Traffic Violation Control using Machine Learning

PROJECT REPORT

Submitted by

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Under the Guidance of
Dr. V. BHARATHI
Professor

in partial fulfillment for the award of the degree of
BACHELOR OF TECHNOLOGY
in
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
MADAGADIPET, PONDICHERRY
PONDICHERRY UNIVERSITY
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BONAFIDE CERTIFICATE

This is to certify that the project work entitled **"TRAFFIC VIOLATION CONTROL USING MACHINE LEARNING"** is a bonafide work done by **ANANDARAJ A [REGISTER NO. : 17TC0209], DEVAKUMAR R [REGISTER NO. : 17TC0239], SIDDARTH S [REGISTER NO. : 17TC0366], SURIYA.R [REGISTER NO. : 17TC0376]** in partial fulfillment of the requirement for the award of B.Tech., Degree in the Department of Electronics and Communication Engineering of Pondicherry University during the academic year 2020-2021.

HEAD OF THE DEPARTMENT	GUIDE
Dr. P. Raja	**Dr. V. Bharathi**
Department of ECE	**Professor, ECE**

Submitted for the University Viva-Voce Examination held on.....…

INTERNAL EXAMINER **EXTERNAL EXAMINER**

ACKNOWLEDGEMENT

First and foremost, we would like to thank our guide, **DR. V. Bharathi**, *Professor, Department of Electronics and Communication Engineering*, for the valuable guidance and advice. She inspired us greatly to work in this project. Her ability to inspire us has made an enormous contribution to our project.

We would like to take this opportunity to express our deepest gratitude to **DR.P.Raja**, *Professor and Head of the Department, Electronics and Communication Engineering*, for giving us valuable suggestions. He has always been a source of inspiration and encouragement towards the project.

We thank our project coordinator **DR. J. Pradeep**, *Professor, Department of Electronics and Communication Engineering*, for his endless support and guidance.

We would like to take this opportunity to thank our respected *Director cum Principal*, **DR. V.S.K. Venkatachalapathy** and our *Management* for providing us the best ambience to complete this project.

We would like to thank all the Electronics and Communication Engineering Department Teaching Staff and Technical Staff for their support to complete this project.

Finally, for the motivation and assistance in completing this mission, an honorable mention goes to our families and friends. Without their support we would have faced many challenges while doing this project.

ABSTRACT

The main objective is to detect the traffic signs and helps to warns the drivers and to reduces the traffic violations by using automatic fine system. In order to ensure the safety of pedestrian and fellow people, drivers must obey the traffic symbols and traffic rules. The main theme is to alert drivers about the traffic symbols and speed limit and ensure that the drivers are obeying traffic rules. Computer vision based technology is used to detect the symbols and alerts drivers. If the driver breaks the traffic rules then by using the Internet of Things the penalty is fined to the vehicle. They can pay bills at post office or at other government sector places.

KEYWORDS:- Internet of things(IOT), Machine learning, Penalty System, Camera, GSM.

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

Violations in traffic laws are very common in a highly populated country like India. The conditions are even worse in metro cities like Delhi, Mumbai, Bangalore and Chennai. Being a metro city and a highly populated one also, has a lot of road accidents every year. The accidents associated with these violations cause a huge loss to life and property. The speed limit violation on high traffic density areas leads to many accidents. Monitoring these kinds of violation for traffic police is very difficult tasks. Drivers forcefully or intentionally violate the traffic rules when there are no police.

1.2 KEY FINDINGS

- The higher the speed of a vehicle, the shorter the time a driver has to stop and avoid a crash. A car travelling at 50 km/h will typically require 13 metres in which to stop, while a car travelling at 40 km/h will stop in less than 8.5 metres
- An increase in average speed of 1 km/h typically results in a 3% higher risk of a crash involving injury, with a 4–5% increase for crashes that result in fatalities.
- Around 71% of road accidents in the India were due to speed violations that too in year 2019.

1.3 INTRODUCTION TO EMBEDDED SYSTEMS

An embedded system is accomplished to perform one particular task albeit with distinct choices and options. Embedded systems consist of processing cores that are either micro controllers or digital signal processors. Micro controllers are broadly known as chip, which may itself be packaged with other microcontrollers in a combination system of Application Specific Integrated Circuit (ASIC). In general, input always comes from a detector or sensors in more accurate words and meanwhile the output goes to the activator which may initiate or terminate the operation of the machine or the operating system. An embedded system is a hybrid of both hardware and software, each embedded system is uncommon and the hardware is highly specialized in the application domain. Hardware

comprises processors, micro controllers, IR sensors etc. On the flip side of the coin, Software is just like a brain of the whole embedded system as this consists of the programming languages used which makes hardware work. Consequently, embedded systems programming can be a widely varying experience. The chip-based framework is built for controlling a capacity or scope of capacities and isn't intended to be customized by the end client similarly a PC is characterized as an implanted framework. An embedded structure is an amalgamation of computer paraphernalia and software program, either fixed incapability or programmable, that is specifically designed for a particular kind of application device. Manufacturing appliances, motorcar, medical tools, vending contrivance and toys are among the countless possible hosts of an embedded system. Embedded systems that are programmable are provided with a programming interface, and embedded systems programming id specialized occupation.

Fig 1.1 Embedded System

On the flip side of the coin, the microcontroller is a single silicon chip consisting of all input, output and peripherals on it. A single microcontroller has the following characteristics:

1. Arithmetic and logic unit
2. Memory for storing program
3. EEPROM for non-volatile and special function registers
4. Input/output ports

5. Analog to digital converter
6. Circuits
7. Serial communication ports

1.3.1 STRUCTURE OF EMBEDDED SYSTEMS

Embedded systems vary in complexity but, generally, consist of three main elements:

- **Hardware.** The hardware of embedded systems is based around microprocessors and microcontrollers. Microprocessors are very similar to microcontrollers and, typically, refer to a CPU (central processing unit) that is integrated with other basic computing components such as memory chips and digital signal processors (DSPs). Microcontrollers have those components built into one chip.
- **Software and firmware.** Software for embedded systems can vary in complexity. However, industrial-grade microcontrollers and embedded IoT systems usually run very simple software that requires little memory.
- **Real-time operating system.** These are not always included in embedded systems, especially smaller-scale systems. RTOS defines how the system works by supervising the software and setting rules during program execution.

1.3.2 CLASSIFICATION OF EMBEDDED SYSTEMS

Embedded Systems are classified based on:

- **Function**
- **Performance**

Based on functions, embedded systems are classified as:

- **Mobile embedded systems** are small-sized systems that are designed to be portable. Digital cameras are an example of this.
- **Networked embedded systems** are connected to a network to provide output to other systems. Examples include home security systems and point of sale (POS) systems.

- **Standalone embedded systems** are not reliant on a host system. Like any embedded system, they perform a specialized task. However, they do not necessarily belong to a host system, unlike other embedded systems. A calculator or MP3 player is an example of this.
- **Real-time embedded systems** give the required output in a defined time interval. They are often used in medical, industrial and military sectors because they are responsible for time-critical tasks. A traffic control system is an example of this.

Based on performance, embedded systems are classified as:

- **Small-scale embedded systems** often use no more than an 8-bit microcontroller.
- **Medium-scale embedded systems** use a larger microcontroller (16-32 bit) and often link microcontrollers together.
- **Sophisticated-scale embedded systems** often use several algorithms that result in software and hardware complexities and may require more complex software, a configurable processor and/or a programmable logic array.

1.4 THE INTERNET OF THINGS (IOT)

The Internet of Things (IoT) plays a significant role in applied science, technology industry, policy, and engineering circles and has become headline news in both the specialty press and the popular media. This mechanization is to personify a broad spectrum of networked outcomes, systems, and sensors, which take primacy of amelioration in computing power, electronics miniaturization, and network interconnections to provide unique capabilities not previously possible.

A multitude of conferences, reports, and news articles discuss and debate the eventual impact of the “IoT revolution”—from modern market opportunities and business models to concerns about security, privacy, and high-tech interoperability. The large-scale implementation of IoT devices assures to transform many aspects of the way we live. For purchasers, unique IoT products like Internet-enabled gadgets, household automation appliances, and energy management tools are moving us toward a perception of the “smart home’’, offering more security and energy efficiency. Other personal IoT appliances like wearable fitness and health monitoring gadgets and network enabled medical devices are transforming the way healthcare services are delivered. This technology is obligated to be

beneficial for people with disabilities and the older people, enabling advanced levels of independence and quality of life at a reasonable cost. IoT computing like networked automobiles, intelligence traffic systems, and sensors embedded or applied in roads and bridges move us closer to the notion of "smart cities'', which help to minimize congestion and energy consumption. IoT technology provides the possibility to renovate farm field workers, manufactures, and energy mass production and distribution by stepping up the availability of information along the value chain of production using networked sensors Today, the Internet of Things has become an eminent term for portraying outlines in which Online connectivity and computing capability broadens to a diverse of objects, devices, sensors, and everyday items. While the term "Internet of Things" is relatively brand-new, the concept of combining computers and networks to monitor and control gadgets has been around for decades. From a wide perspective, the confluence of several manufacturers and marketing trends is making it possible to interconnect more and smaller devices cheaply and easily:

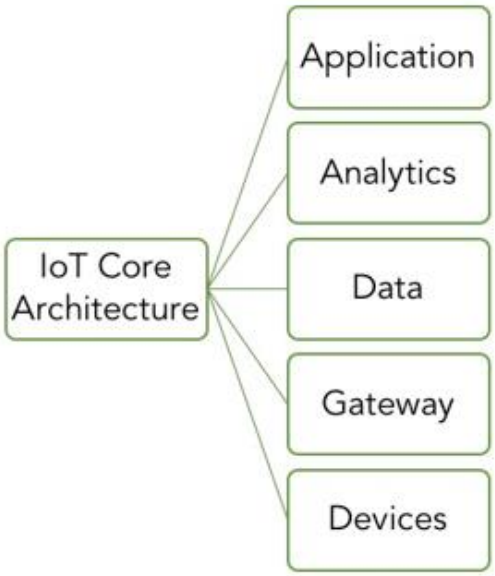
- Connectivity Low–expenditure, high–speed, inescapable network Ubiquitous connectivity, especially through licensed and unlicensed wireless services and technology, makes almost everything "connectable''.
- Broad spread adoption of IP–based networking— IP has become the effectual global standard for networking, contributes a well–defined and widely implemented platform of software and apparatus that can be incorporated into a broad range of devices handily and cheaply.
- Computing Economics— is monitored by industry speculation in research, advancement, and manufacturing, Moore's law21 continues to provides greater computing power at reducing price points and lower power consumption.
- Miniaturization— Manufacturing advances acquiesce cutting-edge computing and communications technology to be incorporated into very small objects. Coupled with greater computing economics, this has rocketed up the development of small-scale and low-priced sensor gadgets, which put up many IoT applications.
- Advances in Data Analytics— Unique algorithms and rapid increases in computing power, data storage, and cloud services empower the aggregation, correlation, and analysis of vast quantities of data; these large and dynamic datasets provide contemporary opportunities for extracting information and knowledge.

