

# **A Linear Perspective Analysis on Speed Limit Violations with SMS Cell Broadcast Message to Reduce Accidental Rates in Indian Highway Roads Using IoT as Transmission Medium.**

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**ABSTRACT:** Intelligent protocols are used in every sector of our lives. The aspiration to work on this facet of application has materialized from the importance of finding a technical solution in order to automatically control the speed of the vehicles at speed restricted areas in highways which is one of the most necessary demands of the hour. The current scenario depicts that the traffic rules are breached by the operator and thus accidental results are due to over speeding. The main aim of this consideration is to picture and evolve a new approach that can productively detect speed violation on highways and helps the operator to comply with traffic regulations while driving, by sustaining the speed according to the prescribed speed limit. Based on the detailed review of the literature and also based on the comparison among the prevailing approaches in addressing the core issues, this analysis has been done in order to understand the various technologies that are currently in use to control over speeding in highways and motivates new researchers to discover an efficient system with an enhanced scope.

**KEYWORDS:** Zigbee, GSM, Transmitter, Microcontroller, Mesh networking, Open standard.

## **I. INTRODUCTION**

Road accidents are the result of various factors, some of which are the over speeding, drunken driving and obeying of road safety regulations etc. Road accident causes damages, mortalities, infirmities and hospitalization with severe socio monetary costs across the nation. Subsequently, road safety has become an alarming issue of concern both at nationwide and global level. Here in this paper, we are trying to reproduce a comprehensive literature study related to the various vehicle speed control technique, accident detection that are necessary to reduce accident to save valuable life of one. Managing travel speeds is a core part of an efficient and safe road transport system.

Many systems have been developed and implemented to prevent these road accidents. In past days, the research is done on traditional automotive mechanical system systems, mini radar guns and handy speed detectors. In some papers, the authors have presented that vehicle speed is monitored by embedding in vehicle or on road to control speed of vehicle automatically. But there is no sign of decrease in the rate of road accidents. Due to the advancement in recent techniques, some vehicle speed control systems are based on microcontroller, GSM, GPS, many different sensor like alcohol detection, close eye detection, RFID, Zigbee, Wi-Fi, CAN bus protocol and radio frequency system, etc. Each system has their own advantages and disadvantages. As accident becomes a major problem nowadays, the speed monitoring systems today needs to make use of the advanced technology where just by sending the information to the person and penalties for violating the rules is not sufficient. Strict rules should be enforced and followed in-order to prevent road accidents. This paper help us in understanding the various techniques that are currently in use and it will also give us an explanation of how the proposed idea will work.

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## II. BACKGROUND STUDY

Statistics suggests that in India every four minutes a person dies in a road accident. According to the “WHO Report 2015:” the total number of fatalities in India in 2013 is 238,562 and reported number of road traffic deaths is 137,572 with the estimated road traffic death rate per 100,000 population being 16.6. Accidents classified according to cause of fault in the driver in the year 2015 is 77.1%.

### 2.1 HISTORY

There are many efforts made by the traffic authorities to reduce the violation on speed limit in highways. Some of the very initial methods include stopwatches which are used by the traffic police to measure the distance travelled by a vehicle between two fixed landmarks and speed traps a device called VASCAR is used to measure the distance covered by a vehicle in a time limit and to perform the average calculations to find the timing. And the next advancement to this method was the use of cameras to take a picture of the vehicle’s number plate that are violating the speed limit of a lane. When the camera takes a picture, the image is forwarded immediately to the authorities and that particular vehicle will be fined .The next advancement to these techniques were the use of RADAR speed guns which is used to detect the speed of a vehicle by using a microwave signal. The LIDAR speed guns calculate the vehicle’s distance from time stamped laser pulses. Then sensors were embedded in lanes to measure the speed of the vehicle passing through it. After all these implementations there was no amount of reduce in number of accidents. There was a need to discover more ideas and methodologies that will be handy, automatic, easily implementable, secure and effective for the prevailing situation. Hence systems were developed with different techniques that would meet the demand of situation by checking the speed limit of the vehicle with the prescribed limit of the lane , comparing both the speeds and controlling it automatically without the interference of the driver. Systems were found to warn and generate fine for not obeying the rules.

