Intelligent Automobile Accident Avoidance System

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Abstract— This paper introduces a new technique in automobile technology regarding the lane changing of vehicle and stopping safely at the side of highway when the drivers fault has been detected due to drowsiness or consumption of alcohol, so that vehicles speeding through the fast lane don't crash or cause any traffic problem. It also provides the hardware implementation of the system. The aim of this system is to prevent accidents occurring on highways because of drowsiness or over consumption of alcohol. The main working of this system is to park the vehicle safely at the side of road by changing the lanes, when it is detected by the image sensing module that the driver is either drowsy or have consumed alcohol. Changing the lane is very important and necessary or else if our vehicle stops on the spot or it loses control then the vehicles coming from behind may crash on our vehicle. For changing of the lane we have used ultrasonic sensors, they detect any vehicle at the side or in front and according to the program they change the lane when there is no vehicle detected. The side end of the road can be informed by the same side sensor because of the reflections from the railing of the road and in case of railing-less road a diagonal sensor informs the side end of the road as the road surface is little higher than the surface off the road. The system also uses motors to rotate steering and also drives for brake, clutch and acceleration. If the car driver is in normal state, the brakes of car will work according to threshold distance set in the program for ultrasonic sensor, making it safer normally on crowded streets.

Index Terms— accident avoidance, ultrasonic, lane changing vehicle, distance measurement.

1 Introduction

1.1 Facts and stats

According to the National Sleep Foundation 2005 report, 60% of adult drivers – about 168 million people – say they have driven a vehicle while feeling drowsy in the past year, and more than one-third, (37% or 103 million people), have actually fallen asleep at the wheel! In fact, of those who have nodded off, 13% say they have done so at least once a month. Four percent – approximately eleven million drivers – admit they have had an accident or near accident because they dozed off or were too tired to drive. The National Highway Traffic Safety Administration conservatively estimates that 100,000 police-reported crashes are the direct result of driver fatigue each year. This results in an estimated 1,550 deaths, 71,000 injuries, and $12.5 billion in monetary losses. These figures may be the tip of the iceberg, since currently it is difficult to attribute crashes to sleepiness.

Reason-There is no test to determine sleepiness as there is for intoxication, i.e. a "Breathalyzer".

- State reporting practices are inconsistent. There is little or no police training in identifying drowsiness as a crash factor. Every state currently addresses fatigue and/or sleepiness in some way in their crash report forms. Self-reporting is unreliable.
- Drowsiness/fatigue may play a role in crashes attributed to other causes such as alcohol. About one million such crashes annually are thought to be produced by driver inattention/lapses.
- According to data from Australia, England, Finland, and other European nations, all of whom have more consistent crash reporting procedures than the U.S., drowsy driving represents 10 to 30 percent of all crashes.

1.2 At Risk

☐ Adults in age group 18-29 are much more likely to drive while drowsy compared to other age groups.

☐ Men are more likely than women to drive while drowsy (56% vs. 45%) and are almost twice as likely as women to fall asleep while driving (22% vs. 12%).

☐ Adults with children in the household are more likely to drive drowsy than those without children (59% vs. 45%).

1.2 System Introduction

This system will help people to avoid accidents which occur on highways during any time because of sleep deprivation, drowsiness and intoxication. At normal times the braking action of car will be active according to ultrasonic sensor, if any obstacle comes in front of the car.

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This system will automatically act according to the image sensing module whether the driver is sleeping or out of control and will go in an automatic mode from manual mode and change the lane. The ultrasonic sensor at normal time will show the respective distances of vehicles adjacent to it. This will be helpful for the driver normally. In auto mode the sensors get the distance of the vehicles or obstacles and according to the algorithm the driver (brake, steering, etc) gets activated. Let's consider Indian highways, i.e. keep left. One sensor comes in front of vehicle for front obstacle detection, one in diagonal for road side end detection and one to the left of vehicle to detect any obstacle of left side. There is no sensor to right side as we want to stop the vehicle to the extreme left lane of the road. Following figure explains the scenario:-

