

A Novel Automatic Brake Failure Indicator for Automotive Vehicles: Low-cost design and development

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Abstract:

Today, Machines are widely controlled by automated control systems. To meet the needs of the growing population, economic, effective, and reliable control of machines as well as their control system is necessary. The main objective of this work is to continuously monitor the braking system at every time during the operation of the vehicle. Nowadays, accidents are occurring for a lot of reasons, and one of the main reasons is brake failure. It is caused to due to poor maintenance, improper use, and product defects. To safeguard valuable humans from accidents accident monitoring of brakes is a very important issue in automobiles. The brake failure indicator circuit is a circuit that monitors constantly the condition of brakes and provides an audio-visual indication. If the brake system fails the LED glows and the buzzer starts to beep continuously to alert the driver to slow down the vehicle and bring it to the control. This system helps avoid accidents caused due to brake failure problems.

Keywords — Brake, Sensor, Automobile.

I. INTRODUCTION

A brake is a mechanical device that hinders, restrain, or prevents motion, slowing or stopping a moving object or preventing its motion. Most of the brakes generally use friction between two surfaces pressed together to change the form of the kinetic energy of the moving object into heat, even though 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 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 are 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.

A brake could be an automaton that inhibits motion by fascinating energy from a moving system. It's used for fastness or stopping a moving vehicle, wheel, or axle, or to forestall its motion, most frequently accomplished by suggests of friction. Brakes square measure typically applied to rotating axles or wheels, however may additionally take alternative forms like the surface of a moving fluid. Some vehicles use a mixture of braking mechanisms, like drag sports cars with each wheel brakes and a parachute, or airplanes with each wheel brakes and drag flaps raised into the air throughout landing. Therefore the brakes square measure generally to failure in friction between 2 surfaces ironed along to convert the mechanical energy of the moving object into heat thus it causes in equipment failure. So, an equipment failure alert

system is developed to scale back numerous accidents in mechanical machines like 2-wheeler, 3-wheeler, and 4-wheeled vehicles.

II. DESIGN AND CONSTRUCTION

The frame setup for mounting the wheel arrangement is fabricated from square tubes and channels with the help of a metal cutting and metal joining process called welding. The wheel has a braking arrangement activated by a brake lever which is connected to the activation pedal for the activation of the brake. The connection between the foot pedal and brake lever can be dismantled for indication of brake failure. At the rear end portion of the brake lever, a limit switch is placed which is connected to the buzzer and LED for indication. The source for activating the buzzer and LED is obtained from the battery. The Schematic outline of the designed setup is shown in the Fig.1.

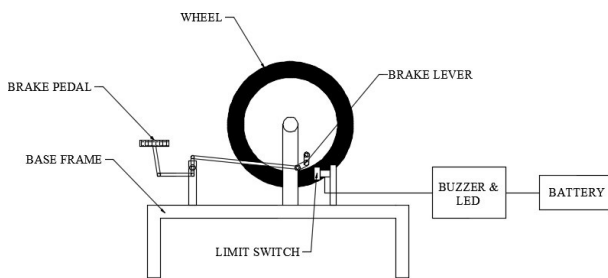


Fig.1 Block Diagram of Brake Failure Indicator

The following Table 1 indicates the bill of materials of the designed setup.

TABLE I
PARTS LIST OF THE DESIGNED SETUP

S. No	Description	Quantity	Material
1	Wheel	1	Rubber
2	Frame	As per requirement	Mild steel
3	Metal strip	As per requirement	Mild steel
4	Shaft	As per requirement	Mild steel
5	Brake wire	As per requirement	Stainless steel
6	Limit switch	1	Electrical
7	Buzzer	1	Electrical

III. WORKING PRINCIPLE

A wheel with brake arrangement setup is used in this work. When the contact between the foot pedal

and brake lever gets damaged it causes the brake lever to rest back due to the gravitational force, due to its motion the push button which is placed behind gets pressed and makes the buzzer and LED activated by closing the circuit between this devices to the battery, which alerts the driver to know about the brake failure condition. Thus the driver can take the necessary action like vehicle speed control and making it stop in a Safe position.

IV. COMPONENTS

The important components included in the design and development and their functions are detailed in the following paragraphs.

