



SPEEDILE: An Intelligent Framework for Controlling Automobiles Speed in Urban Zones using IoT and Wireless Protocols as Communication Medium.

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Abstract

Every year the rate in the number of accidents and deaths occurring due to over speeding of vehicle keeps increasing. The need of the hour is to have a smart speed monitoring systems. The central motive of this research is to develop a prototype on vehicle speed controlling system by means of ZigBee transceivers for transmitting the speed boundary of the zone to the delivery entity and IR wireless sensor for detecting the swiftness of a vehicle. The basic concept of the system is based on the methodology of detecting the speed of an automobile in motion and compare it with the speed limit of the zone that is transmitted via ZigBee and automate the rate of speed of automobile by programming the microcontroller to decrease the speed. A wireless sensor is attached with a wheel of the vehicle which measures the acceleration and produce the rotation per minute(rpm) of a wheel, that is similar to wheels speed and transfers the speed rate wirelessly to the microcontroller. If the detected speed is greater than a set speed limit, the vehicle number,

speed details, time will be automatically saved in a central database in the form of an e-report for taking any further action by imposing penalties for the violators. A webpage is created for the users to access their accounts and render their fine amounts with much ease.

Key Words:Arduino; L293D; Sensors; IoT; Over speeding.

1 INTRODUCTION

All of us would have probably seen reckless drivers in city roads migrating out of their track in order to attend calls while driving, to grasp something in the vehicle and the utmost significant intention is overtaking a vehicle in the lane. The driver likely tends to skip out from his lane and increases the speed of the vehicle and overtakes the vehicle before it in a very small width lane. This serves as a very important cause for disaster to happen in city's crucial areas. Since vehicle riders are more unfocused these days, a quick action system is needed to stop accidents before they could happen. Speedile is a system designed to intimate the driver to avoid over speeding in city and to maintain the speed limit that has been prescribed for the zone. Automatic speed limit controlling of a vehicle within their lane according to the prescribed limit is also implemented in this system. The model is planned to minimize the occurrence of accidents by taking into consideration the main source of crash: mishandling errors, confusions, excess speed and fun.

The proposed system provides effective monitoring, recordkeeping and recording structure about the speed of the vehicle which exceeds the limit. The system will be capable of detecting the speed of a vehicle and compare it with the speed limit of a zone and impose a message to the driver or the car owner regarding the particulars of over speeding in restricted areas. The prototype has the probability of actual point in detecting speed limit violation which can also be used for many applications including tracking a vehicle and its safety measures.

2 RELATED WORK

Different researchers have developed a system to monitor the vehicle speed in order to lessen the occurrence of mishaps, for obstacle detection and for maintaining lane driving in highways. A detailed analysis has been made to discover the various technologies that have been used by them. Each paper uniquely and clearly describes how the working is achieved efficiently and at low cost. These methods are implemented depending on their features, benefits and limitations. Vehicle speed controlling methods include using sensors placed inside car, roadside and smart phone inbuilt sensors. The authors have also developed models based on various software interfaces in order to manage the swiftness of the vehicle and generate appropriate reports. The different wireless technologies that are used by researchers include RFID based, ZigBee based, Bluetooth based, MEMS, DSRC Technology, Ultrasonic Sensor, MPU6050 sensor, GPS & GSM based, WI-FI and color sensors based. The microcontroller based controlling, is the most widely used technique for programming.

Paper	Author	Objective	Hardware Components	Simulation	Working
[12]	Rubini R et al	To detect the over speeding vehicle through zigbee.	GSM CAN Module LCD PIC Controller. ZigBee.	NA	1)ZigBee Transceivers help in wirelessly transferring the speed data between the receiver and transmitter. 2)If the speed is greater than the speed limit of the zone , then the speed of the vehicle is reduced automatically.
[15]	P.Sai Chaitanya et al	To develop a vehicle speed monitoring system using Wi-Fi and GPS	GPS module DC Motor LCD. ARM Processor. Shimmer Sensor	Keil C Software.	1)Different speed limits are set for speed zones. 2)The sensors detects the vehicle speed. 3)The GUI helps in displaying the speed limit and the vehicle speed. 4)If violation occurs, warning messages will be sent along with detailed report to the driver.
[18]	K.Govindaraju et al	To operate the vehicle in safe speed at critical zones	GPS module DC Motor LCD. ARM Processor.	Keil C Software.	1)The modes of operation is displayed. Normal and Critical. 2)When the vehicle speed is greater than the limit, then an alarm is raised until the speed declines to safe mode.
[17]	R.Deepa	To design a wireless instrument cluster to operate the vehicle in safe speed at critical zones.	ZigBee Ultrasonic Sensor LCD. LPC2148 Contoller . Transceiver unit.	NET Framework	1)The transmitter transfers the vehicle speed data. 2)The receiver unit fetches for the data and processes through Keil C software. 3)Ultrasonic Sensor unit will sensing the safe distance between the vehicle. 4)Violations are detected if any.
[22]	Momimul Ahsan et al	To develop an experimental setup modelling the generation of vehicle speed in a laboratory environment	Shimmer Sensor. Java Socket Programming GUI.	Java Socket Programming	1)A mechanical wheel with sensor is made to rotate. 2)Wireless transmission of data between the wheel and sensor happens through Bluetooth. 3)Displayed in GUI

