Anti-Lock Braking System with Obstacle Distance Sensor

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ABSTRACT: ***As we are already aware about the use of Anti-Lock Braking System(ABS) in all the modern automobiles and the purpose of using it in the vehicles that is to provide better traction of the tires with the road and Vehicle stability due to the application of hard brakes or movement of the steering wheel of the vehicle. All the vehicles are using either hydraulic or electronic braking system even though we can use electromagnetic brakes as proposed in some researches too and use of wireless ABS system with zero speed detection system as developed by NTN. In this research paper we will make use of one more sensor that is obstacle distance sensor along with other sensors installed in ABS like speed sensor , rotation sensor. This sensor is also used in vehicle communication to avoid crash but it can also be combined ABS to avoid the crash. With the obstacle distance sensor there will be measurement of the distance between the vehicle and the objects around the vehicle and this input will be send to both the systems that are vehicle communication and ABS system so that the appropriate action can be taken to either turn the vehicle to the safe side or stop the vehicle without skidding and toppling of the vehicle.***

KEYWORDS: ***ABS, speed sensor, rotation sensor, Distance sensor, toppling, traction, toppling.***

INTRODUCTION

Anti-Lock Braking System (ABS)

ABS [1] helps the driver to retain steering control by preventing the wheels of the vehicle to lock up during the use of hard braking. Locking of wheel means wheels stopped rotating and the vehicle starts sliding. Thus vehicles without ABS during wet or dry conditions on the road can result in wheel locking during the application of hard braking. It may also lead to the loss of steering control that will lead to no directional control over the vehicle. Thus during the sliding vehicle cannot be steered and move in a particular desired direction. To avoid such condition ABS helps to steer the vehicle and keep control over the vehicle.

Working of ABS

All ABS work not in the same manner. Some prevent all the four wheels, some only the rear ones from locking. But all the ABS work by monitoring wheel speed and if there any wheel lock is detected due to use of hard braking and releasing the brake ABS starts functioning by effectively "pumping the brake" like the same technique that was taught to the drivers before the advent of the ABS[2]. But ABS works automatically and addresses the problem faster than manually. ABS consists of three major components [3]:

(a) Wheel Speed sensor that monitors the wheel rotation speed
(b) Hydraulic units that pump the brakes during hard braking and locking
(c) An electronic control unit that receives information from the wheel sensors and directs the hydraulic units to pump the brakes on one or more of the wheels

In modern ABS setups, the ECU and the hydraulic units are attached together so that while they have different functions, they are physically one unit. The ECU continually checks for rapid wheel-speed deceleration, an indicator that a wheel is about to lock. If a wheel is about to lock, the ECU directs the hydraulic unit to pump the brake to that wheel until it resumes normal rotation.

Effectiveness of the ABS during the Crashes

The primary purpose of ABS is to allow drivers to have directional control over their vehicle after heavy braking. In support of the effectiveness of ABS, it has been associated with: a 35% decrease in frontal collisions on wet roads, and a 9% decrease in frontal impacts on dry roads. A decrease in frontal collisions suggests that ABS allows drivers to steer to avoid a collision. In addition, under controlled test conditions: 58% of drivers without ABS strayed from their intended path after braking; only 24% of drivers with ABS did the same [4]. One misconception about ABS is that its purpose is to help reduce stopping distance. However, a reduction in stopping distance is not guaranteed and is only a secondary benefit of ABS. Steering too aggressively can still have severe consequences. On a vehicle without ABS, if a panicking driver steers the wheel sharply out of instinct to avoid a collision, nothing results from this action, as steering control is lost when the wheels lock up. However, the addition of ABS means that those same exaggerated steering commands will have an effect, and could lead to other dangerous situations like road departure, collisions, or rollovers. Drivers with ABS should continue to steer as calmly as possible.

Limitations of the ABS

Like many other safety features, realizing the full benefits of ABS depends largely on whether or not drivers interact appropriately with it. Interacting appropriately with safety features like ABS means continuing to drive safely and attentively. Driver behavior like speeding, tailgating, or driving while fatigued can negate the beneficial aspects of ABS. For example, tailgating can make it impossible to steer and avoid a vehicle ahead that suddenly slams on its brakes [5]. Even if ABS activates in this case, there simply will not be enough time to avoid a collision due to insufficient distance between the two vehicles. Similarly, by increasing a driver's reaction time, fatigue or drowsiness can cause drivers to brake too late to safely avoid a collision. ABS does not compensate for unsafe driving or poor road conditions. In order to ensure the ideal performance of ABS, drivers must continue to use caution and good judgment behind the wheel [6]. When combined with safe driving practices, safety features like ABS have been proven to mitigate and prevent road crashes.