1.4.1 IoT Devices Framework

Connected gadgets are part of a framework in which every appliance talks to other related devices in an open environment to automate household and industry tasks, and to communicate usable sensor data to users, business and other interested parties. IoT gadgets are meant to operate in concert for people at household, in industry or in the enterprise. As such, the gadgets can be comprised into three main groups: consumers, enterprise and industrial.

Consumer linked gadgets comprises smart TVs, smart speakers, toys, gadgets and smart contraption, Smart lilt, commercial security systems and smart city technologies such as those used to monitor traffic and weather conditions are one of the instances of industrial and enterprise IoT appliances. The below figure shows the architecture of IoT and steps of analysis of data.

In the enterprise, smart sensors and appliances located in a conference room can aid an employee to locate and schedule an available room for a discussion, ensuring the proper room type, size and features are available. When meeting attendees set foot in the room, the temperature will modify according to the tenancy, and the lights will faint as the appropriate PowerPoint loads on the screen and the speaker begins his presentation. Fig 1.2 represents the architecture of the IOT systems.



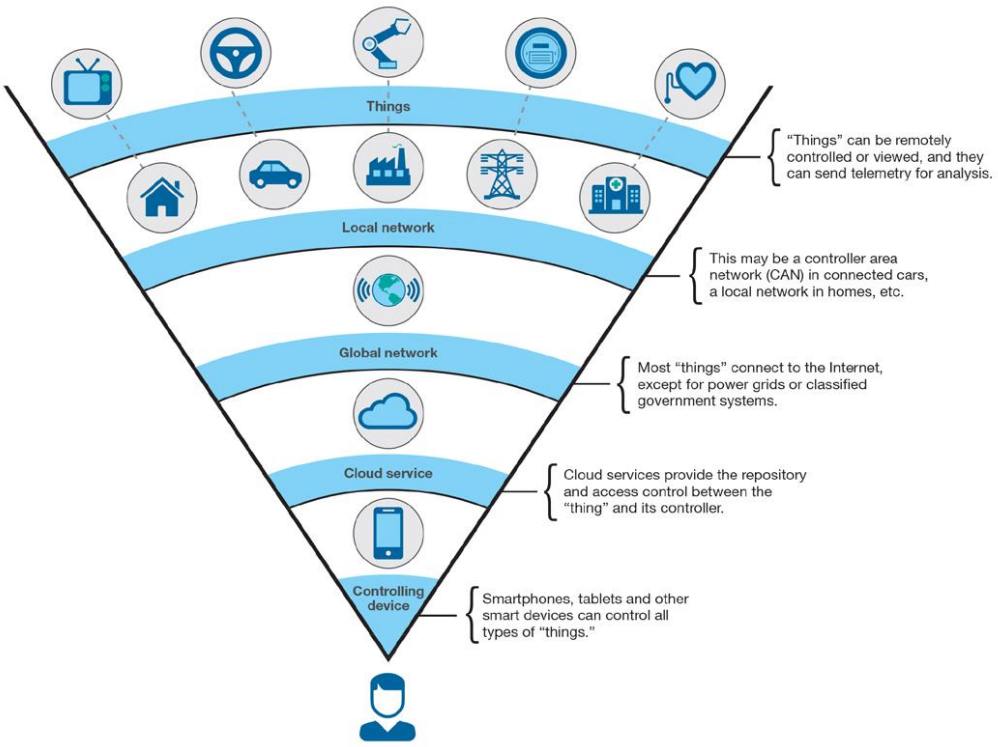


Fig 1.2 Architecture

1.4.2 IoT Security

The coordinated of conventional dumb gadgets elevates a number of interrogations in relation to security and seclusion. As if in most of the cases, IOT automation has advanced more swiftly than the mechanisms accessible to protect the appliances and their users.

1.4.3 Challenges in traditional IoT security

Security is the basic requirement of any user of digital media. An internet user will not share his confidential and important data on the network unless the network is trusted. With the emergence of cloud computing the security demands of its user also increased as they have to trust on third person owned cloud. For cloud vendors to attract more users to use their services they need to build user trust through cloud audits and Certification of compliance to CSA security standards or other standards of security. Although legacy network security solutions are mature enough but it is not feasible to apply it in the context of IoT due to the size of IoT networks heterogeneity in its architecture and resource constrained

IoT end nodes.

- ➢ Cryptographic techniques
- ➢ Key management
- ➢ Denial of Service
- ➢ Authentication and Access Control

1.4.4 IoT device connectivity and networking

The networking, communication and connectivity protocols used with internet-enabled devices largely depend on the specific IoT application deployed. Just as there are many different IoT applications, there are many different connectivity and communications options.

- Device registration
- Device authentication/authorization
- Device configuration
- Device provisioning
- Device monitoring and diagnostics
- Device troubleshooting

1.4.5 Transmitting mail from your Iot device

Mobile-Phone announcements are a superior method to get apprises about an atypical activity. When we are advancing an IOT solution it is always adequate to transmit SMS to the user's Mobile-phone for definite activity as the smartphones are always within reach. It is not always feasible for a user to monitor the statistics with an Mobile app or a website.

If they get a notification about a certain pursuit or a sudden variation in data they will come to know this by time and instantly check it with the mobile app and can take the further steps.

Requirements

- Raspberry Pi 3 Model B+
- USB cable
- Power Supply
- Jumper cables

- Bluetooth Module HC05

1.5 MACHINE LEARNING (ML)

Machine learning is the study of computer algorithms that improve automatically through experience. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as email filtering and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

A subset of machine learning is closely related to computational statistics, which focuses on making predictions using computers; but not all machine learning is statistical learning. The study of mathematical optimization delivers methods, theory and application domains to the field of machine learning. Data mining is a related field of study, focusing on exploratory data analysis through unsupervised learning. In its application across business problems, machine learning is also referred to as predictive analytics.

1.5.1 Artificial intelligence

Artificial intelligence (AI) is the ability of a computer program or a machine to think and learn. It is also a field of study which tries to make computers "smart". They work on their own without being encoded with commands.

1.5.2 Data mining

Machine learning and data mining often employ the same methods and overlap significantly, but while machine learning focuses on prediction, based on known properties learned from the training data, data mining focuses on the discovery of (previously) unknown properties in the data (this is the analysis step of knowledge discovery in databases). Data mining uses many machine learning methods, but with different goals; on the other hand, machine learning also employs data mining methods as "unsupervised learning" or as a pre-processing step to improve learner accuracy.

1.5.3 Optimization

Machine learning also has intimate ties to optimization: many learning problems are formulated as minimization of some loss function on a training set of examples. Loss functions express the discrepancy between the predictions of the model being trained and the actual problem instances

1.5.4 Generalization

The difference between optimization and machine learning arises from the goal of generalization: while optimization algorithms can minimize the loss on a training set, machine learning is concerned with minimizing the loss on unseen samples. Characterizing the generalization of various learning algorithms is an active topic of current research, especially for deep learning algorithms.

1.5.5 Statistics

Machine learning and statistics are closely related fields in terms of methods, but distinct in their principal goal: statistics draws population inferences from a sample, while machine learning finds generalizable predictive patterns. According to Michael I. Jordan, the ideas of machine learning, from methodological principles to theoretical tools, have had a long pre-history in statistics. He also suggested the term data science as a placeholder to call the overall field

1.6 OBJECTIVE

To provide a technology to reduce the speed limit violation of drivers and to ensure the safety of pedestrian and fellow drivers. This project demonstrates driver speed limit monitoring systems to avoid traffic violation using the camera and gsm module.

1.7 ORGANIZATION OF THESIS

The organization of the report is given as follows:

CHAPTER 1 Gives the introduction about the traffic rules and traffic causes of traffic violation. This chapter describes about the device which comprises of IoT, Embedded systems and Machine Learning. It is then followed by the objective of the project.

CHAPTER 2 Deals with a detailed analysis of the previously proposed systems on regarding Traffic signal analysis and traffic rules violation monitoring systems. This literature survey adds sufficient information regarding the different author's work.

CHAPTER 3 Gives the complete explanation about the existing system. Along with the working of the existing system, the limitations are also explained.

CHAPTER 4 Comprises the current proposed work, the components used and the working of the different algorithms in it. It is also provided with the needed block diagrams and images followed by the advantages over the existing work.

CHAPTER 5 Gives the working model of the current proposed system with the components.

CHAPTER 6 Concludes the thesis with the results obtained and the future scope of the proposed work.

CHAPTER -2
LITERATURE SURVEY

2.1 OVERVIEW

The related works in the area of Traffic Safety using Internet of Things along with some of its applications are discussed below. It also includes a detailed analysis on the previously proposed works by different authors. It also highlights some defective areas which are required to be filled up in this regard.

