Accident Prevention Smart Zone Sensing System

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Abstract— **Every year about 1.3 million of people dies in road accident, besides 20-50 million are injured or disabled. Most of them occur as a result of ignoring traffic signals and signs. The conventional system for traffic signs and signal, shown through the road sided sign post or traffic signal post, may pass unnoticed due to bad weather conditions or driver's ignorance or other distractions. This study proposes a system that combines a smart traffic signaling technique and a smart automobile to avoid the road accident. The smart automobile consists of a micro-controller, sonar sensor and a RF receiver with a display embedded in a car whereas the smart traffic signaling system consists of a microcontroller based RF signaling transmitter that placed in every traffic signal or sign post. The sonar on the smart automobile will help to avoid clash by measuring the distance of surrounding vehicles. Therefore, the proposed system ensures that no vital traffic sign will go unnoticed, whatever the condition is. It can be utilized in special areas with sudden sharp & high curve, heavy traffic zones.**

Keywords— Anti-collision; Smart zone; Traffic signal; RF transceiver

I. INTRODUCTION

Road accidents are undoubtedly the most frequent and, overall, the cause of the most of the damage. Accidents involving loaded vehicles occur too frequently despite calls for responsible behavior, for respect of the loading regulations and the Highway Code. Not only it is often drivers avoid the sign boards (like School, Hospitals), no horn zone and also drive the vehicles so impetuous without considering the curves or speed breaker keeping their lives at risk. Several researches have been done for developing smart vehicle system that have all automatic functioning. First efforts for developing such vehicles were in JAPAN in 70's. Then research was successfully and continuously moved on EUROPE in late 80's and early 90's [1]. MITI, Nissan, Fujitsu also worked for the project "Personal Vehicle System" [2]. Advanced Cruise-Assist Highway System Research Association (AHSRA) was established with a large number of research centers in 1992 [3]. In 1995, the US government established the National Automated Highway System Consortium (NAHSC) [4], and launched the Intelligent Vehicle Initiative (IVI) in 1997. Several promising prototype vehicles/systems have been investigated and demonstrated within the last 15 years [5]. The first approach towards anti-collision system was emergency brake assist (EBA) or brake assist (BA or BAS) phenomenon that increases braking pressure during the emergency situation. Another approach is Anti-Locking Braking System (ABS) that works as regular braking system by automatically pumping the brake. In 2012, a real-time online safety prototype that controls the vehicle speed under driver fatigue [6]. The system may helpful in city areas where internet is available but due to bad network this system may not work and system and server congestion delay is a big factor on a highway. The electronic brake-force distribution (EBD/EBFD), electronic brake-force limitation (EBL) are the automobile braking technology that automatically varies the amount of force applied to each of a vehicle's brakes, depending on road conditions, speed, loading, etc. and always coupled with anti-lock braking systems [7]. All of the mentioned preventive systems are very useful. However, after having these automated devices in the vehicle, accident isn't remarkably reduced. This could be due to the unconsciousness of drive while driving. Reckless driving without noticing any zone signals or curves is responsible for about one-

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been used to display messages to the user which is connected to the arduino. The LED and Buzzer are used to alert the user and the motor driver are used to drive the motors of the vehicle. For the processing of entire system arduino mega 2560 is used in the proposed system.

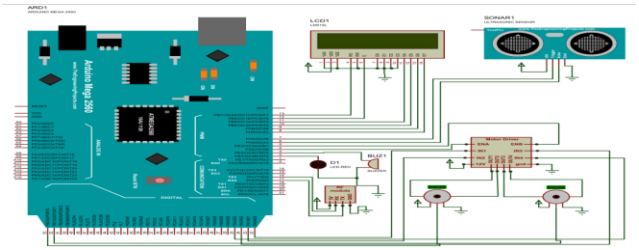

Fig. 1: Schematic diagram of anti-collision and smart traffic signaling subsystems

B. System Hardware

RF Transceiver: The proposed system consists of radio frequency (RF) transceiver (Fig. 2) which has two main parts. Transmitter (shown in Fig. 2(a)) is attached in every road sided signal posts or traffic signal posts. It will transmit the signal such as avoid horn, right turn, left turn, curve etc. from the signal board. The receiver section of the proposed system is shown in Fig. 2(b). The receiver is installed in every vehicle to receive the signals from the smart traffic signals transmitters. An Encoder (HT12E) and a decoder (HT12D) are used to receive or transmit binary data by the transceiver.