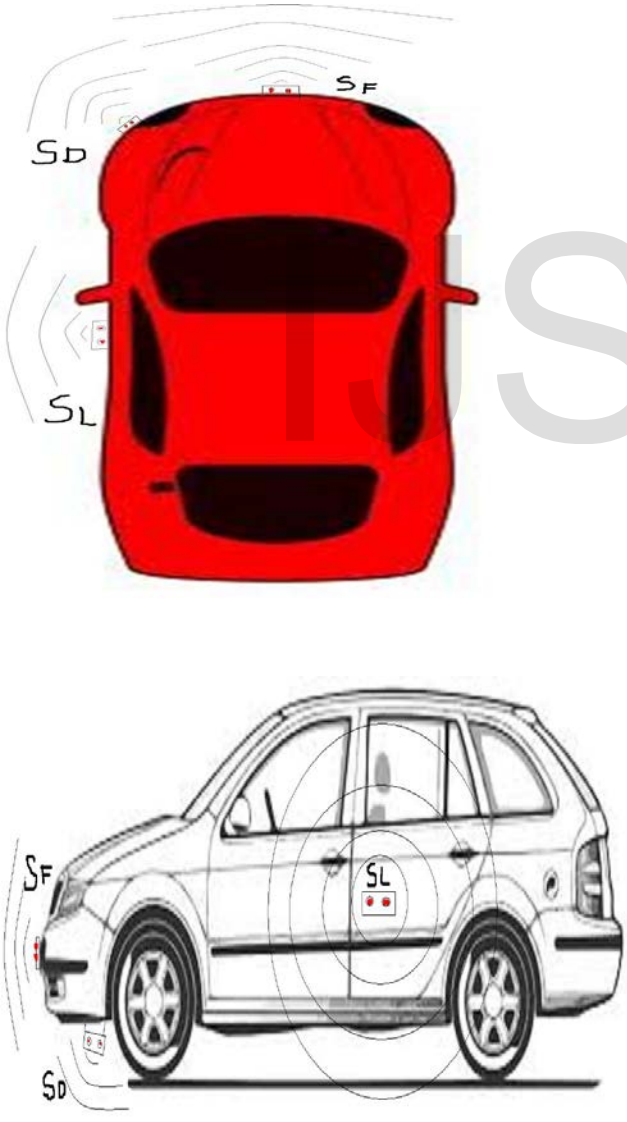

Fig 1.2 Top view and side view.

SF- front ultrasonic sensor

SD- Diagonal ultrasonic sensor

SL- Left ultrasonic sensor.

1 Structure of IAAAS

The structure is shown in following block diagram.

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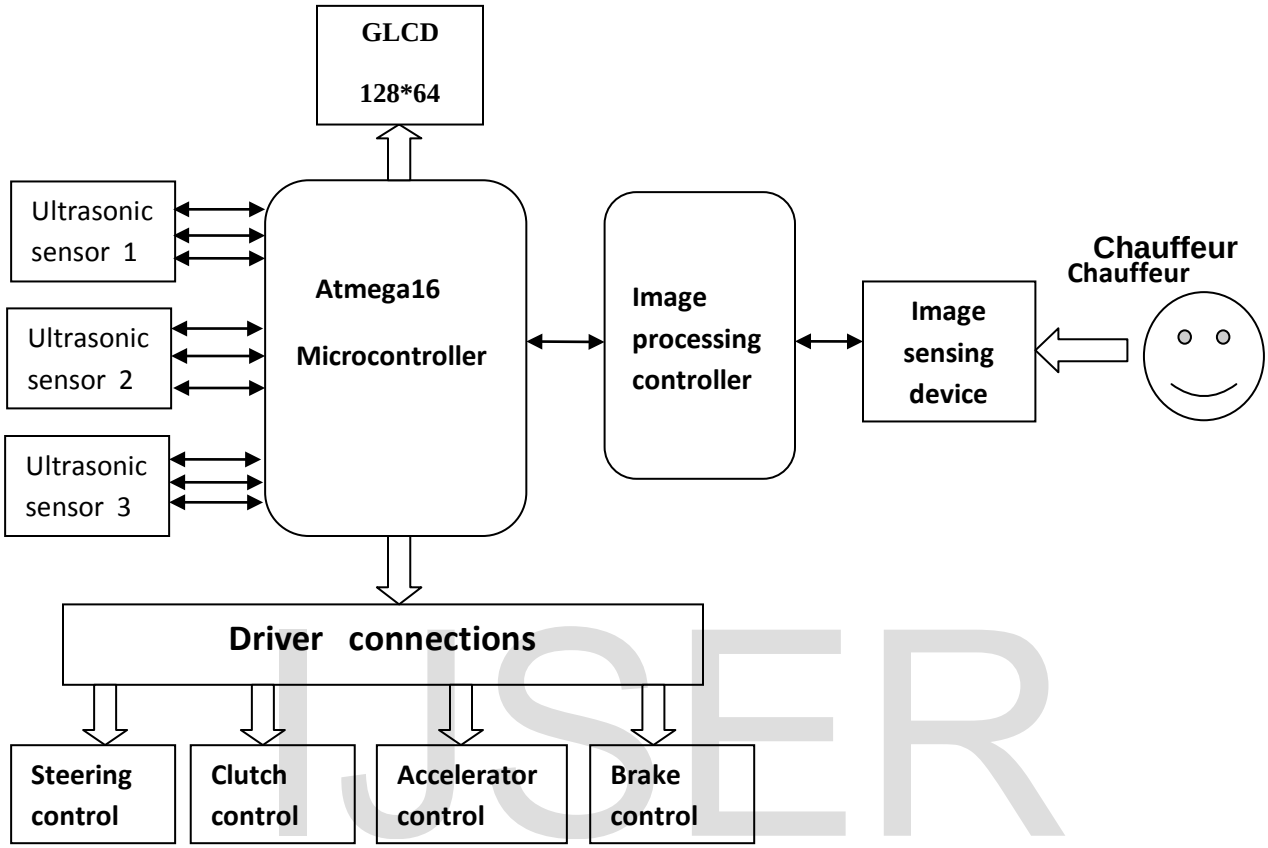


