

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

Design and Fabrication of Pneumatic Bumper Protection by Automatic Brake Actuation System

N.Dileepan,¹ R.Rathish² P.Velmurugan³ V.DhinesKumar⁴ P.Elayaraja⁵ S.Sathish⁶

¹ Lecturer, Department of Mechanical Engineering, Gnanamani College of Technology, Namakkal, India

¹ Assistant Professor, Department of Mechanical Engineering, Gnanamani College of Technology, Namakkal, India

^{3,4,5,6} UG Scholars, Department of Mechanical Engineering, Gnanamani College of Technology, Namakkal, India

ABSTRACT: In a modern world, the technologies are developed in the field of automation that integrates heavy growth of vehicles for public transport. According to Indian road transport situation the Accident are major problem to the Vehicles that considered for Modern braking system in recent years. This project aims to design and develops the technology of break activation system which is electronically controlled and automatically operating the bumper protection mechanism by Pneumatic Power. Our project consists due to the reliable of Pneumatic system and this is used to activate the Bumper when the IR sensor indicates the Presence of Obstacles / Human / Any Vehicles in specified range of distance. Simultaneously the control unit transmits the Signals to apply the brake by Activation of the Solenoid Valve.

KEYWORDS: Pneumatic Bumper Protection, Braking System, Solenoid valve, IR Sensor.

I.INTRODUCTION

In our country, now a day, accidents are becoming proportional to the speed of the Vehicle. The number of peoples which are dead during the vehicle accidents is also very large as Compared to the other causes of death. Though there are different causes for these accidents but proper technology of braking system and technology to reduce the damage during accident are mainly affecting on the accident rates. So today implementation of proper braking system to prevent the accidents and pneumatic bumper system to reduce the damage is must for vehicles. To achieve this system modification goal, we design this Automatic Braking with Pneumatic Bumper system [Shinde abhijeet 2016].In conventional vehicles there is 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. Due to the driver fails to give the proper input to braking system and proper working is not occurs. Also the driver may not able to pay the full attention during night travelling so there are many chances to accidents. In currently used vehicles generally bumpers used are of rigid types. These bumpers have specific capacity and when the range of the accidental force is very high then the bumpers are fails and these force transferred towards the passengers. So this system never reduces the damage of both vehicle and passengers[Patil Pratik 2016]. Automatic braking is one among such system to avoid the severity of accidents and that technology for automobiles to sense an imminent collision with another vehicle, person or obstacle; or a danger such as a high speed approach to a stop sign and to respond with the braking system.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

II. COMPONENTS AND DESCRIPTION

2.1 Pneumatic system

Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When the pneumatic system is being adopted for the first time, it should necessary to deal with the question of compressed air supply. The key part of any facility for supply of compressed air is by means of using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivered the air at a high pressure. The pneumatic systems consist of the following components,

1.Pneumatic single acting cylinder, 2.Solenoid valve, 3.Flow control valve, 4.IR sensor, 5.unit Wheel and brake arrangement, 6.PU connector, 7.Reducer, 8.Hose, 9.collar, 10.Stand, 11.Single phase induction motor.

2.1.1. Specifications

A. Pneumatic Cylinder:

Stroke length: Cylinder stoker length 140 mm = 0.14 m

Pressure Range: 6-8 bar.

Rod Diameter: 15mm

Seals: Nitride (Buna-N) Elastomeric

End covers: Cast iron,

Temperature Range: 0-85 ° C,

B.Solenooid Valve:

A solenoid is an electrical device that converts electrical energy into straight line motion and force. These are also used to operate a mechanical operation which in turn operates the valve mechanism.

Size: 1/4"

Pressure: 0 to 7kgf/cm²

Applied Voltage: 230V A.C

Frequency: 50Hz

2.2 Braking System and Bumper

Brakes are attached to the rear end of the vehicle. They are driven by pneumatic cylinder which operates on flow of compressed air. Assuming the weight of the whole setup not to exceed 30kgs, the bumpers that are installed are of extendable type. They have a stroke length of 140mm. Bumper is aimed for protecting the vehicle. On actuation of solenoid valves compressed air flows through the piston of pneumatic cylinder. The piston rod of the cylinder is welded to the midsection of the bumper.