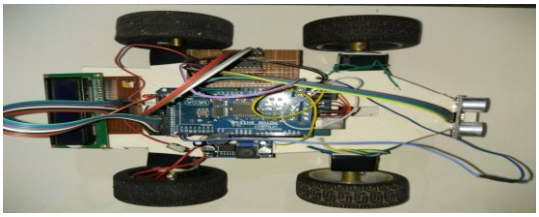

Fig. 2(a): Receiving portion of an implemented device having anti-collision system and zone sensing.

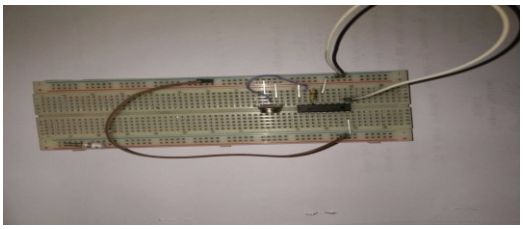

Fig. 2(b): RF transmitted circuit of the implemented device.

Sonar-sensor: A sonar sensor is used in the receiver potion of the circuit to measure the distance of vehicle from any obstacle. If the vehicle approaches to a static as well as running obstacle, then it will calculate the distance between them until the speed of vehicle is below 20 km/hrs.

Arduino Mega: This is the processor and motherboard of the full system as shown in Fig. 2(b). The system calculates the speed of the vehicle using encoder and sends information to the arduino. Arduino receives the signal from the transmitter, process it and drives the system accordingly. A buzzer connected with the arduino is used to cease the horn. When the vehicle get the zone signals like hospital, school, etc. then the processor sends signal to disable the horn.

C. System Software:

The arduino IDE has been used in this study to program the microcontroller. The sonar continuously measure the distance of others vehicles or things from the vehicles installed the system and founds in the serial monitor of arduino. Any vehicles or things within 100 m is considered

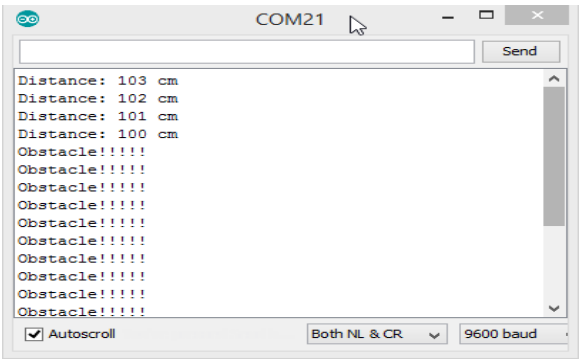

Fig. 3: Measurement of the distance between the car and the nearest obstacle (sonar sensor value from serial monitor).

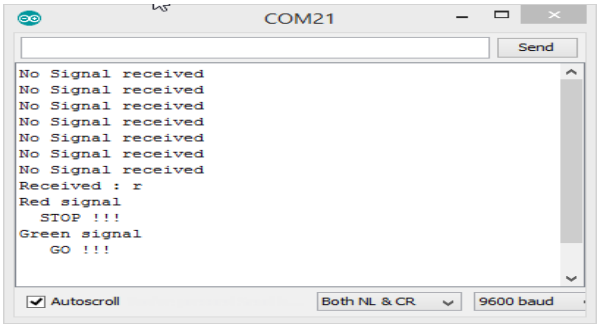

Fig. 4: Automatic detection of traffic signal by the RF module (RF module data reception from serial monitor).