METHODOLOGY

ABS consists of speed sensors and instead of hydraulic sensor; there is usage of electricity control module for electromagnetic brakes. Whenever there will be hard braking due to dry or wet condition of the roads or any obstacle appearance and swerving ABS will send signal to the electricity control module which will supply appropriate supply to the electromagnets so that wheels do not get lock and thus no skidding and toppling of vehicle is there [7]. But this braking depends on the wheel rotation and there is no detection of obstacles in front of the vehicle so crash may be possible. So in this research paper there is usage of input from the distance installed on the front and sides of the vehicles either particularly for this purpose or for the vehicle communication system already used in the vehicle. This input from the distance sensor will help the ABS module for better control on the braking thus avoiding the crash too in addition to better turning and swerving of the vehicle. Data transmission between ABS module and speed and rotation sensors will be through wireless system.

DESIGN METHODOLOGY

Basic design of the ABS will remain the same but there will use of electricity supply control module for electromagnetic brakes as shown in the figure below. Wheel speed sensor will sense the speed of the wheels and electricity supply module will appropriate supply to the brakes during hard braking.

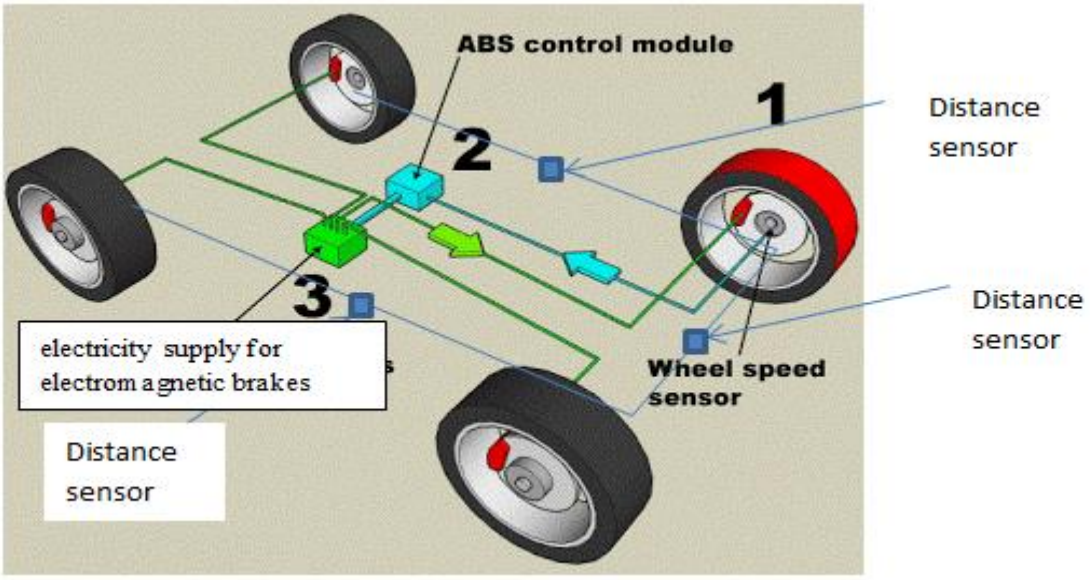

Fig. 1 Diagram depicting the design of ABS with distance sensors

Now in this research paper we have made a little modification that is the use of distance sensor installed on the front of the vehicle that measures gap between the concerned vehicle and the objects around us but we will use the input of front and side sensors only because we apply brakes for front and side objects only.

RESULTS AND DISCUSSION

Today's ABS system uses hydraulic and electronic braking system that varies from vehicle to vehicle but in this research we firstly combined all the system to make the ABS working in a better way i.e. we used electromagnetic braking system instead of manual braking system (hydraulic and electronic). Benefit of using these brakes will be that there will appropriate braking as per requirement neither more nor less like servo motors work. Secondly we combined wireless transmission of data of the speed sensors and rotation sensors with zero speed detection that will make the ABS faster and accurate provided the wireless system should not failed in any of the manners and it will be more reliable than wiring system and thus less maintenance of the ABS system. Now what we did more to make the ABS more intelligent system and fool proof is that we make use of obstacle distance sensor which will be already available in the vehicles having vehicle communication system (V2V system) [8]. With the use of the input from the distance sensor and feed it to the ABS system there will be appropriate action in avoiding the crash addition to avoid skidding and toppling of the vehicle. No doubt it will be a complex system a little bit but it will be fool proof in any of the conditions and without using any extra system just with modification of the programming of the ABS system.

CONCLUSION

Use of the obstacle distance sensor along with ABS will be like providing extra benefit to the system at no extra cost. There will be better control on the vehicle and ABS will become more fool proof. Moreover combination of the electromagnetic brakes and wireless system with ABS will be beneficial for better braking of the vehicle[9]. This system can be used in all the vehicles and in a better way to make driving on the roads crash free and full of comfort. It will provide easiness to the drivers and transportation of the goods and material will be easy than before.

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