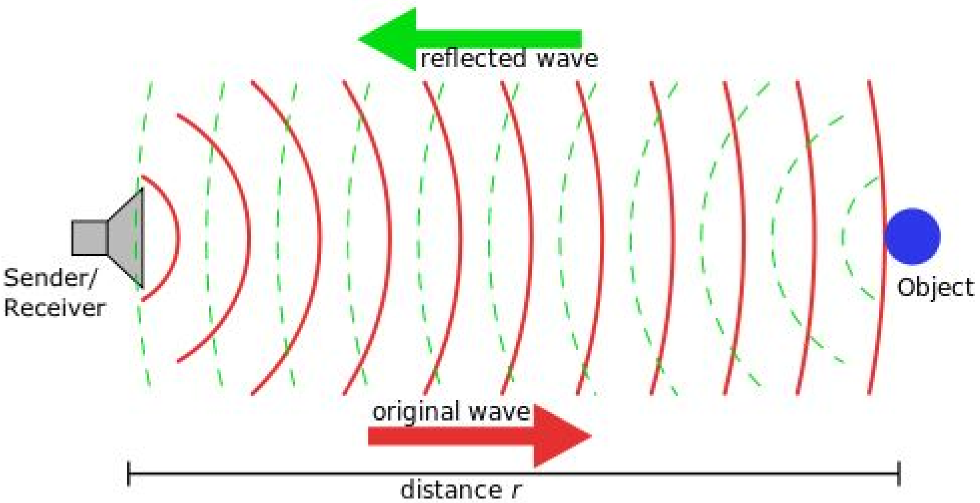


Figure 7: Ultrasonic Working Principal

We need to divide our time by two because what we've calculated above is actually the time it takes for the ultrasonic pulse to travel the distance to the object and back again. We simply want the speed of the object. We can simplify the calculation.

SPEED=DISTANCE/(TIME/2)

3.2.4. Voltage Regulator

This is the basic L7812 voltage regulator, a three-terminal positive regulator with a 12V fixed output voltage. This fixed regulator provides a local regulation, internal current limiting, thermal shut-down control, and safe area protection for your project. Each one of these voltage regulators can output a max current of 1.5A.

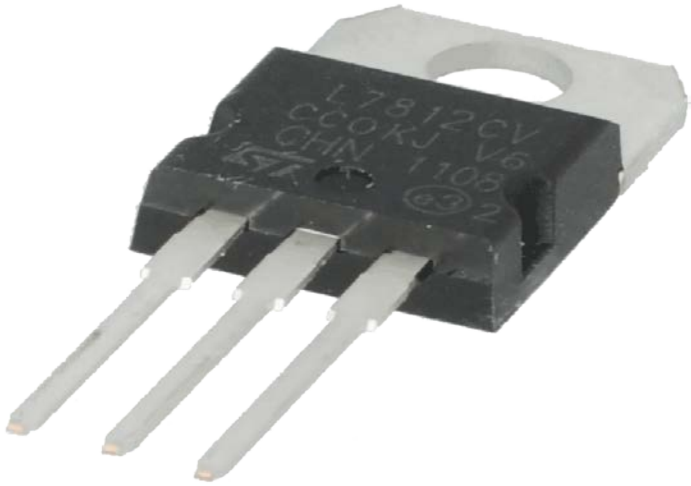


Figure 8: Voltage Regulator

Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the output of the plant. In an electric power distribution system, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage independent of how much power is drawn from the line.

Features

1. Output Voltage: 12V
2. Output Current: 1.5A
3. Thermal Overload Protection
4. Short Circuit Protection
5. Protection of the Circuit
6. Output Transition SOA Protection

3.2.5 Arduino Nano

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.

Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language and the Arduino development environment. Arduino projects can be stand-alone or they can communicate with software on running on a computer.

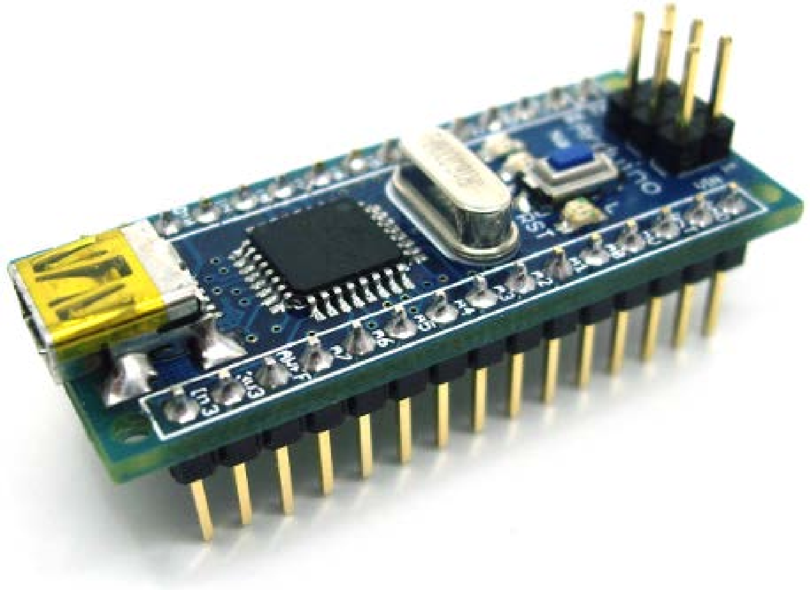


Figure 9: Arduino Nano

Arduino Nano is a surface mount breadboard embedded version with integrated USB. It is a smallest, complete, and breadboard friendly. It has everything that Decimal/Duemilanove has with more analog input pins and onboard +5V AREF jumper. Physically, it is missing power jack. The Nano is automatically sense and switch to the higher potential source of power, there is no need for the power select jumper.

Arduino got the breadboard-ability of the Boarduino and the Mini plus USB with smaller footprint than either, so users have more breadboard space. It's got a pin layout that works well with the Mini or the Basic Stamp. This new version 3.0 comes with ATMEGA328 which offer more programming and data memory space. It is two layers. That make it easier to hack and more affordable.

Communication

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed.

However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).A Software Serial library allows for serial communication on any of the Uno's digital pins.