2.3 IR Sensor Unit

At Normal Condition:

The IR transmitter sensor is transmitting the infrared rays with the help of 555 IC timer circuit. These infrared rays are received by the IR receiver sensor. The Transistors are used as an amplifier section. At normal condition transistor is OFF condition. At that time relay is OFF, so that the vehicle running continuously.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

At obstacle condition:

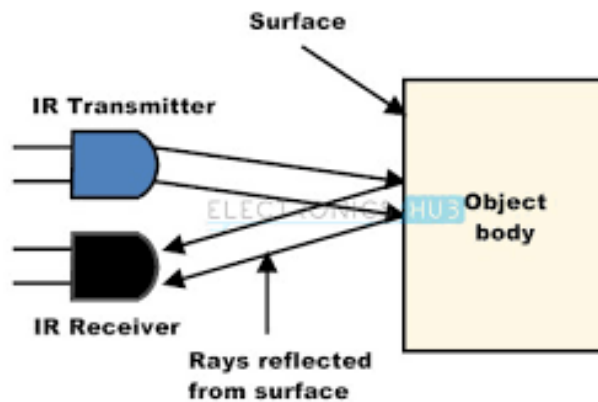


Fig 2.1 obstacle condition

At Obstacle conditions the IR transmitter and IR receiver, the resistance across the transmitter and receiver is high due to the non-conductivity of the IR waves. So the output of transistor goes from OFF condition to ON stage. In that time the relay is ON position. In that time, the solenoid valve is on so that the vehicle stops.

III. EXPERIMENTAL SETUP

The IR Transmitter circuit is to transmit the Infra-Red rays. If any obstacle is there in a path, the Infra-Red rays reflected. This reflected Infra-Red rays are received by the receiver circuit is called "IR RECEIVER". The IR receiver circuit receives the reflected IR rays and giving the control signal to the control circuit..



Fig 3.1 Experimental Setup

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

The control circuit is used to activate the solenoid valve. If the solenoid valve is activated, the compressed air activates the pneumatic cylinder and moves the piston rod forward. Thus the bumper is actuated. When the solenoid valve gets actuated the compressed air also goes to the small single acting pneumatic cylinder and actuates it. The control unit activates the pneumatic braking system, so the brake is applied.

3.1 DESIGN CALCULATION

i) Design of Piston Rod:

Dia of the Piston = 15mm

$$\begin{aligned} \text{Area of the Cylinder} &= \pi d^2 / 4 \\ &= (\pi * 0.015 * 0.015) / 4 \\ &= 0.0001767 \text{m}^2 \end{aligned}$$

Force acting on the rod(P)

$$\begin{aligned} &= p \times \text{Area} \\ &= 600000 \text{ N/m}^2 \times 0.0001767 \\ &= 106.02 \text{N} \end{aligned}$$

ii) Length of Piston Rod:

$$\begin{aligned} \text{Approach stroke} &= 140 \text{mm} \\ \text{Length of Threads} &= 2 \times 20 = 40 \text{mm} \\ \text{Extra length due to front cover} &= 12 \text{mm} \\ \text{Extra length of accumulated head} &= 20 \text{mm} \\ \text{Total length of the piston rod} &= 140 + 40 + 12 + 20 \text{mm} \\ &= 212 \text{mm} \end{aligned}$$

iii) Stopping Distance Calculation:

The braking distance (which is commonly measured as the skid length) given an initial driving speed v is then found by putting $W = E$, from which it follows that

The total stopping distance of a vehicle is made up by following.

$$\text{Braking distance, } D_b = \frac{v^2}{2\mu g} \text{ m}$$

Where,

v = Velocity before applying brakes (App 20km/hr = 5.55m/s)

