

# Brake Failure Indication and Additional Braking System

<sup>1</sup>Suraj Pawar,<sup>2</sup>Kunal Odhekar,<sup>3</sup>Omkar Mulik,<sup>4</sup>Pawan Gurung,  
<sup>5</sup>Shivamkumar,<sup>6</sup>Mr. Vishal Thopate

Alard College of Engineering & Management, Department of Mechanical Engineering

**Abstract:** Now a days Brake failure happens when brake lining is cut-off. The heat energy produced by the friction also used for another energy conversion methods like regenerative braking system which converts kinetic energy into electrical energy which may stored for later use. Other methods also used for braking to convert kinetic energy to potential energy by pressurized air or pressurized oil. Eddy current brake uses magnetic field to convert kinetic energy into electric current into a brake disc, fin or rail etc. Other methods also used to transform kinetic energy into other forms for example by transferring this energy into a rotating flywheel. Brakes are generally applied to rotating axles or wheels but also take other forms such as the surface of moving fluid (flaps deployed into Water or Air) sometimes in vehicle combination braking system used like airplane brakes.

The aim of our project is to design a braking system with indicator and audio signal or buzzer. Brake failure reason is only because of worn out of brake shoe and cut in linear. The system provides audio visual alert when brake failure occurs and apply emergency brake when brake pedal is pressed.

**Keywords:** Brake, Failure, Buzzer, Renewable Energy, LED.

## Introduction

In our project brake failure indicator plays an important role in controlling accidents. Brake failure indicator circuit is a circuit that constantly monitors the condition of brake. The sensor which is attached to the circuit get the chance of a brake failure by monitoring the brake switch and reminds you of the condition of brake every time when the brake is applied. This invention is related to design and development of braking system. In which two different types of braking mechanisms are used first is hydraulic braking system which is used for normal braking purpose and wire operated mechanical drum braking system for emergency braking purpose.

## Related Work

Road accidents are a common place in today's scenario. Accident prevention has been one of the leading areas of research. In Indian scenario normally vehicles are equipped with ABS, traction control, brake assist etc. for driver's safety. This paper focuses on a system known as 'Intelligent braking system' which employ several sensors to respond when emergency conditions occur.[1] The smart braking system is designed for preventing lots of accidents. It is an electro-mechanical device which is designed to prevent accidents and loss of human lives .[2] The exhausted literature study has been carried out on Various ways of Designing of Automatic braking system or intelligent braking system.[3] On the other hand, we have found various manufacturing methods to develop this project. ABS can only help if the rider applies it in right time manually and maintains the distance calculations.[4] ABS has its own braking distance Volvo's laser assisted braking could not work effectively in rainfall and snowfall season and laser is easily affected by atmospheric conditions.[6]The basic function of a brake in a power transmission system is to stop and/or hold the load. The Project work will include the Working construction , its feature scope etc .

## Problem Statement of the Project

Today accidents occur due to lot of reasons; one of the main reasons is the brake failure. In order to safe guard the valuable human life from accidents; the monitoring of brake is an essential thing in automobile. Automobile is equipped by Mechanical Systems and control units Which tends to fail if any malfunction is happened so to avoid the loss of Human life as well as Vehicle the said project is proposed.

## Methodology

- a) At first we collected information about how the brake failure occurs in the vehicles
- b) Then we studied about the types of failure occurring in different types of vehicles
- c) Then we designed an cad drawing for our project to Visualize it and know its design
- d) Then we designed an cad drawing for our project to Visualize it and know its design
- e) Then we studied about different types of stress occurring on it
- f) Then we selected proper material According to the stress on it
- g) We started fabrication work with the approval of our guide and started making the main project model
- h) After Finishing the Project we tested it for various considerations
- i) Afterwards we showed it to our teacher and guide and took approval from them.

## Experimental Result

Braking force required calculation for Braking System

### Drive Motor

- RPM: 30 at 12V.

- Voltage: 4V to 12V
- Stall torque: 28 Kg-cm (2.745862) at stall current of 1.3 Amp.
- Shaft diameter: 6mm.
- Shaft length: 22mm.
- Gear assembly: Spur.
- Brush type: Carbon.
- Motor weight: 143gms.

$$2.7458 = \frac{P \times 60}{2 \times \pi \times N} \quad \text{N/m}$$

Where,

P = Power in W

N = Speed in RPM

T = Torque in N/m

R = Wheel Radius in 183mm

The Rated speed is 30 RPM.

$$2.7458 = \frac{P \times 60}{2 \times \pi \times 30} \quad \text{N/m}$$

P = 8.6261 Watt

$$\text{Force} = \frac{T}{R}$$

$$F = \frac{2.7458}{0.183}$$

F = 15N.

