Autonomous Maneuvering System in Automobile for Collision Avoidance

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Abstract- *The purpose of this project is to design and fabricate a prototype in the form of a setup that could be installed in any vehicle and provide various safety assistance that it needs. The motivation of this project is that India is one of the countries with most number of accidents. We have 1 accident every minute and 1 death in 4 minutes. Therefore, our goal is to minimise this alarming number as far as possible. In addition to this, there are various luxury vehicles which give these safety features as an integrated part, but can't be afforded by the middle class dominated country like India. Hence, we have tried to develop a system with similar features which could be installed in any vehicle. There are various aspects of automobile safety. In our prototype, we have given a passive system which comprises of alarm, automatic braking and steering correction. These are achieved by use of 3 major components viz. sensors, actuators and a microprocessor. This system provides an advanced safety system at a nominal cost.*

Keywords- Automobile, Passive control system, Safety

I. INTRODUCTION

The invention of automobiles is one of the biggest achievements of the human race. The rapid growth of population and increasing living standards has led to an enormous increase in the number of vehicles on road. The need of the hour is safety. Accurate perception of the surrounding of vehicles has been subject to study. Available technology is not within reach of common man. Constant efforts must be continued in this field.

With this regard, we have come up with an idea which might reduce the accidents if not eradicate it. People are not following proper traffic rules and lane disciplines. Even if they follow all the rules, it is not assured that they might not meet an accident. So we thought if people are not so smart, then the vehicle has to be smart.

Supporting the above statement, many high-end flagship vehicles give these facilities integrated. But, talking about the heavy vehicles of early 2000's, which cover the majority of the road, are untouched by these safety features. Therefore, our field of interest has been these existing vehicles which play a major role in the economy of the country.

Talking about the statistics:

- India witnessed 17 deaths and 55 road accidents every hour in 2017, one of the highest in the world.
- 29% of deaths in India are the result of road accidents.
- 15% of the accidents that happened due to the negligence of the driver.
- 9% of these were recorded due to poor visibility, the latest one being the infamous Yamuna expressway accidents.
- And the staggering number continues. This whopping number must be addressed.

Thus, we have come up with this idea of the smart use of sensors and actuators for auto manoeuvring of the vehicle. With this project, we will be developing a setup which would perform all the above activities. Consequently, this setup will be used as an aftermarket accessory and with the similar principle could be easily installed on any of the existing vehicles.

Safe manoeuver, Alert driver.

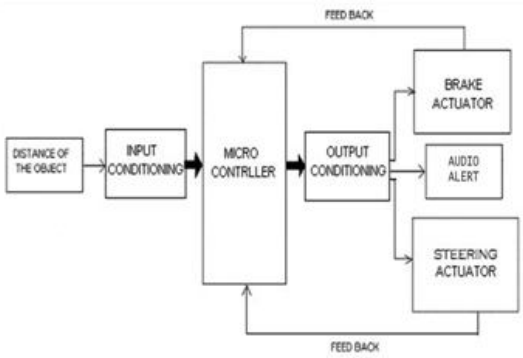
II. INNOVATION

This whole sophisticated system has a very simple working and simple set of components. This idea will reduce vari0us risks and hazards while driving. We started our research on this idea by following a set of objectives.

- To fabricate a working model depicting our idea of passive collision avoidance system.
- To implement our idea of existing vehicles as an aftermarketaccessory.
- To minimize the accidents on road at a nominal cost.

- With the aim of achieving the above objectives, we have tried to develop a system which works on the following block diagram.

2.1 SYSTEM BLOCK DIAGRAM



The system detects the distance of obstacle at various stages and gives output response as programmed at a various level which could be audio, visual or mechanical action or combination of all.

III. METHODOLOGY AND WORKING SETUP

The system will work in two parts,

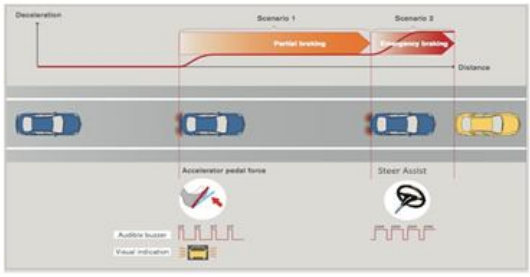
a) Detection of obstruction in the front and application of brake,
b) Detection of swaying of vehicle, steering correction and application of the brake.

In both the cases, audio alert at various stages will be provided to the operator.

Once the system is activated and the vehicle is brought to halt, it will only deactivate when done manually by the authorized operator which can be a coded key which will be known only by the crew and fleet owners.

This will ensure the condition of operation such as him being under influence, stressed due to long journeys and sleep deprivation, under those the vehicle cannot be restarted unless done by anyone authorized. This acts as an added safety feature from potential misuse.

3.1 Case 1: Obstruction Detection at Front.



At this, Distance from the front obstruction will be set as a parameter. This will work in stages were the first action will act as passive driver alert system which will only warn the driver about obstruction directly in line with the path of the vehicle. Here only an audio alert will be given to the driver about the obstruction ahead as could be seen in fig 3.1.

