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EDDY CURRENT BRAKING SYSTEM

Mohd Mahmeen[1], Simabul Alim[2], Shivendra Singh[3], Saddam Hussain[4], Shitanshu Paswan[5], Shamshad Ali[6]
[1, 2, 3, 4, 5, 6]Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, U. P., India
Email: mahmeentaqvi@gmail.com

Abstract: ***The braking system discussed in this paper focuses on a mechatronics-based system which is able to detect obstacle in front of the vehicle. The drawbacks found in conventional system can be removed using mechatronics approach. Humans using the vehicle may not be able to assess the situation at which brake is to be applied. Therefore, there is need to help the driver by using electronic components. Different electronic components will be used to determine the time at which brake is to be applied. Even, if the driver is not able react to the situation, mechatronic system will apply brake on its own. The most common causes of accidents are- unconsciousness of driver, failure of braking system, road condition, uncontrollable speed of vehicle. Thus, there is need to automatically control the vehicle using electronic devices. Therefore, a system known as intelligent braking system came into existence. The name intelligent is given because it can take decisions automatically depending upon the input from ultrasonic sensors [1,2].***

Kewwords: Eddy Current brake, Intelligent braking, Mechatronics

1. INTRODUCTION

The world is growing at a very fast rate. This has led to invention of many great things. One of them is self-propelled vehicles. Now a day, everybody wants to have a vehicle. As a result, number of vehicles have increased many fold. However, roads have not been constructed as faster as production of vehicle. Hence, problem of road accidents has increased. Releasing the 'Road Accidents in India - 2016' report, the Road Transport and Highways Minister said while overall road accidents last year declined by 4.1 percent, the fatalities were up by 3.2 percent, meaning more than 400 people lost their lives daily on roadsOverall, 4,80,652 road accidents took place in India last year resulting in the loss of 1,50,785 lives and inflicting serious injuries on 4,94,624 persons.The working age group of 18-60 years constituted 83.3 percent in the total road accident fatalities, it added.Many of these accidents could have been avoided or they would have been less severe, has the driver applied the brakes at the right time.Many of these accidents could have been avoided or they would have been less severe, has the driver applied the brakes at the right time. Also, there may be failure of brakes. Unfortunately, the time required by driver to understand the potential accident situation, compounded with driver's delayed reaction time in applying brakes, usually causes a lag between the identification of a potential accident situation and execution of the corrective actions that will prevent the accident [3].

This problem can be reduced by automation. Automation is believed to reduce the risk of accidents, improve safety, increase capacity, reduce fuel consumption and enhance overall comfort and performance for drivers. There has been enough reason to assume that more automated automobiles relieve the driver from many undesirable routines of driving task.

Mostly accidents occur because driver is not able react at required time to apply the brakes.A smoother cruise with an automated system can reduce fuel consumption and engine

wear. Based on all these potential benefits of automation, research on automating some or all aspects of driving task has been going on for decades now. However, there were limits in practical implementation of such systems due to rudimentary electronics and sensor technology. While the history of automation goes back to 1930s, in the late 1980s and beginning of 1990s, state and private funded programs started more focused research in the United States, Europe, and Japan.

In this beginning century while some automakers have already introduced features like adaptive cruise control (ACC) in their top of the line cars, many others are pursuing research to introduce ACC and other advanced features like collision warning and avoidance systems into their products. This has led to more comfortable driving system. The system which once was dream can become reality now. There are different types of brakes which are used these days [4,5].

1.1 TYPES OF BRAKES

- Disc brake
- Drum brake
- Hydraulic brake
- Air brake
- Electric brake
- Vacuum brake

DRUM BRAKE

A drum brake is a brake that uses friction caused by a set of shoes or pads that press outward against a rotating cylinder-shaped part called a brake drum.

The term drum brake usually means a brake in which shoes press on the inner surface of the drum. When shoes press on the outside of the drum, it is usually called a clasp brake. Where the drum is pinched between two shoes, similar to a conventional disc brake, it is sometimes called a pinch drum brake, though such brakes are relatively rare. A related type called a band brake uses a flexible belt or "band" wrapping around the outside of a drum.