### 1. SPEED

$$S = \frac{(\pi \times D \times N)}{60}$$

$$S = \frac{3.14 \times 0.183 \times 30}{60}$$

S = 0.2873 m/s

### 2. Power absorbed by wheel during Braking

$$\text{Time for change velocity} = \frac{S}{g} = \frac{0.2873}{9.81}$$

Time for change velocity = 0.02928 seconds

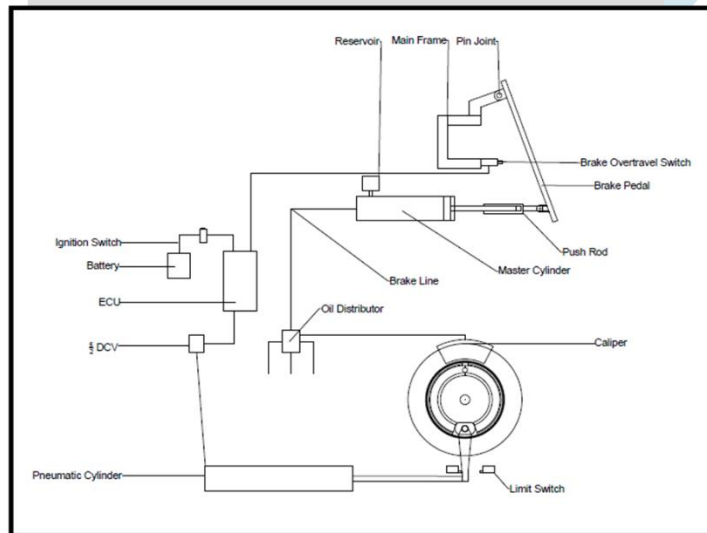


Fig no 1: (Circuit Diagram for project)

### Material and their Specification

#### Various Material And Devices are Used For this Project:

a) **M.S Steel Angels and Tube :**

The L-shaped cross section of the steel angle provides added rigidity and stability to the structure.

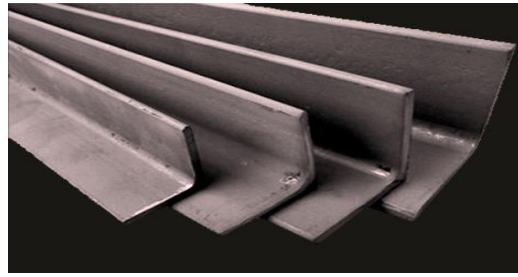


Fig no: 2 ( Steel angel )

**b) Pneumatic cylinder :**

Pneumatic actuators are a popular choice for many industrial applications due to their simplicity, reliability, and cost-effectiveness.



Fig no: 3 (Pneumatic Cylinder)

**c) P.U Tube :**

P.U tubes can carry air through it. it is use to join different ports in the circuit , Such as from compressor to 5/2 DCV

**Pressure carrying capacity : Up to 12 Bars**

**P.U Tube size ( OD ) : 10 mm**



Fig no : 4 ( P.U Tube )

**d) Wheel or Tire :**

A car tire is a construction of hard rubber that fits on a wheel and covers a pocket of air to provide a partial cushion for shocks, plus some level of adhesion to the road surface.



Fig no : 5 ( Bicycle Tire )

**e) Disc Brake :** A **disc brake** is a type of **brake** that uses the **calipers** to squeeze pairs of **pads** against a disc or a "rotor" to create friction.

brake are applicable to almost any rotating shaft.



Fig no : 6 ( Disc Brake )

**f) Brake over travel switch :**

BOT switch works as KILL SWITCH in condition of brake system failure. This switch is placed in such a way that brake paddle does not touch the BOT switch even in case of panic braking.



Fig no : 7 ( Over Travel Switch )

**g) 5/2 DCV Solenoid type :**

A valve is a device that regulates the flow of fluid (gases, liquids, fluidized solids, or slurries) by opening and closing or partially obstructing passage ways. A 5/2 way directional valve from the name itself has 5 ports equally spaced and 2 flow positions.



Fig no : 8 ( 5/2 DCV )

**h) Electric Circuit :**

**Electric Circuit** contains different switches , sensors , Relay , resistors , buzzers etc. It contains of different components such as .

- a) Solenoid : 12 Volts
- b) Relay switches : 5 Volts
- c) Buzzer : 10 Volts

**Led bulbs :** A light-emitting diode is a two-lead semiconductor light source. It is a p-n junction diode that emits light when activated.

