e-ISSN(O): 2348-4470
p-ISSN(P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 13,Issue 2, February 2026

Intelligent Automotive Driver Assistance and Vehicle Safety System

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Abstract — *Vehicle safety is the system which is use to minimize the occurrence and consequences of Vehicle accidents. Some of the basic reasons for road accidents may be Avoidance of Wearing Seatbelt, Poor visibility at sharp turns due to insufficient light Blind eye towards Blind Spots, ignorance of sign boards & traffic signals, Drowsiness during Driving. This article presents an overview of seat belt detection, Blind spot detection using ultrasonic sensor, adaptive headlight using steering wheel, sign board & traffic signal detection using RF module or ZigBee module. In this article, we also present several design guidelines for such a system, based on the results of our analytic and empirical studies. Finally, evaluation of our prototype provides evidence that the system can indeed detect potential risks in advance and provide early warnings to the driver in real-world scenarios, lowering the probability of traffic accidents.*

Keywords- *Blind Spot, Adaptive Head Light, Ultra sonic, servo motor, RF module*

I. INTRODUCTION

The vehicle safety and automotive driver assistance system is currently being developed for enhancing vehicle safety and vehicle- to-road side communications. One of the first formal academic studies into improving vehicle safety was by Cornell Aeronautical Labs of Buffalo, New York. The main conclusion of their extensive report is the crucial importance of seat belts and padded dashboards. The number of road accidents reported in India is highest in the world. As per the data available from National Transportation Planning and Research Centre, it is three times higher than any other country. Some of the basic reasons for road accidents may be

- Avoidance of Wearing Seatbelt.
- Poor visibility at sharp turns due to insufficient light
- Blind eye towards Blind Spots.
- Avoidance of traffic signal &sign boards.
- Drowsiness during Driving

According to National Highway Traffic Safety Administration 33,808 people died in traffic crashes in 2010 in the US, including an estimated 10,000 people who died in driving crashes. Death driving fatalities accounted around 32% of all traffic deaths last year due to poor visibility due to blind spots, insufficient light during night driving or even weather conditions.

In such cases driver is not alert of an obstacle thus resulting into a fatal accident. Multiple vehicle pile ups or chain accidents are becoming a common incident these days as a result of above mentioned reasons.

Considering all the difficulties, an effort has been made by us in order to make the driver aware of the situation before hand so as to prevent the fatalities.

Thus we have designed a prototype of an “Accident Preventing/alerting system” using various sensors and controller that we are confident will prove useful in reducing the road accidents.

Reading road sign boards due to Lack of visibility due to Insufficient light at nights, Heavy rains, fog, Line of sight blocked by heavy vehicles, Higher speed of vehicles which increases the probability of missing out the sign boards.

In our prototype we provide five modules:

- Signboard Detection
- Real Time Display Of Traffic Signal Status
- Seatbelt Detection
- Adaptive Headlight Control
- Blind Spot Detection

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II. METHODOLOGY

The Functionality of this system is mainly categorized in following steps.

- Seat Detection
- Blind spot detection
- Adaptive head light control
- Sign board detection
- Traffic signal detection
- Power supply

Fig 1 shows the block diagram of Vehicle Safety and Automotive Driver Assistance System.

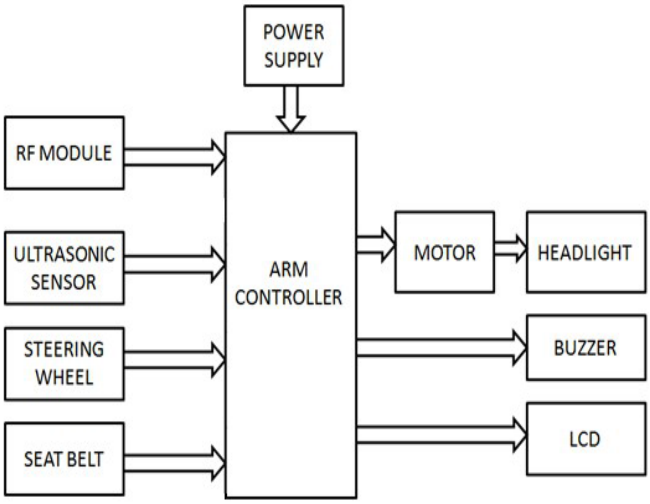

Figure 1. Block diagram of vehicle safety and automotive driver assistance system.

2.1 Seat Belt Detection:-

This system is already implemented in almost all Cars but still we are using this system because the measure reason of 'death in accidents' is avoidance of wearing seatbelts. A mechanism of seat belt is like one switch. Fig. 2 below shows the mechanism of Seat belt[3].

Figure 2.Mechanism of seat belt

As we are designing prototype system, we are using simple on/ off switch for seat belt detection, when driver wears seatbelt then supply to the motor is on.

2.2 Blind spot detection

A **Blind Spot** in a vehicle is an area around the vehicle that cannot be directly observed by the driver. Blind spots exist in a wide range of vehicles: cars, trucks. Other types of transport have no blind spots at all, such as bicycles, motorcycles. Proper adjustment of mirrors and use of other technical solutions can eliminate vehicle blind spots[2].

