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Design And Implementation Of Automated Emergency Braking System In Modern Vehicles By Modifying Brake Padel Assembly

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Abstract-Vehicle technology has increased rapidly in recent years, particularly in relation to braking systems and sensing systems. Additional hardware that allows brake pressure to be increased above pedal demand as well as to be reduced, combined with additional software control algorithms and sensors allow traction control (TC), electronic brake force distribution (EBD), brake assist (BA) and electronic stability control (ESC) functions to be added. In parallel to the development of braking technologies, sensors have been developed that are capable of detecting physical obstacles, other vehicles or pedestrians around the vehicle.

If no vehicle is ahead, the vehicle maintains the desired "set-speed". Theoretically, a vehicle equipped with modern braking technology and adaptive cruise control is equipped with the basic building blocks for a simple collision avoidance system that would be capable of detecting when a collision is likely to occur and applying emergency braking to avoid it. The focus of this project has been on the physical requirements and Designing of AEBS systems rather than any requirements or benefits relating to human factors issues, which although important were excluded from the project because of the limited scope of work available. Thus, the potential benefits of the project have also aimed to be independent of the technology and shorten the cost of Emergency Braking System with new age Design.

The project has aimed to distinguish between systems currently in production and those future systems currently in development. However, the rapidly developing market for such systems has meant that some systems in development at the start of the project had reached production by the end.

Systems are currently in various phases of development towards the end of the project we Developed a prototype system that offering some collision functionality in production vehicle, a system which can operate automatically with the help of high profile sensors Based Relay Circuit and some Modification in traditional Braking System that can alert the Driver in Front Collision and Apply the Brake automatically in Emergency or Critical situation.

Keywords-
ABS-Antilock Braking System.
TRCS-Traction Control System.
ECU-Electronic Control Unit.

1. Introduction-

1.1 Method To Redesign The Traditional Braking:-

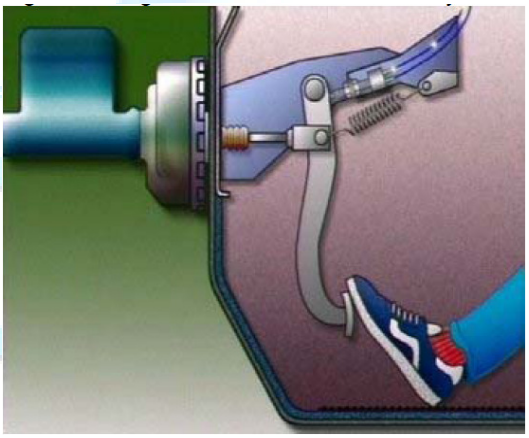


Fig No 1 Traditional Braking

When you apply the brakes, brake fluid is forced, under pressure, into the wheel cylinder which, in turn, pushes the brake shoes into contact with the machined surface on the inside of the drum. When the pressure is released, return springs pull the shoes back to their rest position. As the brake linings wear, the shoes must travel a greater distance to reach the drum. When the distance reaches

a certain point, a self-adjusting mechanism automatically reacts by adjusting the rest position of the shoes so that they are closer to the drum.

1.2 Brake Shoes

Like the disk pads, brake shoes consist of a steel shoe with the friction material or lining riveted or bonded to it. Also like disk pads, the linings eventually wear out and must be replaced. If the linings are allowed to wear through to the bare metal shoe, they will cause severe damage to the brake drum.

1.3 Backing Plate

The backing plate is what holds everything together. It attaches to the axle and forms a solid surface for the wheel cylinder, brake shoes and assorted hardware. It rarely causes any problems.

1.4 Brake Drum

Brake drums are made of iron and have a machined surface on the inside where the shoes make contact. Just as with disk rotors, brake drums will show signs of wear as the brake linings seat themselves against the machined surface of the drum. When new shoes are installed, the brake drum should be machined smooth. Brake drums have a maximum diameter specification that is stamped on the outside of the drum. When a drum is machined, it must never exceed that measurement. If the surface cannot be machined within that limit, the drum must be replaced.

1.5 Wheel Cylinder

The wheel cylinder consists of a cylinder that has two pistons, one on each side. Each piston has a rubber seal and a shaft that connects the piston with a brake shoe. When brake pressure is applied, the pistons are forced out pushing the shoes into contact with the drum. Wheel cylinders must be rebuilt or replaced if they show signs of leaking.

1.6 Return Springs

Return springs pull the brake shoes back to their rest position after the pressure is released from the wheel cylinder. If the springs are weak and do not return the shoes all the way.

Pre mature lining wear because the linings will remain in contact with the drum. A good technician will examine the springs during a brake job and recommend their replacement if they show signs of fatigue. On certain vehicles, the technician may recommend replacing them even if they look good as inexpensive insurance.