This will greatly help drivers in low visibility conditions such as fog, very dark nights with inadequate headlights etc.

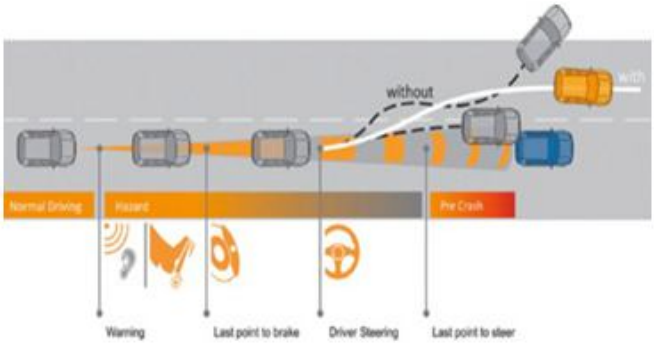
After approaching a certain distance high-intensity alarm will sound alerting driver his closeness to the obstruction ahead. When a driver fails to maintain distance, the power to the engine will be cutoff.

Incase if the vehicle is moving downhill, the vehicle will continue to roll irrespective of power which may result catastrophically.

To handle a situation like this, emergency braking will be applied which.

To warn the vehicle coming from the rear, a visual indication will be provided which will avert any inconvenience to other road users.

Case 2: Obstruction Detection on Right Side of Vehicle



India is a country where 80% of heavy freight moves at night. Truck drivers are restricted to drive at night so that their slow phases should not obstruct fast vehicle like a car and another motorist in the day.

Due to improvement in road infrastructure, better vehicle suspension quality has made truck and bus driving even smoother. During long journeys, the truck driver often finds themselves lonely roads which tend to doze them off due to fatigue. This can be fatal when they sway into others lane.
To overcome this a system has been designed which is explained below with reference to fig. 3.2.

The system uses a low range Ultrasonic sensor to detect distances at close range. This can be a divider or a moving vehicle in the parallel lane.

The system is programmed in such a way that as soon as it detects the obstruction in a defined direction, it raises an audio alarm to alert the driver. If the vehicle still goes too close or sways from its lane, in that case, minor steering correction is done with reference to the obstruction to bring back the vehicle to its lane. Simultaneously this system also activates a visual alert for a vehicle at rear and partial braking is applied to bring the vehicle to standstill safely.

This system also ensures that no obstruction and suddenchange in lane takes place which may affect other road users.

The system will also ensure that driver may overpower the steering if required in case of evasive manoeuvres taken by driver deliberately.

IV. RESULTS AND FINDINGS

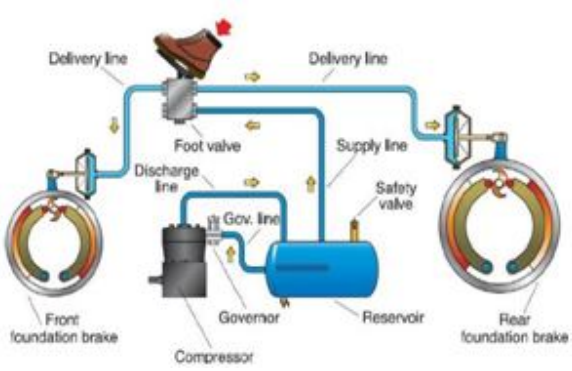
Based on the available resources and constraints of space, time and money, a small working setup depicting our idea was designed and tested. The components used such as sensors (ultrasonic), microprocessor etc. were of lesser capacity range. Although the actual aftermarket accessory would show results a lot more precisely with respect to the distance of action and reaction time, this prototype showed results accurate enoughto support our claim. The following table gives the action of the prototype with respect to the distance.

CASE 1 FORWARD COLLISION	
Distance	Action
< 3 ft	No action
>3 ft <2 ft	Light and Audio alert at interval
>2 ft <1 ½ ft	Light and audio alert continuously
>1 ½ ft < 1 ft	Power to wheel disabled
>1 ft < ½ ft	Actuation of Brake

CASE 2 SIDE COLLISION	
Distance	Action
<2ft	No action
>2 ft< 1 ½ ft	Audio alert
>1 ½ ft< 1ft	Power to wheel disabled
>1 ft< ½ ft	Actuation of the Steering actuator

V. FUTURE RESEARCH

The basic idea of our project was to show a concept or a setup that could be installed as an aftermarket accessory in any of the existing vehicles on the road. This objective is well and truly fulfilled as with a certain set of modifications in our components, this could be achieved. For an instance, the electrical actuators would be replaced by the pneumatic ones as there is the abundant availability of compressed air in heavy vehicles. Similarly, stepper motors could be used for steering correction. In a nutshell, the principle of this safety feature remains the same also in the real-time application. The following figures give a good idea of what could be done in future with respect to further work and research of this project.



VI. CONCLUSION

- We successfully designed and tested a prototype depicting our idea with respect to available resources and constraints.
- We created a basis for further research and application in a vehicle on road.
- A system that proves road safety is no more a myth.

VII. ACKNOWLEDGEMENT

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