

# A Theoretical Study based Framework for Reducing Road Violation with Over Speed of Vehicles using IoT Protocols -ZigBee

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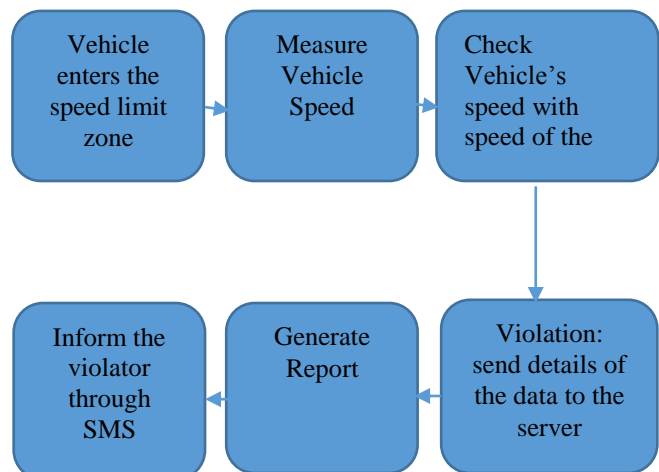
**Abstract**— Over Speeding is one of the major reasons for accidents and crime in city highways. Though a speed limit of 40 km per hour is set within the city parameters, no driver takes ownership to maintain the speed limit in crucial and prime areas such as school, hospital and highways. Vehicular Speed Detecting and Monitoring system in vehicles is lacking due to various known and unknown conditions. Due to its implementation cost, inadequate support and lack of awareness about the importance of speed management systems are the significant drawbacks. The chief objective of this work is to propose an over speed detecting and management system with advanced techniques in order to reduce the number of accidents arising due to unskilled errors (drivers) and to save human lives. This study proposes a theoretical approach, to compute the vehicle speed when the vehicle enters the speed limit zone and to compare the vehicle's speed with the prescribed zone limit, if the vehicle speed exceeds the limit, then actions has to be taken by reducing the speed of the vehicle automatically. No actions are taken if the vehicle's speed is below the set limit of the zone. This is important because it prevents the vehicles that are driven at a fast speed, which in turn causes superfluous accidents. The ZigBee wireless technology is ideal for this use because of its cost effective deployment and battery mode operation. GSM (Global System for Mobile Communication) is used in our model for sending SMS to bring an alert to the driver for violating the speed limit of the zone. If the violation occurs for more than twice by the same vehicle, then fine will be imposed on the vehicle's owner.

**Keywords**— ZigBee; GSM; Internet of Things; Transceiver system; Over speed management; Sensors.

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## Introduction:

Road accidents are growing day by day. The major cause for road accidents are because of the bad driving behavior. The automobiles are driven at very high rate in city and highways. Decrease in number of such accidents is the major need of the hour. Various models and researches have been developed in order to avoid the occurrence of calamities. Some of them are Cruise control system (CC) which helps in maintaining the speed that is suggested by the driver. [2] CWS have been developed to detect the curved roads by using Global Positioning System (GPS) was helpful in detecting the curves in the roads, so that the driver can reduce the speed and drive safely. Similar to these techniques many wireless technologies were used to monitor the speed of a vehicle and to prevent it from exceeding the limit of a restricted zone. Here we propose a dynamic model where the system controls the speed of the automobile according to the data in the frame that is transmitted by the ZigBee transmitter fixed to the Speed Sign Boards. Paper is organized as follows. Section I describes the social benefits of the objective. The literature analysis of various proposed methods by other researches is given in Section II. Section III presents the existing methodology. Section IV presents the proposed model with its architecture. Section V depicts the design components that are required for our model. Finally, Section VI presents the conclusion.



**Fig: 1 A General Framework of Vehicle Speed Monitoring System**

## I. SOCIAL BENEFITS

Conveyance methods are an essential part of every human day to day life. People cannot survive in this world

without transportation facilities. Hence various models were executed in order to reduce the occurrence of deaths due to accidents. But still the statistics says that graph of deaths occurring due to accidents keeps increasing. To change this situation an efficient prototype is required in order to reduce the death rate.

This system can be implemented in for two wheelers and four wheelers. The key factor of our system is, when the speed of the vehicle is greater than the speed limit of the zone, our system will automatically reduce the speed and does not depend upon the driver control. The major benefits of our system are:

- There will be an enhancement in the traffic conditions in city and inhibits careful driving techniques near school, hospital and accident zones.
- Life is precious. Immense security measures have to be taken in order to protect a life. In that way, losing lives due to accidents has to be reduced.
- To develop a prototype that will be cost efficient and implementable in all vehicles.

## II. LITERATURE REVIEW

Various researches have been performed for developing an appropriate prototype for vehicle speed detecting and monitoring and implementing Intelligent Traffic System. But still, when these prototypes are implemented, the results seemed to be deceiving. A few machineries that have been used in previous shots include inductive loop detectors, micro-loop probes, and pneumatic road tubes, all of which use underground disturbing sensors [1]. However, these sensors disrupt traffic during installation and repair, which leads to a high installation and maintenance cost. Various wireless technologies such as Bluetooth, Wi-Fi, RFID, ZigBee, Video and ultrasonic sensors are being used by various researchers for detecting and monitoring the vehicle's speed. But these systems are expensive and maintenance is difficult. The proper working of these devices depends on the environment condition. These approaches are also implemented depending on their characteristics, advantages and disadvantages.

In paper [3] Saivignesh H et al, has designed a system using RF communication method for controlling the speed of the vehicle. RF Receiver is attached to the vehicle and the RF Transmitter is attached to the road zones. The transmitters are programmed to send the coded signals continuously with certain delay in between. The receivers receive these signals and then the speed of the vehicles is controlled automatically by taking control action in the throttle valve.

