Wireless Vehicle Speed Limiter

Srijan Saumya [1], Sumit Saikia [2], Shubham [3], Subashka [4]
[1, 2, 3, 4] Department of Computer Science & Engineering, SRM IST, Ramapuram, Chennai, Tamil Nadu, India.

Abstract – In any area with infrastructures like schools, hospitals, etc. which see a lot of sudden foot traffic, there are innumerable cases of accidents happening due to speeding vehicles. Now, inspite of traffic signs highlighting the need for caution, it is apparent that these vehicle owners are willing to sacrifice their own safety and others just to save some time. The problem which we face is that vehicles in sensitive public zones don't limit their speed, thereby risking the lives of pedestrians and fellow vehicles. To overcome this problem we have come up with is a system which will automatically detect and decrease the velocity of the vehicles and maintain it under a limit in the required area. This is done by integrating a wireless module in the Electronic Control Unit i.e. (E.C.U), and providing a network for the area, we can create a system that checks the speed of vehicles when in range of the network. The system in the vehicle is linked to the throttle-valve, which in turn will decrease the speed of the vehicle.

Index Terms – vehicle speed limiter, sensitive public zones, effective range, ECU, Wi-Fi.

1. INTRODUCTION

The main aim to implement traffic discipline and reduce the number of accidents in a hospital or school-zone setting can be achieved by implementing an automatic speed limiter system. Problems like over speeding, rash driving can be solved by installing a speed limiter system. Systems that use radio frequency and infrared system technology need more number of sensors and installations for its operation, whereas this problem is overcome by using a Wi-Fi installation that provides a network for a wider range and requires very few substations for the specific zone. We need a system that automatically reduces speed of a vehicle which would need to be wireless and must work in real-time. Since it is challenging to provide manual services for enforcing the speed limit on vehicles at all times, as a demonstration on a small scale we have proposed a model which uses a Wi-Fi module to detect and connect the network and a driver motor to reduce the speed of the model, programmed with the help of arduino software.

According to studies, Wi-Fi has its reach of only about 50 to 200 meters. This range can equip the specified zone with a strong Wi-Fi network which when detected by the vehicle will reduce the speed of the vehicle to the speed limit assigned. The vehicle will have a Wi-Fi detector to detect the Wi-Fi network available in the zone. Installing this device in various zones will not only reduce the chance of accidents to a great extent but also reduces the liability of the driver as safety is automatically monitored by restricting the speed. The system's efficiency is increased by making use of the range of Wi-Fi signal thereby minimising the number of substations, owing to lesser set up area. This will help a long way in improvising the technology and benefitting the society. There are three major limitations that cannot be ignored if the security of the system is compromised – it may be prone to hackers, it may have certain ethical issues due to controlling speed of the vehicle, there may be interference of other electronic devices.

However, unique data encryptions can be used to enhance security of the system. As an emergency fail safe mechanism, when the wireless speed limiter is not required the respective substation, covering the specified area can be turned off. The paper is organised as follows. Section II comprises of the related work. Section III explains the proposed system. Section IV covers the results and discussion followed by Section V gives details of the future work. The paper is concluded in section VI.

2. RELATED WORK

The techniques of implementing velocity control over automobiles have seen various strategies adopted over the course of time. This paper develops a particular type of speed controller that uses Wi-Fi technology. Sai.Vignesh et al [2] has designed a RF based automatic speed limiter by controlling throttle valve. K govindaraju et al [3] has implemented an Embedded based vehicle speed control system using wireless technology. U.Jyothi Kameswari et al [4] has proposed a Design model for automatic vehicle speed controller. Seong-eun Yoo et al [5] has developed a wireless sensor network application called School zone Safety System (S3) to help regulate the speed limit and to prevent illegal parking in school zones. P. Sai Chaitanya et al [6] has worked on Automatic Vehicle Speed Control System Using Wireless fidelity.

Rubini.R et al [7] has implemented a speed violation system using zigbee technology to alert the violators. Jyotika Kapur [8] has presented an automatic breaking system to prevent accidents using Bluetooth technology. R.Deepa [9] has proposed a wireless network to which will control functionalities like accelerating, braking, and steering in the vehicle. Nehal Kassem et al [10] have presented model called RF-based vehicle motion detection and speed estimation system (ReVISE) which helps in vehicle detection and speed estimation. Vladimir Glavtchev et al [11] implemented a hardware-accelerated version of the radial symmetry detector to achieve real-time performance in detecting speed-limit signs on a graphics processor.