Fig 2.1 Block diagram.

2.1 Hardware description

An image sensing and processing device which will detect the drowsiness or the error of the driver driving the vehicle. This will be connected to a microcontroller. Here we have used an ATmega 16 microcontroller. To this controller ultrasonic sensors are connected along with a graphic LCD for user interface. The steering drive, accelerator drive, brake and clutch drive are connected to this controller.

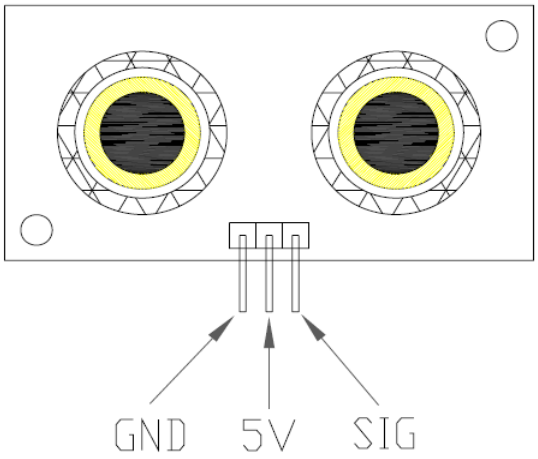
2.2 Software description

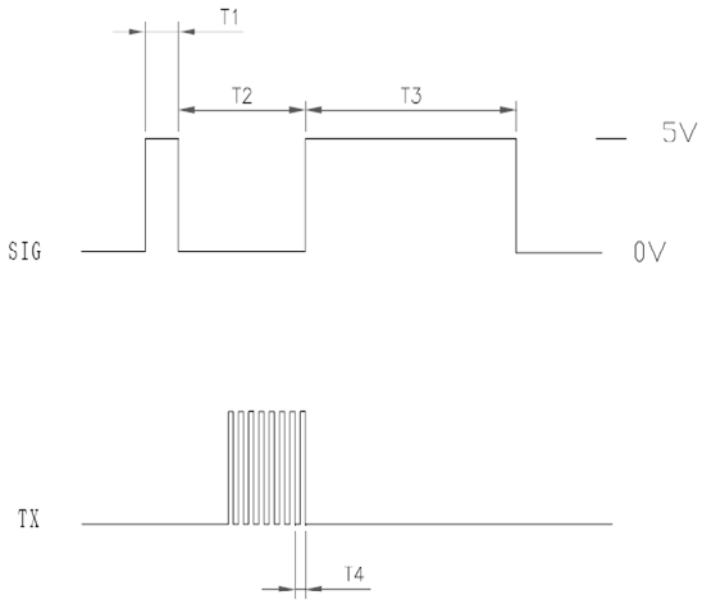
- Software for image processing i.e. MATLAB.
- AVR Studio for ATmega programming.