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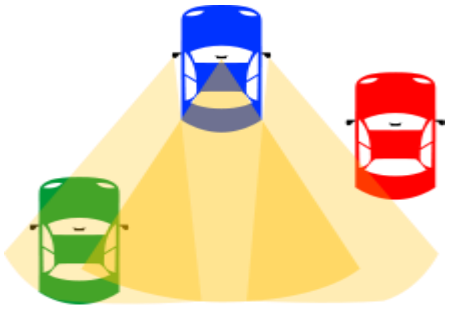

Figure 3.Concept of blind spot

Fig. 3 Shows the concept of Blind spot.The blue car's driver sees the green car through his mirrors but cannot see the red car without turning to check **blind spot** (the mirrors are not properly adjusted)

The current solution for this problem is provided using Digital image processing. A camera is installed which detects the cars, trucks, motorboats. Captures the image of same and exact replica is displayed on a graphic LCD display inside the car.

But this solution has a few disadvantages:-

Line of sight is required for image processing which is obstructed due to

- Climatic conditions
- Heavy vehicles in front of car.
- High definition camera is required for capturing images at night

So we are using ultrasonic sensor to detect blind spot. When we give indicator or press indicator switch, then ultrasonic sensor continuously transmits ultra sonic waves. When obstacle is detected then buzzer will start ringing. Fig. 4 below shows the blind spot detection using Ultrasonic sensor.

Figure 4.Blind spot detection using ultrasonic sensor

2.3 Adaptive Head Light Control

All car have 2 fix headlights. But there is some disadvantage of this system. During night time focus of our headlight goes straight. So During at sharp turn, if there is obstacle then that obstacle is not visible and then there is a large chance of accidents. One example is shown in fig. 5 below.

Figure 5A.Car without adaptive headlight

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Figure 5 B. Car with adaptive headlight

Adaptive Headlight is one extra headlight which is place on the car bonnet. In the daytime headlights is off hence no need for system of adaptive headlight to be on. A switch is used to detect headlight on/off and module is operated accordingly. In the module when steering wheel is moved by a small degree say 5, the headlight does not move but it moves if motion is more than 5 degrees and even if motion is greater than 20 degrees then the module does not move the headlight further. Hence the motion is restricted to 20 degrees which is sufficient to view during the turns Fig. 6 Shows the mechanism of adaptive headlight.[4]

Figure 6.Mechanism of adaptive headlight.

2.4 Sign Board Detection & Traffic Signal Detection

Sometimes Driver misses some important sign boards due to bad weather condition, or large vehicles in front of our car. Some traffic signal (RED, GREEN) are also not visible due to large vehicle like trucks are present in front of our car.

The current solution for this problem is provided using Digital image processing. A camera is installed which detects the road sign boards, captures the image of the board and exact replica is displayed on a display inside the car. But this solutions has a few disadvantages

- Line of sight is required for image processing which is obstructed due to Climatic conditions & Heavy vehicles
- High definition camera is required for capturing images at night

So we are using RF module to avoid this problems. Fig.7. shows operation of sign board & traffic signal detection using RF Module.

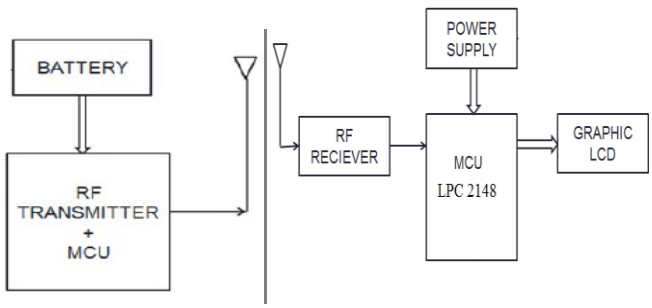

Figure7 a. Tx side ***Figure 7 b. Rx (car) side***

Figure 7.Operation of sign board & traffic signal detection using RF Module

The above figure shows the block diagram of the tag side module. This module will be fitted to the road sign board and it will transmit the information about the sign board.

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The components of this module are:

RF transmitter and MCU: This is the main component of the tag side module. The transmitter will transmit all the information about the sign board using radio frequency.

The Transmitter has a built in microcontroller unit which will decide the frequency of transmission. This module will have no mains supply available. So the battery will provide the power requirements of the transmitter unit. The battery is used to provide supply to module. The block diagram of the car side module that is the receiver module is shown above The information transmitted by the tag will be received by the RF receiver. The received signal will be passed on to the microcontroller. The MCU will process the information and it will identify the signboard which has transmitted the signal with the help of a look up table. The MCU will then drive the graphic display and the exact replica of the sign board will be displayed on the LCD. The car battery will be used to generate the required power for operation of the entire module[5].

III. SOFTWARE DESIGN

Software is also important in developing system. This system is developed in Embedded C language. For the Design and Simulation purpose Proteus software is used.

IV. ACKNOWLEDGMENT

This work was supported by the AISSMS's IOIT, Pune.

V. CONCLUSION

Thus we are making an attempt to design a prototype of a "Vehicle Safety and Driver Assistance" system using basic electronic principles. This system will play a crucial role in preventing road accidents.

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