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Intelligent Braking System Using Electromagnetic Actuators

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Abstract: ***Accident prevention has been one of the leading areas of research today. Our paper is designed to prevent accidents due to loss of control, drunken driving, and rash driving, using circuitry aided by a microcontroller kit. In our work, braking distance and the distance of the obstacle are taken into consideration along with the speed of the vehicle. The sensor helps in finding the speed of movement of the vehicle and the ultrasonic sensor senses the distance of the object in front. These sensors provide real- time inputs to the microcontroller program. Using sensor the system will sense the speed of the vehicle and with the microcontroller, it will calculate the distance required to bring the vehicle to a complete stop for that speed. Breaking motors is incorporated to activate the brakes thereby achieving automatic breaking procedures. The system helps in conjunction with the driver judgment if the driver doesn't sense the obstacle and applies the brake at the right time then the microcontroller initiates braking motor to apply the brakes automatically. Our future work deals with incorporating real time brake shoe wear system to provide enhanced feature for the intelligent braking system.***

- ***By looking at safety in terms of avoiding accidents in the first place.***
- ***And then protecting occupants when a crash is unavoidable.***
- ***We can prevent more accidents, save more lives, and reduce insurance and medical costs to society.***

Intelligent Braking System approach represents a significant shift from the traditional approach to safety, but it is fundamental to achieving the substantial benefits.

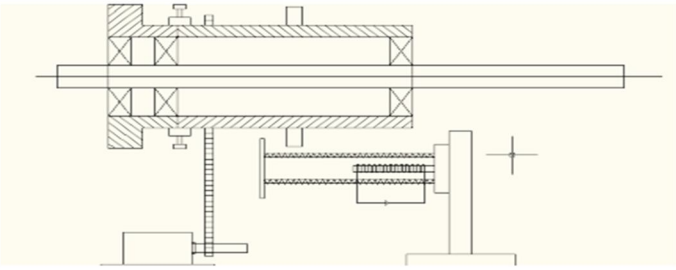
I. INTRODUCTION

The Braking System is the most critical system on your vehicle. Its maintenance and proper functioning are vital to you, your family and other motorists. You should not attempt to effectuate maintenance or repair work on brakes. Servicing or repairing the braking system requires specific tools and adequate technical training. That is exactly what Auto tech Performance offers you.

Electromagnetic brakes have been used as supplementary retardation equipment in addition to the regular friction brakes on heavy vehicles. We outline the general principles of regular brakes and several alternative retardation techniques in this section. The working principle and characteristics of electromagnetic brakes are then highlighted. The principle of braking in road vehicles involves the conversion of kinetic energy into thermal energy (heat). When stepping on the brakes, the driver commands a stopping force several times as powerful as the force that puts the car in motion and dissipates the associated kinetic energy as heat. Brakes must be able to arrest the speed of a vehicle in a short periods of time regardless how fast the speed is. As a result, the brakes are required to have the ability to generating high torque and absorbing energy at extremely high rates for short periods of time. Brakes may be applied for a prolonged periods of time in some applications such as a heavy vehicle descending a long gradient at high speed. Brakes have to have the mechanism to keep the heat absorption capability for prolonged periods of time. In the electromagnetic brake, the coil or solenoid attracts a steel disc. The steel disc presses a brake disc made of sintered or asbestos material between itself and a stationary steel disc. The torque is thus 'grounded' and braking action takes place. This type of brake is used in machines like lathes, presses etc. In electro-magnetic braking system electro-magnetic property is used due to this action of braking will be done. In this system, electro magnet iron plate, liners, tension spring, stud, disc brake plate are used. The brake liners are attached with electro- magnet and iron plate individually and both plate insert the disc plate and this plate rigidly attached with wheels. The battery of minimum 12 volt is used for external power supply. Electromagnet consists of wire wound over a soft iron core. When current is passed through the coil, it produces a magnetic field which magnetizes the core into the bar magnet with the polarities. Strong magnetic field is obtained by high currents of large self-induction. High currents are not always feasible, which is why a high self-induction is obtained by making a loop of wire in the shape of a coil, a so-called solenoid. More current and more turns produce a stronger magnetic field which results in stronger electromagnet. When current is switched OFF field disappears and the iron core no longer a magnet. This ability of an electromagnet provides a strong magnetic force of attraction. Shape geometry and material used in construction of electromagnet decide the shape and strength of magnetic field produced by it.