2. Bottlenecks of Braking:-

2.1 Death Occurs During Impact:-

There have been a range of estimations about the number of accidents that are caused by, or contributed to, by driver distraction. It is hard to make an accurate estimate as accident databases are generally constructed from reports following an accident and it is probable that not every driver admits to being distracted or inattentive at the time of the accident.

At the end of the study, researchers also had 15 police-reported and 67 non-police reported crashes to study, as well as 761 near-crashes and 8,395 'incidents'.

1. The study says that about 78% of all crashes are taking place due DISTRACTION Driving.
2. The 65% of these Crashes take place due to less reaction time while breaking.
3. About 2 million Passenger yearly Died or may injure fatally.
4. Thus 60 %of Accident Happen Bcoz of close impact.

2.2 FACTORS INFLUENCING THE EFFECTIVENESS OF BRAKING:-

Three Major Factors are influencing the Braking and leads to Accident:-

1. Distraction Driving:-
2. Defected Part:-
3. Other Factors:-

"It is an inevitable consequence of being human such as driver distraction cannot be eliminated." **So what we can do?**

But let us know The Reaction time is provided by the System to Driver while travelling at different speed.

Table No1 Braking Distance Calculation

Braking Distance Time Calculation Table (as per Automobile standard number 206)						
Design speed (mph)	Detection Time	Response Time	Lane Change	Decision Sight Distance (ft)		
				Summation	Computed	Rounded
30	1.5-3.0	4.2-6.5	4.5	10.2-14.0	449-616	450-625
40	1.5-3.0	4.2-6.5	4.5	10.2-14.0	598-821	600-825
50	1.5-3.0	4.2-6.5	4.5	10.2-14.0	748-1027	750-1025
60	2.0-3.0	4.7-7.0	4.5	11.2-14.5	986-1276	1000-1275
70	2.0-3.0	4.7-7.0	4.0	10.7-14.0	1098-1437	1100-1450

if Decision and response time increases by Standard it will lead to fatal Accident, and Brake having ABS, TRC Does not give any **Advantage Possible danger can't Be avoided But If we reduced the Driving Interference of Braking And Give the Responsibility To Intelligence Sensor which will Take decision**

and initiate the Response To give Warning alarm First and if Distance of impact is Closing it will Apply brake Automatically and Stop the Vehicle in advanced.

Here is Actual Concept of Ultimate Automatic Braking Unit:-

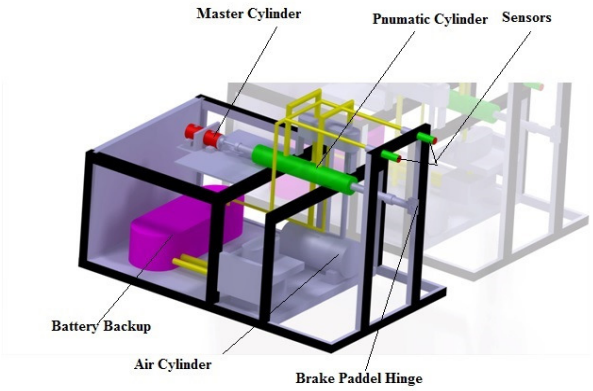


Fig No 2:- Prototype Test Setup

2.3 Here is Flow Diagram of how it will Work:-

Instrument Used:-

The System is Consist of Two Photoelectric Distance Measurement Sensors, kit of Electronic control Unit to give input and output of sensor, Hydraulic Ckt and Single Acting Hydraulic Cylinder .The Sensor is Having 15volt Supply and can Measure Hurdle up to 10m .The Brake Kit is going to be Fabricate Having Redesign Brake Paddle With reduced mass. The Hydraulic Cylinder we are using is Single acting Spring Return type having Solenoid Valve.

Procedure:-

Let us Consider that A Vehicle Speeding at 25Km/h Constantly and think worst case that Driver is Fallen Asleep While Driving And Vehicle is Approaching to a park car at same speed, so here is how the Auto brake System will Work:-

1.The Photo electric Sensor Which will sense the any object in Front and Will give Continues output while on go ,in this case if car in front comes in contact with the sensor it will give output to the Electronic Control Unit at 10M Distance remaining.

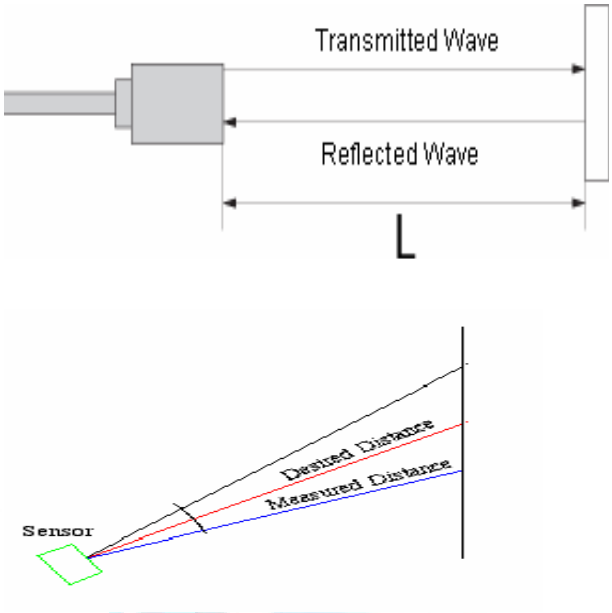


Fig No 3:- Working of Photoelecteric Sensors.

