

Automatic Braking System with Pneumatic Bumper by using Proximity Sensors

Nilesh D. Patil¹, Sagar B. Pawar², Suraj N. Warke³, Akshay D. Ughade⁴, Vaibhav G. Jape⁵
^{1,2,3,4}Students, ⁵Asst. Professor

Dept. of Mechanical Engg,

Loknete Gopinathji Munde Institute of Engineering Education & Research, Nashik

Abstract:- Now-a-days vehicle accidents is the major problem. Automatic Braking with Pneumatic Bumper System Using Proximity Sensor is used as novel project for the purpose of prevention of accidents happened in the restricted roadways. The system is based on an intelligent electronically controlled with automatic bumper activation system “Automatic Braking with Pneumatic Bumper System Using Proximity Sensor”, will be assembled on four wheeler vehicle. Generally this system consists of two mechanisms and these are automatic braking system and pneumatic bumper system. Automatic braking system uses the Infrared Sensor (IR) which senses the vehicles which come in front of our system and which may be a cause for accident. Then sensor gives feedback to the engine through relay to stop the working of engine. During the working of Automatic Braking System simultaneously the driver of the vehicle will also try to stop the vehicle by pressing the brake pedal. Limit switch is provided below the brake pedal which is used to activate the pneumatic bumper and disc brake simultaneously to reduce the damage to the vehicle which occurs if both vehicles collapse on each other. This provides pre-crash safety for vehicle. As well as this system improve the response time of vehicle braking to keep safe distance between two vehicles. By using this system we control the speed of vehicle in small distance.

Keywords:- Automatic Braking System, Pneumatic Bumper, Infrared Sensors, Pre-crash Safety, Decrease Response time of braking System, Restricted roadways, Bumper activation system.

I. INTRODUCTION

In cars, the hand brake (also known as the emergency brake, e-brake, or parking brake) is a latching brake usually used to keep the car stationary. Automobile e-brakes usually consist of a cable (usually adjustable for length) directly connected to the brake mechanism on one end and to some type of mechanism that can be actuated by the driver on the other end. The mechanism is often a hand-operated lever (hence the *hand brake* name), on the floor on either side of the driver, or a pull handle located below and near the steering wheel column, or a (foot-operated) pedal located far apart from the other pedals.

Although sometimes known as an emergency brake, using it in any emergency where the footbrake is still operational is likely to badly upset the brake balance of the car and vastly increase the likelihood of loss of control of the vehicle, for example by initiating a rear-wheel skid.

Additionally, the stopping force provided by using the handbrake instead of or in addition to the footbrake is usually small and would not significantly aid in stopping the vehicle, again because it usually operates on the rear wheels; they suffer reduced traction compared to the front wheels while braking. The emergency brake is instead intended for use in case of mechanical failure where the regular footbrake is inoperable or compromised, hopefully with opportunity to apply the brake in a controlled manner to bring the vehicle to a safe, if gentle halt before seeking service assistance. Modern brake systems are typically very reliable and engineered with fail safe (e.g. dual-circuit hydraulics) and failure-warning (e.g. low brake fluid sensor) systems, meaning the handbrake is no longer often called on for its original purpose.

The most common use for an automobile emergency brake is to keep the vehicle motionless when it is parked, thus the alternative name, *parking brake*. Car emergency brakes have a ratchet locking mechanism that will keep them engaged until a release button is pressed. On vehicles with automatic transmissions, this is usually used in concern with a parking pawl in the transmission.

Automotive safety experts recommend the use of both systems to immobilize a parked car, and the use of both systems is required by law in some jurisdictions, yet many individuals use only the "Park" position on the automatic transmission and not the parking brake. It is similar to manual transmission cars: These are recommended always to be left with the handbrake engaged, in concert with their lowest gear (usually either first or reverse). The use of both systems is also required by law in some jurisdictions. However, when parking on level ground, many people either only engage the handbrake (gear lever in neutral), or only select a gear (handbrake released).