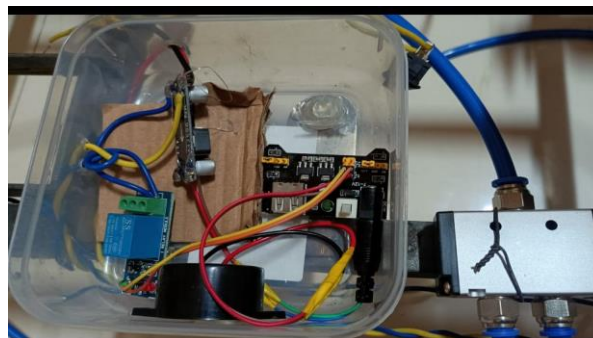


Fig no: 9 ( Electric circuit )

**i) Battery pack :**

Acid battery occupies a very important position in the global battery market for its high security and excellent cost-effective.

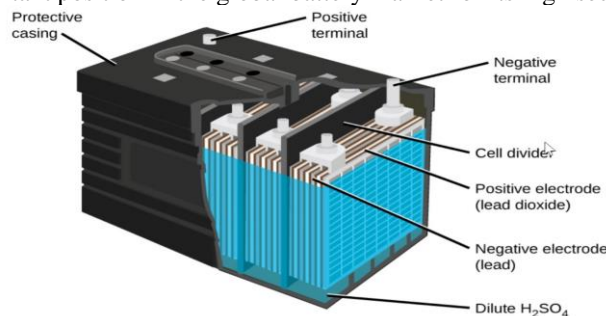


Fig no : 10 ( lead acid battery )

**j) Step Down Transformer :**

Transformers work on the principle of mutual induction. A changing magnetic field in one loop of wire induces an electromotive force (EMF) in an adjacent loop of wire, inductively coupled to the first.

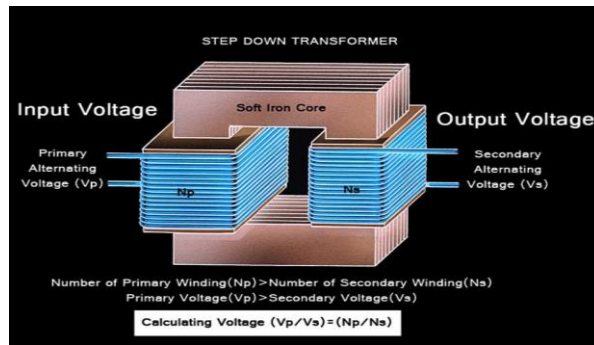


Fig no : 11 ( Step down transformer )

### Fabrication

While Making this project we selected many parts and raw materials according to the project requirement. And Wear and tear property of the material. Therefore we selected M.S angels and square tubes to make our project strong and Light in weight. Strong raw material such as MS Steel helped us to withstand the forces and stress which act on the hole body due to Pneumatic cylinders .

#### ➤ Fabrication of Main frame :

➤ Used MS Steel Angles and square tubes.  
(All the dimensions were taken in Centimetre (cm))

#### ➤ Angle : Cutting

- 20 cm × 2
- 10 cm × 1
- 35 cm × 1

#### ➤ Square Tube : Cutting

- 20 cm × 2
- 10 cm × 1
- 35 cm × 1
- 21.5 cm × 1
- 30 cm × 1
- 6 cm × 1
- 3.5 cm × 1
- 50cm × 1

#### ➤ Dynamo (Car Viper Machine)

An easily available Car viper machine is used of following specifications:Volts : 12V

#### ➤ Pneumatic Cylinders :

Size : 20 × 50 cylinders ( quantity 2 )

Size : 25× 50 cylinders ( quantity 1)

Size : 16 inch plastic tire



Fig No.12 ( Brake Failure Indication and Additional Bracking System)

### Working

In our project brake failure indicator plays an important role in controlling accidents. Brake failure indicator circuit is a circuit that constantly monitors the condition of brake. The sensor which is attached to the circuit get the chance of a brake failure by monitoring the brake switch and reminds you of the condition of brake every time when the brake is applied. Most vehicles retain some degree of control over the brakes even if the main system doesn't work and most vehicles have two braking systems. One acting as back up system. The most common cause is that there is a leak in the brake line, master cylinders or wheel cylinders. In order to solve this problem. I choose the 'Brake failure indicator' as our project. This invention is related to design and development of braking system. In which two different types of braking mechanisms are used first is hydraulic braking system which is used for normal braking purpose and wire operated mechanical drum braking system for emergency braking purpose. The normal braking system works on the Pascal's law as it is working on hydraulic pressure. The single master cylinder and single brake pedal is used to operate the hydraulic braking system. The brake pedal over travel switch is used to identify the pedal movement because, when the braking system works normally then due to the pressure the pedal movement is defined to a specific distance. When the system losses the pressure then the brake pedals travels more distance than normal braking. This travel movement is used to push brake over travel switch and push type direction control valve which turn on the buzzer. As well as supply the pressure to the pneumatic cylinder connected to the secondary braking system and brake is applied. The vehicle is remains stationery until the brake over travel switch is not pressed again manually. as system is applying gradual braking instead of sudden brake as applied by hand brakes the system is safe for use. This system avoids skidding of vehicle.