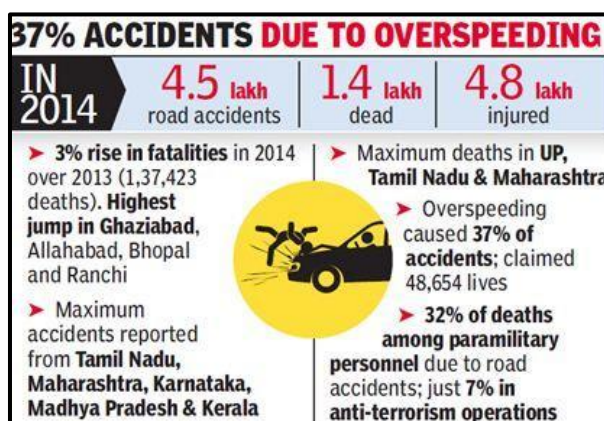


Fig: 1 an Article from Times of India 2014

In 2014, 4.5 lakhs of road accidents occurred of which 1.4 lakhs of peoples were dead and 4.8 lakhs of people were injured due to over speeding of vehicles in highways .There was about 37% rate of accident recorded on the year 2014. It is stated that Maharashtra, Karnataka, Madhya Pradesh and Kerala is recorded with maximum number of accidents where from these accidents, UP and Tamilnadu were recorded with highest number of deaths. It is also mentioned that there was a rise in the number of accidents from 2013 to 2014 by 3% recording the highest leap in Allahabad,Ghaziabad,Bhopal and Ranchi[Fig:1].

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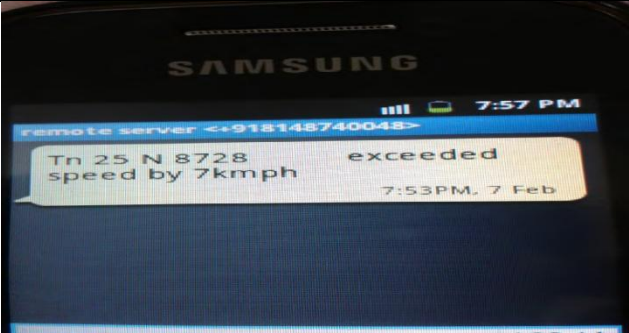
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### III. LITERATURE ANALYSIS

There is strong societal benefit in analyzing the issues of increased road accidents on Indian highways which is causing traumatized situation on day to day livelihood of common people. This highly a happening initiative and an assortment of experienced along with young researchers have paved off their contributions towards this trenchant and vulnerable act of road accidents which is done due to a lot of economic reasons of mankind. With an elaborate understanding many researchers have suggested several solutions, approaches and suggestion to this happening issue. Unfortunately the deployment cost and the technology imbibed are quite expensive and sometime it is also due to lack of funding along with improper technical assistance those suggestions are still a theoretical approach. Having this as a foremost objective this analysis focuses on the most important contributions and research proposal that is already existing and available through literature analysis. We have analyzed numerous research articles and perspective study to come with a approach that is comparatively cost cutting and deployable from the existing approach to an extent. Some of the findings are analyzed and tabulated as below mentioned chronologically.

(i) *Over speed violation management of a vehicle through ZigBee, Rubini.R and Uma Makeswari.A, Mar 2013[1].*

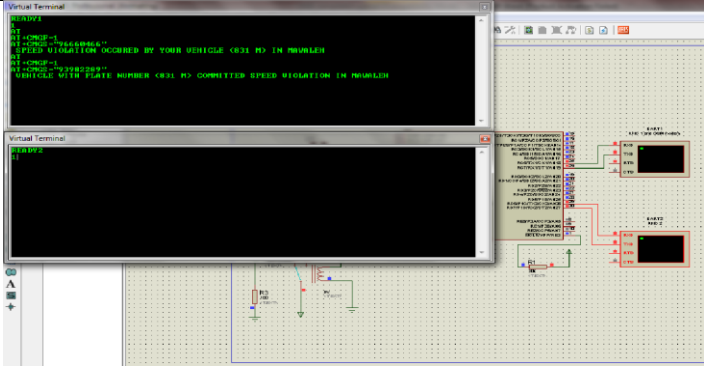
<b>Objective</b>	To control the speed of a vehicle through wireless mode of transmission of data with the help of ZigBee.
<b>Hardware Component Used</b>	<ul style="list-style-type: none"> <li>● PIC 16F877A.</li> <li>● ZigBee CC2530 transceiver.</li> <li>● 18 pin MCP 2515 CAN controller.</li> <li>● GSM.</li> <li>● LCD Screen.</li> </ul>
<b>Application</b>	 <p style="text-align: center;">Message received through GSM</p>
<b>Work Mechanism</b>	<ul style="list-style-type: none"> <li>● The ZigBee transmitter sends the speed limit to the ZigBee receiver placed inside the vehicle when it enters the speed limit zone.</li> <li>● The ZigBee receiver sends the data to microcontroller and the speed of the vehicle is obtained and action is taken accordingly.</li> <li>● A message is sent to the traffic control room regarding the violation details.</li> </ul>

