ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

AUTOMATIC BRAKE FAILURE INDICATOR

Abhishek Chaudhary*, Kapil Jariya, Mohit Kumar Sharma, Mr. Vikas Kumar
B.K. Birla Institute of Engineering and Technology, Pilani.
Department of Electrical Engineering, BKBIET, Pilani.

DOI: 10.5281/zenodo.50438

ABSTRACT

Today, Machines are widely controlled by automated control system. To meet the need of growing population economic, effective and reliable control of machines as well as their control system is necessary. The main objective of this project is to continuously monitor the braking system at each and every time during the operation of the vehicle. Now a days, accidents are occurring due to lot of reasons, the one of the main reason is brake failure, it caused to due to poor maintenance, improper use and product defect, in order to safe guard the valuable human for accident the accident monitoring of brake is very important issue in automobile. The brake failure indicator circuit is a circuit that monitors constantly of the condition of brakes and provides an audio visual indication. When the brake is applied in order to slow down or to stop the vehicle the green LED blinks and the piezo buzzer beeps for about one second if the brake system is accurate and working properly. If brake system fails the red LED glows and the buzzer do not beep when the brakes are applied.

KEYWORD:.

INTRODUCTION

A **brake** is a mechanical device that hinder, restrain, or prevents motion, slowing or stopping a moving object or preventing its motion.

Most of the brakes generally uses friction between two surfaces pressed together to change the form of the kinetic energy of the moving object into heat, despite the fact that other methods of energy conversion may be employed for the same. For example, regenerative braking converts a large amount of the energy to electrical energy along with the heat energy, which may be stored or can be sent back to the source for later use. Some other methods convert the kinetic energy into potential energy in such stored forms as pressurized oil or pressurized air. Magnetic fields is used in Eddy current brakes to convert kinetic energy into electric current in the brake disc, fin, or rail, which is converted into heat energy. Still there are other braking methods to transform kinetic energy into different forms, for example by transferring the energy to a rotating flywheel.

TYPES OF BRAKES

Depending on the vehicle, there are several types of brake systems. As an example, many modern passenger cars use an antilock braking system, whereas semi-trucks and trailers may require an air braking system.

Disc Brakes: A friction system which basically uses a wheel brake to slow down or to stop the rotation of the automobile's wheels; brake pads are pressed against the brake's rotor with a set of calipers.

Drum Brakes: A friction system using a set of brake shoes or pads to press against a brake drum of the wheels of the vehicle.

Single-Circuit Hydraulic Brakes: A master or primary cylinder fed by a reservoir of hydraulic brake fluid and connected by a system made up of metal pipes and rubber fittings attached to wheel cylinders; each wheel is having

an opposing pistons on band or drum brake; pressure is produced to push pistons apart and force brake pads into wheel cylinder

Dual-Circuit Hydraulic Brakes: consists of a command circuit which is activates when the brakes are pressed and a second circuit controlled by the vehicle's computer that calculates applied force and applies it to the hydraulic pump system.

Brake-by-wire: A system consisted of electronic wires that, when brake pedal is pressed or pushed, measures electrical resistance and sends the signals to the car's computer, which here calculates the applied force and applies it to the hydraulic pump system.

Antilock Braking System (ABS): An electrical control unit, hydraulic actuator and individual wheel speed sensors that work together to prevent the brakes from locking up when they are "slammed on" by rapidly pumping brakes when a potential lockup is detected by the system, each wheel is controlled individually to maintain traction between the wheels and the road.

Power Brake Booster: A system utilizing the vacuum power which is been produced in an engine naturally to amplify the pressure applied by the driver's foot to stop even very heavy vehicles.

Air Brakes: A system using air instead of using the hydraulic fluid to slam a standard disc or drum brake, it is usually used in buses, trucks, trailer and other heavy vehicles.

Advanced Emergency Braking System (AEBS): An autonomous safety system that uses the sensors to monitor a vehicle's proximity to others in the area near or surrounding and automatically applies emergency braking mechanisms to avoid collision about to happen.