2.2 LITERATURE SURVEY

Shreya Asoba; Shreya Supekar; Tushar Tonde; Juned A. Siddiqui[1] The RFID and the image processing techniques are utilized for traffic control. After experimentation and recreation, it is inferred that the purposed technique can be carried out in the current framework and give solid outcomes. The purposed strategy shows clear extension to lessen the likelihood of mistake in petty criminal offense control. Be that as it may, this work can be improved further by utilizing further developed picture handling procedures and adding new highlights.

Djebbara Yasmina; Rebai Karima; Azouaoui Odaiba[2] A deep learning based street traffic signs acknowledgment strategy is created which is promising in the improvement of Advance Driver Assistance System(ADAS) and self-ruling vehicles. The framework engineering is intended to remove principle highlights from pictures of traffic signs to group them under various classes. The introduced strategy utilizes an adjusted LeNet-5 organization to extricate a profound portrayal of traffic signs to play out the acknowledgment. It is established of a Convolutional Neural Organization adjusted by interfacing the yield of all convolutional layers to the Multi-layer Perception (MLP).

Canyong Wang[3] A vision-based vehicle direction framework for street vehicles can have three principle jobs: (1) street identification; (2) obstruction location; and (3) sign acknowledgment. Traffic signs furnish drivers with entirely important data about the street, to make driving more secure and simpler. The creators imagine that traffic signs most assume similar part for independent vehicles. They are intended to be effectively perceived by human

drivers principally on the grounds that their shading and shapes are altogether different from indigenous habitats. The calculation depicted in this paper exploits these highlights. It has two primary parts. The first, for the location, utilizes shading threshold to section the picture and shape examination to distinguish the signs. The subsequent one, for the grouping, utilizes a neural network.

Aashrith Vennelakanti; Smriti Shreya[4] In an attempt to focus on the road while driving, drivers regularly pass up signs out and about, which could be perilous for them and for individuals around them. This issue can be kept away from if there was a productive method to inform the driver without having them to move their core interest. Traffic Sign Detection and Recognition (TSDR) assumes a significant part here by identifying and perceiving a sign, in this manner informing the driver of any forthcoming signs. This guarantees street security, yet in addition permits the driver to be at minimal more straightforwardness while driving on precarious or new streets. Another usually dealt with issue isn't having the option to understand the significance of the sign. With the assistance of this Advanced Driver Assistance Systems application, drivers will presently don't deal with the issue of understanding what the sign says. CNNs have a high acknowledgment rate, hence making it alluring to use for executing different PC vision undertakings. TensorFlow is utilized for the execution of the CNN.

Md. Abdul Alim Sheikh; Alok Kole; Tanmoy Maity[5] Automatic traffic sign identification and acknowledgment is a field of PC vision which is vital angle for cutting edge driver emotionally supportive network. This proposes a structure that will distinguish and group various sorts of traffic signs from pictures. The method comprises of two principle modules: street sign location, and order and acknowledgment. In the initial step, shading space change, shading based division are applied to see whether a traffic sign is available. In the event that present, the sign will be featured, standardized in size and ordered. Neural organization is utilized for characterization purposes. For assessment reason, four sort traffic signs, for example, Stop Sign, No Entry Sign, Give Way Sign, and Speed Limit Sign are utilized.

Banhi Sanyal; Ramesh Kumar Mohapatra; Ratnakar Dash[6] The need of traffic street wellbeing has been talked about and an outline of traffic sign discovery and acknowledgment research works has been given including novel, advancement draws near. Traffic sign information bases and its intrinsic advances: Pre handling, Feature Extraction

and Detection, Post preparing have been examined completely. Be that as it may, above all a general similar investigation of proficiency over the different AI and picture preparing techniques utilized has been drawn, regardless of the much assortment in the pre-owned information base. The difficulties that are looked regardless of the expanding number of investigates going on in the field of Traffic Sign Recognition (TSR) are likewise recorded.

Zhe Zhu; Dun Liang; Songhai Zhang[7] Although promising results have been achieved in the areas of traffic-sign detection and order, scarcely any works have given concurrent answers for these two assignments for reasonable genuine pictures. This made two commitments to this issue. First and foremost, we have made a huge traffic-sign benchmark from 100000 Tencent Street View scenes, going past benchmarks. These pictures cover enormous varieties in illuminance and climate conditions. Each traffic-sign in the benchmark is explained with a class name, its jumping box and pixel veil. Besides, this exhibit how a strong start to finish convolutional neural network can all the while recognize and arrange traffic signs. Most past CNN picture preparing arrangements target protests that involve an enormous extent of a picture, and such organizations don't function admirably for target objects possessing just a little part of a picture like the traffic-signs here**.**

Ying Sun;Pingshu Ge;Dequan Liu[8] Traffic sign location and acknowledgment point are quite possibly the most famous subjects of PC vision and picture preparing lately, as they assume a significant part in self-governing driving and traffic wellbeing. The quantity of signs utilized in this paper for characterization is 28, which are utilized from one side of the planet to the other. Two separate neural organizations have been utilized for discovery and acknowledgment reason; one orders the sign and other the shape. Picture expansion has been utilized to make the preparation and approval dataset. The pictures are prepared to discover the locale of interest, which is then taken care of to two CNN classifiers for characterization. 40,000 pictures have been utilized to prepare the main classifier with 28000 positive and 12000 negative images and 3600 pictures were utilized to prepare the second classifier with 2400 positive pictures and 1200 negative pictures.

Md Tarequl Islam[9] Traffic sign acknowledgment framework is a critical bit of smart transportation framework (ITS). Having the option to distinguish traffic signs precisely and viably can improve the driving wellbeing. Initially, a picture is preprocessed to feature

significant data. Furthermore, Hough Transform is utilized for distinguishing and finding regions. At long last, the distinguished street traffic signs are ordered dependent on profound learning. TensorFlow is utilized to execute CNN. The article, a traffic sign location and recognizable proof strategy because of the picture handling is proposed, which is joined with convolutional neural network to sort traffic signs. Because of its high acknowledgment rate, CNN can be utilized to acknowledge different PC vision assignments.

CHAPTER 3
ADVANCED TRAFFIC VIOLATION CONTROL AND PENALTY SYSTEM USING IOT AND IMAGE PROCESSIING TECHNIQUES

3.1 OVERVIEW

It focuses on a security system that's designed uniquely to serve the aim of providing security and safety for drivers. The target of research work is to form a monitoring system for drivers, which provides following facilities

1. Captures the images of the vehicle and identifies the registered number of vehicle for penalty and legal actions.
2. It gives warning about the Real time traffic signal light.

This model is a monitoring module for traffic violation control. In this module Passive RFID is used to sense the stop line violation by the vehicle. If the vehicle crosses the stop line then the RFID transmitter sends information to RFID receiver. After the Signal received from the transmitter, RFID triggers the Camera to capture the Image of the vehicle and its registration number for legal action. Here GSM, which is capable of sending SMS to the particular server in real time.

The various devices are connected through IOT. RFID transmitter and receiver are connected. Camera is interconnected with RFID receiver, which triggers the ON and OFF of the camera in order to capture the image of the vehicle. A specific web application is employed to activate SMS and image capturing process. Finally, the appliance of IOT technology here is to upload all the present status from the implemented module to server for the storage and for all accessible users. The GSM module, which is used only allows one-way communication, i.e. only the message is send to the server and there is no any reply from the server. Figure below depicts the construction and working of the existing prototype. Fig. 3.1 shows the flow diagram of the system.

Fig. 3.1 FLOW DIAGRAM

3.2 HARDWARE SPECIFICATIONS

The specifications of the hardware utilized in the existing system are given below:

RFID TAGS

It is a type of tracking systems. RFID tags use smart barcodes in order to identify the products. It uses radio technology in order to communicate the information which is previously feeded for the particular purposes. These tags transmit date from RFID tag to the reader. There are two types of RFID tags are in real time usage, they are active and passive tags. In this module, passive RFID tag is used in order to transmit the data. The tags are already preloaded with the information about the vehicle. An RFID tag may also be called an RFID chip. They can also use to

track vehicle, in supermarkets and in various other real-time usage. The RFID tag is shown in Fig. 3.2

Fig. 3.2 RFID Tag and Reader

CAMERA

It is an optical instrument, which is used to capture the image. In this module camera is used to capture the complete image of the violating vehicle. Camera lens takes all the light rays bouncing around and uses glass to redirect them to a single point, creating a sharp image. A camera lens collects and focuses the light. The Camera is shown in Fig. 3.3

Fig. 3.3 CAMERA

GSM MODULE

GSM/GPRS shown in **Fig 3.4** module is employed to line up communication between a computer and a GSM-GPRS framework. Global System for Mobile communication (GSM) may be a design utilized for mobile communication during a large portion of the nations. Global Packet Radio Service (GPRS) is an augmentation of GSM that empowers higher information transmission rate. GSM/GPRS module comprises of a GSM/GPRS modem amassed alongside power supply circuit and communication interfaces (like RS-232, USB, then on) for the pc . The model used for designing this prototype comes with an attached mic and speaker. The SIM800L module supports quad-band GSM/GPRS network, available for GPRS and SMS message data remote transmission. The SIM900L communicates with the microcontroller via UART port, supports SIMCOM enhanced AT Commands. It also features a built-in level translation, so it can work with the microcontroller of upper voltage more than2.8V default. Aside from, the board also supports A-GPS technique which is named mobile positioning and gets the position by the mobile network. This feature makes it a tracker module.