3 Sensor and drives

3.1 Ultrasonic sensor

3.1.1 Electric connection





3.1.2 Characteristics

Range of measurement	0.03～3 M
Precision of measurement	±2CM
Mean of output Impulse width	Impulse width
Rated working voltage	5 VDC
Working current	≤15 mA
Frequency of sensor	40 KHz
Continual response time	5ms

3.1.3 Principle of operation

The host offers the ultrasonic module with an impulse through SIG, the trailing edge springs, and transmits a string of ultrasonic signal of 40 KHz when the module receives it. Then the electrical level of SIG stitch will be raised. The duration of high level T3 will be ensured by the distance between the object and the sensor. After 18.5ms, the high level descends, when no object is in a distance of 3M.

1 T1 (Trigger): 5μs
2 T2 (Postpone): 200μs
3 T3 (Pulse width): 0-18.5ms
4 T4 (Cycle) : 25μs

3.2 Steering drive

The following drive is recommended for rotation of the steering. The motor used can be a servo or stepper motor. This is connected to a high current driver which is controlled by the microcontroller ATmega 16. In similar way with the help of motors we can control clutch brake and accelerator.

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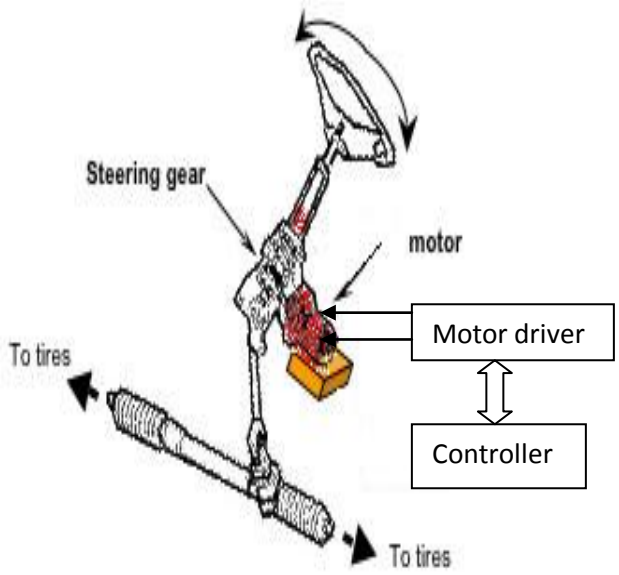

Fig 3.6.7 Steering drive

4. Working

The brakes of this system will be electronically active always, needless to say whether car driver is responding or not. It will be controlled by the ultrasonic sensor and the distance cut off, that we set in the program. When the driver is found drowsy by the image sensing and processing module then it sends a control signal to the controller ATmega 16. This ATmega 16 controller is always in a loop to detect the control signal. If it detects a control signal then the vehicle goes in automatic mode. Its steering, acceleration, brake and clutch are now controlled by the controller according to the program. According to the algorithm there will be four conditions viz.

I] Obstacle (other vehicle) present in left and front.

II] Obstacle present only in left.

III] Obstacle present only in front.

IV] Obstacle present neither in front nor left.

According to the algorithm the car will stop on the spot if there is a stationary or slow moving vehicle in front or the diagonal sensor detects the end of the road. Other than the above condition, if there is vehicle in left and no vehicle in front then our car will move straight with a slow constant speed till the vehicle in our left moves forward. Then once that vehicle moves forward our car will move to the left lane and again it will scan if there is a vehicle in 3m range in front and left. Again the same working will take place till the road end is detected by the diagonal sensor or if there is vehicle in front and left, then the car will stop on the spot.

5. Algorithm

1) Image processing module checking whether car driver is normal or drowsy.
2) If yes then send control output to ATmega 16 microcontroller else repeat from (1).
3) ATmega 16 checks its control input from image processing module.
4) If control input is high then go to (5) else (1).
5) If road end detected by diagonal sensor then STOP i.e. Brakes actuated else go to (6).
6) If vehicle present in front and left of car then STOP else go to (7).
7) If vehicle present in front only then turn left i.e. Steering drive actuated and again go to (5).
8) If vehicle present in left only then go straight with constant low speed i.e. accelerator and clutch drive actuated. Check for the left vehicle to go forward.
9) If no vehicle is in the left or in the front then turn left and go to (5) else go to (6).
10) END

6. Conclusion

This system uses ultrasonic sensors which correctly measures the distance of the vehicle ahead and to the left so that driver will get the judgment of other vehicles and normally at a distance less than threshold distance set in program the brakes will be active for front ultrasonic sensor. If the driver of our car feels drowsy or is intoxicated, then the system will go in automatic mode.