When the brakes are applied, brake fluid is forced under pressure from the master cylinder into the wheel cylinder, which in turn pushes the brake shoes into contact with the machined surface on the inside of the drum. This rubbing action reduces the rotation of the brake drum, which is coupled to the wheel. Hence the speed of the vehicle is reduced. When the pressure is released, return springs pull the shoes back to their rest position.

DISC BRAKE

A disc brake is a type of brake that uses calipers to squeeze pairs of pads against a disc or "rotor" to create friction. This action retards the rotation of a shaft, such as a vehicle axle, either to reduce its rotational speed or to hold it stationary. The energy of motion is converted into waste heat which must be dispersed.

Hydraulically actuateddisc brakes are the most commonly used form of brake for motor vehicles, but the principles of a disc brake are applicable to almost any rotating shaft.

The disc is usually made of cast iron but may in some cases be made of composites such as reinforced carbon–carbon or ceramic matrix composites. This is connected to the wheel and/or the axle. To retard the wheel, friction material in the form of brake pads, mounted on the brake caliper, is forced mechanically, hydraulically, pneumatically,
or electromagnetically against both sides of the disc. Friction causes the disc and attached wheel to slow or stop.

HYDRAULIC BRAKE

A hydraulic brake is an arrangement of braking mechanism which uses brake fluid, typically containing glycol ether or diethylene glycol, to transfer pressure from the controlling mechanism to the braking mechanism.In a hydraulic brake system, when the brake pedal is pressed, a pushrod exerts force on the piston(s) in the master cylinder, causing fluid from the brake fluid reservoir to flow into a pressure chamber through a compensating port. This results in an increase in the pressure of the entire hydraulic system, forcing fluid through the hydraulic lines toward one or more calipers where it acts upon one or more caliper pistons sealed by one or more seated O-rings (which prevent leakage of the fluid).

The brake caliper pistons then apply force to the brake pads, pushing them against the spinning rotor, and the friction between the pads and the rotor causes a braking torque to be generated, slowing the vehicle. Heat generated by this friction is either dissipated through vents and channels in the rotor or is conducted through the pads, which are made of specialized heat-tolerant materials such as Kevlar or sintered glass.

AIR BRAKE

An air brake or, more formally, a compressed air brake, is a type of friction brake for vehicles in which compressed airpressing on a piston is used to apply the pressure to the brake pad needed to stop the vehicle. Air brakes are used in large heavy vehicles, particularly those having multiple trailers which must be linked into the brake system, such as trucks, buses, trailers, and semi-trailers, in addition to their use in railroad trains. George Westinghouse first developed air brakes for use in railway service. He patented a safer air brake on March 5, 1872. Westinghouse made numerous alterations to improve his air pressured brake invention, which led to various forms of the automatic brake. In the early 20th century, after its advantages were proven in railway use, it was adopted by manufacturers of trucks and heavy road vehicles.

ELECTRIC BRAKE

Electric friction brake, often referred to as just electric brake or electric trailer brake is a brake controlled by an

electric current and can be seen on medium duty trailers like caravans/RVs and Consumer-Grade Car Trailers. It is related to the Electromagnetic track brake used in railways which also uses electric current to directly control the brake force.

Electric brakes are devices that use an electrical current or magnetic actuating force to slow or stop the motion of a rotating component. They are used in industrial and vehicular braking applications that require fast response times and precise tension control. There are two main types of electric brakes: magnetic and friction. Each has various subtypes.