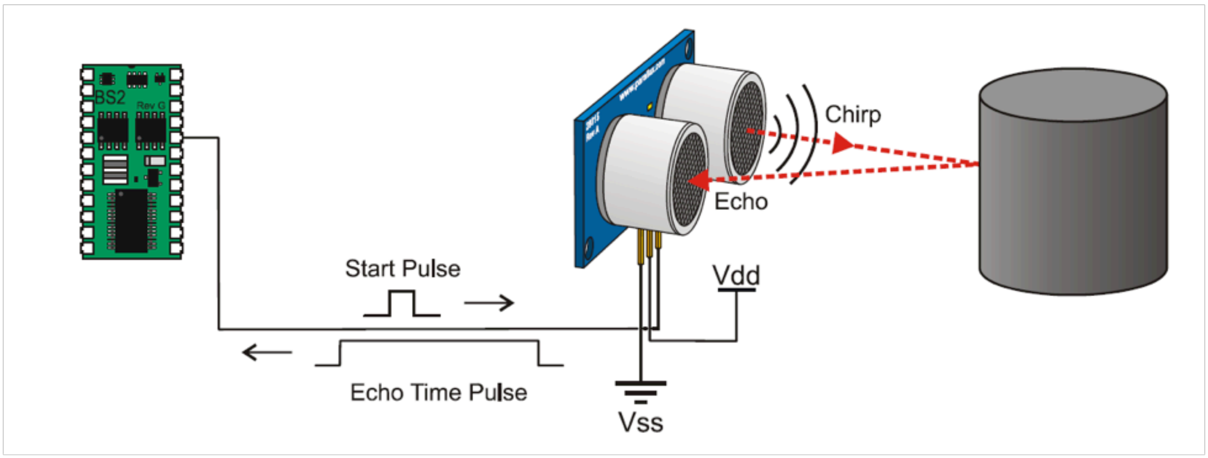


Figure 10: Ultrasonic Sensors Interfaced with Arduino

The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

Specifications

Microcontroller	Atmel ATmega328
Operating Voltage (logic level)	5 V
Input Voltage (recommended)	7-12 V
Input Voltage (limits)	6-20 V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	8
DC Current per I/O Pin	40 mA
Flash Memory	32 KB (of which 2KB used by bootloader)
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz
Dimensions	0.70” x 1.70”

Features

- Automatic reset during program download
- Power OK blue LED
- Green (TX), red (RX) and orange (L) LED
- Auto sensing/switching power input
- Small mini-B USB for programming and serial monitor
- ICSP header for direct program download
- Standard 0.1” spacing DIP (breadboard friendly)
- Manual reset switch

Power

The Arduino Nano can be powered via the mini-B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin 27). The power source is automatically selected to the highest voltage source.

The power pins are as follow

1. VIN. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
2. 5V.This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.
3. 3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
4. GND. Ground pins.
5. IOREF. This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.

3.2.6 RF Transmitter and Receiver

Transmitter

RF transmitter is basically used to get the data from sensor 1 that is connected with an Arduino and transmit it to sensor 2 that is also connected with another Arduino. Both sensor 1 and sensor 2 are connected wirelessly. The operating frequency of this transmitter is 433MHz.There is a direct relationship between transmitter and the input voltage. If the voltage is high then transmission rage is going to increase but this voltage should not be much that it could burn the transmitter. In our case this transmitter is connected with pin 13 of the Arduino, as it gets the signal from Arduino it transmits this information to other Arduino

Figure 11: RF Transmitter

Specifications

1. Working voltage: 3V - 12V for max. power use 12V
2. Working current: max Less than 40mA max , and min 9mA
3. Working frequency: Eve 315MHz Or 433MHz
4. Transmission power: 25mW (315MHz at 12V)
5. Frequency error: +150kHz (max)

Receiver

When signal is transmitted through 1st Arduino then it will be received by other Arduino. In our case we have connected the receiver with the reset pin. When it receives a signal then second Arduino comes into action and measures the speed. If the speed limit exceeds the limit that is set in the code then pin 13 of this Arduino which is connected with raspberry pi will transmit a signal to take the picture of the vehicle. The communication between 2nd Arduino and raspberry pi is wired.

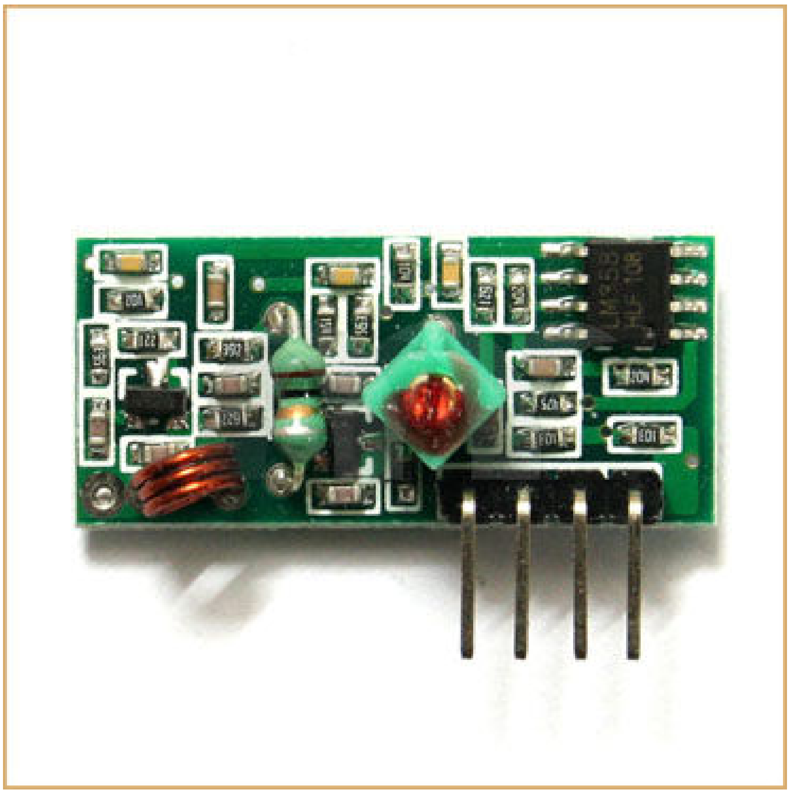


Figure 12: RF Receiver

Specifications

1 Working voltage: 5.0VDC +0.5V

2 Working current:≤5.5mA max

3 Working frequency: 315MHz-433.92MHz

3.2.7 Raspberry Pi Camera Module

The Raspberry Pi Camera Board plugs directly into the CSI connector on the Raspberry Pi. It's able to deliver a crystal clear 5MP resolution image or 1080p HD video recording at 30fps.

The Raspberry Pi Camera Board features a 5MP (2592×1944 pixels) Omni vision 5647 sensor in a fixed focus module. The module attaches to Raspberry Pi, by way of a 15 Pin Ribbon Cable, to the dedicated 15-pin MIPI Camera Serial Interface (CSI), which was designed especially for interfacing to cameras. The CSI bus is capable of extremely high data rates, and it exclusively carries pixel data to the BCM2835 processor.

