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Anti-Collision of Vehicles by an Automatic Speed Reduction Intelligent System

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ABSTRACT

In the rapidly flourishing country like India, accidents at junctions in the national highways (junctions where the national highway and service road meets) and speed limited zones like schools, government buildings are increasing day by day and no fruitful steps have been taken so far in these areas. This paper deals with automatic collision avoidance system and ensures the safety of road users in national highways and other speed limited zones. By introducing anti-collision automatic speed reduction intelligent system in such an areas we can avoid the accidents and deadly collision of high speed vehicles and we can save the life of human lives.

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INTRODUCTION

Road transportation is lifeline of India and it is being the familiar and easy modes of transportation preferred over all other means of transportation. When we go through the daily newspapers we come across many accidents in national highway, speed limited zones like higher traffic occurrence roads, schools zones, government buildings and etc. Road transportation related accidents are more dangerous than other transportation accidents in terms of severity and death rate etc. Jha *et al*. (2003) stated that more efforts are taken to improve the safety, collisions with vehicle are generally catastrophic, in that the destructive forces of a vehicle usually no match for any other type of vehicle in road transportation system. Collisions between vehicles to vehicle occur frequently in national highways junctions and other speed limited zones all the latest technology.

Road accident in India: A Snapshot:

Transport Research Wing, Ministry of Road Transport and Highways (2013) reported that issue of road accident in India.

I. Emergence of Road Traffic Injuries (RTIs) a leading cause of Deaths & Disabilities at India: 2013
- Accidents 4.97 lakh (annual) (1 every minute)
- Deaths 1, 42,485 (one death every 3.7 minutes).

II. Accidents impose significant costs • 3% GDP for India (1999-2013)
- 1% GNP for low income countries
- 1.5 % GNP for middle income countries
- 2% GNP for high income countries
- 9th leading cause of death in 2004 and expected to be 5th leading cause of death by 2030 worldwide.

Table I: Road accident scenario of India in recent years

Year	Number of accidents		Number of persons	
	Total	Fatal	Killed	Injured
2002	4,07,497	73,650(18.1)	84,674	4,08,711
2003	4,06,726	73,589(18.1)	85,998	4,35,122
2004	4,29,910	79,357(18.5)	92,618	4,64,521
2005	4,39,255	83,491(19.0)	94,968	4,65,282
2006	4,60,920	93,917(20.4)	1,05,749	4,96,481
2007	4,79,216	1,01,161(21.1)	1,14,444	5,13,340

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2008	4,84,704	1,06,591(22.0)	1,19,860	5,23,193
2009	4,86,384	1,10,993(22.8)	1,25,660	5,15,458
2010	4,99,628	1,19,558(23,9)	1,34,513	5,27,512
2011	5,05,874	1,23,618(24.4)	1,45,485	5,33,394
2012	5,12,632	1,25,809(25.2)	1,49,674	5,42,498
2013(P)	5,16,439	1,31,321(27.8)	1,52,534	5,48,542

P: provisional, source: information supplied by states/UTs (Police Departments). Figures within parentheses indicate share of fatal accidents to total *Accident Severity: No.of person killed per 100 accidents .

Ministry of Road Transport and Highways, Government of India (2013) and National Crimes Records Bureau (2013) released the report for Road accident scenario of India in recent years

Incidents of road accident:

- Rise in number of accidents, injuries & deaths per lakh of population – Reflects rise in motor vehicle population, increase in duration & number of travel trips with rise in income.
- Sharp decline in number of accidents, injuries, & deaths per 10,000 vehicles – Reflects improved crash worthiness vehicles & occupant protection better enforcement.
- Rise in number of accidents, injuries & deaths per 10,000 km – Reflects higher exposure to risk due to heterogeneous nature of traffic, lack of traffic separation etc.

Table II: Accident prone zone report for major cities and its reasons.