1.2 ANTI-LOCK BRAKING SYSTEM

ABS braking systems have been well-known in the automotive industry for many years. At first, they were optional extras for upmarket vehicles, then became more ‘‘democratic’’ as part of the basic equipment of most vehicles. Antilock braking systems (ABS) are designed to stop vehicles as safely and quickly as possible. Safety is achieved by maintaining lateral stability (and hence steering effectiveness) and trying to reduce braking distances over the case where the brakes are controlled by the driver. Current ABS design typically uses wheel speed compared to the velocity of the vehicle to measure when wheels lock (i.e., when there is “slip” between the tire and the road) and use this information to adjust the duration of brake signal pulses.An antilock braking system is an automobile safety system that allows the wheels on a motor vehicle to maintain tractive contact with the road surface according to driver inputs while braking, preventing the wheels from locking up (ceasing rotation) and avoiding uncontrolled skidding. It is an automated system that uses the principles of threshold braking and cadence braking which were practiced by skillful drivers with previous generation braking systems. It does this at a much faster rate and with better control than many drivers could manage. ABS generally offer improved vehicle control and decreases stopping distances on dry and slippery surfaces; however, on loose gravel or snow-covered surfaces, ABS can significantly increase braking distance, although still improving vehicle steering control. Typically, ABS include a central electronic control unit(ECU), four-wheel speed sensors, and at least two hydraulic valves within the brake hydraulics. The ECU constantly monitors the rotational speed of each wheel; if it detects the wheel rotating significantly slower than the speed of the vehicle, a condition indicative of impending wheel lock, it actuates the valves to reduce hydraulic pressure to the brake at the affected wheel, thus reducing the braking force on that wheel; the wheel then turns faster. Conversely, if the ECU detects a wheel turning significantly faster than the others, brake hydraulic pressure to the wheel is increased so the braking force is reapplied, slowing down the wheel. This process is repeated continuously and can be detected by the driver via brake pedal pulsation. Some anti-lock systems can apply or release braking pressure 15 times per second. Because of this, the wheels of cars equipped with ABS are practically impossible to lock even during panic braking in extreme conditions.

1. COMPONENTS OF BRAKING SYSTEM

- Microcontroller
- Ultrasonic sensor
- Single relay board
- Solenoid gun
- Battery

MICROCONTROLLER

A microcontroller is a small computer on a single integrated circuit. In modern terminology, it is similar to, but less sophisticated than, a system on a chip or SoC; an SoC may include a microcontroller as one of its components. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals. Program memory in the form of ferroelectric RAM, NOR flashor OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computer or other general-purpose applications consisting of various discrete chips.A microcontroller is a small and low-cost computer built for the purpose of dealing with specific tasks, such as displaying information in a microwave LED or receiving information from a television’s remote control. microcontroller is mainly used in products that require a degree of control to be exerted by the user.Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded system.

ULTRASONIC SENSOR

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object.Since it is known that sound travels through air at about 344 m/s (1129 ft/s), you can take the time for the sound wave to return and multiply it by 344 meters (or 1129 feet) to find the total round-trip distance of the sound wave. Round-trip means that the sound wave traveled 2 times the distance to the object before it was detected by the sensor; it includes the 'trip' from the sonar sensor to the object AND the 'trip' from the object to the Ultrasonic sensor.

SINGLE RELAY BOARD

The Single Relay Board can be used to turn lights, fans and other devices on/off while keeping them isolated from your microcontroller. The Single Relay Board allows you to

control high-power devices (up to 10 A) via the on-board relay. Control of the relay is provided via a 1 x 3 header – friendly to servo cables and convenient to connect to many development boards. A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relay. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

SOLENOID GUN

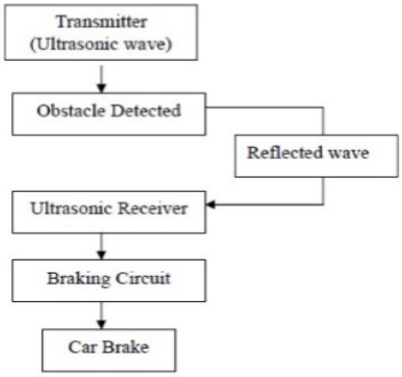
A coil gun is a type of projectile accelerator consisting of one or more coils used as electromagnets in the configuration of a linear motion that accelerate a ferromagnetic or conducting projectile to high velocity. Coil guns generally consist of one or more coils arranged along a barrel, so the path of the accelerating projectile lies along the central axis of the coils. The coils are switched on and off in a precisely timed sequence, causing the projectile to be accelerated quickly along the barrel via magnetic forces. Coil guns are distinct from railguns, as the direction of acceleration in a railgun is at right angles to the central axis of the current loop formed by the conducting rails. In addition, railguns usually require the use of sliding contacts to pass a large current through the projectile or sabot but coil guns do not necessarily require sliding contacts.[1] While some simple coil gun concepts can use ferromagnetic projectiles or even permanent magnet projectiles, most designs for high velocities actually incorporate a coupled coil as part of the projectile.