The board itself is tiny, at around 25mm x 20mm x 9mm, and weighs just over 3g, making it perfect for mobile or other applications where size and weight are important. The sensor itself has a native resolution of 5 megapixel, and has a fixed focus lens onboard. In terms of still images, the camera is capable of 2592 x 1944 pixel static images, and also supports 1080p @ 30fps, 720p @ 60fps and 640x480p 60/90 video recording.

The camera is supported in the latest version of Raspbian, the Raspberry Pi's preferred operating system.

Specifications

1. Fully Compatible with Both the Model A and Model B Raspberry Pi
2. 5MP Omni vision 5647 Camera Module
3. Still Picture Resolution: 2592 x 1944
4. Video: Supports 1080p @ 30fps, 720p @ 60fps and 640x480p 60/90 Recording
5. 15-pin MIPI Camera Serial Interface - Plugs Directly into the Raspberry Pi Board
6. Size: 20 x 25 x 9mm
7. Weight 3g

Figure 13: RPI Camera Module

Chapter 4

4.1 Project Analysis and Evaluation

Initially we interfaced the camera module along with the ultrasonic sensors. The picture captured by the camera is being sent over the email id and the emailed picture is shown below

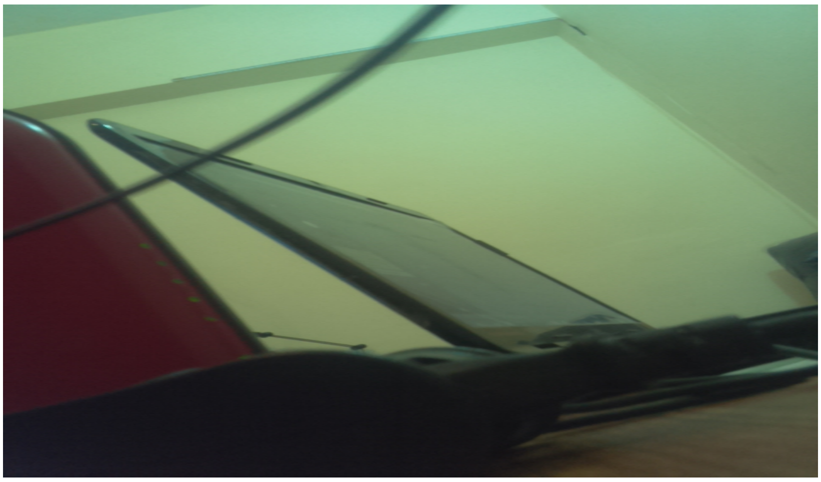


Figure 14: Camera Output

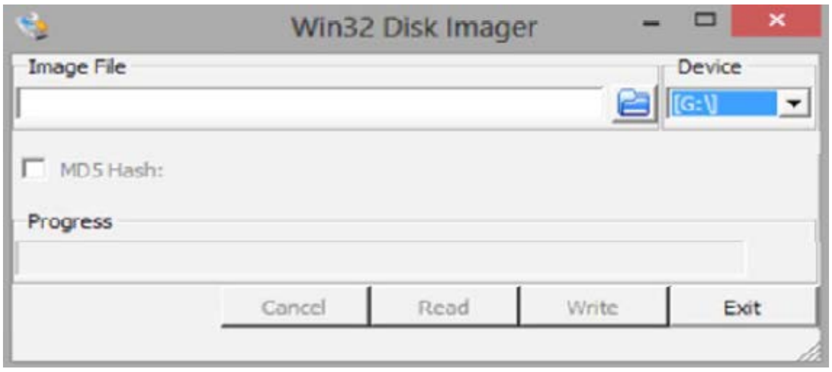


Figure 15: Image Burning on SD Card

We did a hard run of the prototype to capture images and to track the speed of an object

This was the time when we were measuring the speed of the vehicle

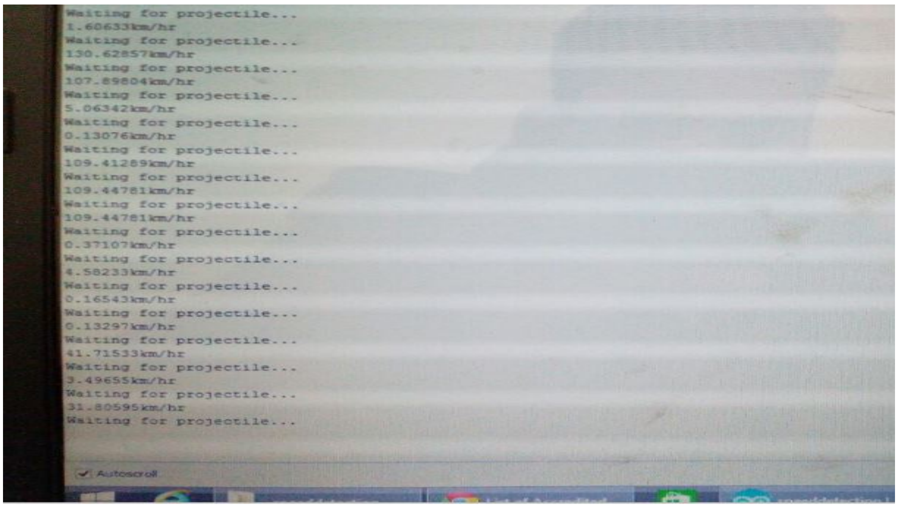


Figure 16: Speed Detection

This was the prototype of our initial work. These two sensors they were set in such a way so that they could have measured the speed of the vehicle. If an object crossed the first sensor then second sensor was ready to detect the same object. In this way we had been able to check the speed of the object on our laptop screen.

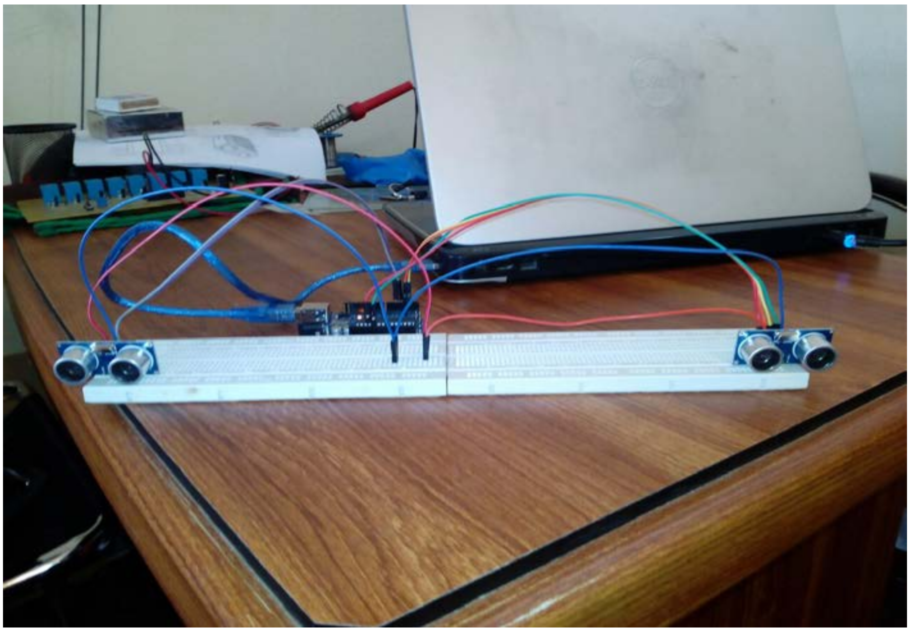


Figure 17: Prototype

This was the initial work on raspberry pi .We wrote the code to take the picture and it over the email. This is the process of sending picture that is being shown in the following picture.