2.Thus ECU automatically alert the driver by blowing the alarm, thus if Driver here the alaram,the Distraction phase of Driver such that (Sleeping while Driving, Use of Mobile,Gossiping,or doing any other Activity)will come to end and he will take control of the situavetion,and further damage can be Prevented.

3. If Driver does not respond to this Alarm mean that no action is implies to stop the Vehicle then ECU will send the Signal to Hydraulic ckt.

4. Thus Stroke Of Hydraulic cylinder will start and lead to Auto Forcing the Brake Paddle to engage Position and lead to stopping the Vehicle, if in case Driver reaction lead to take control the situation , Driver will apply the force on Paddle then the Connection Between the Piston And Brake Paddle Will Disengage and Paddle will Force Down.

5. Thus After stopping the Vehicle Spring will Force the Paddle to And Thus returning it will connect to a Piston and Help to reposition the stoke

6. Thus Brake will apply normal way and also in Distraction Situation and Accident can be prevented, with reducing the Reaction time.

2.4 Is Indian condition suitable for it:-

1. India has 5.3 million kilometers of road network, the second largest in the world.
2. Accident rate is third in the world.
3. 65% of freight, 87% of passenger traffic is by road transportation.
4. Traffic on roads is growing at 15% per annum.
5. Vehicle population growth is of the order of 12% per annum.
6. 11 vehicles per 1,000 persons.

3 Case Studies on the Auto Braking:-

3.1 The Test Vehicle

Participants were loaned the test vehicle shown in Figure 3 for a period of up to one week to allow familiarisation with the controls. The test car was an S80 loaned by Volvo that was retro-fitted with the City Safety system for purposes of the research. The system is only fitted to new cars, and was launched on the XC60 in November 2008. LIDAR sensor unit

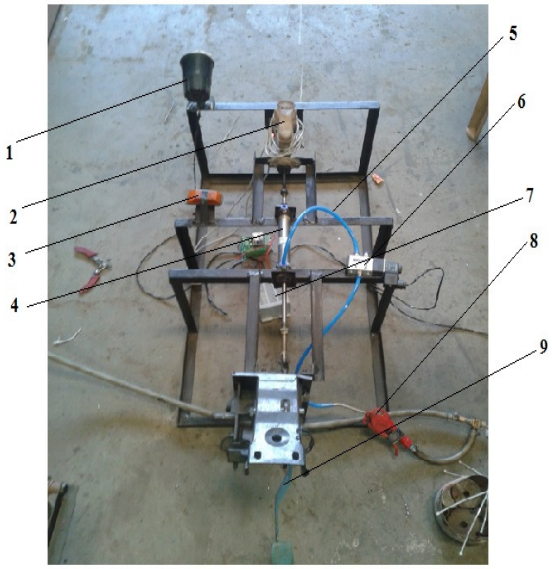


Fig No:-4 Prototype Assembly

The drivers used the car for normal road driving within the UK on varying urban and inter-urban journeys. Feedback was gathered from 11 drivers who regularly travel high mileages. The mileage travelled included an equal split between motorways as well as urban and rural roads, all of which were normal UK roads, for a combined distance of over 20,000 kilometres. Participants were aged between 25 and 55 years old, and all held full driving licences.

During the road driving trials all the 11 drivers had the City Safety system operational, since it could not be de-activated on the test vehicle. For all drivers, no positive interventions of the City Safety system were reported and no false interventions either. 50% of drivers reported that they felt safer than usual knowing that they were driving the car fitted with City Safety that had the capability of preventing a low speed collision. 30% felt no different driving the test vehicle compared to their usual driving. 10% of drivers felt more confident driving the car fitted with City Safety, and the remaining 10% felt more nervous.