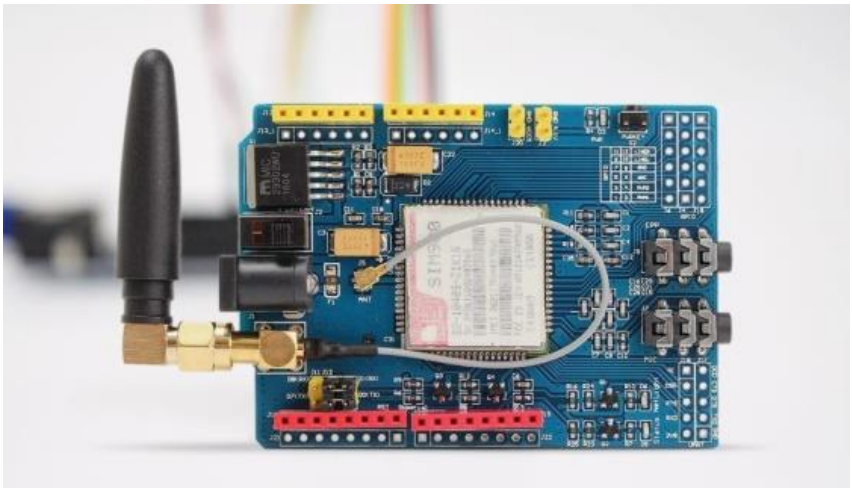


Fig. 3.4 GSM MODULE

SERVER

A server is a part of hardware and software that provides functionality for other functions Server is used for specific purpose either for storage of the data and various other information's or used for any specific web functionality. The server may be acts as a host for their client computers. A client server and host may be connected either by wired medium or by wireless medium. Client–server systems are today most frequently implemented by (and often identified with) the request–response model: a client sends a

request to the server, which performs some action and sends a response back to the client, typically with a result or acknowledgment. A single server can serve multiple clients, and a single client can use multiple servers. A client process may run on the same device or may connect over a network to a server on a different device.

3.3 RESULT

The below figure 3.5 shows the architecture of the existing model.

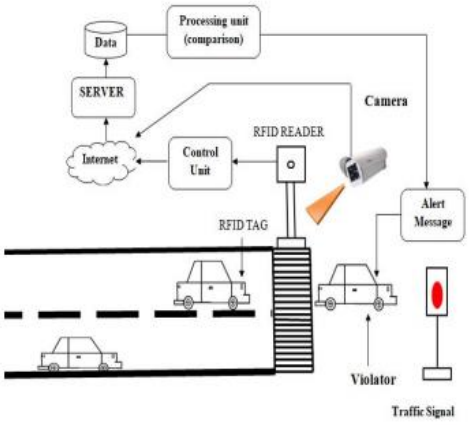


Fig. 3.5 EXISTING SYSTEM

The below figure 3.6 shows the real-time implementation of the traffic violation control system.

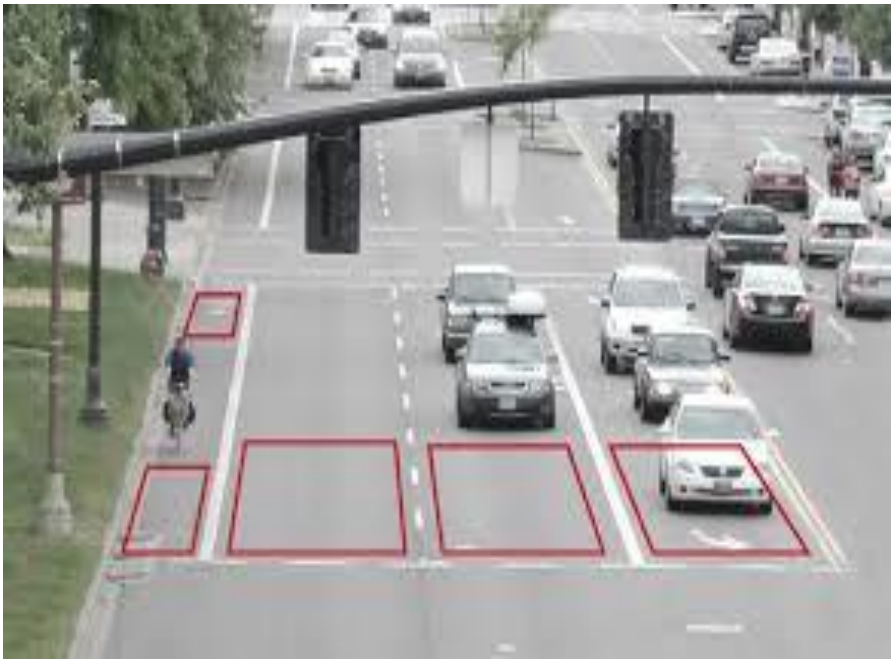


Fig. 3.6 REAL-TIME IMPLEMENTAION

The below figure 3.7 shows the preloaded information about the vehicle in RFID tags.

RFID TAG NO. DETECTED(in decimal)	LICENSE PLATE NUMBER AS PER DATABASE	LICENSE PLATE NUMBER OBTAINED BY IMAGE PROCESSING	MATCHED/ UNMATCHED	ACTION
169	MP09HC4168	MP09HC4168	MATCHED	SMS SENT
162	MP09UF4579	MP09UF4579	MATCHED	SMS SENT
175	MP09TT0806	MP43TC2201	UN-MATCHED	TEMPERING SMS SENT
145	MP09VH5706	MP09VH5706	MATCHED	SMS SENT

Fig. 3.7 PRE-LOADED INFORMATION

The below figure 3.8 shows the real-time penalty implementation.

Penalty Portal

RFID	Owner Name	Vehicle Number	Address	Contact Number	Penalty
169	Shreya Asoba	MP 09 SK 5010	122 Krishna vihar	8839162954	500
162	Tushar Tonde	MP 09 HC 4168	27 Dravid nagar	8770561376	500
145	Sandeep Sharma	MP 13 KU 4586	63 Vijay nagar	9827542954	500
45	Shreya Supekar	MP 09 JT 7855	82 Vaishali nagar	8109568755	500
155	Rajesh Verma	MP 04 GH 7548	05 Aajad nagar	9770684557	500
204	Sanidhya Soni	MP 09 HG 5010	45 Gumasta nagar	8839457156	500
144	Yashasvi Sharma	MP 09 SH 7844	45 Shiv sagar colony	8770497852	500
162	Ishita Pandey	MP 09 JF 7846	48 B Sudama nagar	8106578425	500

Fig. 3.8 PENALTY PORTAL

3.4 DISADVANTAGES OF ADVANCED TRAFFIC VIOLATION CONTROL AND PENALTY SYSTEM

- This system only monitors the stop line violation that too only in the place of traffic signal.
- Any other violation such as over speed, One-way violation, etc., will not be taken in account for monitoring process.
- If more number of vehicle over steps the stop line, then this system's process will be slow and have a chance of miss out of vehicle.
- Individual records are not maintained properly and penalty charges are not collected properly.
- It requires pre-loaded information about the vehicle, so it is difficult to preload all information and requires more space for server to maintains this record.

CHAPTER 4

Traffic Violation Control using Machine Learning

4.1 INTRODUCTION

The main cause for road accidents are mainly due to traffic rule violation and high traffic density. Every year around 1.5 million peoples are met with an road accidents and nearly half of them lost their lives and their body parts. Every day nearly around 3500 peoples lost their lives due to road accidents globally. Particularly in India every day nearly 1214 road crashes were occurred. Nearly 25% of people who lost their lives in road crashes were two wheelers. For every minute one major accident take place in our country and every hour 16 of our people lost their life in our country. Every day 377 die in India due to road accidents. Uttar Pradesh, is a state with maximum number of road crash death. TamilNadu is a state with maximum number of road accidents injnuries in India. In 2019 alone the country reported over 1,51,000 fatalities due to road accidents. Every year about 3%-5% of our country's GDP was invested onm roads aaccidents. Delhi lies in the top position in India for road accidents. These much number of road accidents are due to traffic rules violatiion and improper monitoring system. In highly populated country like india, we need much more proper monitoring system in order to encounter this problem. In the current framework, the traffic signal light is mounted with the module that incorporates with RFID transmitter and receiver, GSM module, Camera. An complaint message about the stop line violation will sent to an specific server inorder to file an legal complaint with pjhotograph proof. But the major drawback is that, this module will not moniors any kind of various other traffic violation. In order to overcome this problem, in the proposed frameworkl, the working module is mounted on each individual vehicle in order to alert the drivers about the nearby symbols and also to monitors the traffic violation.

Utilizing raspberry pi this gadget is proposed for road safety monitoring. The device intends to work in two sections.

1. Detection and Recoganisation of traffic symbols.

2.Speed Detection and penalty generation.

The camera is turned on in order to capture the nearby traffic symbols. The ML trained raspberry pi model is used to recognizance the captured traffic symbol. The alert message is indicated to the drivers. The second section monitors the speed of the vehicle and compares it with the allocated speed limit. It also monitors various other traffic violation like one-way traffic violation, u-turn violation, etc. If driver breeches any of the traffic rules then the Ml trained raspberry pi module which is connected to internet through WiFi, will generate the complaint to the specific server and initiate the penalty to the particular driver. Individual module for individual vehicle is used, so the vehicle registration number is already preloaded on the SMS module, which will initiate the complaint message to the specific server which monitors all the previous violation record of the vehicle.

4.2 SYSTEM ARCHITECTURE

This system is proposed for traffic violation monitoring and penalty system using Raspberry pi micro controller. This module intends to work in two sections. The first section involves in detection and recoganisation of traffic symbols. Camera is used to capture the image of traffic sign boards. The individual modules are implemented on individual vehicle in order to indicate driver about the nearby traffic symbols and speed limits. Raspberry Pi plays a major role for interconnections of all other devices as shown in Fig. 4.1.