Parking Brakes- A parking brake allows for a vehicle to stay in the same place when parked on an incline or flat surface, and prevents free rolling of the vehicle when it is not in operation. The parking brake is usually operated by a small pedal near the driver's side door below the steering column, or by a lever in the center console, either requiring mechanical force to operate. Some latest vehicles have replaced these devices with a simple button which is been controlled by the electronic system or the computer of the vehicle. The mechanism uses a simple latching system with a cable that directly connects the brakes to the brake pedal or lever inside the vehicle, which in turn uses a ratchet-locking device. Usually, the cable used in a parking brake will bypass the service braking system to ensure the vehicle is able to stop in the event of service brake failure.

Emergency Brakes- The emergency brakes are as same as that of parking brakes, so the mechanisms used to control are the same for both the brakes. The difference in both the terms is situational, and the way the vehicle responds when using the parking brake as an emergency brake can be completely different than the use of service brakes.

When the parking/emergency brake is applied by the driver, the cable connecting the device and the brake system passes to an intermediate lever, which causes the force to increase while passing through a part called an equalizer. The equalizer then splits the cable in two, and divides the force between the rear wheels equally to slow the automobile.

Because the emergency brakes are only applied to the rear wheels, when they are used when a vehicle is in motion, it is likely that the brake balance of the car may be upset, which can result to loss of control. It is also possible that the force applied by the emergency brake may not be enough or sufficient to stop the vehicle. Emergency brakes are meant for use in cases of service brake failure as a means of backup.

HOW DOES BRAKE SYSTEM WORKS

The brake pedal, on which you apply the pressure to stop or slow down our vehicle, is connected by levers and rods to the brake booster or can be called as brake amplifier. The brake booster/amplifier multiplies and transfers the resultant force produced by stepping on the brake pedal to the **master or primary cylinder**. In turn, the master or

primary cylinder uses that amplified force by the lever to pressure the **brake fluid** from its reservoir through **hydraulic lines** toward the front and rear brakes that are mounted on the wheels of the vehicle.
The **hydraulic pressure** that reaches to each wheel's brake is then used to create **friction** in order to slow down and to stop the vehicle. The harder you push on the pedal, more the pressure is applied to the brakes, and after a certain period locking the wheels – that is in the case your vehicle is not equipped with an **Antilock Braking System (ABS)**.

More precisely, in conventional braking system (without ABS), the hydraulic pressure is applied to the wheels through **proportional valves** that distribute pressure the pressure or the brake fluid accordingly to weight distribution on each wheel.

Note that **brake fluid** has a slippery oily feel and having no smell or odor when new. As it ages, the fluid changes into smoky brown from the water and various contaminants that collect in the system with the usage.

Disc Brakes - In a conventional **disc brake** (usually located in the front wheels of the vehicle), the brake fluid is pumped through a **hydraulic line** toward the **hydraulic caliper**. The caliper is fitted with a pair of **brake pads made up of fiber** that grabs a spinning metal disk so called **rotor** – attached to the front axle in order to slow down or to stop the vehicle. The pads are always in contact with the rotor, it is necessary that they are periodically checked and adjusted in order to detect any sign of wear or damage to the pads.

Drum Brakes - A basic **drum brake** (usually located at the rear of the vehicle) consists of a rotating drum that is attached to the wheels of the vehicle, and two expanding **brake shoes**. The brake shoes are so arranged that when the brake is applied they both are expanded in the opposite direction with respect to each other towards the drum of the wheels. The brake shoes are basically made up of the curved metal pads that is equipped with a fiber lining on the outer side of the arc of the brake pads. They are located at the non-rotating part of the wheel. When the brake pressure is applied at the brake pedal by the driver, the brake fluid goes through the hydraulic pipes of the brake system towards the wheel cylinder located at the brake shoes, which is then expands the brake shoes towards the outer side of the brake shoes and comes in contact with the inner side of the brake drum and due to this contact of brake shoes and drum, friction is created between them i.e. the rotating part and the non-rotating part of the wheel which slowdowns the vehicle and stops it after some time.