There are two main types or setups of a coil gun: single-stage and multistage. A single-stage coil gun uses one electromagnet to propel a projectile. A multistage coil gun uses several electromagnets in succession to progressively increase the speed of the projectile.

BATTERY

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars When a battery is supplying electric, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved additionally to include devices composed of a single cell.

2. METHODOLOGY



FACTORS CONSIDERED

Factors considered in designing of the vehicle are-

- Braking distance
- Distance of obstacle in front of the vehicle

BRAKING DISTANCE

Braking distance is the distance covered by the vehicle between the point of application of brakes to the point at which the vehicle comes to complete stop. Braking distance refers to the distance a vehicle will travel from the point when its brakes are fully applied to when it comes to a complete stop. It is primarily affected by the original speed of the vehicle and the coefficient of friction between the tires and the road surface and negligibly by the tires' rolling resistance and vehicle's air drag. The type of brake system in use only affects trucks and large mass vehicles, which cannot supply enough force to match the static frictional force. The braking distance is one of two principal components of the total stopping distance. The other component is the reaction distance, which is the product of the speed and the perception-reaction time of the driver/rider.

DISTANCE OF OBSTACLE IN FRONT OF VEHICLE

The distance between the obstacle and vehicle is sensed using an ultrasonic sensor and it is fed to the microcontroller. This sensor gives an idea about the at which the brake is to be applied [6,7].

3. WORKING

At present fuzzy logic is used to apply brakes when the obstacle is near to vehicle or the speed of the vehicle is very high. Ultrasonic sensors are placed at front of the vehicle to calculate the distance between the obstacle and the vehicle. The ultrasonic sensor sends out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object. However, it should be noted that, this ultrasonic sensor is not able detect the distance of vehicle which are on the side of vehicle [8, 9].

The ultrasonic sensor at the front of vehicle produces and emit ultrasonic waves frontward at a predetermined distance. An ultrasonic receiver is also placed at front of the vehicle operatively receiving a reflective ultrasonic wave signal. The reflected wave (detected pulse) give the distance between obstacle and the vehicle. Then a micro controller is used to control the speed of the vehicle based on the detection pulse information to push the brake pedal and apply to the car stupendously for safety purpose [10,11].

4. CONCLUSION

It is a system which has got various applications in today's world especially in countries which has high number of vehicles plying on roads. During foggy days when visibility is near zero, intelligent braking system can be used for saving of life and money.

The system when combined with regenerative braking system, float sensors, traction control etc. will result in smart vehicle maneuver. In present scenario where accidents are common in every type of industry, this system can be used to prevent loss of life

REFERENCES

[1]. Divya P., Murugesan A, intelligent car braking system with collision avoidance and ABS, international journal of computer application (0975-8887)

[2]. GV Sairam, B.suresh , CH Sai hemanth, K Krishna Sai, intelligent mechatronic braking system, International journal of emerging technology and advanced engineering

[3]. Hemlatha BK, P Pooja, Chaithra M Megha S, Rakshitha R T, Automatic braking system using IR sensor International journal of advanced research electrical, electronic and instrumentation engineering

[4]. C Clement Christy Deepak, P.Guruprasath, S hareesh Kumar and V Lourdu Anthony, Intelligent braking system in automatic application , International conference on latest innovation in applied science, engineering technology

[5]. Gajanan koli, Akshaypatil, Prasad patil, Shubham Sokashe, Intelligent braking system using IR sensor , International journal of advances in research and engineering

[6]. Tushar kavatkar, Harshalsalvi, Minalrahate, Design and analysis of intelligent braking system

[7]. http://en.wikipedia.org/wiki/antilock-braking system

[8]. Intelligent Control for Brake Systems William K. Lennon and Kevin M. Passino, Senior Member, IEEE

[9]. Research Advances in Intelligent Collision Avoidance and Adaptive Cruise Control ArdalanVahidi and Azim Eskandarian

[10]. Wikipedia

[11]. A mechatronic conception of a new intelligent braking system Gérard Gissinger, Christian Menard, Alain Constans