3. PROPOSED SYSTEM

A theoretical model of our proposed methodology has been described in this section. The model has been bifurcated into two parts - Car interface and School interface- each of them is shown and described as follows:

A. Car Interface

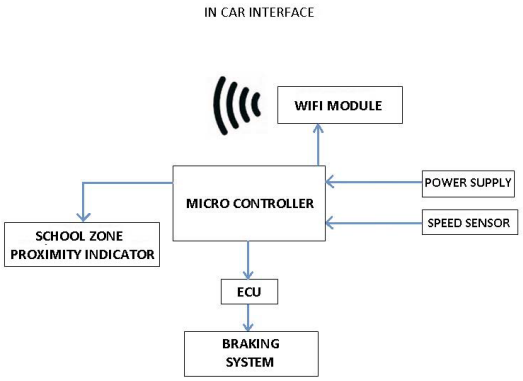

Figure 1: Car interface

Figure 1 shows a simple prototype of the interfact that would be installed at the vehicle. The system would require full access to the braking system of the vehicle via the Electronic Control Unit i.e. ECU. Each school zone would have its own unique Wi-Fi system. Thus through a pre designed Wi-Fi module in the system, the exact location of the vehicle can be established. An alternative to this would be to map the location of the vehicle via GPS, and to signal to the system when it is in the vicinity of a school zone.

Once it is entrenched that the vehicle is in fact in the environs of a school zone, speed sensors attached to the system can detect the speed of the vehicle. The system will then apprise the driver to reduce his speed. If the warning is not met the system automatically slows down the vehicle through the braking system via the ECU, while dispatching relevant information through its Wi-Fi module to the school zone hub. Pertinent Information could be the speed, vehicle number and the driver's credentials.

B. School interface

Figure 2 shows the system that would be installed at a school, for example. Every school would have its unique Wi-Fi system that stretches out around the school. Any vehicle entering this area by connecting to the school's Wi-Fi would be alerted. Speeding vehicles' credentials that failed to slow down after a calculated amount of time would be logged at the school server via its Wi-Fi module. Relevant authorities would have full access to the school server, thus they can then review the data logged and punish the violators by imposing fines.

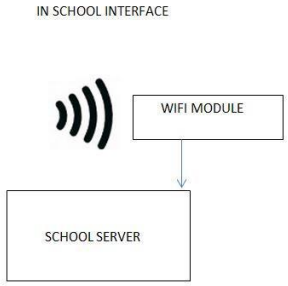

Figure 2: Proposed school interface

C. Working

The process flow of the system is shown in Figure 3 and its intricate details are:

- When the car is in motion, the module is initialized. The Wi-Fi detector in the car will scan for school zone network. If the zone is detected, the module connects to the network.
- The school zone network will acknowledge the connection by sending a message back to the module.
- This message is a trigger for the module to alert the driver to slow down the vehicle below the speed limit.
- If the warnings go unheeded, the module then starts slowing down the speed of the car. The module, along with the car's ECU, overrides the driver's inputs and applies the brakes in a gradual manner, till the speed of the vehicle is abated below the predetermined threshold.
- The driver's credentials and details are sent to the school zone network and they are stored in a database.
- The database may be used by law enforcement officials to impose penalties/fines on the driver for violations.
- If the speed of the vehicle is lesser than the assigned speed limit the vehicle has its usual working.
- In case the vehicle in question is an emergency vehicle(for example ambulance, police, fire-truck) the said vehicle may be given a unique code that can cause the network to identify it and allow it to pass through without causing its speed to be limited.
- This message is displayed through the "school zone proximity indicator".
- The module checks the speed of the car and if found to be greater than the speed limit, it issues a warning to the driver to slow down. The warning may be sent via a display module or as an alarm.