Table 1: Comparative study on the different methodologies undertaken by various researchers.

3 PROPOSED SYSTEM SPEEDILE

3.1 OBJECTIVE:

The key sources of road and highway mishaps are driving vehicle at a very high rate, drunken driving and thoughtless driving. Over speeding effects both crash risk and crash consequence especially at road junctions and while overtaking as road users underestimate the speed and overestimate the distance of an approaching vehicle. Drivers are not aware of the set speed limits on various roads and hence they end up exceeding the limit. Most over speed detection methods such as radar, speed cameras and ticketing methods

- To check over speeding on city roads and highways.
- To automate speed checking, alert and fine imposition.

- To save a life.

3.2 BLOCK DIAGRAM:

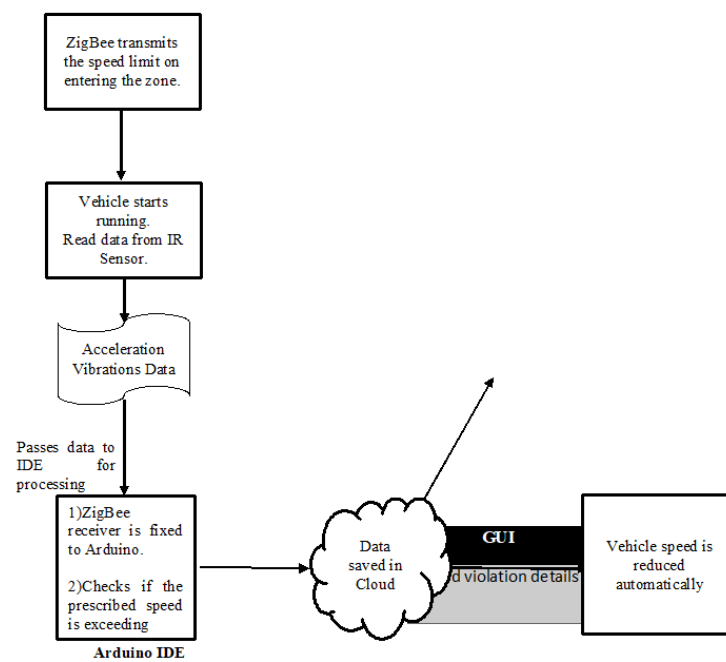


Fig:1 Proposed Architecture of SPEEDILE.

3.3 FLOW CHART:

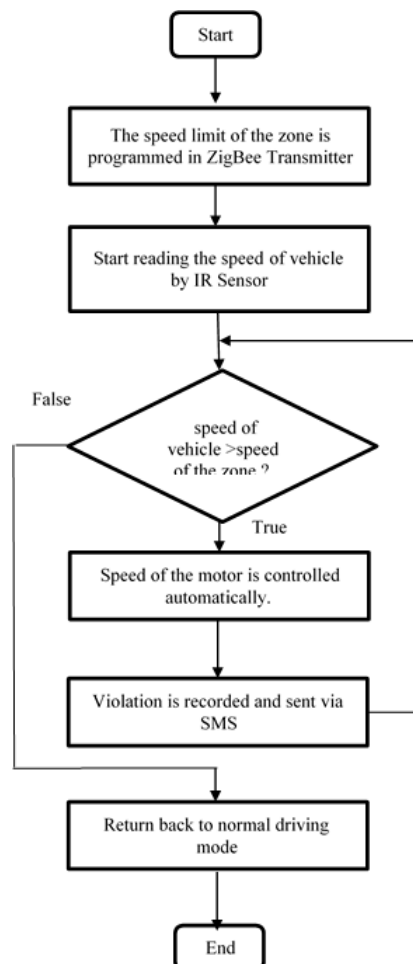


Fig:2 General flow diagram of the proposed architecture.