μ = coefficient of friction = 0.7 (for dry surfaces)

g = acceleration due to gravity (9.81m/sec²)

$$\text{Braking distance, } D_b = \frac{5.55 * 5.55}{2 * 0.7 * 9.81} = 2.24 \text{ m}$$

The total stopping distance is the sum of the perception-reaction distance and the braking distance.^[8]

$$D_{\text{total}} = D_{p-r} + D_b = v t_{p-r} + \frac{v^2}{2\mu g}$$

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

A common baseline value $t_{p-r} = 1.5$ second, $\mu = 0.7$ is used in stopping distance charts. These values incorporate the ability of the vast majority of drivers under normal road conditions. However, a keen and alert driver may have perception-reaction times well below 1 second^[9] and a modern car with computerized anti-skid brakes may have a friction coefficient of 0.9--or even far exceed 1.0 with sticky tires.

$$= 5.55 \times 1 + 2.24 = 7.79\text{m}$$

Then, The total braking distance = Total stopping distance + Bumper actuation length

$$= 7.79 + 0.212 = 8.002 \sim 8\text{m}$$

Hence the sensor sensing range is set at 8m

IV) Impact Force Calculation

Force, $F = \text{mass (m)} \times \text{acceleration (a)}$

Mass of the vehicle $m = 25\text{kg}$

By motion Equation, $2as = v^2 - u^2$

Where, $v = \text{Final velocity} = 5.55\text{m/s}$

$a = \text{acceleration}$, $s = \text{braking distance (D}_b = 2.24\text{m)}$

$u = \text{Initial velocity} = 0$

$$2 \times a \times 2.24 = 0^2 - 5.55^2 = -6.87\text{m/sec}^2$$

Force, $F = m \times a = 25 \times (-6.87) = -171.75\text{N}$

The Final impacting force value $F = 171.75\text{N}$

IV. CONCLUSION

Our main aim behind the designing of this system is reached successfully which is having some limitations. We observed that our system can able to achieve all the objectives which we have determined. The system can be disconnected with a switch thus the driving is comfortable in traffic situation. In future this project can be modified by using the retarded braking system.

REFERENCES

- [1]. Balashanmugam.P, Balasubramaniam.K "Fabrication of high speed indication and automatic pneumatic braking system." International Journal of Engineering Trends and Technology 5 (2013): 40-46.
- [2]. Jordan Lewis, Karthik B.M. "Fabrication of an Automated Collision Avoidance System Using Ultrasonic Sensor." Journal of Mechanical Engineering and Automation 06, no. 5A (2016): 97-101.
- [3]. Rohit P Jain, Dr.V.Singh. "Automatic Hydraulic Bumper and Speed Limiting System." IJSRD-International Journal for Scientific Research & Development 03, no. 06 (2015): 357-361.
- [4]. Sammed M Kesti, Dhananjaykumar J upadhaye. "Design and Fabrication of automatic pneumatic bumper and braking system for four wheeler." A National Level Conference and technical Fest, 2016: 1-8.
- [5]. Shinde Abhijeet, Panase Prathmesh. "Automatic Pneumatic Braking System." IJSRD- -International Journal for Scientific Research & Development 04, no. 01 (2016): 806-809.
- [6]. Srinivasa Chari.V, Dr.Venkatesh.P.R. "Automatic Pneumatic Bumper and Brake Actuation Before Collision." IRJET-International Research Journal of Engineering and Technology 02, no. 04 (2015): 1015-1023.
- [7]. Patil Pratik, Pitale Chetan. "Study of Pneumatic Braking system with Pneumatic Bumper Protection." International Conference on Emerging Trends in Engineering and Management Research, 2016: 305-312.
- [8]. Taoka, George T. (March 1989). "Brake Reaction Times of Unalerted Drivers" ITE Journal. 59 (3): 19-21.
- [9]. Robert J. Kosinski (September 2012). "A Literature Review on Reaction Time". Clemson University. Archived from the original on 2013-1010.