Antilock Braking System (ABS) - The **Antilock Braking System** is basically used in order to prevent the wheels from "**locking up**" when the brake is applied by the driver. It is located between the brake master cylinder and the wheels of the vehicle. Its basic purpose is to prevent instability of the vehicle in the extreme braking condition. ABS modulates the fluid pressure applied on each of the front and rear wheels depending upon their speed and the weight shared by them which avoids the locking up condition of the wheel which is not possible in the conventional Braking System. ABS constantly monitors each wheel through an **electronic wheel sensor** while in normal braking system brake fluid pressure is restored from the hydraulic pipes when there is no longer possibilities of the wheel locking up. While turning the vehicle, speed of inner wheels is slower than that of outer wheels and thus antilock system releases the pressure from the inner wheels of the vehicle.

Even if the system is failed due to any reason, it is displayed with an indicator on the front panel in front of the driver and along with that brake shoes are also equipped with sensors in the Ant locking Braking System which constantly keep a check on brake shoe so if that brake shoe wears off it will notify the system so that it could be replaced.

Emergency Brake – Each and every vehicle consists of an Emergency Braking System that is fully independent from the main braking system of the vehicle. The emergency brake expands the shoe of the brake in case of drum brakes and compresses the shoe of the brake in case of disc brakes for the rear wheels of the vehicle.

ANTI BRAKE SYSTEMS

Antilock brake systems uses a computer system to control and monitor the whole braking system. Fundamentally the computer system keeps the check on the rotational speeds of the each and every wheel and then releases the pressure from the brakes when the wheels are going to lock up. Wheel lock up is undesirable for following two reasons:
The braking system which includes the tires is most effective due to the reason it produces the most retardation, before the condition of wheels lock up and start to slide. Thus it is advantageous to keep the wheels rotating at a rate of about 5%-10% of the free rolling velocity for the speed of the vehicle. This improved the braking efficiency, in the present time, is actually a secondary benefit of Antilock Braking System however.

The directional or rotational control of the vehicle can't be controlled by the locked wheels. So, when the rear wheels locks up, the vehicle will starts to rotate towards the braking interval. When the front wheels lock up, the vehicle steering cannot be controlled. It is a second aspect of the ABS system of the vehicle control i.e. usually demonstrated but the actual purpose of the system is to provide accident prevention and injury reduction. Light trucks are the vehicles which are most in need of the ABS. To maintain the pay load of these vehicles, the braking system are usually biased toward the rear. But this system results in early wheel lock up and loss of control due to too much rear biasing when load is very light. Pick-ups of the vehicles usually faces this problem, therefore, a load sensing valve must be installed in pick-ups to maintain the rear brake pressure but it is hardly founds.

BRAKE FAILURE INDICATOR

A. Background:

With the passage of time, today's generation is growing up with the dreams of high speed vehicles. The problem is that as the birth ratio is increasing, the accidents are getting in number which is one of the major problem faced in this era and it would be rapidly increasing in the coming period. So, everyone tries to avoid accidents while travelling but sometimes it is unavoidable. Accidents are happening at each nook of the streets around the world. Lakhs of life result in death as an aspect of these accidents. As the population is increasing, the number of vehicles are increasing in the same proportion. Which suggests there needs a lively hood of the brakes giving out.

The condition of brakes is regularly monitored by the brake failure indicator circuit. The brake failure condition is sensed by the sensors attached to the circuit through monitoring the brake switch. So, when the brake is applied it shows the condition of brake every time.