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(ii) *Automobile Speed Violation Detection System using RFID and GSM Technologies, Lujaina Al-Shabibi, Nadarajan Jayaraman, Jayavrinda Vrindavanam, Volume 7– No.6, July 2014*[2].

<b>Objective</b>	To plan a model which will be useful in clicking a picture of the vehicle when violation occurs and sending it to the traffic personnel and vehicle user.
<b>Hardware Component Used</b>	<ul style="list-style-type: none"> <li>● PIC (18F45K22) microcontroller,</li> <li>● Radio Frequency Identification (RFID)</li> <li>● Global System for Mobile Communications (GSM)</li> </ul>
<b>Application</b>	 <p style="text-align: center;">Simulation results.</p>
<b>Work Mechanism</b>	<ul style="list-style-type: none"> <li>● Proteus v7.10 software is used for simulating the model.</li> <li>● If the vehicle crosses the distance between two RFIDs before time reaches zero then the SMS will be sent to the police and owner.</li> <li>● LED s made to glow indicating as if a snap of the vehicle has been taken.</li> </ul>

(iii) *Intelligent Vehicle Monitoring System using Wireless Communication, Srinivasan.J, Volume 1 Issue 10 (November 2014)*[3].


<b>Objective</b>	To develop a system that will be used for call detection while driving and preventing the accidents.
<b>Hardware Component Used</b>	<ul style="list-style-type: none"> <li>● Microcontroller AT89C51</li> <li>● Vehicle Speed Sensor</li> <li>● GPS Module-ZX 41215P</li> <li>● GSM Modem</li> <li>● RS-232</li> <li>● Call Sensing Circuit</li> </ul>
<b>Work Mechanism</b>	<ul style="list-style-type: none"> <li>● If a person drives a car above 40km/hr then the jammer should be activated and the driver should not be able to receive or make calls.</li> <li>● The device turns on the GSM Modem and it will send a message to the cops.</li> </ul>

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iv) *Autonomous Speed Control of Over Speeding Vehicles Using Radio Frequency, Prof. Vishal Pande, MalharMohite, SupriyaMhatre, Siddhesh Desai & Anjali Kumari, Volume 8, No. 5, May – June 2015*[7].

<b>Objective</b>	<ul style="list-style-type: none"> <li>To design a controller and a LCD screen to display the vehicle's speed and vehicle's speed and to monitor the zones via embedded systems.</li> <li>To calculate the vehicle speed and reduce it automatically according to the speed limit of the restricted area and when it is about to collide with any other nearby vehicle</li> </ul>
<b>Hardware Component Used</b>	<ul style="list-style-type: none"> <li>Zone status transmitter unit and receiver (speed display and control) unit.</li> <li>IR sensor</li> <li>Active RF module TWS 434 and RWS 434 for our prop.</li> <li>89S52 Microcontroller</li> <li>16x2 LCD screen along with IR module to determine the speed.</li> </ul>
<b>Application</b>	 <p style="text-align: center;">Over speeding Vehicle approaching Speed limit zone      Speed of vehicle controlled as it enters Speed limit zone</p>
<b>Work Mechanism</b>	<ul style="list-style-type: none"> <li>The IR sensor is used to determine the speed of the DC motor.</li> <li>The RF transmitter is used for sending the data to the RF receiver. The receiver will send the data to the microcontroller in order to compare the speed of the vehicle with the limit.</li> <li>If the speed of the motor is less than the limit zone, then no action is required. If the speed of the motor is greater than the limit zone then the Microcontroller instructs the driver to reduce the speed.</li> </ul>

v) *Detection of Over Speeding Vehicles on Highways, Monika Jain, Praveen Kumar, Priya Singh, Chhavi Narayan Arora & Ankita Sharma, Vol. 4, Issue. 4, April 2015*[8].