A. Limit Switch

In electrical engineering, a limit switch is a switch operated by the motion of a machine part or the presence of an object. They are used for controlling machinery as part of a control system, as safety interlocks, or to count objects passing a point. [1] A limit switch is an electromechanical device that consists of an actuator mechanically linked to a set of contacts. When an object comes into contact with the actuator, the device operates the contacts to make or break an electrical connection. Limit switches are used in a variety of applications and environments because of their ruggedness, ease of installation, and reliability of operation. They can determine the presence or absence, passing, positioning, and end of travel of an object. They were first used to define the limit of travel of an object; hence the name "Limit Switch". A limit switch with a roller-lever operator; is installed on a gate on a canal lock, and indicates the position of a gate to a control system. Standardized limit switches are industrial control components manufactured with a variety of operator types, including lever, roller plunger, and whisker type. Limit switches may be directly mechanically operated by the motion of the operating lever. A reed switch may be used to indicate the proximity of a magnet mounted on some moving part. Proximity switches operate by the disturbance of an electromagnetic field, by capacitance, or by sensing a magnetic field.

Rarely, a final operating device such as a lamp or solenoid valve will be directly controlled by the contacts of an industrial limit switch, but more typically the limit switch will be wired through a control relay, a motor contactor control circuit, or as an input to a programmable logic controller.

Miniature snap-action switches may be used for example as components of such devices as photocopiers, computer printers, convertible tops, or microwave ovens to ensure internal components are in the correct position for operation and to prevent operation when access doors are opened. A set of adjustable limit switches is installed on a garage door opener to shut off the motor when the door has reached the fully raised or fully lowered position. A numerical control machine such as a lathe will have limit switches to identify maximum limits for machine parts or to provide a known reference point for incremental motion. The Limit switch type used is shown in the Fig.2.



Fig.2 Limit switch type used in the setup

B. Buzzer

Title A buzzer or beeper is an audio signaling Device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. Buzzer - A buzzer or beeper is an audio signalling Device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. The Buzzer type used is shown in the Fig.3.



Fig.3 Buzzer type used in the setup

V. DEVELOPMENT

The development of the setup involved various manufacturing processes. All Manufacturing processes are the steps through which raw materials are transformed into a final product. The manufacturing process begins with the creation of the materials from which the design is made. These materials are then modified through manufacturing processes to become the required parts. Manufacturing processes can include treating (such as heat treating or coating), machining, or reshaping the material. The manufacturing process also includes tests and checks for quality assurance during or after the manufacturing, and planning the production process before manufacturing. Various manufacturing processes used for the development of the project are explained below.

A. Sawing

Cold saws are saws that make use of a circular saw blade to cut through various types of metal, including sheet metal. The name of the saw has to do with the action that takes place during the cutting process, which manages to keep both the metal and the blade from becoming too hot. A cold saw is powered by electricity and is usually a stationary type of saw machine rather than a portable type of saw. The circular saw blades used with a cold saw are often constructed of high-speed steel. Steel blades of this type are resistant to wear even under daily usage.

The end result is that it is possible to complete a number of cutting projects before there is a need to replace the blade. High speed steel blades are especially useful when the saws are used for cutting through thicker sections of metal.

B. Welding

Welding is a process for joining similar metals. Welding joins metals by melting and fusing 1, the base metals being joined, and 2, the filler metal applied. Welding employs pinpointed localized heat input. Most welding involves ferrous-based metals such as steel and stainless steel. Weld joints are usually stronger than or as strong as the base metals being joined. Welding is used for making permanent joints. It is used in the manufacture of automobile bodies, aircraft frames, railway wagons, machine frames, structural works, tanks, furniture, boilers, general repair work, and shipbuilding.

C. Drilling

Drilling is a cutting process that uses a drill bit to cut or enlarge a hole of a circular cross-section in solid materials. The drill bit is a rotary cutting tool, often multipoint. The bit is pressed against the workpiece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the workpiece, cutting off chips (swarf) from the hole as it is drilling.

VI. CONCLUSIONS

The work makes its impact in reducing accidents due to brake failure. Most of the accidents can be reduced by using the system effectively. The aforesaid disadvantages can be reduced and it can be controlled in the future extension of the project. Implementation of the project in the automobile is also cheaper which will be affordable for any automobile industry to implement in the vehicles.

The design ensured low-cost automation for the important problem in vehicles and consumes less power. Also, the operating principle is very easy and simple installation make it suitable for all vehicles.

The testing conducted on the developed setup revealed that the expected performance was achieved without any deficiency. The device can be made as compact as it can be fitted in the vehicles.

In conclusion, the automatic brake failure indicating device have fulfilled the requirements and the device performed the intended function.

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