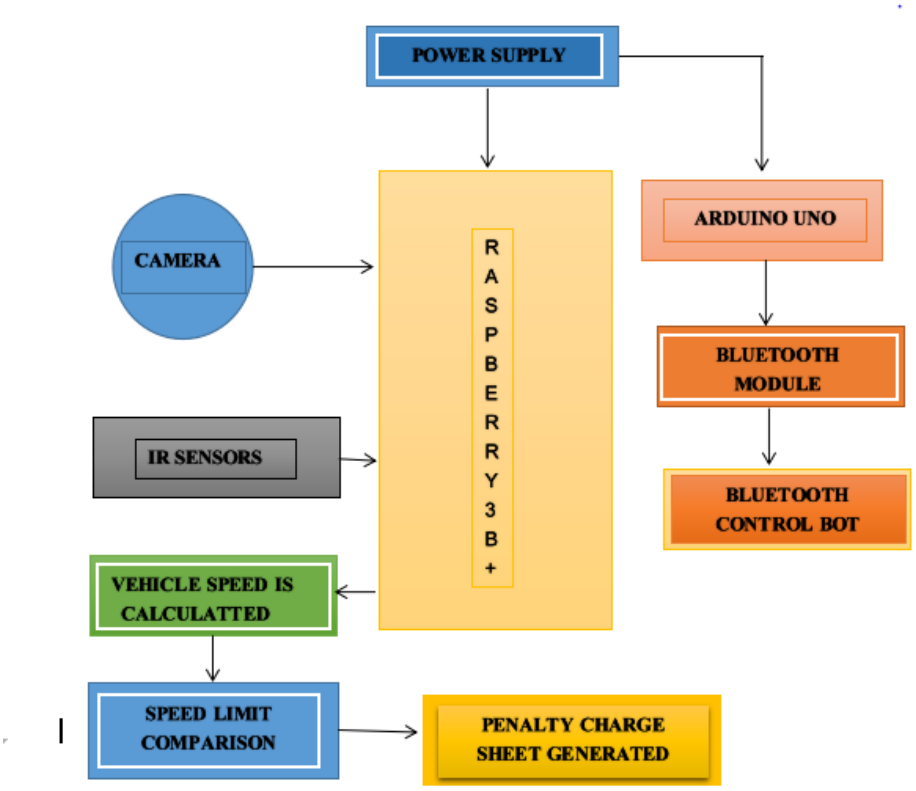


Fig. 4.1 System Architecture

Raspberry Pi 3b+ is a ML trained module, which involved in recoganisation of the detected traffic symbol based on their categories. YOLO algorithm is used to recoganisation of detected image. This module also helps in creating awareness to the drivers.

The second section involves in the detection of the vehicle speed. In this prototype module, IR sensors are used to find out the speed of the vehicle. The IR sensors are placed with the pre-set distance. The time take by the vehicle to cross the IR sensors are measured in order to calculate the speed of the vehicle. By using the following formulae, the speed is measured.

$$\text{Speed} = \frac{Distance}{Time}$$

But in reality, it is impossible to track the speed of the vehicle in this method. So, for the real-time implementation, information about the real time speed of the vehicle is taken from vehicle's speedometer. It is possible because now a days digital speedometers are used and many vehicle supports adaptive cursive method. The ML trained Raspberry pi compared

the speed of the vehicle with the allocated speed limit. If the speed limit is breached by the vehicle, then the vehicle's information is sent to the specific server, where all the other previous records are maintained. The information about the vehicle, i.e., registration number, owner name and other necessary details are preloaded in the module.

The major role for this module is continuous monitoring of the vehicle at all time. It collects all the violation records of the vehicle, in order to isolate the most annoying vehicle. So this continuous monitoring system will help to gradual reduction of traffic violation. This will ensure the road safety of fellow drivers.

Following are the hardware and software components required in the construction of the module.

HARDWARE TOOLS	SOFTWARE TOOLS
Raspberry pi 3b+	Open CV
Arduino Uno	TensorFlow
IR Sensor	Python
Camera module	Numpy
Motor driver(L298N)	Arduino IDE
Bluetooth Module(HC-05)	-
Dc Motors	-

4.2.1 HARDWARE TOOLS

Raspberry Pi 3 B+

The Raspberry pi is a single credit card size computer board that can be used for many of the tasks your computer is doing, such as football, word processing, spreadsheets and even

play HD video. It was founded by UK foundation Raspberry pi. Since 2012, it has been ready for public consumption with the aim of creating an educational microcomputer for students and children at low cost. The main purpose of designing the raspberry pi board is to inspire the students at school level to read, experiment and innovate. The raspberry pi board is a low cost, compact one. Raspberry Pi Model B Hardware Specifications The raspberry pi board includes a program memory (RAM), processor and graphics unit, CPU, GPU, Ethernet port, GPIO pins, Xbee socket, UART, power source connector. And to other external devices, various interfaces. It also needs mass storage, for which we use an SD memory flash card. So the raspberry pi board can boot similarly from this SD card as a PC boots from its hard disk up into windows. Raspberry pi board's important hardware requirements mainly include SD card that contains Linux OS, US keyboard, display, power supply, and video cable. Additional hardware specifications include USB mouse, powered USB hub, case, internet connection.

Raspberry Pi 3 B+ may be a single board computer with Quad core 64-bit processor clocked at 1.4GHz, 1GB LPDDR2 SRAM, Dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 4.2 / BLE, Higher speed Ethernet up to 300Mbps and Power-over-Ethernet capability. The Raspberry Pi board comes equipped with an SD card. The SD card is that the main memory device for a raspberry pi boards sort of a hard disc of a private computer. The Raspberry pi model 3b+ is shown in Fig. 4.2.

Here Raspberry pi acts an ML trained model. The main purpose is to integrates all the devices and input and output data. It recoganise the input image based of the symbol category. It is connected with internet through WIFI network inorder to send the violation message to the server through SMS module. In realtime usage it gets information from the speedometer of the vehicle and compare it with allocated speed limit and find whether their is any kind of violation. It acts as an brain of this module, which involves in decision making. Fig 4.2 represents the real time module of Raspberry Pi 3b+.

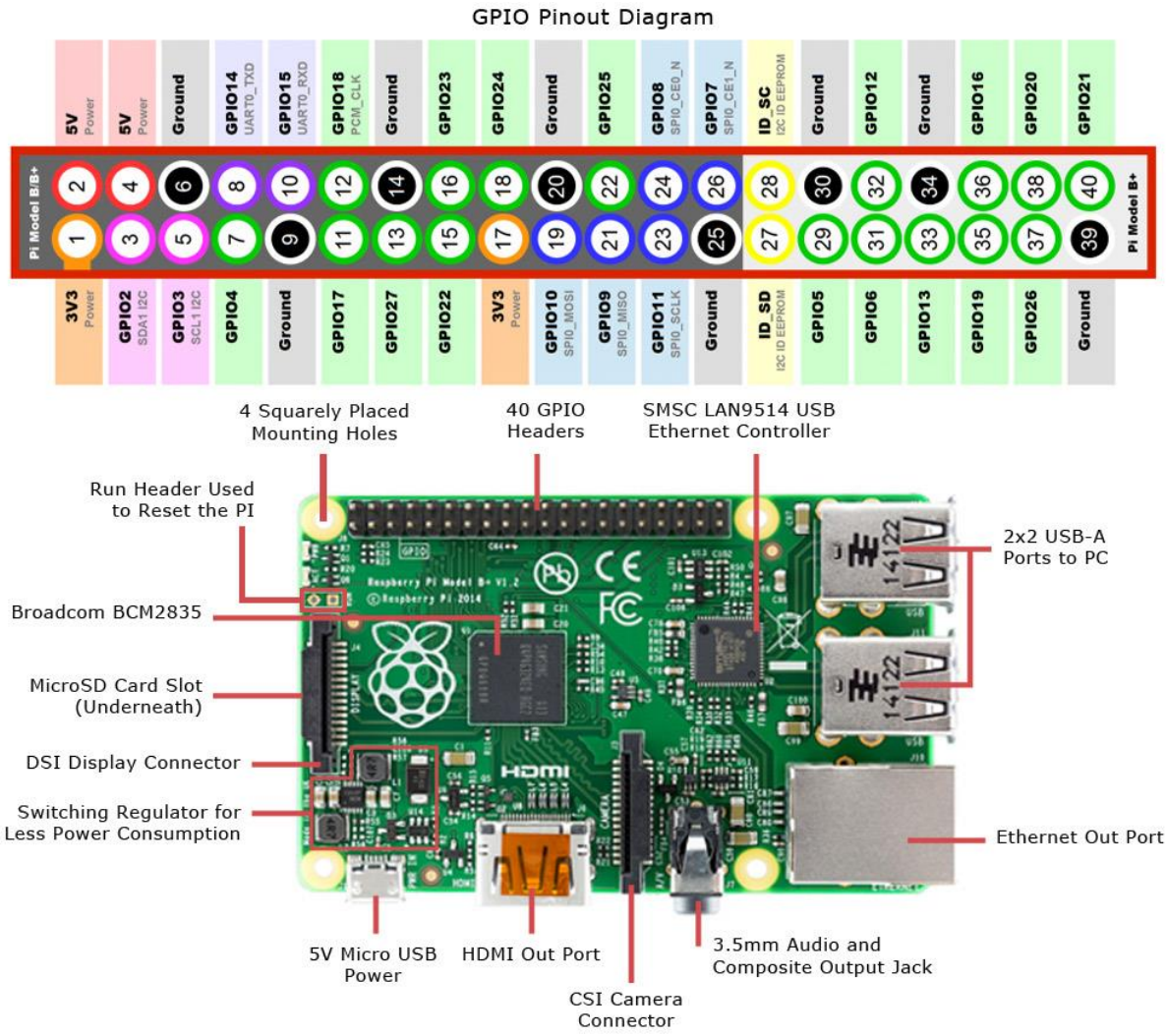


Fig. 4.2 Raspberry Pi 3+

Pi Camera Module

The Pi camera module is a portable light weight camera that supports Raspberry Pi. It communicates with Pi using the MIPI camera serial interface protocol. It is normally used in image processing, machine learning or in surveillance projects. It is commonly used in surveillance drones since the payload of camera is very less. Apart from these modules Pi can also use normal USB webcams that are used along with computer.

Here this pi cam module is used to capture the image of the nearby traffic signal which acts an input for image processing ML model. Fig 4.3 represents the real time module of pi camera.