A. Problem Statement

In conventional vehicles there are different mechanism operated for braking system like hydraulic, pneumatic, air, mechanical, etc. But all these braking mechanisms receive the signal or input power directly from the driver so it totally manual operated. When the driver see some obstacle or any vehicle in front of his vehicle, he gets irritated or becomes messy. Due to this the driver fails to give the proper input to braking system and proper working does not occurs. Also the driver may not able to pay full attention during night travelling so there are many chances of accidents. After the accident, there is no provision to minimize the damages of vehicle. In currently used vehicles generally bumpers used are of rigid type. These bumpers have specific capacity and when the range of the accidental

force is very high then the bumpers fail and this force is transferred towards the passengers. So this system never reduces the damage of both vehicle and passengers. To overcome these unwanted effects we have to design the Automatic Braking System with Pneumatic Bumpers.

B. Objective

- To increase crashing distance during accident.
- Improve the pre-crash safety.
- Avoid the percentage of passenger injury by using external vehicle safety.
- Decreasing the response time of braking system.

II. CONSTRUCTION AND WORKING

As this system is used at the time of emergency during work in normal travelling of vehicle this system is off and it never impact on the normal working. When any obstacle, humans, animals or vehicle is come in front of the vehicle then the installed infrared sensor senses that obstacle. The range of distance between the vehicle and obstacle is variable. This range is varied according to the density of vehicles or humans on road. The received signal by IR sensor is provided to the control unit. This control unit operates the relay according to the input signal. The relay operated by control unit cut off the electric power supply given to the engine so the working of engine is stop. When the engine stops the working the motion of vehicle suddenly reduces. At the same time of working of IR sensor the driver also applied the brakes so, braking system works by two methods. There are some incidents when the working of automatic braking works and engine running also stop. But due to the moment of inertia on vehicle tries to forward motion of the vehicle. This inertia motion causes accidents. During such incidence the driver also uses manual braking system. In this manual braking system limit switch is also installed below the brake pedal.

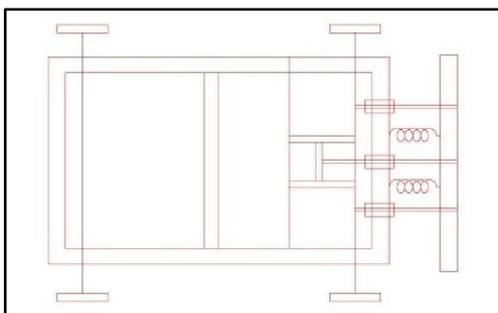


Fig 1:- Automatic Braking System

By receiving the foot force of driver the limit switch activates and provides the signal to the solenoid control valve. Solenoid control valve open sport going towards the bumper system and brake shoes. This pneumatic force used to forward motion of the bumper. By receiving the impact of accidental force bumper try to deflects. The flexible nature of the bumper is able to sustain the force and so the impact of this force on vehicle is reduced. When the

external body is kept safe then there is no chance of inner damage.

III. MATERIALS AND METHODS

Technical specification of materials that we used

A. The Cylinder

The cylinder converts the energy of compressed air into the linear motion. The air enters the cylinder and pushes the piston from one end of the cylinder to the other. There are two main types of cylinders-single acting and double acting. A single acting cylinder has only one air connection while a double acting has two.

In single acting cylinder, the piston is forced out by the pressure of air. When the air supply is removed and air inside the cylinder is allowed to piston moves back, driven by the force of spring.

By restricting the escaping air (exhaust), it is possible to slow down the return movement of the piston. The double acting cylinder has two air connections. When compressed air is supplied to one connector and the end is allowed to exhaust to atmosphere (i.e. the air is allowed to escape freely), the piston is driven to the other end of the cylinder. When air is then applied to second connector and first is allowed to exhaust to the atmosphere, the piston returns back. This type of cylinder gives more power on return stroke than single acting cylinder. Also ensures that piston is effectively locked in the position at both ends of its stroke. Pneumatic cylinders (sometimes known as air cylinders) are mechanical devices which produce force, often in combination with movement, and are powered by compressed gas (typically air).