B. Rationale:

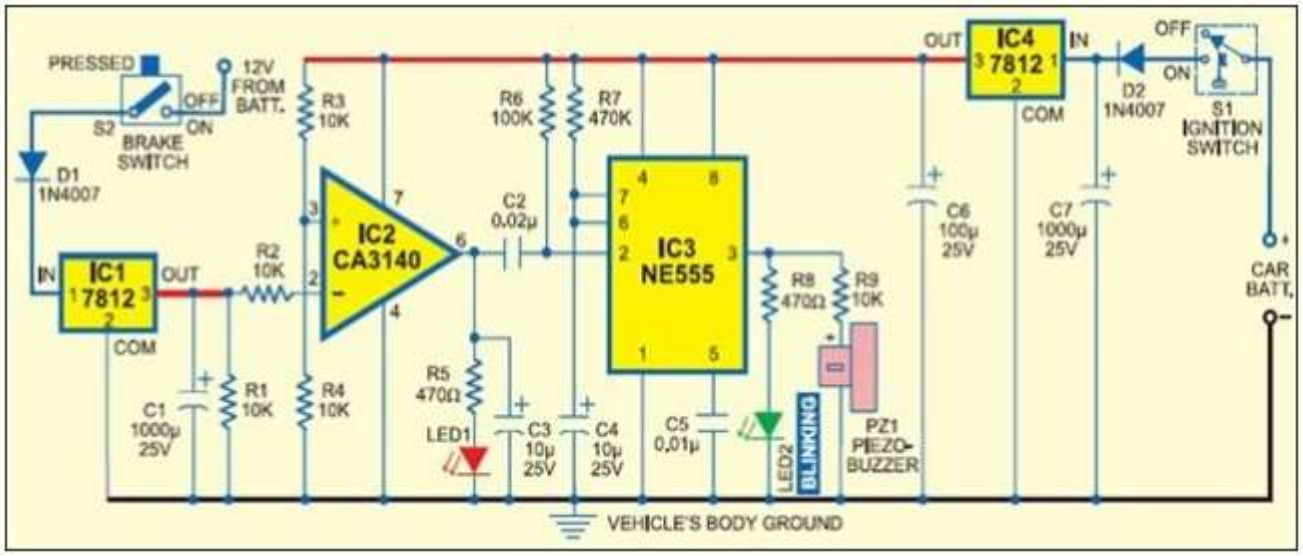
There are several limits that must be keep in mind while driving a vehicle. The brake failure indicator circuit contains many electrical as well as electronic equipment such as LED, sensors, piezo buzzers, ICs, transistors, etc. The brake failure indicator are used to avoid major damage. It is a main advantage of brake failure indicator, and it operate in automatic mode that make it easy to use. At present many other instrument or system can be used to warn before any accident condition but it is only use to monitor the braking system or any disturbances in electrical circuit of the braking system when the brake is applied to stop or slow down the vehicle. But this project i.e. Automatic Brake Failure Indicator uses sensors for constant monitoring of the braking switch and gives the whole condition of braking system of the vehicle. Many problem occur while using automatic braking system like some says hydraulic pipes are not connected tightly and temperature of braking system increases, it can give adverse effect on brake pad and the rotor.

C. Objectives:

The main objective of this project is to avoid accidents. The specific objectives of this project were:

- For the protection of lively hood.
- To reduce accidents of trains and boats due to the brake failure.
- To sense the change in hydrolytic pressure.
- In order to indicate the failure of brake switch.
- It can operate and monitor all the moving units in the vehicle.
- It can sense the leakage of the fuse.
- To connect the audio visual indicator with a sensor.

- To measure the pressure of braking fluid.
- To keep a check on whether the brake is working or not.



PROCESS DESCRIPTION

It is a device used for avoiding accidents. This circuit is continuously monitor the conditions of brake and gives audio visual indication. If the brake system is intact then green LED blinks and for around one second piezo buzzer beeps and when the brake fails the buzzer do not beeps and also only red will LED glows. This circuit only works in vehicles with negative grounding. In nowadays as we know the hydraulic brake system is implemented in the vehicle so a brake switch is mounted on brake cylinder and that will glow the rear brake lamps. This brake switch works on when pressure is maintained and if the pressure drops due to leakage, the brake switch is not operated and do not perform any function. The pressure drop can't be easily detected unless there would be a large pressure drop in the brake pedal of the vehicle.