3.4 SYSTEM COMPONENTS:

- IR Sensor:

An infrared sensor is an electrical and electronic device, that emits radiations for the sake of sensing some features of the environment. An IR sensor can calculate the heat that is emitted from an object as well as to detect the motion of any object. The radia-

tions are invisible through our naked eyes, which can be spotted by an infrared sensor. The emitter is an IR LED and the detector is an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED [18].

- L293D:

L293D is an integrated circuit chip for a motor driver which is helpful in controlling the motors. This driver is acting as a middleware between the motor and Arduino. L293D has in total of 16 pins and consists of two half bridge.

- Arduino UNO:

Arduino is an enormous device for creating communicative objects, by captivating information from various types of sensors and switches and for regulating different types of motors. Arduino is a microcontroller board, that consists of the entire computer system on a tiny chip. Arduino IDE which is used as the programming language tool for Arduino. It is an open-source software/hardware which is available and can be customized and expanded according to the developers idea easily.

- GSM:

A GSM Module is connected to a Printed Circuit Board, where various results can be fetched from microcontrollers. The data could be used to send The use of involving a GSM module with Arduino is to dispatch and obtain SMS through Arduinos TTL Output provisions. When a vehicle violates the speed limit, then Arduino board.

- ZigBee:

The wide use of ZigBee in real time applications are for home automation, communication appliances, Smart Metering, Smart Grid monitoring and Industrial automation. ZigBee Transceiver is modeled for our system to enable wireless transmission of data from the sign board to the vehicle, transporting the speed limit of the restricted zone.

- GUI:

The Graphical User Interface is helpful in visualizing ones violations in aspects of date, time and the speed limit which the vehicle violated and the amount that is to be paid by the violator. A separate account is created for every user and facilities are created for the user to pay the penalties online. The GUI can be in the form of a webpage or a user friendly mobile app.

3.5 METHODOLOGY:

The model proposed in this paper is based on ZigBee protocol. The major objective behind choosing this wireless transmission medium is to provide proper results with utmost secure facility and which can equally be implemented at low cost. The overall architecture of the prototype is, ZigBee transmitters are placed in the roadways and highways sides which holds the speed limit of the prescribed and ZigBee receivers are placed inside the vehicle unit. The Transmitter wirelessly transmits the data when the vehicle enters the zone. The receiver ZigBee unit which is present inside the vehicle unit passes the data to the microcontroller. The speed of the vehicle is determined by IR sensor and the RPM is calculated through Arduino IDE. Arduino IDE progresses the vehicles speed with the speed limit of the zone. If the vehicle seems to exceed the speed of the zone, then Arduino takes control over the DC Motor which is connected to L293D [10] driver motor and reduces the speed of a vehicle automatically. Payment of fine can be done through the mobile app or through a webpage. If the speed of the vehicle is below the range of speed limit then no violations are raised.

4 PERFORMANCE ANALYSIS

The proposed SPEEDILE Prototype is intended to be implemented with the above mentioned system components. There are various models available currently which were developed by numerous researchers. Though they are available, still the safety road measures that is to be considered for a good driving skill is in its lacking phase. The various features that are measured for defining the performance of these prototypes does not ensure safe and secure principles to save a life. The rate of accuracy, consistency and speed of response is very low in regards to the developed models. A system which will provide immense safety and automatically controlling the vehicle when the speed exceeds is implied to reduce the number in occurrence of accidents and will also reduce the number of deaths for the same. Hence the proposed prototype is subjected to detect the speed of the vehicle and automate the vehicle control when the speed exceeds the limit of zone and can act quickly to take accurate decisions.

5 CONCLUSION

In this paper, a prototype is designed for automatically controlling the speed and generating fine for violators. The system is designed in such a way that it can be implemented at a very low cost with efficient functioning of reducing the accident rate in highways and city limit roadways which was considered to be our primary objective. The system has been designed with an additional feature of sending valid violation SMS in order to indicate when the driver exceeds the limit. If the violation occurs more than twice fine will be imposed and the user has to pay the prescribed amount by accessing his account in mobile app / webpage. The proposed model has been designed according to the overall understanding of the various technologies that are available in the literature review section and the implementation of this system may subject to change.

References

- [1] Rose Jr, R. Edward. "Uniform system for verifying and tracking articles of value." U.S. Patent No. 5,521,815. 28 May 1996.
- [2] Fujii, Toshishige, et al. "Wind-induced accidents of train/vehicles and their measures in Japan." Quarterly Report of RTRI 40.1 (1999): 50-55.
- [3] Kamijo, Shunsuke, et al. "Traffic monitoring and accident detection at intersections." IEEE transactions on intelligent transportation systems 1.2 (2000): 108-118.
- [4] Wang, Chieh-Chih, Charles Thorpe, and Sebastian Thrun. "Online simultaneous localization and mapping with detection and tracking of moving objects: Theory and results from a ground vehicle in crowded urban areas." Robotics and Automation, 2003. Proceedings. ICRA'03. IEEE International Conference on. Vol. 1. IEEE, 2003.
- [5] Sun Z., Bebis, G. and Miller R., (2004) On-road vehicle detection using optical sensors: a review, In: 7th International IEEE Conference on Intelligent Transportation Systems, 3-6 October, NV, USA, pp. 585-590.