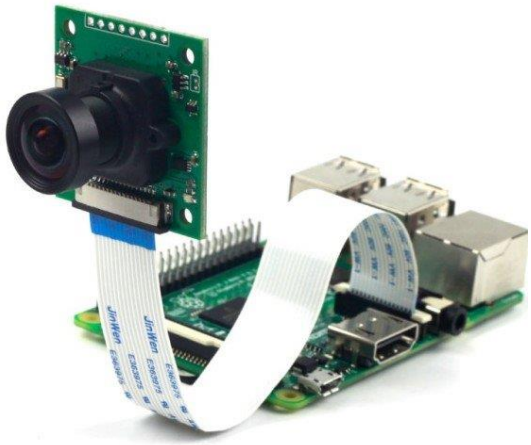


Figure 4.3 - PI cam

Arduino Uno

Arduino Uno is a small, compatible, flexible and breadboard friendly Micro controller board. It is based on ATmega328p (Arduino Uno V3.x) / Atmega168 (Arduino Uno V3.x). It comes with an operating voltage of 5V, however, the input voltage can vary from 7 to 12V.Arduino Uno Pin out contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins. Each of these Digital & Analog Pins are assigned with multiple functions but their main function is to be configured as input or output. They are acted as input pins when they are interfaced with sensors, but if you are driving some load then use them as output. The SRAM can vary from 1KB or 2KB and EEPROM is 512 bytes or 1KB for Atmega168 and Atmega328 respectively.

Here Uno is used to represent the vehicle structure. It is connected with the bluetooth module through which we can operate the bot. Arduino is connected to motor driver so the vehicle movement is uniform. Fig 4.4 represents the real time module of Arduino Uno.

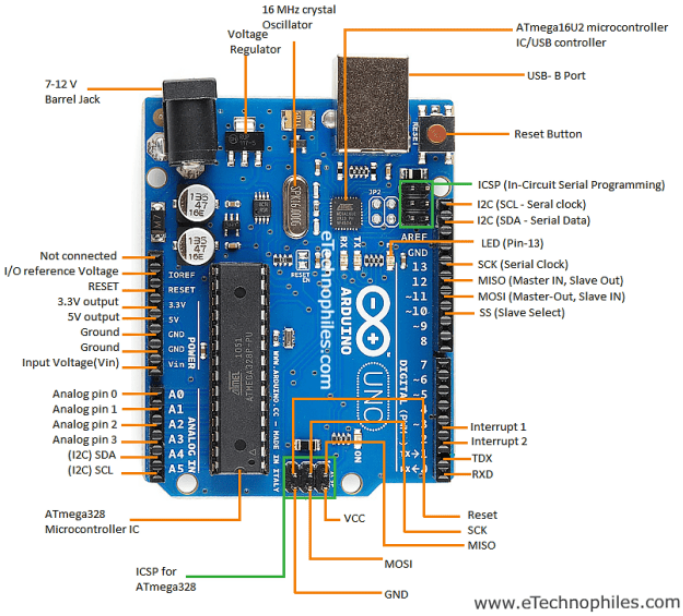


Figure 4.4– Arduino uno

Bluetooth Module HC05

HC-05 is a module which can add two-way (full-duplex) wireless functionality. This can act as both master and slave. This module is used to communicate between two microcontrollers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop. There are many android applications that are already available which makes this process a lot easier. The module communicates with the help of USART at 9600 baud rate hence it is easy to interface with any microcontroller that supports USART. Configure the default values of the module by using the command mode. So this module could transfer data from your computer or mobile phone to microcontroller or vice versa then this module might be the right choice for you. This module cannot used to transfer multimedia like photos or songs. The HC-05 module has two operating modes, one is the Data mode in which it can send and receive data from other Bluetooth devices and the other is the AT Command mode where the default device settings can be changed. We can operate the device in either of these two modes by using the key pin as explained in the pin description. It is very easy to pair the HC-05 module with microcontrollers because it operates using the Serial Port Protocol (SPP). Simply power the module with +5V and connect the Rx pin of the module to the Tx of MCU and Tx pin of module to Rx of MCU.

It has 6 pins,

1. Key/EN: It is used to bring Bluetooth module in AT commands mode. If Key/EN pin is set to high, then this module will work in command mode. Otherwise by default it is in data mode. The default baud rate of HC-05 in command mode is 38400bps and 9600 in data mode.

HC-05 module has two modes,

1. Data mode: Exchange of data between devices.
2. Command mode: It uses AT commands which are used to change setting of HC-05. To send these commands to module serial (USART) port is used.

2. VCC: Connect 5 V or 3.3 V to this Pin.

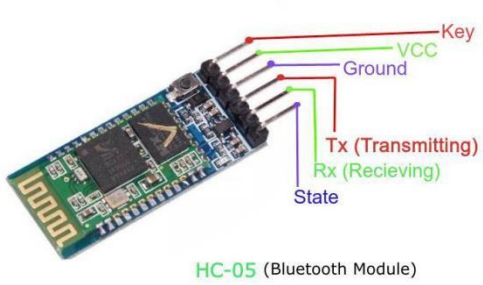
3. GND: Ground Pin of module.

4. TXD: Transmit Serial data (wirelessly received data by Bluetooth module transmitted out serially on TXD pin)

5. RXD: Receive data serially (received data will be transmitted wirelessly by Bluetooth module).

6. State: It tells whether module is connected or not.

Here Bluetooth module is connected to Arduino uno to control the bot. The vehicle speed can be varied with different threshold values. Fig 4.5 represents the real time module of Bluetooth Module HC05.



HC-05 (Bluetooth Module)

Figure 4.5 – Bluetooth Module HC-05

IR sensors

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. IR Sensors are commonly used to detect objects and determine the distance of the obstacle from the sensor. This is a great tool to measure the distance without any physical contact, like as Water Level Measurement in tank, distance measurement , Obstacle avoider robot etc. So here, we have detected the object and measured the distance by using IR Sensor and Raspberry Pi. There are two types of infrared sensors: active and passive. Active infrared sensors both emit and detect infrared radiation. Active IR sensors have two parts: a light emitting diode (LED) and a receiver. When an object comes close to the sensor, the infrared light from the LED reflects off of the object and is detected by the receiver. Active IR sensors act as proximity sensors, and they are commonly used in obstacle detection systems. IR sensor HC-SR04 is used to measure distance in the range of 2cm-400cm with an accuracy of 3mm. The sensor module consists of an IR transmitter, receiver, and the control circuit. IR Sensor consists of two circular eyes out of which one is used to transmit the IR wave and the other to receive it. We can calculate the distance of the object based on the time taken by IR wave to return back to the sensor. The value is divided by two since the wave travels forward and backward covering the same distance. Thus the time to reach obstacle is just half the total time taken. HC-SR04 IR sensor is a 4-pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the IR transmitter and Receiver. The sensor works with the simple formula that

Distance = Speed × Time

Here IR sensor are used to measure the speed of the vehicle. IR sensors are fixed at uniform position. The time taken by the vehicle to cross all the 3 IR sensors are measured to calculate the speed of the vehicle. Fig 4.6 represents the real time module of IR Sensor.

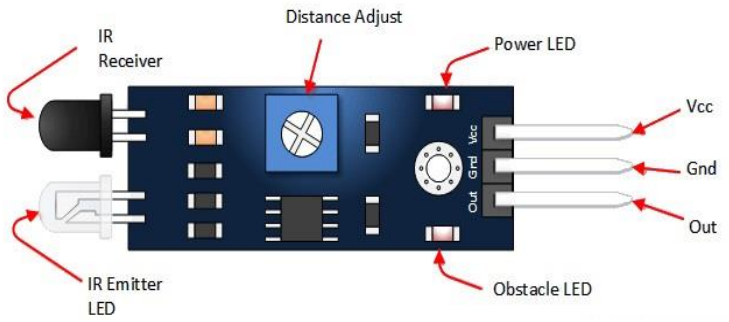


Figure 4.6 – IR Sensor

Motor Driver L298N

Motor drives are circuits used to run a motor. In other words, they are commonly used for motor interfacing. These drive circuits can be easily interfaced with the motor and their selection depends upon the type of motor being used and their ratings (current, voltage). A motor controller is a device or group of devices that can coordinate in a predetermined manner the performance of an electric motor.[1] A motor controller might include a manual or automatic means for starting and stopping the motor, selecting forward or reverse rotation, selecting and regulating the speed, regulating or limiting the torque, and protecting against overloads and electrical faults. Motor controllers may use electromechanical switching, or may use power electronics devices to regulate the speed and direction of a motor.

Here motor driver is used to synchronize all the four motors inorder to maintains the uniform motion. If the different motors are not synchronized then the rpm of each motor will change and the motion of the bot will be in UN-uniformed manner. Fig 4.7 represents the real time module of Motor Driver.

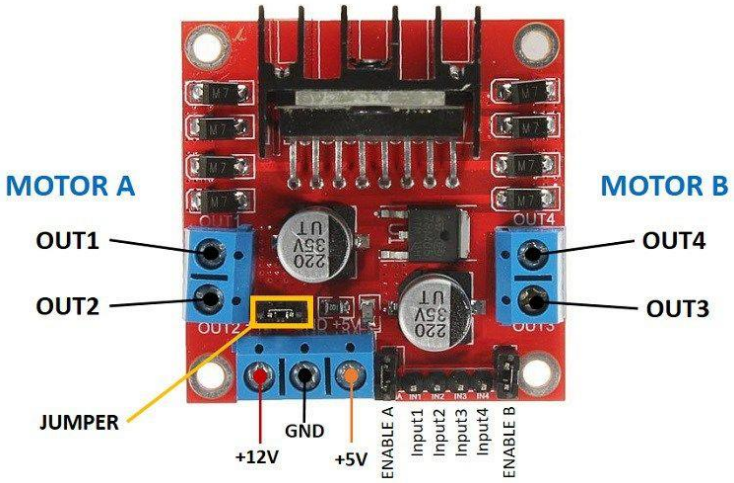


Figure 4.7 – Motor driver L298N

DC Motor

A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor. DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications. The working principle of DC motros is Flemming's Left Hand Rule. Fig 4.8 represents the real time module of DC Motor.