3.2 Result:-

Table No -2 Result Taken on AEBS

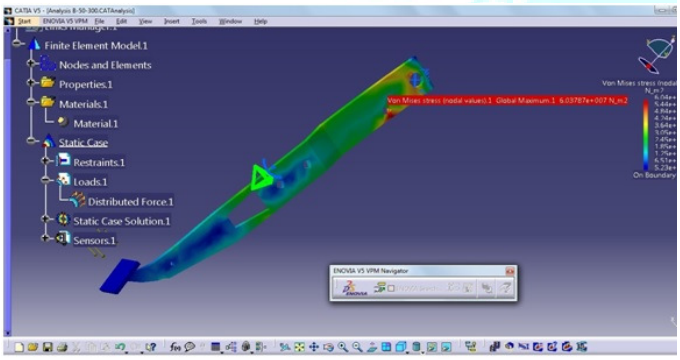
Reaction Time	Speed of Vehicle	Coefficient of Friction	Reaction (Ft)	Braking Distance
2.0	20	0.400	38.9	70.3
2.0	20	0.431	43.6	82.6
2.0	20	0.405	42.7	86.7
2.5	20	0.400	56.3	91.2
2.5	20	0.431	57.5	92.0
2.5	20	0.405	56.2	90.0
3.0	20	0.400	68.2	102.9
3.0	20	0.134	68.0	103.8
3.0	20	0.405	69.25	102.0

Comparison Of Normal And AEBS Braking:-

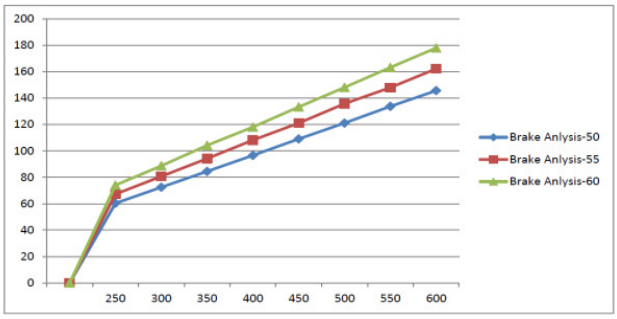
1. The Reponses Time is reduced by Large Margin so Driver can reliable on System for close impact, but in Traditional breaking it Required Total attention on every aspect and Response time Should Under the calculated time.
2. Large Number of accident is Reduced as system give Alarm Attention to the Driver so it can respond to the Brake immediately.

3. If Mass of paddle is High, Driver will Need Extra force to apply Brake and it is Very Tired Job When You Are Travelling in Traffic or for Long Distance thus Considering this fact we Redesign the Paddle and we reduced the Mass of Paddle up to 30 % and thus force on paddle to apply Max Braking is also Reduced.
4. System is also Works Effectively well in Night and give Effective Result in Even Dark as in traditional Braking Driver will have to give Extra attention to braking when Driving in Night.

Stress Analysis:-



Load in N	Brake-50	Brake -55	Brake -60
0	0	0	0
250	60.4	67.3	74.1
300	72.5	80.8	88.8
350	84.5	94.2	104.2
400	96.6	108.2	118.1
450	109.1	121.1	133.3
500	121.1	135.8	148.1
550	133.8	148	163.2
600	145.7	162.3	178



4. Conclusion-

1. If we can reduced the Driving Interference of Braking and Give the Responsibility To Intelligence Sensor which will Take decision and initiate the Response To give Warning alarm First and if Distance of impact is Closing it will Apply brake Automatically and Stop the Vehicle in advanced.
2. Such that Distraction Driving is a Major Contributor to Accident death, thus by implementing this System we can reduced the Close impact Potential Accident.
3. The Mass of Brake Paddle is Also Important Issue becoz If Mass of paddle is High, Driver will Need Extra force to apply Brake And it is Very Tired Job When You Are Travelling in Traffic or for Long Distance thus Considering this fact we Redesign the Paddle and we reduced the Mass of Paddle up to 53% and thus force on paddle to apply Max Braking is also Reduced.

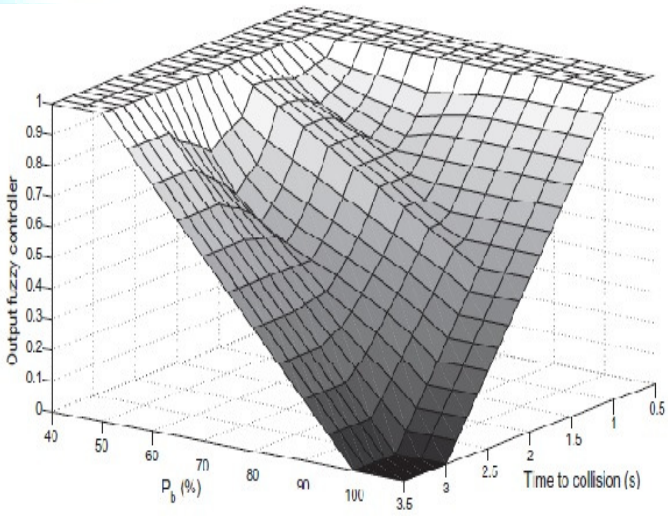


Fig. 5. Emergency pedestrian avoidance control surface.

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