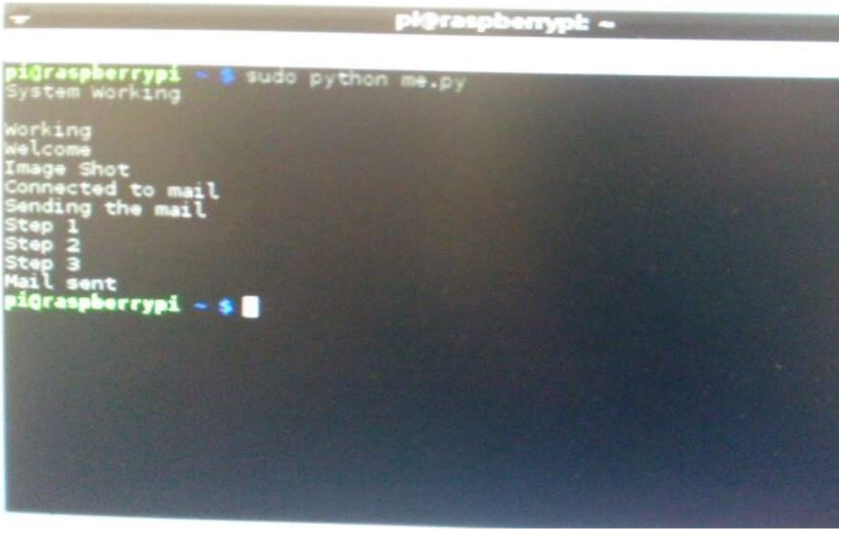


Figure 18: Image Transfer

Once the picture has been received by the base station then MATLAB processing techniques will be implemented on that picture. At the end we have been able to extract the code from the picture. MATLAB results for number plate extraction are given below.

Original Image taken by a camera that is placed at the check point

Figure 19: Picture Captured By Camera

Number plate recognition window where we will insert the image which is received via email to extract the number.

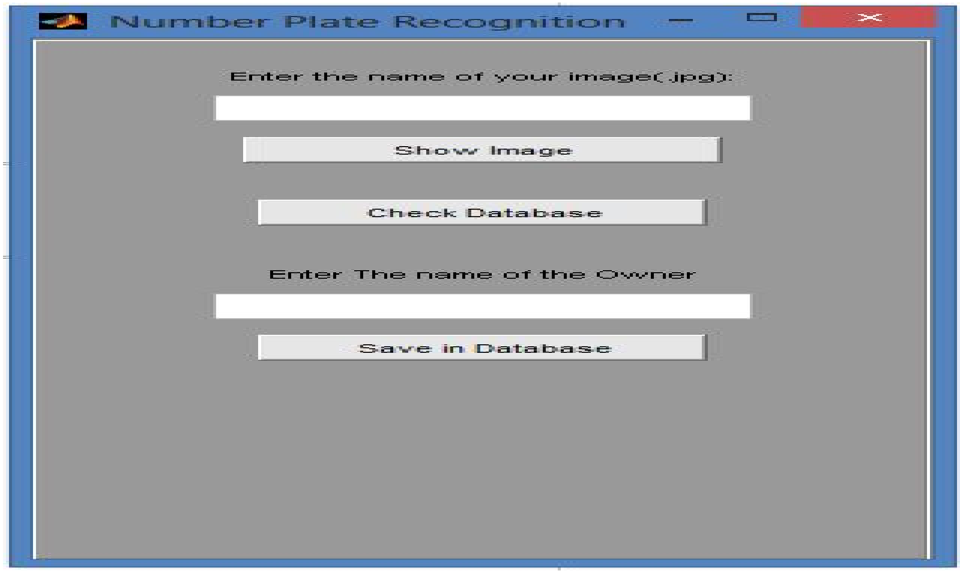


Figure 20: Input Picture Window

The extracted number plate is as below that is shown on note pad

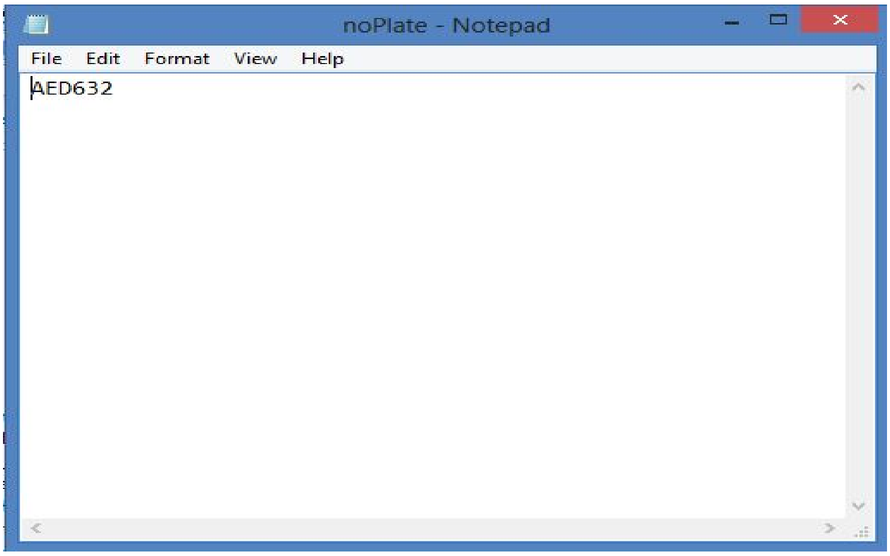


Figure 21: Extracted Number Plate

Chapter 5

5.1 Recommendations for future work

The center might be to actualize the controller utilizing DSP as it can dodge substantial interest in modern control PC while acquiring enhanced computational power and improved framework structure. More data about this strategy can be found in.