Similarly, it is shown in Figure 4 that the Arduino received data from the RF module (traffic signal) and took action accordingly. The whole set of characters that the post RF modules transmitted and the actions taken by the Arduino has been listed in Table I.

Table I: Detection of traffic signal and corresponding action taken by the proposed system.

Serial	HT 12D-E Code words	Message display	Action
1.	1110	Red signal stop	Stops the vehicle
2.	1101	Green signal go	Return to normal condition
3.	1100	Yellow signal slow down	Reduce speed up to a safe level
4.	1011	School ahead avoid horn	Disable the horn
5.	1010	Hospital ahead avoid horn	Disable the horn
6.	1001	Curve ahead	Reduce speed up to a safe level
7.	1000	Rail crossing ahead	Reduce speed up to a safe level

III. Methodology

This system is divided into two sub-systems: Anti-collision and smart zoon sensing and smart traffic signaling.

A. Smart Traffic Signaling System:

The smart traffic signaling sub-system will transmit specific RF signal based on button pressed by the traffic controller. The signal will be available within the range of the RF transmitter. Any vehicle within the range of the RF transmitter will receive the signal. Based on the signal the receiver portion will show certain massage on LCD display and other action will be taken by Arduino (Table: I) for the corresponding signal transmitted on the receiving end of the system. For example, the red LED will light up for the red signal in the traffic light and safety massage will display on the LCD. For the normal signals the fixed post transmitters will always be transmitting a single signal. It will be attached to a fixed post having a single message. Any receiver within the range of the transmission will be able to see the message on the LCD. If receiver receives any signals like no horn then the system will disable the horn.

B. Anti-collision and Smart Zoon sensing System:

In the anti-collision system, the distance between the owner's vehicle and any other vehicle or obstacles must be measured. For this purpose ultrasonic sensor (HC-SR04) has been used that will emit an ultrasonic sounds and receive the reflected sound. If any objects (front-side) come within the safety limit (100 cm), Arduino will force the vehicle to stop and the LED situated in the back of the car will start flashing to alert other vehicles.

The flow chart of the system is shown in Fig. 5. When drivers start the vehicle this system will be initialized. LCD display will show the speed of the vehicle. Then the RF receiver will try to find the transmitted signals from the zone (like educational institutions, hospitals, etc.) transmitter. If the vehicle's speed goes beyond the zone limit then the system automatically reduce the speed and maintain a moderate distance. When curved road is detected, the system will reduce the speed automatically. If the receiver receive no horn zone then the horn system will be disabled. This system also takes care of the traffic signals.

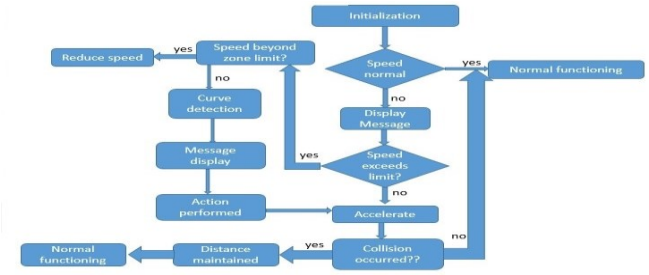

Fig. 5: Flow chart of automatic anti-collision and smart zone sensing technique.

IV. Results

The whole system has been successfully implemented in traffic system, hospital road, and school roads.

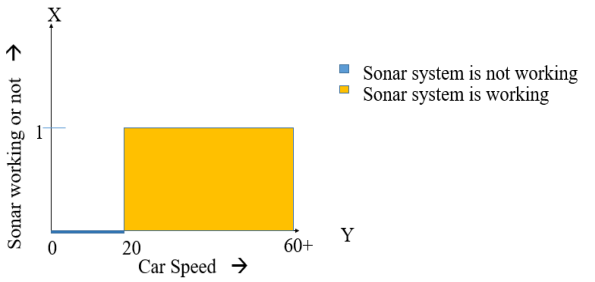

Fig. 6: A graphical view of working the sonar system. When the car speed is below 20 cm or at the time of parking the car sonar won't work.