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A. Construction and Working



Layout of Electromagnetic Braking System

B. How does the Braking System Work

Electromagnetic braking means applying brakes using electronic and magnetic power. Here we use the principle of electromagnetism to achieve friction less braking. This tends to increase the life span and reliability of brakes since no friction leads to less wearing out of brakes. Also it requires less maintenance and oiling. This is an upcoming technological replacement for traditional braking systems. The main purpose behind the proposed use of these brakes in vehicles is that it is frictionless. This leads to a sizably less maintenance cost due to no friction and no oiling. Also traditional braking systems are prone to slipping while this one is guaranteed to apply brakes to the vehicle. So without friction or need of lubrication this technology is a preferred replacement for traditional braking. Also it is quite smaller in size compared to the traditional braking systems.
To make electromagnetic brakes work, a magnetic flux when passed in a direction perpendicular to the rotating direction of the wheel, we see eddy current flowing in a direction opposite to the rotation of the wheel. This creates an opposing force to the wheel rotation and in turn slows down the wheel. Thus we achieve electromagnetic braking as a better braking system for future automobiles

C. Design

Factors considered in designing the system are:

1) Braking distance
2) Distance of obstacle in front

II. CONCEPT PROPOSED:

With the proposed framework these sorts of mischances can be turned away. Utilizing a HALL sensor the framework will sense the rate of the vehicle and with the microcontroller, it will compute the braking separation: that is the separation required to convey the vehicle to a complete stop for that speed. Utilizing an Optical sensor, the framework will sense any moving or stationary hindrance in front and ceaselessly monitor its separation. At the point when the driver sees a deterrent in front and backs off there is no issue. Then again, in the event that he doesn't have any significant bearing brakes and continue the same velocity, he goes to a point where the separation of the impediment equivalents to braking separation. This is the last risk for the driver to apply the brake and back off the vehicle. In the event that regardless he goes at the same speed, the microcontroller in the framework will actuate the brakes and evade an impact by conveying the vehicle to as top. Regularly, one would not stop at a moment that the vehicle is touching the impediment. Some separation is left before the snag. The separation is additionally accounted by the microcontroller. Assume for 50 km/hr if the braking separation is say 12.28 m, then 0.5 m is included and the braking separation is computed as 12.78m.

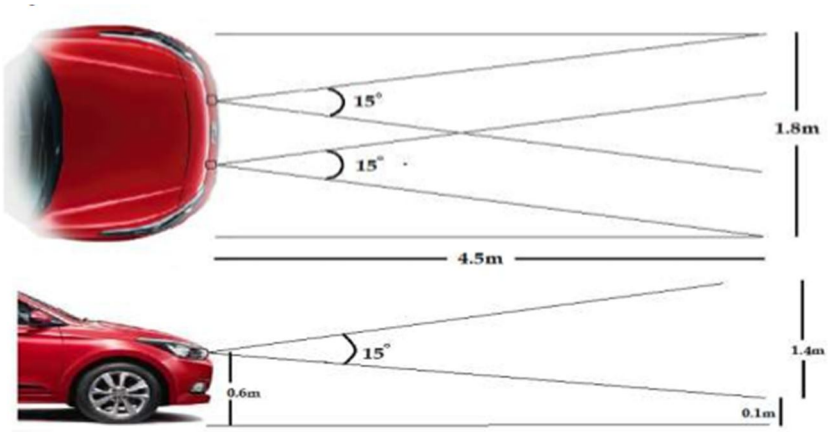
III. COMPONENT LIST

1) Ultrasonic Sensors
2) Microcontroller
3) Tyres
4) DC Motors
5) Brakes
6) TSOP Sensor

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A. Working

Ultrasonic Sensor position:



To get maximum catchment area in front of the vehicle and to avoid false indication we have to adjust the sensor position. Also number of sensors use is crucial parameter because if one sensor faces the failure then other can do the work.

B. Advantages

1) It allows the driver to maintain directional stability and control over steering during braking.
2) Safe and effective
3) Automatically changes the brake fluid pressure at each wheel to maintain optimum brake performance.
4) ABS absorbs the unwanted turbulence shock waves and modulates the pulses thus permitting the wheel to continue turning under maximum braking pressure.
5) Less time and more profit.