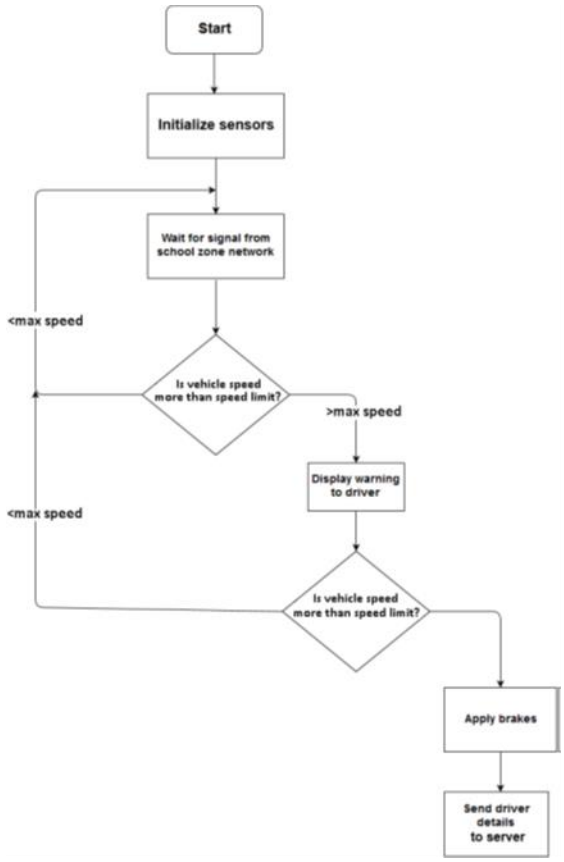

Figure 3: Working

C. Prototype Implementation

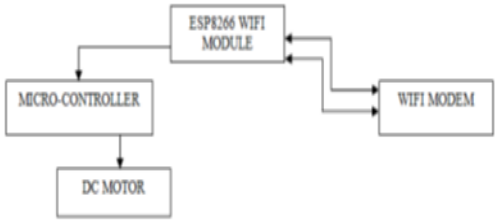

Figure 4: Prototype of the proposed system

Figure 4 shows the prototype of the proposed system. Here, the consolidation of the micro controller, Wi-Fi -module and dc motor is analogues to the Car interface, while the Wi-Fi modem represents the School interface providing the network. When the Wi-Fi module is outside the vicinity of the modem's network, the motor is allowed to run without restriction. The module attempts to connect to the network periodically. When a connection is established, the microcontroller thwarts the speed of the motor and ensures it is under the pre -determined limit. This prototype can be used as a precedent while establishing the advanced, complex, robust and holistic system.

4. RESULTS AND DISCUSSION

Three instances are considered for the proposed model, assuming the specified zone has a predetermined speed limit of 30kmph.

A. At higher speeds

When the vehicle just enters the zone the vehicle's speed is detected and is found to bevery much higher than the predetermined speed limit, immediately within a second the driver is alerted to reduce the speed. In figure 5 as the blue line indicates that the vehicle continues to be above the speed limit, hence the system will reduce speed of the vehicle gradually until it goes below 30kmph indicated by the red line.

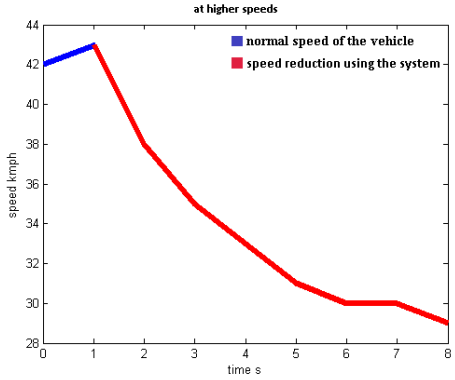

Figure 5 "speed v/s time" analysis at higher speeds

B. At Tolerable speeds

When the vehicle enters the zone with a speed just above the predetermined limit, the system indicates the driver to reduce speed providing a couple of seconds. Here, considering tolerable speed limit till 35kmph, in Figure 6, the vehicle continues to be at tolerable speeds, hence the vehicle is provided time to reduce its speed indicated by an yellow line. The red line indicates that the speed is reduced by the system as the vehicle does not reduce its speed in the given amount of time.

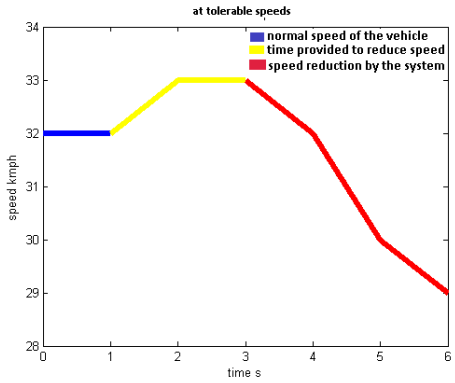

Figure 6: "speed v/s time" analysis at tolerable speeds

C. At permissible speeds

When the vehicle enters the zone with a speed below 30kmph, the system keeps a note of the vehicle and does not permit the vehicle to go beyond the predetermined limit. In this way, the speed limiter system provides a structured design for system implementation with different predetermined speed limits considering the type of locality at various places and gives time to the driver to make his decisions.

The statements displayed on the LCD screen in the vehicle are demonstrated in Figure 7. This scenario is explained in the following steps:

When the vehicle is about to enter the Wi -Fi enabled zone, it alerts the driver about the speed limit to be followed in the zone.