In paper [4] Prof. Paras Gosai et al has proposed a speed limit destruction, reduction and cautioning system through Raspberry Pi for determining the vehicles that are crossing the speed limit of an area and impose a fine on the violators. Messages will be sent through GSM, the users can access their account through a mobile app and wage their fine.

In paper [5] Monika Jain et al, has proposed a handheld device for traffic consultants to detect the vehicles that are exceeding the speed limit of a particular lane and to detect rigorous driving in highways. The device is developed with an IR transmitter, an IR receiver, a control circuit and a buzzer. The speed is calculated by the time taken by a vehicle to cross two fixed distance and the microcontroller processes and displays the rate of speed in LCD screen.

In paper [6] Vaishal B. Niranjane et al has developed a system to spontaneously control the speed of a vehicle at speed limited zones such as hospital, highways and school etc. The main functionality of the system is to avoid accidents and allow the general public to bypass the pedestrian crossing safely. The system is developed via ZigBee Transceivers to exchange the speed data of a vehicle and microcontroller is used to reduce the speed limit in a speed limited zone.

## III. EXISTING SYSTEM

Currently detecting and monitoring system hosted in vehicles in order to prevent accidents occurring due to over speeding and save peoples life. People and traffic authorities use speed control systems installed in their vehicles such as school bus and taxis. But still application of such devices in all the vehicles is still in its early stages and these systems does not guarantee for safety results too [9]. The major reason for such an outcome of a system is because of its expensive cost where most of the vehicle users does not prefer to spend on it. To change the motive behind this idea, a system which will provide safety at all environment conditions, trustworthy and cost effective has to be developed. Penalties has to be imposed on the reckless drivers in order to follow the rules of driving.

## IV. PROPOSED SYSTEM

The model proposed in this paper is based on ZigBee convention. The reason for choosing this technology is to provide robust results and enables to deploy the system at a very low cost. The framework of the proposal is, ZigBee transmitters are placed in the sign board which holds the value of the speed limit of the zone 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 calculated via the vehicle speed sensor. Arduino processes the calculated speed of the vehicle with the speed limit of the zone. If the vehicle's speed is greater than the prescribed limit, immediate actions are taken to control the speed and fine is imposed via sending an SMS to the violator's mobile with the help of GSM modem. A graphical user interface is created to visualize the details of violation by the vehicle user. Payment of fine can be done through the mobile app. If the vehicle speed is below the limit then no actions are performed.

ZigBee benefits are [8]:

- Supports for different system topologies.
- Long battery life.
- Low latency.

- Direct Sequence Spread Spectrum (DSSS).
- 128-bit AES encryption for information security.

Arduino:

Arduino is not a microcontroller and it is an open source hardware and software tool. Arduino platform helps in easy and quick prototyping. It is a strong and suitable tool that can easily deploy any idea. Arduino provides facilities to access internet, to provide wireless networking, data logging and controlling the device efficiently. Arduino IDE allows software development in platforms like Mac, PC and Linux.

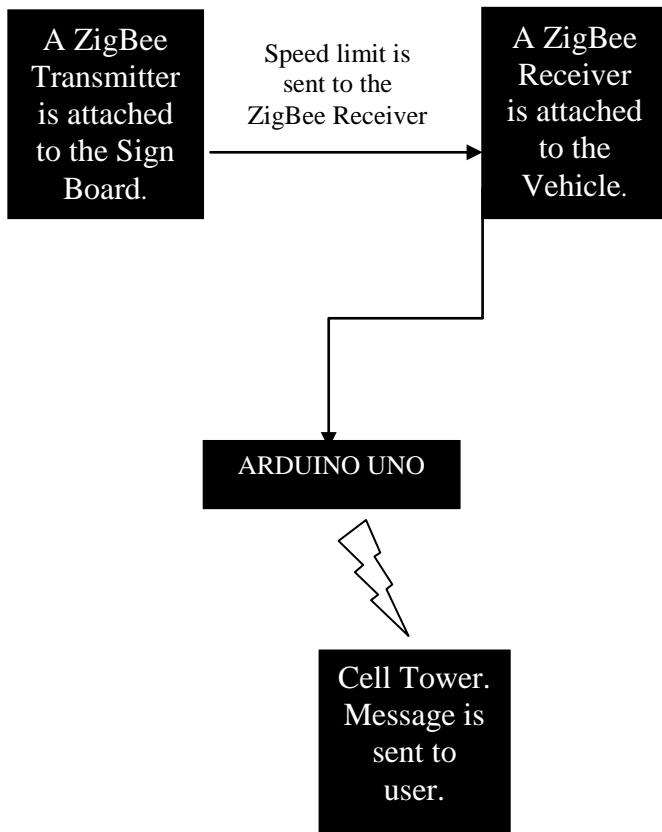


FIG 2: ZigBee based Vehicle Speed Controlling System

#### V. DESIGN COMPONENTS

The proposed architecture includes the following components:

- 1) ZigBee Transceiver
- 2) Arduino UNO
- 3) GSM
- 4) LCD
- 5) Vehicle Speed Sensor
- 6) Android Application

#### VI. CONCLUSION

In this paper, a theoretical model that can enrich road safety considerably by automatically detecting and monitoring the speed of the vehicle when it enters a restricted zone via ZigBee protocol and sending a SMS to the violators mobile by imposing a fine on the driver. The proposed prototype is simple, robust and offer implementation at a very low cost. As ZigBee components are used, the system consumes little power. The defined structure is easy to implement on the existing system which guarantee extreme security for motorists, travelers and pedestrians. The driver gets all the information on a LCD, which helps in care free driving. The model has been planned based on the overall study of the existing system and the application of this model might vary according to requirements.

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