This is a high fluid leakage which can be sensed by the brake pedal only. This circuit performs its operation every time when the break is applied so that it can aware every time about the condition of the vehicle breaking system. The circuit contains seven capacitors, seven resistors, two diodes, two LEDs, a piezo buzzer and four ICs. One of IC (IC2) is an operational amplifier which is used as voltage comparator and sets the monostable configurations of timer for alarm, this IC2 sense the level of voltage across break switch. It takes not inverting input which gets half the supply voltage through potential divider resistors of 10 kilo-ohms (R3 and R4). The brake switch is connected to the IC2 through diode D1, IC2 and resistor R2. When the brake is applied its receives a high voltage. Normally the red LED glows, because the output of IC2 remains high until the brake is applied. For input stability of IC2 the resistor R1 is used, for ripple free regulated supply to the input of IC2, IC1 and C1 is used. IC3 is used as a monostable which gives pulse output of one second, also R7 and C4 timing element are also connected to make the output high for one second to activate the buzzer and the green LED. Usually the buzzer and the green LED remains off as the trigger pin of IC is high due to RC.

When the pressure is applied on the brake pedal, the pin 2 of IC2 receives high voltage from the brake failure switch so that the output of IC2 goes low and as a result the red LED is switched off. Where the pressure is in braking system is dropped due to leakage, the pressure sensor works and turns on the green LED and buzzer beeps for one second. Brake Failure Indicator circuit gets its power from the vehicle's battery and it can be assembled on any general PCB (Project Circuit Board). To avoid the unwanted triggering while the charging of the battery, a well regulated power supply is required. IC4, C6 and C7 provides the regulated 12V supply to the circuit and prevent from unwanted triggering of the circuit. The supply can be taken from the ignition switch as positive terminal and the vehicle's body as a ground terminal.

FUTURE SCOPES

- It can be used with high sensitivity pressure sensor.
- By using micro-controller we can extent its application in many aspects like controlling of vehicle's starting (vehicle starts only when all the parts of vehicle is in proper working condition).
- If in case the brake fails, brake failure indicator can also be used in order to shut down the vehicle's engine.

INSTRUCTION TO USE

- Always operate vehicles with proper negative grounding.
- Keep the volume of audio visual indicator sound high so it can be easily hear by vehicle operator.
- It is important and necessary to attach the sensor with brake switch.
- Always monitor the level of fluid leakage and its condition.

CONCLUSION

The main purpose of this project is to provide such a device to vehicles operator so that any harmful damage and accidents cause by failure of brake switch can be easily prevented by the proper indication of working condition of brake switch. There are many aims of this project describe as:-

- To sense the pressure drop due to the pressure leakage
- To indicate the proper working condition of brake switch
- To observe the level of hydraulic pressure.
- To calculate the fluid braking pressure when the brake is applied
- To prevent small number of accident occurs in trains and boats by the failure of brake switch
- To gives the audio visual indication when there is a mistake in braking system. Audio visual indicator attached with sensors

REFRENCES

[1] http://www.Electronics4u .com
[2] http://saranyasblog.blogspot.in/2009/02/introduction-brake-failure-indicator.html
[3] https://en.wikipedia.org/wiki/Brake
[4] http://www.edwardslawok.com/types-of-auto-brakes.html
[5] http://westislandgarage.com/en/auto-repairs/55-systeme-de-freinage
[6] http://www.smartmotorist.com/driving-guideline/failure-of-vehicles-braking-system.html
[7] http://www.e-z.net/~ts/hybrakes.htm
[8] http://www.electronicsforu.com/electronicsforu/circuitarchives/view_article.asp?sno=232