1. This framework can be introduced in moving cars by making few changes.
2. Ultrasonic sensors can be traded with long range laser sensors. \
3. Raspberry pi camera can be supplanted with night vision camera.
4. This project can be used in the night as ultrasonic sensors are independent of light. The only need is to replace this camera with night vision camera.
5. Ethernet to get to the web, this can be transformed into 3G or 4G.

5.2 Challenges

To pick the working framework for our raspberry was a troublesome employment in light of the fact that there are numerous OS with distinctive uses. Additionally, the ultrasonic sensors utilized have a low scope of discovery. To pick such a sensor, to the point that is more productive and minimum expense was not all that simple. We tried numerous sensors to use in our task which incorporate ultrasonic sensors, offer wave sensors, SOGA laser sensors and LIDAR sensors and so forth. Those sensors which have long range were expensive .So ultrasonic sensors were the best alternative for us who are productive inside of their extent, give better results and minimum expense.

Moreover inadequate spending plan likewise imperatives us from obtaining a much unrivaled camera module for catching the pictures. At first we attempted USB camera to catch the photo yet here and there it stayed undetected. To conquer this issue we expected to purchase a camera that has great execution yet it was too expensive to buy it. So we utilized raspberry pi camera module that has preferred execution over minimal effort USB camera Moreover, a great deal of time was obliged to dispose of such difficulties

Chapter 6

6.1.1 Conclusion

Overview

This project is a cost efficient speed surveillance system which will detect and monitor speed of a vehicle and compare with the inbuilt detect speed of system. We set different parameter for speed according to object availability in path and set speed criteria according to them. Basically in this project we have two module one on check point and other on Base Station. The most beneficial part of our project is that once the system has been installed then there is no man needed to operate this system because it is self operating system.

Objectives Achieved

This project is completed, with the understanding of all the components which are used in it. We have used Raspberry Pi B, ultrasonic sensors, ARDUINO NANO and RF transmitter and receiver in it. This project revealed us everything how and where these components can be used and how to sort out the problem when you are provided only these components.

Limitations

1. Sensors have limited range of five meter. They cannot detect the object beyond this range.
2. Camera has less capability to capture the picture of moving object.
3. LAN Internet is required to mail the picture of violating vehicle and thus limiting the easy–to- carry feature to some extent.

Chapter 7

7.1 Demonstration Outline

All the results related to speed monitoring and different sensor have been demonstrated in the report. These are the basic outline of demonstration:

Fig 22: System Ready to Detect the Vehicle

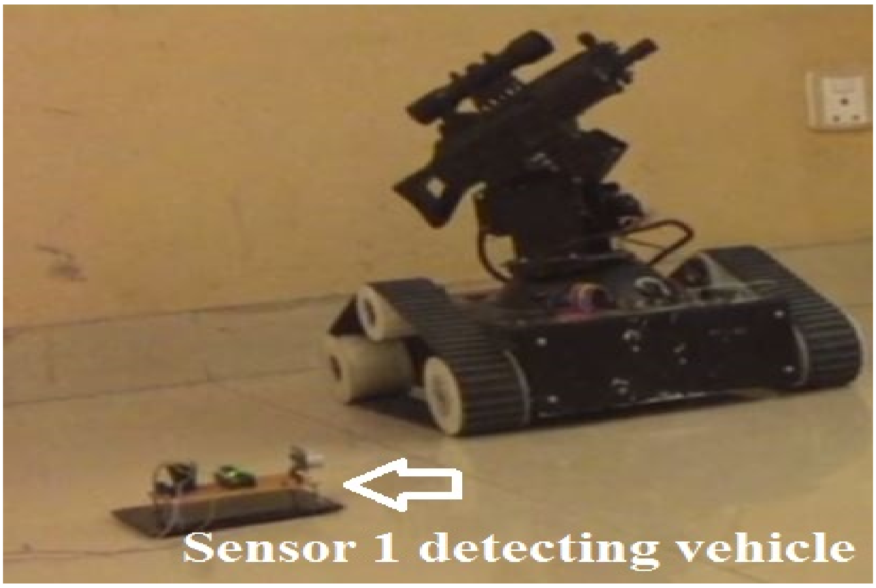


Fig 23: Sensor 1 Detecting Vehicle

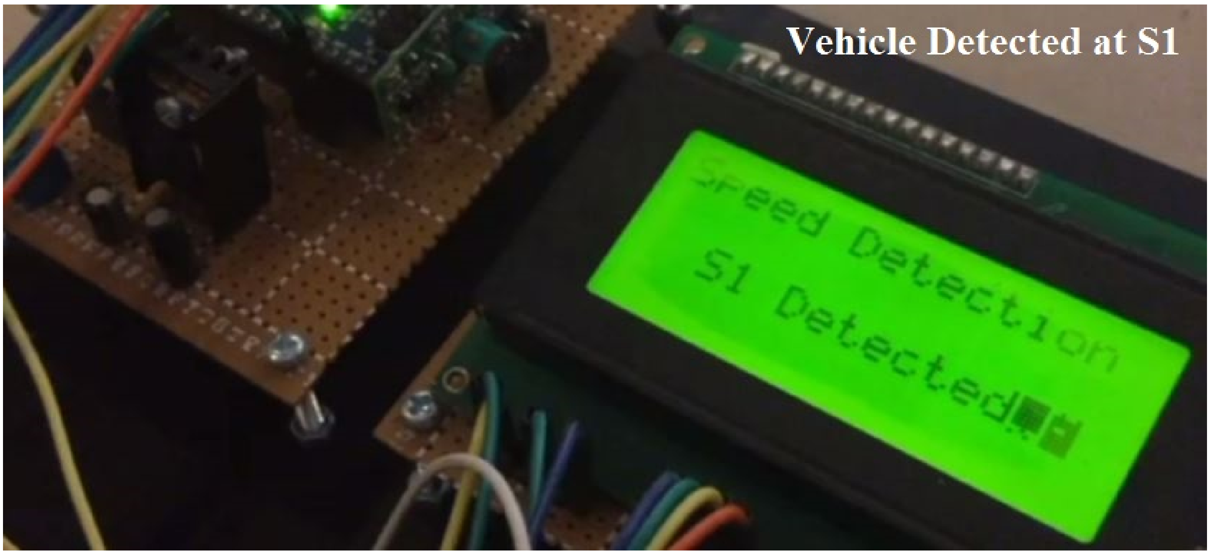


Fig 24: Vehicle Detected at S1

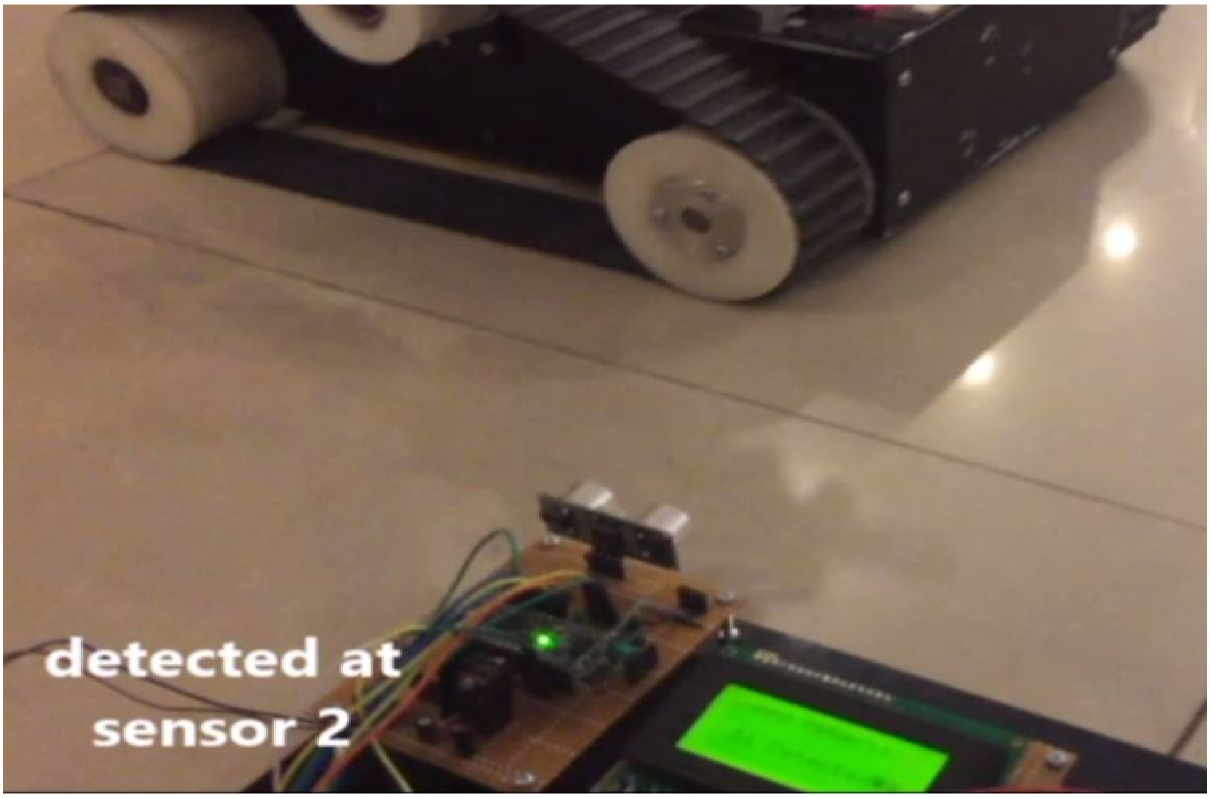


Fig 25: Vehicle Detected at Sensor 2

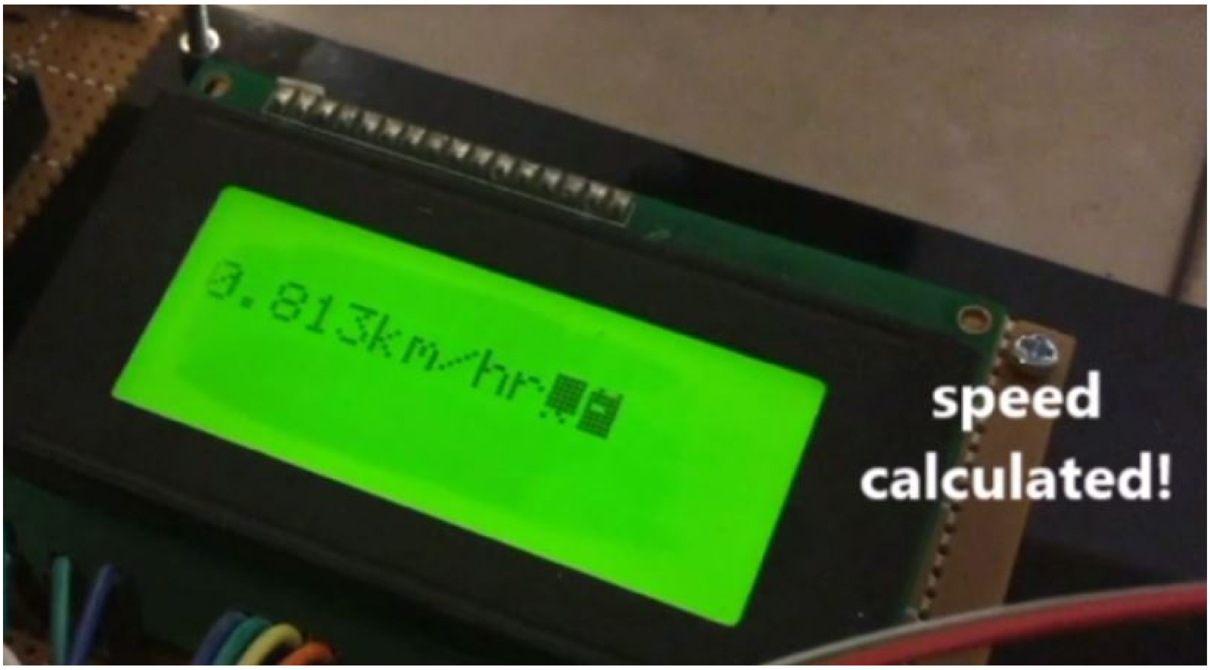


Fig 26: Speed Calculated by the Arduino

Fig 27: Picture Captured By the RPI

References

Many institutions and companies working on the satellite projects have done this type of work. Some references of these works are as follows:

1. D. Beymer, P. McLauchlan, B. Coifman, and J. Malik. Real-time computer vision system for measuring traffic parameters. In Computer Visionk8 Pattern Recognition, 1997

2. D. Gibbins, G. N. Newsam, and M. J. Brooks. Detecting suspicious background changes in video surveillance of busy scenes. In Proceedings 3rd IEEE Workshop on Applications of Computer Vision, pages 22–26, Sarasota, FL, USA, Dec 1996.

3. C. Stauffer and W. E. L. Grimson. Adaptive background mixture models for real-time tracking. In Computer Vision Pattern Recognition, pages 246–252, Ft. Collins, CO, 1999.

4. Chen, B., Lei, Y., Li, W. A novel background model for real-time vehicle detection. 7th International Conference on Signal Processing. Volume 2, pp.1276-1279, September 2004.