ACCIDENT PRONE ZONE	
Top five states which reported maximum number of roads • Maharashtra - 68,438 • Tamilnadu - 65,873 • Madhya Pradesh - 52,406 • Karnataka - 49,321 • Andhra Pradesh - 44,731 Top five cities which reported Maximum number of road accidents • Mumbai - 25,471 • Delhi - 8,281 • Bangalore - 7,462 • Indore - 5,432 • Bhopal - 4,995	Major cause of road accidents in 2013 • Driver's fault - 77% • Pedestrian's fault - 2.4% • Cyclist's fault - 1.3% • Defect in road condition - 1.5% Urban-Rural distribution • Accidents in rural areas - 53% • Road accident deaths in Rural areas - 63% • Accidents in urban areas - 46% • Road accident deaths in Urban - 36%

Total road accidents in 2013 - 5, 16,439
Total road accident death - 1, 52,534

Methodology:

A. Intelligent system operation in National highway:

The intelligent system perform operation like reduces the speed of the vehicles (car, bus, lorry and etc) before the junction about 200 meters without knowledge of the driver and the intimation message passed to driver about the speed reduction of the vehicle due to junction by sounds and it also avoids the collision of vehicles which are moving with different speed on the same track. Once the speed of the vehicle reduced, the driver cannot raise the speed without the release of speed control signal applied to the speed control unit present in the vehicle. By using this kind of automatic speed reduction intelligent system, the safety and the speed control is ensured in national highway junctions. After crossing such a junction about 50 meters automatically the speed control signal is release and it is applied to the vehicle and the alert message will be passed to the driver and to do the work further. Heath and Steve (2003) reported about an embedded system is a microprocessor based system that is built to control a function or a range of functions

B. Intelligent system operation in speed limited zones:

In speed limited areas like school zone, government buildings and industrial areas, speed limitation can be fixed depending upon the requirement. Once the vehicle enters into these zones, the intelligent system performs operations by reducing the speed of the vehicles like car, bus, lorry etc. An intimation message will be passed to the driver about the speed reduction of the vehicle. The speed reduction technique also avoids the collision of different vehicles at different speed at the same track. Once the speed of the vehicle is reduced the driver cannot rise the speed without speed release control signal applied to the speed control unit in the vehicle. By reducing speed of the vehicle we get better control and the safety is ensured in speed limited zones. After crossing such an area automatically the speed limit release signal is applied to the vehicle and again the intimation message

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will be passed to the driver and the driver can do further work. United Nations Decade of action for road safety (2013) and United Nations Road Safety Collaboration (2013) reported that the safety begins with the construction of equipment and speed regulation to minimize the occurrence and consequences of automobile accidents. The Fig.1.5 shows the proposed layout of the above discussed system.

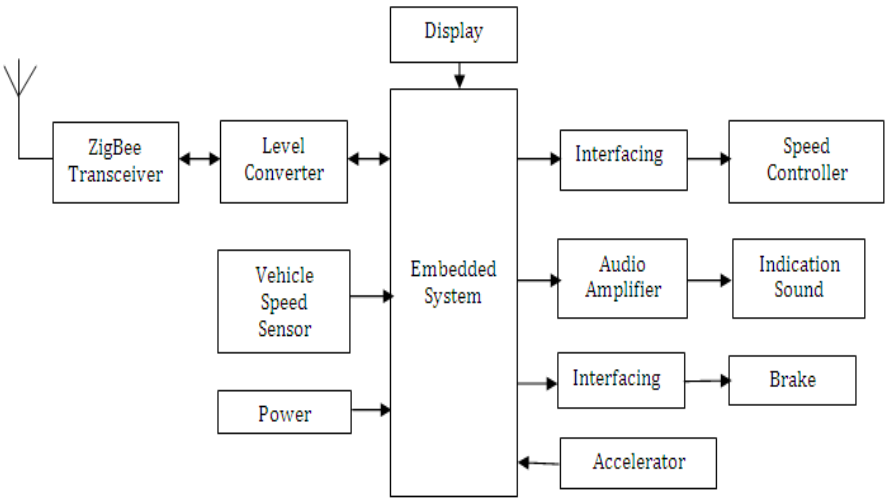

Fig. 1.1: System architecture at vehicle end.