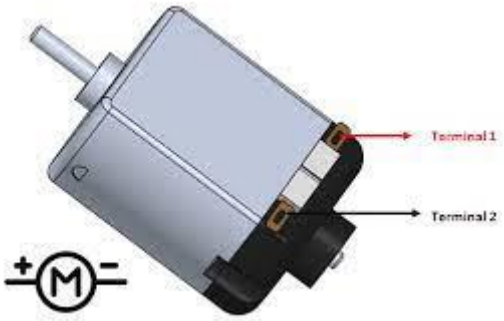


Figure 4.8 –DC Motor

4.2.2 SOFTWARE TOOLS

OPEN CV

OpenCV is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage then Itseez. The library is cross-platform and free for use under the open-source Apache 2 License.

PYTHON

Python is an interpreter, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed. Often, programmers fall in love with Python because of the increased productivity it provides. Since there is no compilation step, the edit-test-debug cycle is incredibly fast. Debugging Python programs is easy: a bug or bad input will never cause a segmentation fault. Instead, when the interpreter discovers an error, it raises an exception. When the program doesn't catch the exception, the interpreter prints a stack trace. A source level debugger allows inspection of local and global variables, evaluation of arbitrary expressions, setting breakpoints, stepping through the code a line at a time, and so on. The debugger is written in Python itself, testifying to Python's introspective power. On the other hand, often the quickest way to debug a program is to add a few print statements to the source: the fast edit-test-debug cycle makes this simple approach very effective.

TENSORFLOW

TensorFlow can be used across a range of tasks but has a particular focus on training and inference of deep neural networks. TensorFlow is a free and open-source software library for machine learning. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks. Tensorflow is a symbolic math library based on dataflow and differentiable programming

NUMPY

NumPy is a library for adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays.

4.3 IMPLEMENTATION

In the proposed framework, there are two things which are ceaselessly observed, i.e when the driver breeches the speed limits the automatic penalty system is activated to send the sms. The second thing is continous monitoring system. Fig 4.9 gives the block diagram of the proposed system.

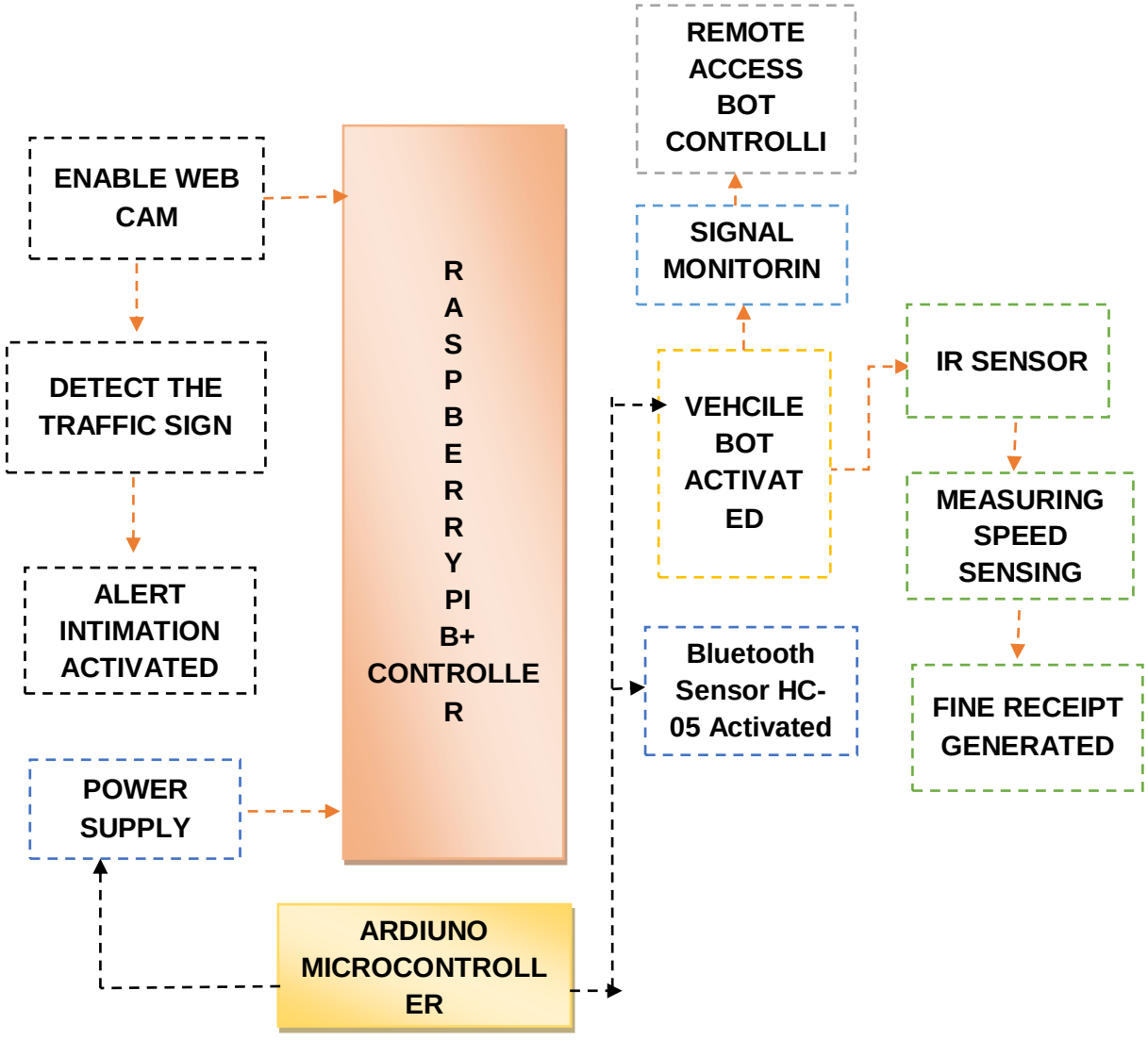


Figure 4.9 –BLOCK DIAGRAM

1. The camera detects the nearby traffic sign boards and capture the image. This image is

fed as an input for detection of the traffic sign. Pi cam is defined as a module that detects the light and capture the image using optical sensor.

2. System is turned on after the capture image is fed as an input. The Raspberry Pi receives the signal from the camera as an digital input, so it generates output(detection) based on the category of the symbol .
3. The recoganised traffic sign is indicated to the driver . The vehicle speed is monitored by using the speedometer. Speedometer works based on the ratio 1000:1. It is connected to the rotating shaft to calculate the speed of the vehicle.
4. The ML trained module compares the speed of the vehicle with the allocated speed in the traffic symbol. If the speed is within the limit then there is no any action. But if the driver breeches the speed limits then the information about that particular vehicle is send to the server through Sms module.
5. The implemented module is pre-loaded with all the necessary information about the vehicle because individual modules are mounted on the individual vehicle. So the accurate information about the annoying vehicle are registered for further legal action.
6. Based on the traffic violation laws, the penalty action will be taken on the particular vehicle with proper proofs.

4.4 ADVANTAGES OF PROPOSED SYSTEM

- It helps in continuous monitoring of the vehicle even in the absence of traffic police or any other methods.
- Unlike the existing system it doesn't monitors only the stop line violation, it also monitors speed violation, one-way violation, u-turn violation,etc,
- It also maintains the previous records of the vehicle, so that it is very easy to separate the most violating vehicle and initiate strict legal action.
- It can monitors and collects records of huge number of vehicle at same time because of individual mounted modules.
- Due to continous monitoring there will be a gradual reduction in the number of traffic violation and no one can escape from the law.

CHAPTER-5

RESULT

5.1 OVERVIEW

This chapter gives a brief discussion about the results obtained from traffic symbol detection, reorganisation and speed limit detection.

5.2 IDLE MODE

YoloV2 traded accuracy for speed. It affected smaller object detection. MAP on coco dataset is around 28% with 0.5 IOU. Prediction was made on a single feature map as it becomes difficult to recognize object of different sizes in an image. So, we have used You only look once (YOLO) version3. When no symbol is detected by the camera, it remains in idle mode and only respond when the symbol is detected. Fig 4.2 represents the real time module of

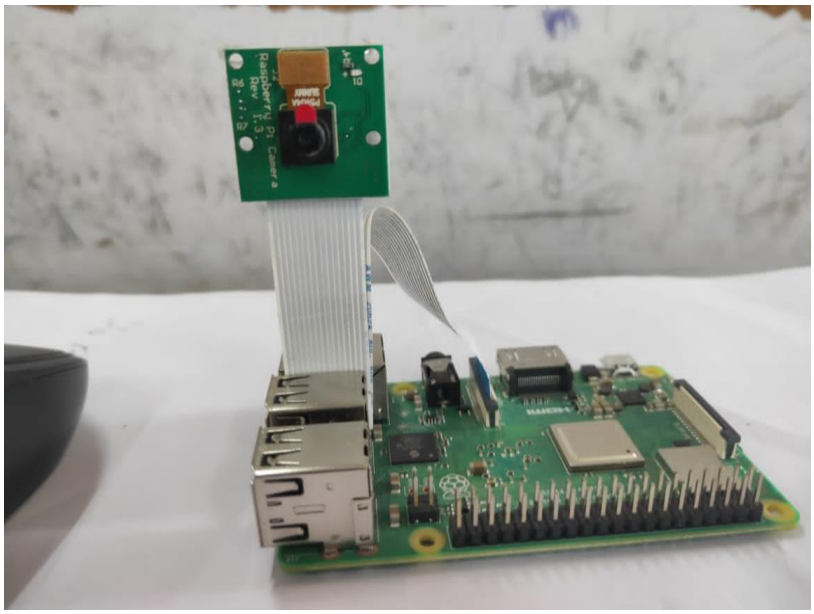


Fig 5.1 Idle model

5.3 WORKING MODE

When the power supply is given, the camera turns on and start detects the

traffic sign boards. A sample traffic symbol is feed as an input for an ML model. The ML model starts detect the symbol and recognise the symbol and produce awareness alert to the drivers.