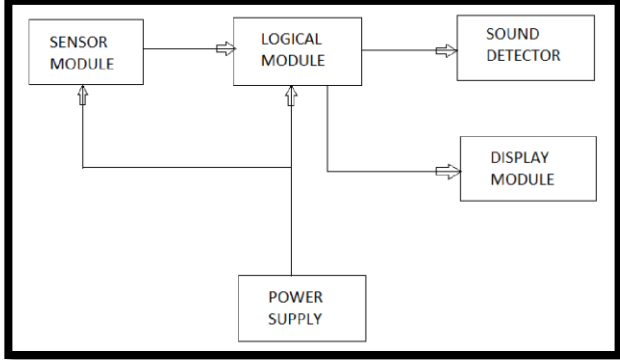
<b>Objective</b>	Speed checker for highways using Timer
<b>Hardware Component Used</b>	<ul style="list-style-type: none"> <li>555 Timer</li> <li>IR transmitter</li> <li>IR receiver</li> <li>Speed control</li> <li>Buzzer</li> </ul>



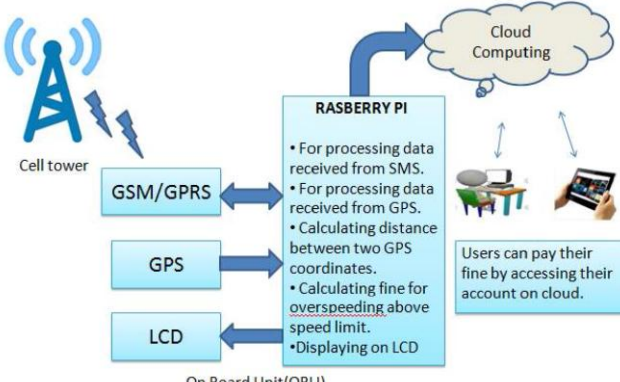
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<b>Application</b>	 <p style="text-align: center;">Block diagram of Vehicle speed detector using Timer</p>
<b>Work Mechanism</b>	<ul style="list-style-type: none"> <li>• A timer is fixed which helps to determine the speed of a vehicle by calculating the time taken to cross two set of points at a established length.</li> <li>• IR transmitter and an IR receiver are the sensors that are fitted in either sides of the road.</li> <li>• The time taken to cross the two sets of points will be calculated by the circuit board.</li> <li>• If the vehicle exceeds the speed limit, a buzzer sounds informing the traffic personnel.</li> </ul>

(vi) *Automatic Speed Limit Violation Detection and Warning System Using GPS and GSM Modem, Prof. Paras Gosai& Jay Joshi, Vol. 5, Issue 3, March 2016*[10].

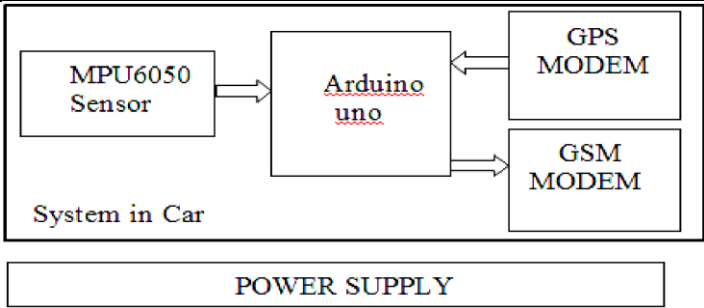
<b>Objective</b>	To develop a speed limit violation detection and warning system hardware prototype.To analyze a GSM modem this will receive SMS and eventually generate fine. An SMS will be sent to the user’s registered mobile.
<b>Hardware Component Used</b>	<ul style="list-style-type: none"> <li>• Raspberry Pi</li> <li>• GPS module</li> <li>• GSM modem</li> </ul>
<b>Field of Application</b>	 <p style="text-align: center;">On Board Unit(OBU)</p>
<b>Work Mechanism</b>	<ul style="list-style-type: none"> <li>• The speed of the vehicle is delivered by the Cell Broadcast Services.</li> <li>• The Raspberry Pi is programmed to process data, calculate speed and compare with the over speeding limit and displaying the speed on LCD.</li> <li>• If violation occurs, a message is sent to the users account.</li> <li>• The user can pay the penalty by accessing the web page portal.</li> </ul>

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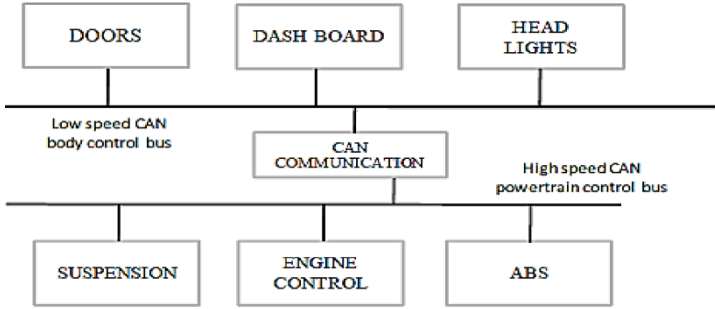
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(vii) *Automatic Vehicle Accident Detection and Emergency Rescue Alert System, BhushanWarudkar,AmuthaJeyakumar, Vol. 5, Issue 05, 2017*[13].