In automatic mode, system will work according to algorithm i.e. it will either stop (when there is any vehicle ahead and to the left) or will go in the left lane and stop (when there is no vehicle ahead as well as to the left). So the vehicles moving in fast lane can easily move ahead without causing traffic problems and also preventing crashes.

This system will certainly prevent the accidents happening at the midnights due to sleep deprivation or

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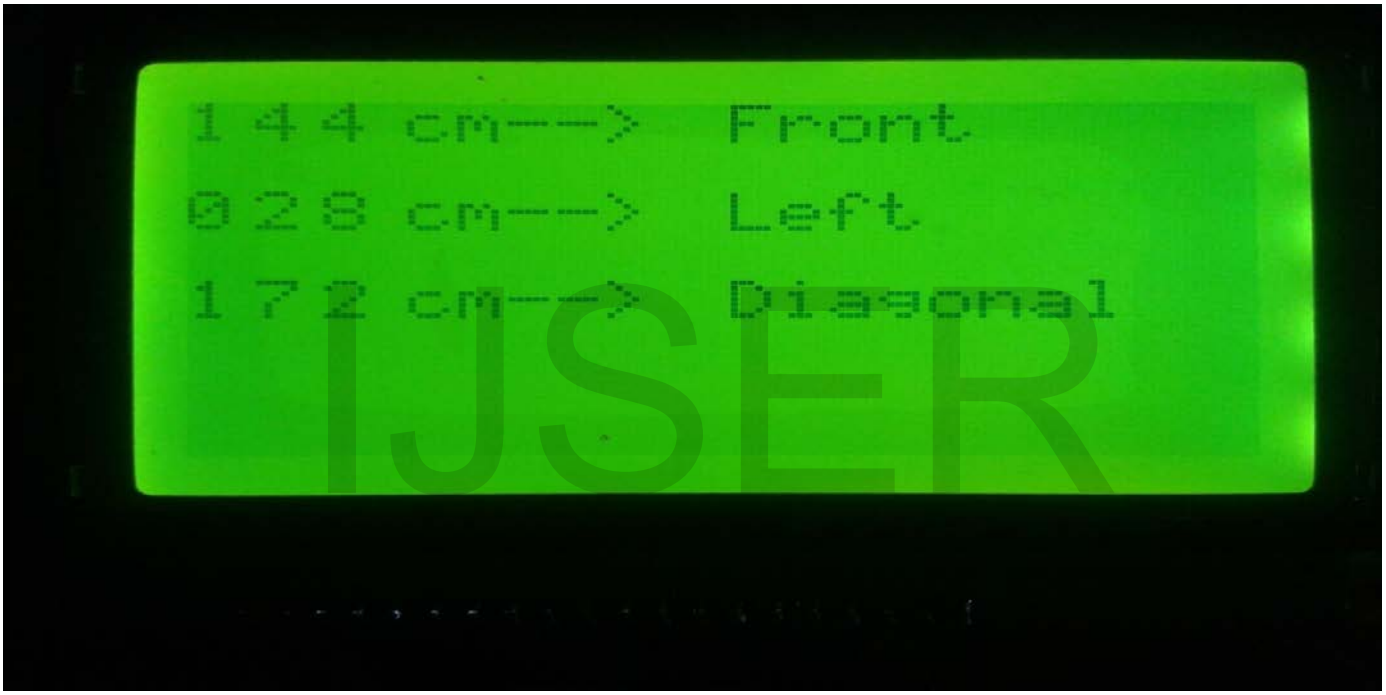
drowsiness. Such system can be implemented not only in high end cars like Mercedes and Audi but also for small end cars like Swift and even Nano with some modifications.

Preventing Mishaps and protecting lives with economic modifications for the already manufactured or in manufacturing process of vehicles is the main aim of this project.

Result:



1. Distance measurement of nearby vehicles with the help of ultrasonic sensors is DONE. The following image shows the user interface.
2. Ultrasonic sensors can detect the objects which are at the distance 0.03~3 meters.
3. One sensor is fitted at the left front of the vehicle having direction diagonally downward, detects the end of road.
4. The system is cheap and requires ultrasonic sensors as major components.
5. If this system is installed in cars, heavy vehicles like bus, truck, etc the accidents and traffic problems would reduce by 70% to 90%.

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