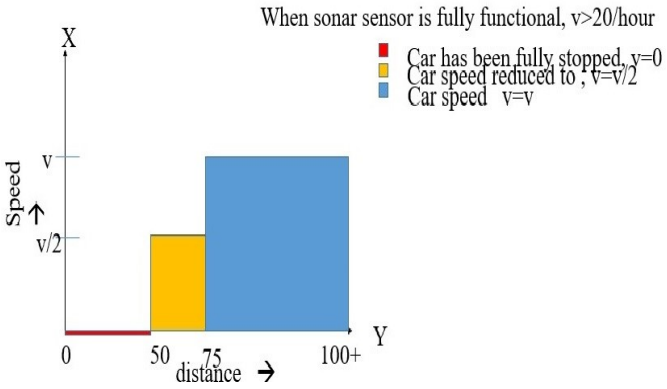

Fig. 7: A graphical view when sonar is fully functional

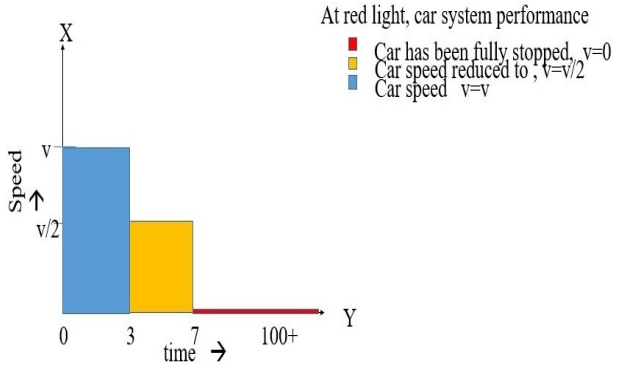

Fig. 8: A graphical view when the vehicles take in action after receiving the red light signal from zone transceiver.

The transmitter worked inside the range of 100 meter. When traffic signal was red and the system based car (demo) reached inside 100 meter, the buzzer started to beeping, respected message was shown in the car display and the speed of the car reduced by 50%. And after 4-5 second the car automatically stopped (Fig.8).

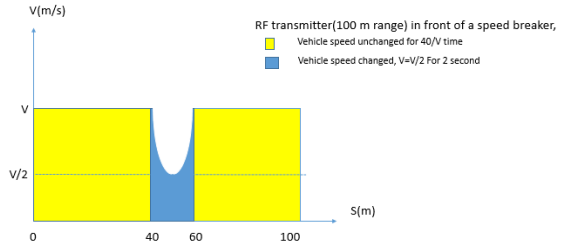

Fig. 9: A graphical representation of decreasing the speed of car in front of speed breaker and schools roads zebra-crossing

If a car running at V m/s detects a speed breaker S meter's away, it reduces its speed to V/2 m/s for 2 second after S/V seconds. After crossing, the speed again increases to V m/s. At green and orange light it also worked perfectly. When the car was passing school or a hospital, the horn of the car was disabled and preferred message was shown in the display. The anti-collision system worked perfectly when a wall/vehicle raised in front of the car inside the range of 100 cm.

V. Further Improvement

Alcohol detecting sensors can be used for detecting driver's condition at the time of driving. GSM and GPRS can be used for tracing the location of the vehicle and message is send to nearer hospitals and the police station in the case of accident. Eye blink detector can be used to count the eye blink and detect whether driver is in dizziness.

VI. Conclusion

In this study, heavy traffic zone accident preventions technique in the real world has been proposed. A prototype of the system with the proposed technique has been presented. It has been mainly designed in order to avoid accidents and to alert the drivers about the speed limits for safe travelling. It can be utilized in special areas with sudden sharp & high curve and thus accident will be able to prevent in old bridges and Ghats section. It could be successfully implemented to control the speed of the vehicle in hospital, school, and work zones. Accidents can be prevented which are caused by the negligent driving or speeding of the user. At the same time it detects obstacle and stops the vehicle, so that accident will be prevented.

VII. References

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