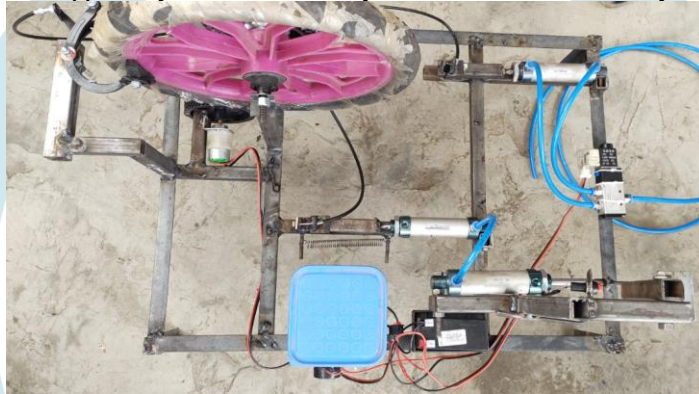


Fig No.12 ( Brake Failure Indication and Additional Bracking System)

### Validation

In order to detect the efficiency and its working of Brake failure indicator, several tests were conducted. Before releasing it as a new product into the market, every product undergo testing. so product testing is essential to verify the working of the product. The test should be decided in order to verify whether the product satisfied all the objectives. Therefore, with the help of this tests, we find out whether the "Brake Failure Indicator" is working properly or not. Brake failure indicator is a device which is used to avoid accidents. The brake failure indicator circuit is a circuit that constantly monitors of the condition of brakes and gives an audio-visual indication. When the brake is applied the green LED blinks and the piezo buzzer beeps for around one second if the brake system is intact. If brake fails the red. The circuit will work only in vehicles with negative grounding. It also gives an indication of brake switch failure. In hydraulic brake systems of vehicles; a brake switch is mounted on the brake cylinder to operate the rear brake lamps. The brake switch is fluid operated and doesn't function if the fluid pressure due to leakage. The fluid leakage cannot be detected easily unless there is a severe pressure drop in the brake pedal. This circuit sensor the chance of brake failure by monitoring the brake switches and reminds you of condition of brake every time the brake is applied. The circuit comprises of Pressure producing component, pressure cylinder & a mechanically operated limit switch & a LED set for the indication purpose. We have tested the System with the appropriate pressure & with various test conditions. Once we release or leak the pressure from the pressure cylinder it immediately actuates the limit switch & the connection to the motor gets shut off automatically so the propelling of vehicle will be stopped. & Similarly, on the other hand circuit will engage the LED & Buzzer connection for the user awareness. As drivers, we need both of these features as much as we need to breathe in and out. If driver ever been in a vehicle that did not stop, driver know the sheer terror that brake failure can cause. Whether driver's vehicle is equipped with disc or drum brakes, driver expect them to work when driver hit the brake pedal.

### Conclusion

This system can prove to be advancement in mechanical and automotive industry. system endlessly monitors the condition of the brake wire and alerts the rider before it gets cut. The indication to the rider is given within the type of audio-visual sign. All the elements area unit placed rigorously, therefore contributory to the most effective working of the unit. therefore, the project has been with success designed and tested. the indication system will be a new era of vehicle protection system if implemented in any motor vehicles to protect them from accidents. there have been many devices to stop the vehicle at abnormal conditions. but the proposed model deals with indication of brake failures with mechanicals means before any accident could happen and also ensures the safety of human as well as vehicle

### Future Scope:

The future scope is to design and develop control system based on an automotive braking system is called "Automatic Braking System The Automatic Braking System with ultrasonic sensor would alert the driver when the distance between vehicle and obstacle is in within the sensing range zone then the brakes are applied. It is verily useful to public sector and users. It is also avoiding the accidents in large or metropolitan cities. So, we feel it is a better idea for automatically braking & indication of vehicle with moderate cost. [7]

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