IV. APPLICATIONS

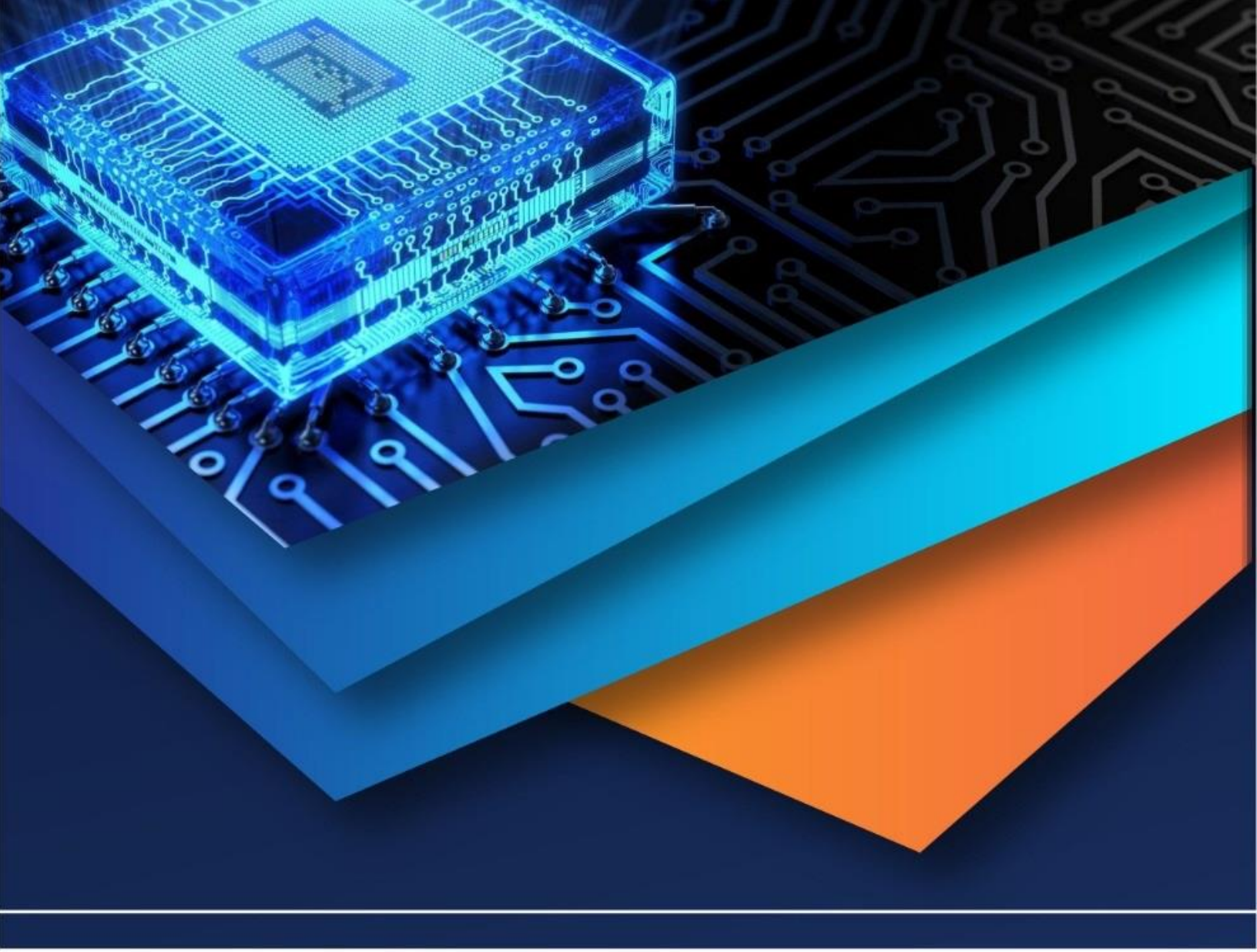
A. We can use this system as safety purpose.
B. Highly accurate system for automatic braking system.
C. Less operating force is required
D. Automated operation

V. CONCLUSION

The system is working efficiently in both modes forward and reverse direction. When the sensor senses any obstacle behind and in front of the vehicle, it sends signals to the control unit which allows the vehicle to stop the running wheel. Thus we have an "intelligent braking system" which helps in understanding how to achieve low cost automation.

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