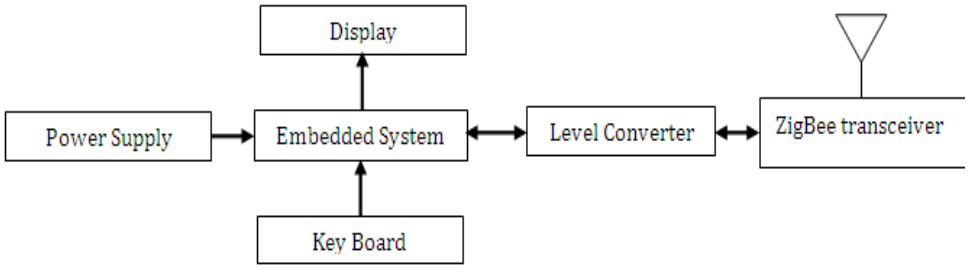

Fig. 1.2: System architecture at road end.

C. Concept of automatic Vehicle speed reduction:

In general, the speed of the automobile is varied according to the accelerator's Pedal position. The variation in the Pedal Position is fed to the Embedded System (ES). Clarinox (2011) stated that "Working across Multiple Embedded Platforms" to merge the embedded system with the mechanical unit to perform a task like controlling the speed and other parameters. Here ES determines the position of the throttle based on the accelerators pedal position and the inputs received from the core control unit present at the road end and other sensors. Adjustment of throttle position causes changes in the variation of automobiles speed. Such type of hardware scheme is shown in Fig.1.3. The PROTEUS simulation output for speed control unit shown in Fig.1.4.

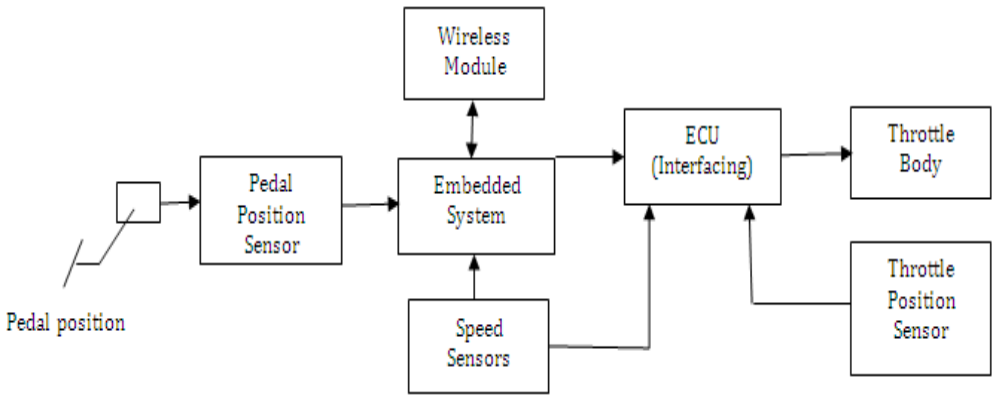

Fig.1.3: Hard scheme of automobile in our proposed design.

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III. Application:

- National Highway Junction.
- Speed limited like school zones, Hospital, Government buildings and industrial area.