<b>Objective</b>	To detect accident from Micro-Electro-Mechanical System (MEMS) accelerometer signal using a threshold algorithm.
<b>Hardware Component Used</b>	<ul style="list-style-type: none"> <li>● mpu6050 sensor</li> <li>● Arduino UNO</li> <li>● GPS device</li> <li>● GSM module</li> </ul>
<b>Application</b>	 <p>The diagram shows a 'System in Car' containing an MPU6050 Sensor, an Arduino uno, a GPS MODEM, and a GSM MODEM. Arrows indicate data flow from the sensor to the Arduino, and from the Arduino to both the GPS and GSM modems. A separate 'POWER SUPPLY' block is shown below the system.</p>
<b>Work Mechanism</b>	<ul style="list-style-type: none"> <li>● The accident will be detected when the mpu6050 sensor values exceeds the set of threshold values</li> <li>● MEMS sensor will send information about the accident through a mobile phone short message indicating the position of the vehicle by GPS system to the family member, emergency medical service, and nearest hospital.</li> </ul>

(viii) *Vehicle Speed Monitoring And Control Using Can Protocol, Shakti Kumar Shukla, Rajat Pandey, VakkalagaddiDivyaKumari& Prof. H.S. Hemane, Volume 4, No. 05, May 2017*[14].

<b>Objective</b>	An automobile vehicular system with a combination of CAN bus systems.
<b>Hardware Component Used</b>	<ul style="list-style-type: none"> <li>● ATmega328</li> <li>● CAN bus module</li> <li>● LCD</li> <li>● IR sensor.</li> </ul>
<b>Application</b>	 <p>The diagram illustrates a CAN bus system in an automobile. It shows two main bus types: 'Low speed CAN body control bus' and 'High speed CAN powertrain control bus'. The low speed bus connects to DOORS, DASH BOARD, and HEAD LIGHTS. The high speed bus connects to SUSPENSION, ENGINE CONTROL, and ABS. A central 'CAN COMMUNICATION' block is connected to both bus types.</p>
<b>Work Mechanism</b>	<ul style="list-style-type: none"> <li>● Pad2pad – software that has been used for designing the PCB.</li> <li>● The coding and compilation of the program is performed using Arduino software.</li> </ul>

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(ix) *Intelligent Vehicle Control and Monitoring Using Raspberry Pi3, Vishal Netake, Abhishek Save & Lav Mandal, Vol. 5, Issue 03, 2017*[16].

<b>Objective</b>	To get inputs from a user through android application and control the working of a car.
<b>Hardware &amp; Software Component used</b>	<ul style="list-style-type: none"> <li>● Ultrasonic sensors</li> <li>● Raspberry pi3</li> <li>● Arduino Mega</li> <li>● Router</li> <li>● DC Motors</li> <li>● Stepper Motor</li> <li>● Rain Drop Sensor</li> <li>● Android Application</li> <li>● Wi-Fi</li> </ul>
<b>Work Mechanism</b>	<ul style="list-style-type: none"> <li>● The vehicle can be manually operated through the user's input in the android app.</li> <li>● Rain sensor and wiper are fixed to the Arduino board .Keys are present in the android app in order to activate it.</li> <li>● The left and the right arrows placed in the app will operate as a steering to control wheels of the car. Left motor in front and right motor in rear will rotate to turn the car in left direction and vice versa.</li> </ul>

## IV. COMPARISON SCRUTINY – SPEED CONTROL SYSTEMS

From the literature analysis we understand that there are various methods available for controlling the speed of a vehicle, because it plays a very crucial issue in highways like junction points, pedestrian crossings and service lanes. Every technology is designed in such a way that it never provides inconvenience to the driver and can automatically control the speed of the vehicle. Each technology has its own features like network topology, security, power consumption, complexity, data rate, range and applications. In order to understand better and to find an efficient technology, we present here a comparative study on the different wireless technologies that are used by the researchers.