- [6] Tate, F. and Carsten, O. (2008) Intelligent speed adaptation, Implementation scenarios, Transport Technology and Standards Division, Department for Transport, Project Partners: The University of Leeds and MIRA Ltd.
- [7] Agrawal, Sarita, and Manik Lal Das. "Internet of ThingsA paradigm shift of future Internet applications." Engineering (NUICONE), 2011 Nirma University International Conference on. IEEE, 2011.
- [8] Hu, Chunye, Jie Zhang, and Qiaoyan Wen. "An identity-based personal location system with protected privacy in IoT." Broadband Network and Multimedia Technology (IC-BNMT), 2011 4th IEEE International Conference on. IEEE, 2011.
- [9] El Faouzi, Nour-Eddin, Henry Leung, and Ajeesh Kurian. "Data fusion in intelligent transportation systems: Progress and challengesA survey." Information Fusion 12.1 (2011): 4-10.
- [10] Kameswari, U. J., Satwik, M. and Lokesh, A. (2011) A Design Model for Automatic Vehicle Speed Controller, International Journal of Computer Applications, Vol. 35, No. 9, pp. 19-24
- [11] Yu, Xi, Fuquan Sun, and Xu Cheng. "Intelligent urban traffic management system based on cloud computing and internet of things." Computer Science & Service System (CSSS), 2012 International Conference on. IEEE, 2012.
- [12] Rubini.R et al. (Feb-Mar 2013) 'OVER SPEED VIOLATION MANAGEMENT OF A VEHICLE THROUGH ZIGBEE ', International Journal of Engineering and Technology (IJET), Vol 5 (No 1).
- [13] Ding, L. Y., et al. "Real-time safety early warning system for cross passage construction in Yangtze Riverbed Metro Tunnel based on the internet of things." Automation in construction 36 (2013): 25-37.
- [14] Jiang, Jia, and Kai Su. "Management platform architecture of modern tobacco logistics based on internet of things technologies." LISS 2012. Springer, Berlin, Heidelberg, 2013. 1403-1409.

- [15] P. Sai Chaitanya, V. Vikram, B. Kalesh (2014) 'Automatic Vehicle Speed Control System Using Wireless fidelity', IJAEEEE, Volume-3(Issue-4).
- [16] Da Xu, Li, Wu He, and Shancang Li. "Internet of things in industries: A survey." IEEE Transactions on industrial informatics 10.4 (2014): 2233-2243.
- [17] R.Deepa (January 2015) ' Design of Vehicle speed Control System Using Wireless Instrument Cluster ', International Journal of Engineering Science and Innovative Technology (IJESIT) , Volume 4(Issue 1).
- [18] K.Govindaraju, S.Boopathi, F.Parvez Ahmed , S.Thulasi Ram, M.Jagadeeshraja (August 2014) 'Embedded Based Vehicle Speed Control System Using Wireless Technology', INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING , Vol. 2(Issue 8) .
- [19] Hollnagel, Erik, Robert L. Wears, and Jeffrey Braithwaite. "From Safety-I to Safety-II: A white paper." The resilient health care net: published simultaneously by the University of Southern Denmark, University of Florida, USA, and Macquarie University, Australia (2015).
- [20] Jagtenberg, C. J., Sandjai Bhulai, and R. D. van der Mei. "An efficient heuristic for real-time ambulance redeployment." Operations Research for Health Care 4 (2015): 27-35.
- [21] Fagnant, Daniel J., and Kara Kockelman. "Preparing a nation for autonomous vehicles: opportunities, barriers and policy recommendations." Transportation Research Part A: Policy and Practice 77 (2015): 167-181.
- [22] Mominul Ahsan, Julfikar Haider, Jennifer McManis, M. Saleem J. Hashmi (April 2016) 'Developing intelligent software interface for wireless monitoring of vehicle speed and management of associated data ', IET Journals, Vol. 6 (Iss. 3), pp 9099.

- [23] L293D Motor Driver, Available at:
<http://www.instructables.com/id/L293D-Motor-Driver/>.
- [24] Motor Speed Tester Using Arduino & IR Sensor
<http://www.instructables.com/id/Simple-Motor-Speed-Tester-Tachometer/>.