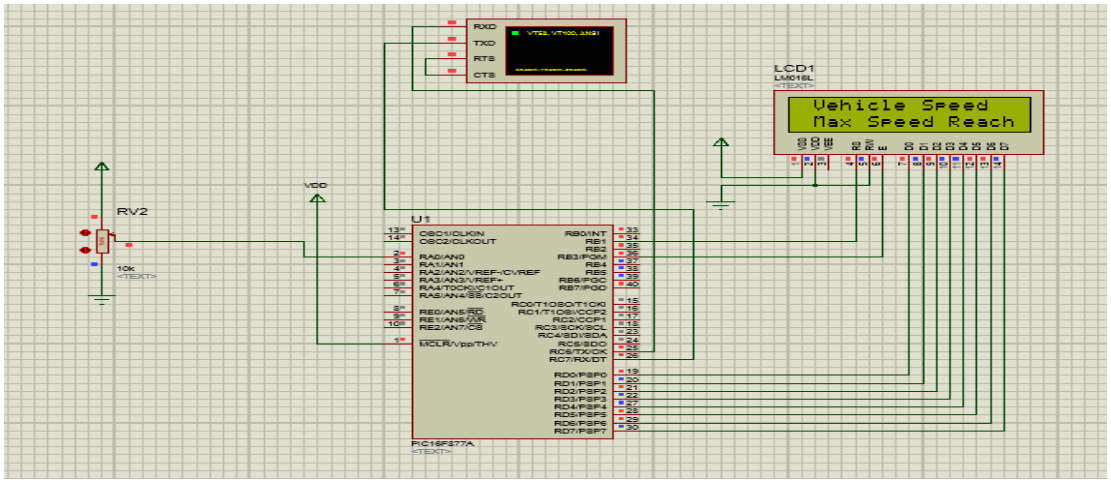

Fig.1.4: PROTEUS simulation output for speed control unit.

Literature review:

Already many papers exist based on alerting accident occurrence, vehicle speed sensing and vehicle speed reduction. But most of them have the drawback of reducing the accident because of improper methodology and lack of technology which do not fulfil the safety criteria of road user. Effective solution can be obtained by optimizing the above discussed solution.

Conclusion:

Automobile safety is the study and practice of design, construction of equipment and speed regulation to minimize the occurrence and consequences of automobile accidents. Road traffic safety more broadly includes roadway design. Improvements in roadway and automobile designs have steadily reduced injury and death rate in all first world countries. This paper proposes a new way to reduce the vehicle speed automatically in order to reduce the accident occurrence and ensure the high safety in this area.

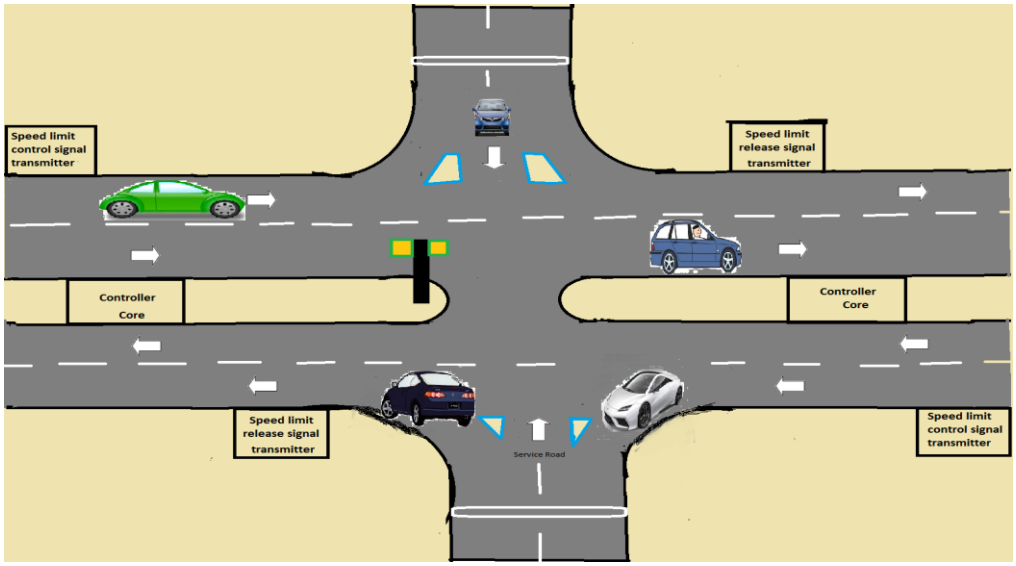

Fig.1.5: Automatic speed control intelligent system at road.

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