5. Abe, K., Tobana, T., Sasamori, T., Koizumi, H. A study on a road-vehicle communication system for the future intelligent transport systems. Seventh International Conference on Parallel and Distributed Systems: Workshops, July 2000.

Appendix A

SPEED SURVEILLANCE SYSTEM

Extended Title: Vehicles Speed Surveillance System Using Sensors

Brief Description: The syndicate will design hardware to provide a surveillance system. The aim is to develop a hardware that will enable the user to measure the speed of an object moving in day light or in night with the help of an infrared night vision camera. If the approaching object speed excesses the imposed limit, video of the real time event will instantly be transmitted to a monitoring post. Alarm is generated, speed and video is displayed and the data will be successfully saved in a linked database. In the monitoring post we will have a monitor displaying speed of the vehicle when an illegal action has been taken. The receiver at that point will receive the transmitting video.

Scope of Work: The over speed vehicles are not only a threat to passengers traveling in it but also to many others and whole of the traffic. It is a universal problem which has been discussed at highest forums and practical steps are also taken in this regard. We propose to enhance the speed monitoring activity of Traffic Police Departments. The aim of the proposed project will be to record the speed of approaching vehicles using speed radars and recording the video to help monitor the traffic to avoid accidents.

Academic Objectives: The project will involve:

- Understanding of Antennas and Amplifiers.
- Understanding of Basic Electrical Circuits
- Understanding and use of Microcontrollers.

Application / End Goal Objectives: The speed-o-meter can be used on the check posts to impose speed limit as the drivers would not be aware of a hidden camera monitoring speed. Ordinary speed cameras lack the capability to measure the speed at night and the proposed hardware will be a solution to this particular problem.

Material Resources Required :

- Antenna TX/RX
- OP Amplifiers
- Bipolar Junction Transistors
- RF receiver and camera
- Other Basic Electrical Components

No of Students Required : Three

4/4/14

Previous Work Done on The Subject:

- Role of Night Vision equipment (University of Glasgow)
  www.dcs.gla.ac.uk/~johnson/papers/night_accidents.pdf
- Night Vision: Requirement for FIR and NIR (Aulitov Research, SE-447 Vargada, Sweden)
  www.aulitov.com/documents/research%20papers/5.%20Kalhammer.pdf

Approval Status **Supervisor Name & Signature**: Fazal Ahmed
Assistant Professor
MCS NUST

Assigned to:

- GC Azmat Ullah
- GC Bilal Riaz
- FC Wasef Misaad

HoD Signature ____________________ 4/4/2014.

Coordinator Signature____________________ 4/4/14

Appendix B

Code used for the project

Sensor 1

```
#include <EasyTransfer.h>

#include <NewPing.h>

//create object

EasyTransfer ET;


//#define echoPin 12 // Echo Pin

//#define trigPin 11 // Trigger Pin

#define TRIGGER_PIN  11  // Arduino pin tied to trigger pin on the ultrasonic sensor.

#define ECHO_PIN     12  // Arduino pin tied to echo pin on the ultrasonic sensor.

#define MAX_DISTANCE 200 // Maximum distance we want to ping for (in centimeters). Maximum sensor distance is rated at 400-500cm.


NewPing sonar(TRIGGER_PIN, ECHO_PIN, MAX_DISTANCE); // NewPing setup of pins and maximum distance.


//long duration, distance; // Duration used to calculate distance


struct SEND_DATA_STRUCTURE{

  //put your variable definitions here for the data you want to send
```

```
  //THIS MUST BE EXACTLY THE SAME ON THE OTHER ARDUINO
  int sensor1;
  //int sensor2;
};

//give a name to the group of data
SEND_DATA_STRUCTURE mydata;

void setup(){
  Serial.begin(4800);
  //start the library, pass in the data details and the name of the serial port. Can be Serial, Serial1, Serial2, etc.
pinMode(13, OUTPUT);
//pinMode(echoPin, INPUT);

  ET.begin(details(mydata), &Serial);


}
long distance;
void loop(){

  digitalWrite(13,LOW);
```

```
 delay(50);
unsigned int uS = sonar.ping(); // Send ping, get ping time in microseconds (uS).
//Serial.print("Ping: ");
//Serial.print(uS / US_ROUNDTRIP_CM); // Convert ping time to distance in cm and print result (0 = outside set distance range)
//Serial.println("cm");
 distance = uS / US_ROUNDTRIP_CM;
Serial.println(distance);
// mydata.sensor2 = 0;
 //send the dat
// ET.sendData();


 if ( distance > 5 && distance < 50   )
 {digitalWrite(13,HIGH);
   Serial.println("loop1");
 //this is how you access the variables. [name of the group].[variable name]
 mydata.sensor1 = 1;
 ET.sendData();
  mydata.sensor1 = 1;
 ET.sendData();
  mydata.sensor1 = 1;
 ET.sendData();
 //delay(10);
```

```
  while ( distance > 5 && uS / distance < 50 )
  {
delay(50);
unsigned int uS = sonar.ping(); // Send ping, get ping time in microseconds (uS).
distance = uS / US_ROUNDTRIP_CM;
//Serial.print("Ping: ");
//Serial.print(uS / US_ROUNDTRIP_CM); // Convert ping time to distance in cm and print result (0 = outside set distance range)
//Serial.println("cm");
    //delay(10);
  }


  }
  //delay(100);
  }
```