- **ZigBee**- ZigBee is an IEEE 802.15.4-[1] based specification and it is helpful in wireless transmission of data while the power consumption is very low and it has a collection of high level connecting rules and regulations to create PAN for small scale projects
- **Wireless Fidelity (Wi-Fi)** -Wi-Fi[16] is the wireless networking technology that uses radio waves to provide wireless high-speed Internet and network connections. It is based on IEEE 802.11 specification.
- **RFID**-Radio Frequency Identification, or RFID, uses electromagnetic field to automatically identify and track tags attached to objects[2][7]. The tags contain electronically stored information.
- **Infrared**- It allows to communicate at short range [7][8]. Data can be sent bidirectional.

SPECIFICATIONS	RFID	Wi-Fi	ZigBee	IR Wireless
<i>Data Rate</i>	varies	11 and 54 Mbps	20, 40 and 250 Kbps	20-40Kbits/sec
<i>Range</i>	3 meters	50-100 meters	10-100 meters	<10 meter line of sight
<i>Operating frequency</i>	varies	2.4 and 5 GHz	2.4 GHz	800 -900 nm
<i>Complexity</i>	Low	High	Low	Low
<i>Power Consumption</i>	Medium	High	Very Low	low
<i>Security</i>	64 and 128 bit encryption	128 AES plus application	-	-



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		layer security		
<i>Typical Applications</i>	EZ-Pass, Tracking items	WLAN connectivity, Broadband Internet access	Industrial control and monitoring, Sensor networks, building automation, Home control and automation	Remote control, PC, PDA, Laptop
<i>Networking Topology</i>	Point to point	Point to Hub	Ad-Hoc, peer to peer ,star or mesh	Point to point
<i>Other Information</i>	-	Device connection needs 3-5 seconds	Devices can join an existing network in under 30ms	-

**Table 1: Various Wireless Technologies and their Comparison [12]**

A comparative study on the various programming interface such as Raspberry Pi , Arduino ,microcontrollers used by the researchers that helps in detecting the speed of the vehicle and take immediate measures to control the speed.

- **Arduino**-Arduino is a microcontroller motherboard. A microcontroller is a simple computer that can run one program at a time, over and over again. It is very easy to use. It is an open source electronic prototyping platform enabling users to create interactive electronic objects [16][17].
- **Raspberry Pi**- Raspberry Pi, is a ultra-low cost, credit card sized, fan less and instant start up device. It is a completely easy to program computer. It is a cheap ,easy and open and secured computer to maintain in schools. It is a computer which has its own OS and mostly python language is used for programming [10][17].5.

SPECIFICATIONS	ARDUINO	RASPERRY PI
Programming Language	Arduini, C/C++	Python, C,C++
Processor Speed	16 MHz	700MHz
Hardware	Open Source	Closed Source
Real Time	\$24.99	\$37.43
Analog to Digital	Yes	No
OS	NA	Raspbian, Linux, Android
Storage	32 KB	NA
RAM	2 KB	1 GB
I/O Pins	20	17

**Table 2: Programming Interfaces and their Comparison.**

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## V. CONCLUSION

Safe journey can be intensified by controlling the driving behavior, enforcing strict traffic and driving rules in order to maintain the speed limit in highways which will result in reducing the number of accidents. Recording the destructive driving behavior and fining the driver for his action will definitely have an outcome in the reduction rate of accidents. This literature study is designed to analyze the various cause, course and results of over speeding of vehicles in highways. The paper explains that Intelligent System is a huge category that consists of many technologies and the advantages of Intelligent System deployments are security, performance, flexibility and convenience.

This study in a linear perspective surveys various methods and technologies that are discovered for controlling the speed limit in highways by placing sensors in vehicles to detect the speed and alerting the driver to maintain the speed limit and violations can be reduced prior by informing the driver about the particular speed of the lane. But still there is no decrease in the rate of accidents, because systems that are developed are not efficient and it costs very high to be implemented. These technologies can be expanded so that the model can be implemented in all types of vehicles at a very low price were the recording facilities of the violations can also be easily accessed by the traffic personnel. Wireless technologies have been most widely used by the researcher's. The advantages of ZigBee and RFID paves a way to develop a system which ultimately saves cost in transmitting data, provides safety transportation and it consumes low power. Thus we hope this can revolutionize the accident avoidance caused due to over speeding in the near future.

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