If the vehicle is detected to be above speed limit, the system will warn the driver to slow down the vehicle.

If these warnings go unheeded, the system is authorized to slow down the speed of the vehicle

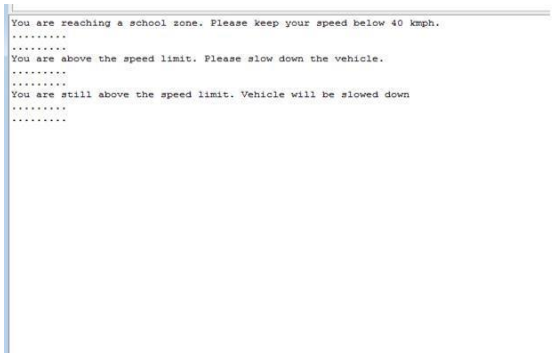

Figure 7 Statements displayed on the LCD screen in the vehicle

5. CONCLUSION

The proposed system would help eliminate speeding in school or hospital zones and ensure drivers exercise caution while driving in such areas. The system could employ technologies other than Wi-Fi, like ZigBee, 6LoWPAN, etc. to communicate with the network and alert drivers who are driving above the speed limit. If the driver fails to adhere to the warnings, the system automatically reduces speed of the vehicle, thus ensuring the safety in the sensitive zone. This not only provides an economical solution to implement safety in public places but also immensely contribute to the welfare and benefit of the people.

6. FUTURE WORK

The proposed model has paved a way to be implemented practically for usage in various public places where safety is of utmost importance. As an extension of the model, mobile devices containing Wi -Fi technology can take the role of the receiver module in the car when connected through a cable to the ECU and this can reduce speed through the mobile device. Also, in case there are any inconveniences or accidents, knowing the details and location of the car using the Wi-Fi system, a facility can be made so as to send a distress signal which can be automatically reported to the emergency services.

ACKNOWLEDGMENT

The work reported in this paper is supported by the college through the Multi Disciplinary Domain. We are greatly indebted to our college, SRM IST, Ramapuram, for providing us a healthy environment that is conducive to learning that made us reason out, question and think out of the box. It has also strengthened our confidence and has enabled us to conceptualize, realize our dream project. We are also grateful for the support provided by Dr.J.Jagadeesan, Head of the Department, Computer Science & Engineering, SRM IST, Ramapuram for providing us with such an opportunity.

REFERENCES

[1] Vrushali. V. Kadil and D. S. Adane, “Maximizing range of signal strength by homemade Wi-Fi booster antenna”. WCIT magazine, Nov 2012.
[2] Saivignesh H, Mohamed Shimil M, Nagaraj M, Dr.Sharmila B, Nagaraja pandian M, “RF based automatic speed limiter by controlling throttle valve”. (IJIRSET), Vol. 4, Issue 1, January 2015.
[3] K.Govindaraju, S.Boopathi, F.Parvez Ahmed, S.Thulasi Ram, M.Jagadeeshraja, “Embedded based vehicle speed control system using wireless technology”. (IJIREEICE), Vol. 2, Issue 8, August 2014.
[4] U. Jyothi Kameswari, M. Satwik, A. Lokesh, “A Design model for automatic vehicle speed controller”. International Journal of Computer Applications (0975 – 8887). Volume 35– No.9, December 2011.
[5] Seong-eun Yoo, Poh Kit Chong and Daeyoung Kim, “ S3: School Zone Safety System Based on Wireless Sensor Network”. Sensors 2009.
[6] P. Sai Chaitanya, V. Vikram, B. Kalesh, “Automatic Vehicle Speed control System Using Wireless fidelity”, Volume-3, Issue-4, 2014.
[7] Rubini.R and Uma Makeswari.A, “Over speed violation management of vehicle through zigbee”. (IJET), Vol 5 No 1 Feb-Mar 2013.
[8] Jyotika Kapur, “Accident Prevention via Bluetooth”, (IJESIT) Volume 2, Issue 4, July 2013.
[9] R.Deepa, “Design of Vehicle speed Control System Using Wireless Instrument Cluster”, (IJESIT)
[10] Nehal Kassem, Ahmed E. Kosba, and Moustafa Youssef, “RF-based Vehicle Detection and Speed Estimation”. Vehicular Technology Conference (VTC Spring), 2012
[11] Vladimir Glavtchev, Pınar Muyan-O¨ zc¸elik, Jeffrey M. Ota, and John D. Owens, “Feature-Based Speed Limit Sign Detection Using a Graphics Processing Unit” Intelligent Vehicles Symposium (IV), 2011