Sensor 2

```
`#include <EasyTransfer.h>
// include the library code:
#include <LiquidCrystal.h>
#include <NewPing.h>


int over_speed=0;
```

```
// initialize the library with the numbers of the interface pins

LiquidCrystal lcd(9, 8, 7, 6, 5, 4);


#define TRIGGER_PIN  11  // Arduino pin tied to trigger pin on the ultrasonic sensor.

#define ECHO_PIN     12  // Arduino pin tied to echo pin on the ultrasonic sensor.

#define MAX_DISTANCE 200 // Maximum distance we want to ping for (in centimeters). Maximum sensor distance is rated at 400-500cm.


NewPing sonar(TRIGGER_PIN, ECHO_PIN, MAX_DISTANCE); // NewPing setup of pins and maximum distance.


//#define echoPin 12 // Echo Pin

//#define trigPin 11 // Trigger Pin

#define resetPin 10 // Trigger Pin


//long duration, distance; // Duration used to calculate distance


unsigned long time, time2;

float mps, elap, second;

float kmhour=0;


//create object

EasyTransfer ET;
```

```
struct RECEIVE_DATA_STRUCTURE{
  //put your variable definitions here for the data you want to receive
  //THIS MUST BE EXACTLY THE SAME ON THE OTHER ARDUINO
  int sensor1;
};

//give a name to the group of data
RECEIVE_DATA_STRUCTURE mydata;

void setup(){


    // define callbacks for i2c communication



digitalWrite(resetPin, HIGH);
delay(200);
pinMode(13, OUTPUT);
//pinMode(echoPin, INPUT);
pinMode(resetPin, OUTPUT);

  Serial.begin(4800);
```

```
  //start the library, pass in the data details and the name of the serial port. Can be Serial, Serial1, Serial2, etc.
  ET.begin(details(mydata), &Serial);


  lcd.begin(16, 4);
  // Print a message to the LCD.
  lcd.print("Speed Detection");
  delay(1000);
}


int S1;
//int S2;
int check=0;
long distance;


void loop(){
//  Serial.write(0);
//Serial.print(0);
  check = 0;
  S1=0;
  digitalWrite(resetPin, HIGH);
  //digitalWrite(13,HIGH);
  //Serial.println("Waiting for projectile...");
```

```
  //check and see if a data packet has come in.
  if (ET.receiveData()){
//  Serial.println("loop1");
 S1 = mydata.sensor1;
// Serial.println(S1);
 delay(100);
  }
 /*
 digitalWrite(trigPin, LOW);
 delayMicroseconds(2);

 digitalWrite(trigPin, HIGH);
 delayMicroseconds(10);

 digitalWrite(trigPin, LOW);
 duration = pulseIn(echoPin, HIGH);

   //Calculate the distance (in cm) based on the speed of sound.
 distance = duration/58.2;
*/
```

```
if ( S1 == 1 )
  { S1=0;
//Serial.println("loop2");
    //Serial.println("loop1");
time=micros();
lcd.setCursor(-2, 2);
lcd.println("S1 Detected");

while ( check == 0)
{ delay(50);
  unsigned int uS = sonar.ping(); // Send ping, get ping time in microseconds (uS).
  //Serial.print("Ping: ");
  distance = uS / US_ROUNDTRIP_CM; // Convert ping time to distance in cm and print result (0 = outside set distance range)
//  Serial.println(distance);

 if (  distance > 5 && distance < 50 )
 {    //Serial.println("loop4");

    time2=micros();
lcd.setCursor(-2, 3);
lcd.println("S2 Detected");
   //digitalWrite(13,HIGH);
```

```
  while ( distance > 5 && distance < 50 )
  {
   delay(50);
 unsigned int uS = sonar.ping(); // Send ping, get ping time in microseconds (uS).
 //Serial.print("Ping: ");
 distance = uS / US_ROUNDTRIP_CM; // Convert ping time to distance in cm and print result (0 = outside set distance range)
//  Serial.println(distance);
    //Serial.println("loop5");
  }


  elap= time2 - time;




 // distance between sensor is 4 inch = 0.1016 m
 // if distance 15 Inch then = 0.381 m


 mps = 2000000 / elap;
 // 1 m/s = (18 / 5) km/hour


 kmhour = mps * 3.6;
```

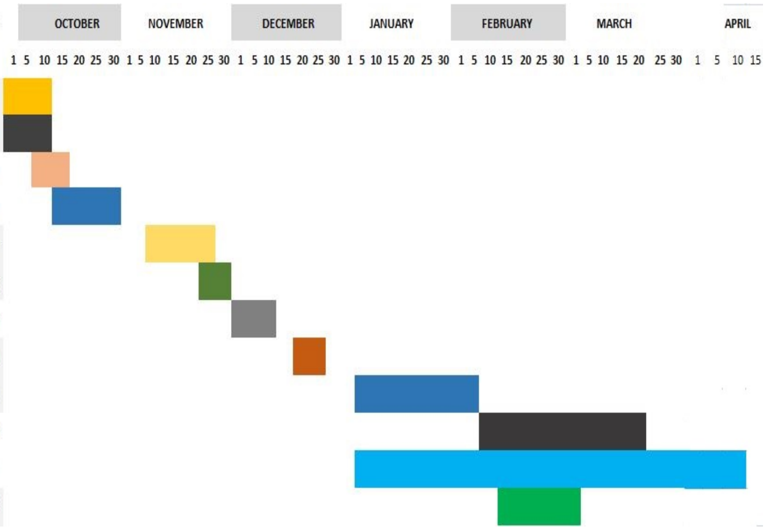
```
  check=1;
  S1 = 0;

  if (kmhour < 300)
  {

//  Serial.write(0);
//Serial.print(0);
//  Serial.print(kmhour,3);
//  Serial.println("km/hr");
  lcd.clear();
  lcd.setCursor(0, 1);
  lcd.print(kmhour,3);
  lcd.println("km/hr");


if (kmhour > 10){
Serial.print(2);
//Serial.write(2);
over_speed = 1;
digitalWrite(13,HIGH);
delay(1000);
digitalWrite(13,LOW);
```

```
//delay(1000)
}
delay(2000);
digitalWrite(resetPin,LOW);
}

  //S1 = 0;
}
}
}


 //delay(100);
}
```

Appendix C

Timeline

ACTIVITY	PLAN START	DURATION	END TIME
Literature Review	01-Oct-14	1 Week	08-Oct-14
Background Study	01-Oct-14	1 Week	08-Oct-14
Previous Work	10-Oct-14	1 Week	17-Oct-14
Platform/Sensors	17-Oct-14	2 Weeks	31-Oct-14
Selection of Sensors	10-Nov-14	2 Weeks	24-Nov-14
Selection of RPI	24-Nov-14	1 Week	30-Nov-14
Coding on RPI	01-Dec-14	2 Weeks	14-Dec-14
Software Implementation	20-Dec-14	1 Week	27-Dec-14
Hardware Implementation	09-Jan-15	4 Weeks	06-Feb-15
Testing Phase	06-Feb-15	6 Weeks	20-Mar-15
Thesis & Documentation	09-Jan-15	13 Weeks	10-Apr-15
End	15-Feb-15	2 Weeks	01-Mar-15



Appendix D

Cost Breakdown

Estimated cost for described project is Rs 33800

Name of Component	No of Units	Unit Price	Total Price
Raspberry Pi B	1	Rs 4500	Rs 4500
Arduino Nano	2	Rs 2000	Rs 4000
RF transceiver	1	Rs 1500	Rs 1500
LCD	1	Rs 400	Rs 400
Ultrasonic Sensors	2	Rs 1500	Rs 3000
Voltage Regulator	1	Rs 200	Rs 200
RPI Camera Module	1	Rs 4000	Rs 4000
Connectors		Rs 200	Rs 200
Misc Components (Resistors , Capacitors, inductors, HDMI etc)			Rs 8000
PCB board			Rs 1000
Batteries	2	Rs 1000	Rs 2000
Miscellaneous			Rs 5000
GRAND TOAL			Rs 33800