To perform their function, pneumatic cylinders impart a force by converting the potential energy of compressed gas into kinetic energy. This is achieved by the compressed gas being able to expand, without external energy input, which itself occurs due to the pressure gradient established by the compressed gas being at a greater pressure than the atmospheric pressure. This air expansion forces a piston to move in the desired direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved.

Once actuated, compressed air enters into the tube at one end of the piston and, hence, imparts force on the piston. Consequently, the piston becomes displaced (moved) by the compressed air expanding in an attempt to reach atmospheric pressure.

Pneumatic systems are often found in settings where even rare and brief system failure is unacceptable. In such situations locks can sometimes serve as a safety mechanism in case of loss of air supply (or its pressure falling) and, thus, remedy or abate any damage arising in such a situation. Due to the leakage of air from input or output reduces the pressure and so the desired output.

B. Limit switch

A mechanical limit switch interlocks a mechanical motion or position with an electrical circuit. A good starting point for limit-switch selection is contact arrangement. The most common limit switch is the single-pole contact block with one NO and one NC set of contacts; however, limit switches are available with up to four poles.

Here we required to send an electrical pulse to electronic relay circuit. So we used a simple normally closed limit switch. This sends electric current when driver stands from his seat. When driver on his seat, his weight presses down the limit switch and then it is in open mode. We have to send a 12 volt dc voltage through the circuit. So we select KW-8 series limit switch, which can pass 0 to 25 volt dc.

C. Solenoid valve

Solenoid valve is used in automatic brake system to control the compressed air towards the brake chamber during the brake needed and release the compressed air when driver release the parking brake. Different types of solenoid valves are available in the market. But most common is $\frac{1}{2}$ solenoid valve and $\frac{2}{5}$ solenoid valve. $\frac{1}{2}$ indicates one way operation and two ports and $\frac{2}{5}$ indicates two way operation and five ports.

D. Basic frame

This project, automatic brake system, is a demonstration model. We used a simple AC motor with belt drive to rotate the wheel disc. Basic frame is formed by mild steel angle and the complete unit is fitted on the frame. Seat is made of sheet metal of gauge 18. A spring is fitted below the seat to prevent the action of limit switch due to seat's weight

Ac motor used is 230 volt, 50Hz, single phase, $\frac{1}{2}$ Hp of electrical motors. V-belts and pulleys are used to rotate the brake drum with a reduction of 1:4.

E. Emergency switch

Emergency switch is a simple electrical switch. Common type one way switch is used in this project. This switch can provide the same action of limit switch, when driver needs brake in emergency.

F. Electronic relay circuit

Electronic relay circuits are electromechanical switching devices. They have two outputs. The two outputs are connected to two solenoid valves. The electronic relay provides electric current to a solenoid valve at a time.

G. 3.7 Spring

A spring is an elastic body which deflects under load and recover to its original shape upon release of the load. It is also resilient member which stores energy once deflected and release the same as it recover to its original shape.

IV. RESULTS

We got that by giving 4 to 8 bar pressure of compressor and speed 2m/sto our work model, we found that if any obstacle comes in front of the vehicle automatic

bumper will move forward with help of pneumatic system and will increase the crashing distance between the two vehicles.

The model which we have created will stop the vehicle by applying brake for the distance of 0.15m in 1sec.

V. CONCLUSIONS

Automatic brake system is an additional safety to heavy vehicles. It is easy to make such a system in heavy air brake vehicles. An emergency switch is provided for emergency uses. This switch avoids the driver to stand from his seat. The project carried out by us made an impressing task in the field of automobile manufacturing industries. It is very useful for the workers work in the lathe and small scale industries. Project has been designed to perform the entire requirement task at the shortest time available. The aim of our project is to improve the prevention technique of accidents and also reducing the hazard from accidents like damage of vehicle, injury of humans, etc.

VI. FUTURE SCOPE

Our future work deals with incorporating this system with various different features to provide enhanced protection by the automatic braking system in real time application:

- Infrared sensor can be replaced by hydraulic bumper.
- Regular bumper can be replaced by hydraulic bumper.
- Infrared sensor can sense eye blinking and give signal to solenoid valve when driver sleep.
- Bumper design can further be enhanced to act as external air bags.

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