Fig 5.2 Sample Speed limit Input

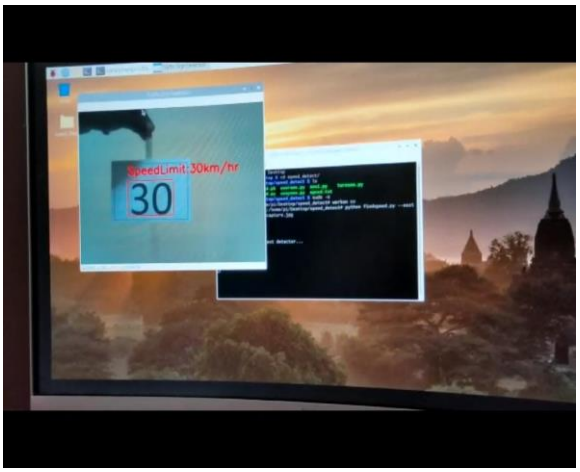


Fig 5.3 Detected Output

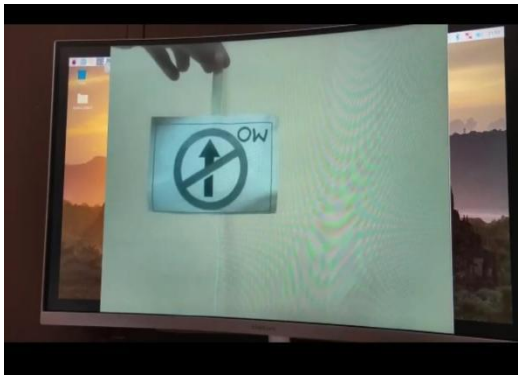


Fig 5.4 Sample Symbol Input

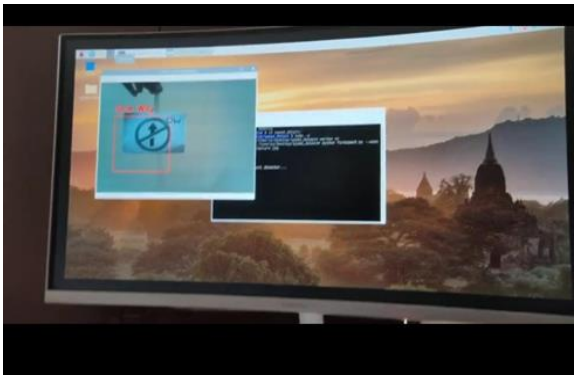


Fig 5.5 Detected Output

The above method is used for traffic sign detection. The following is the method to detect the speed of the vehicle using Infra-Red sensor. By using the formula **Speed** = **Distance* Time,** the time taken by the bot to cross the specific distance is taken into account in order to calculate the speed of the vehicle. In the figure 5.2 and figure 5.3 shows the sample inputs values. Then figure 5.3 and figure 5.5 shows the detected outputs.

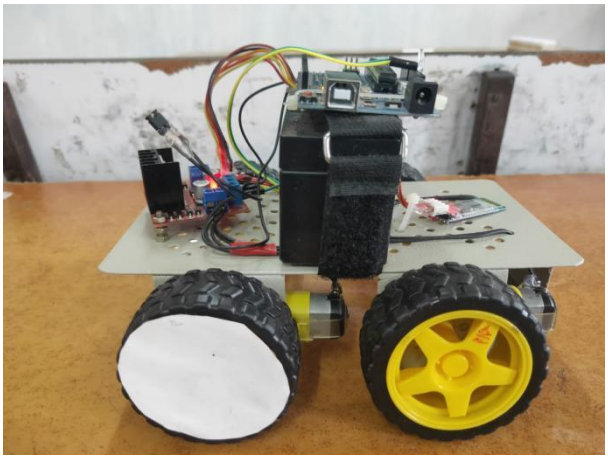


Fig 5.6 Bluetooth Controlled Bot

In the figure 5.6 shows the Bot which is controlled by the Bluetooth module, in the figure 5.7 shows that the IR Sensors connected serially which is used to calculate the speed of the bot.

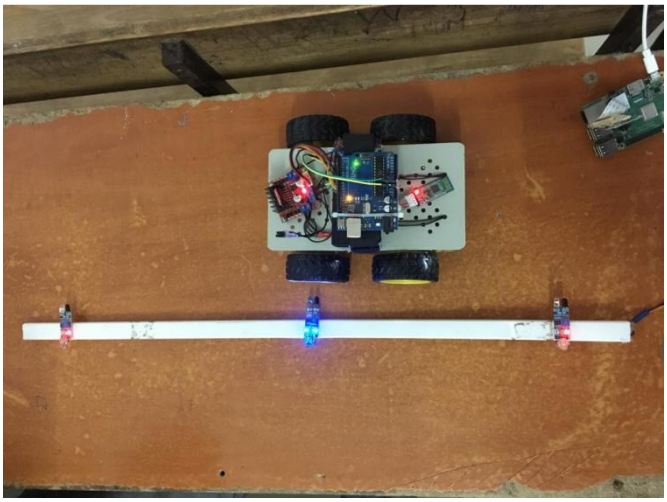


Fig 5.7 IR Sensor Used to Calculate Bot Speed

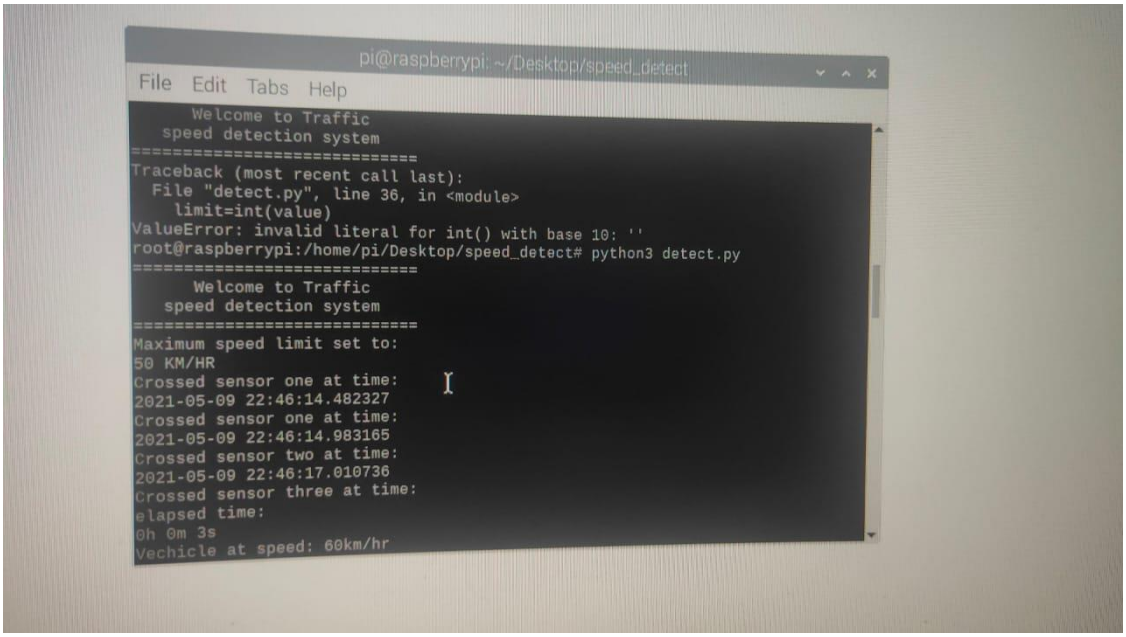


Fig 5.8 Output of Speed Detection

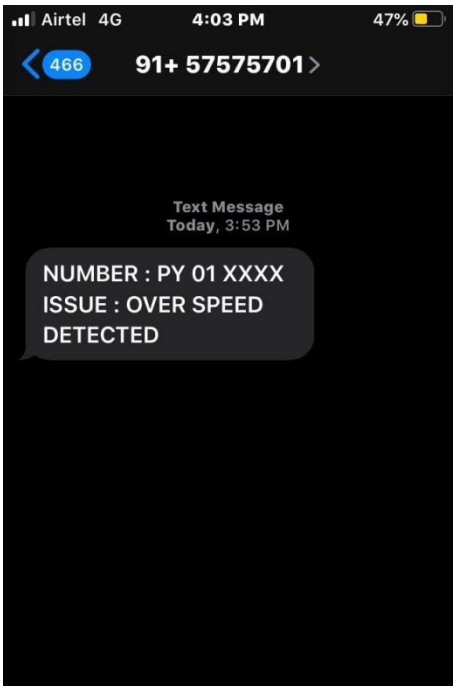


Fig 5.9 SMS Generated to Server

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 CONCLUSION

Human life stands at the top priority no matter what ever comes in life. Consistently almost 1214 street mishaps are happening in India. Almost 25% of bikes engaged with street mishaps. There are nearly 415 deaths per day due to road accidents. These accidents are due to traffic rules violations and over speed. Staying healthy and keeping the environment healthy matters a lot and being the most difficult task. To ensure the safety of the fellow drivers and pedestrians the continuous monitoring of individual drivers is necessary. Our project helps in minimizing the road traffic violation by continuous monitoring system. It also has previous violation records of drivers and helps in regular monitoring of traffic violation.

This module is joined with singular vehicle to screens the vehicle routinely. It additionally produces the punishment sheet with explicit traffic rule infringement. So, the criminal traffic offense control office will screen the most disregarded principles and will make a move as indicated by that particular infringement.

6.2 FUTURE SCOPE

This design of traffic monitoring has lot of scope in future. This system enhances to reduce the traffic violation due to continuous monitoring system. In future mobile app will create to send penalty to particular drivers. In future vehicle engine will be connected to the speed controlling electronic unit in order to control the speed of the vehicle when it breeches the allocated speed limit. Instead of capturing the traffic symbols we can use specific radio signals for particular traffic symbols, so that the danger ahead will be indicated to drivers before reaching the destination. Thus, implementation of this system in real time will gradually reduce the traffic violation due to continuous monitoring.

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