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PNEUMATIC BUMPER WITH BRAKING SYSTEM

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Abstract -*Now a days to ensure the safety of a driver and passengers of a vehicle we have required new systems to be added to a vehicles. Hear in this project we add a system that works on pneumatics to increase a passenger safety. Hear in this system we use ultra-sonic distance sensor, pneumatic cylinder, arduino board, solenoid valve to operate this system. Also pneumatic braking system is used in this project to control the speed of vehicle.*

Key Words:Pneumatic System, Pneumatic bumpers, IR Transmitter, Automatic braking, Vehicle safety.

1.INTRODUCTION

We hear to introducing our project "PNEUMATIC BUMPER WITH BRAKING SYSTEM" Which is contains by Ultra-sonic sensors, Controlling Unit and pneumatic cylinder with bumper and braking system. The technology of pneumatics plays a major role in the field of automation and modern machine. The aim is to design and develop a control system based on intelligent electronically controlled automotive bumper activation system is called "Pneumatic Bumper for Four Wheeler Using Two Cylinder. The Ultra-sonic sensor senses the distance from an obstacles. If there is any obstacle nearby to the vehicle then control signal is given to the arduino board. Than arduino board controls a bumper moment and braking system of vehicle.

2. OBJECTIVES

Automatic Braking System with Pneumatic Bumpers which is following:-

a) To minimize the passenger and vehicle damage.
b) To increase response time of braking system.
c) To improve pre-crash safety.

3.1 Components

a) Pneumatic cylinder
b) Ultra-sonic sensor
c) Brakes
d) ARDUINO Board
e) Pneumatic hose pipe
f) Bearings
g) Solenoid valve

3.2 Component description

a) Ultrasonic sensor: - It is a sensor major a distance between any object to sensor position by emitting and receiving sound waves. This sensor has to part one is transducers and microphone. Ultrasonic sound is transmit through a transducer and receive by microphone.

b) ARDUINO Board:-It is use to control a whole system operation. It detect the obstacle and send signal to solenoid vale to control the operation of bumper and braking system. For proper working of a system we have to feed arduino board with correct computer program.

c) Pneumatic cylinder: - hear we use Double acting cylinder, which means that the air pressure operates forward and backward strokes of a cylinder. For a working of the cylinder compressed air is used. Than air from the compressor is passed through the solenoid valve which regulates the pressure to required amount by controlling its opening of valves. A pressure gauge is attached to the air compressor for showing the pressure inside the compressor.

d) SOLENOID VALVE: -A SOLENOID VALVE is used to control the air flow in the system. When the signal came from the arduino board than valve open its way by using electromechanically operation. They also controls air pressure inside a system. Hear by using solenoid valve we control the moment of bumper and braking system operation.

4. Working

When an obstacles is detect at rang of 30 to 60 cm in front of vehicle, ultra-sonic sensor sense that distance give signal to ARDUINO controller. Than ARDUINO control opening and closing of solenoid. Than solenoid valve direct air to bumper and operate braking mechanism.

Bumper get expanded and absorb an impact shock and at the seam time brakes are get applied.

5. Block Diagram

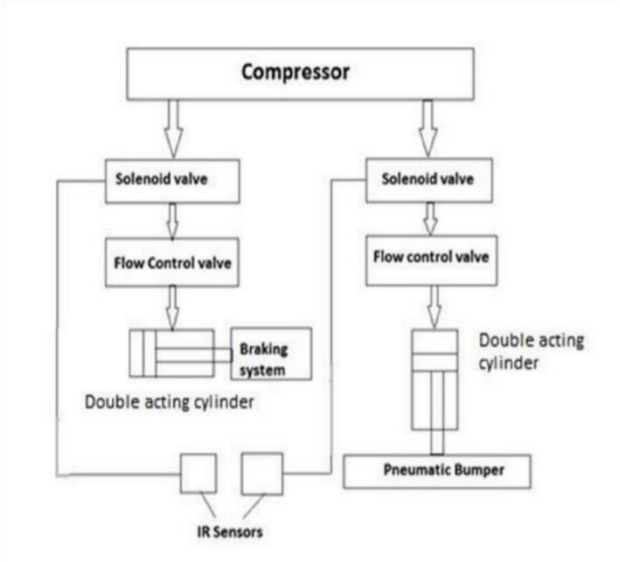

Fig -1: Block Diagram

5. 3D Model of project

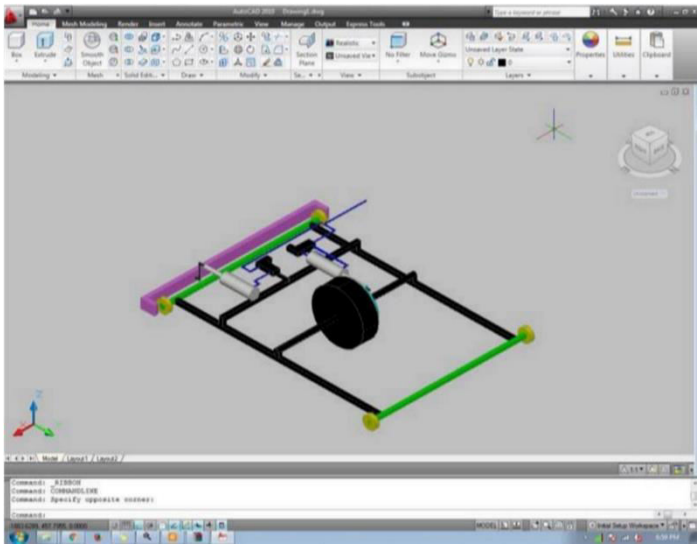

Fig -2: 3D model

6. CALCULATION

Radius of drum R = 55 mm

Face Width b = 30 mm

Brake drum =110mm

h = R-(b/2)

=55- (30/2)

= 40 mm

Length between pivot and spring = L = 90 mm

μ = 0.4

Pmax = 0.3

ɵ1 =0

ɵ2 =90

= 90* (π/180)

= 1.57079 rad

θmax = 90

For leading shoe :-

MNL

$$= \frac{Pmax{*}{*}b{*}R{*}h}{4\sin\theta max}{*}\{2(\theta 2-\theta 1)\text{-}(\sin 2\theta 2-sin\theta 1)\}$$

$$= \frac{0.3{*}30{*}55{*}40}{4\sin 90}{*}\{2(1.57079-0)\text{-}(\sin 180-sin0)\}$$

= 4950*(3.14158-0)

=15550.821 N-mm

MFL

$$= \frac{\mu{*}Pmax{*}b{*}R}{4\sin\theta max}\{4R(\cos\theta 1-\cos\theta 2)\text{-}h(\cos 2\theta 1-\cos 2\theta 2)\}$$

$$= \frac{0.4{*}.3{*}30{*}55}{4\sin 90}\{4*55(\cos 0-\cos 90)-40(\cos 0-\cos 180)\}$$

= 49.5*(180*1-70)

= 6930 N-mm

Actuating Force,

F*L = MNL - MFL

$$F = \frac{15550.821-6930}{90}$$

F= 93.7859 N

Braking Torque

$$T = \frac{\mu * Pmax * R^2 * b * (cos\Theta 1 - cos\Theta 2)}{sin\theta max}$$

$$T = \frac{0.4 * 0.3 * 55 * 30 * (cos0 - cos90)}{sin90}$$

= 10890 N-mm

T=10.89 N-m

For trailing shoe

MNT

$$= \frac{Pmax{*}{*}b{*}R{*}h}{4\sin\theta max}{*}\{2(\theta 2-\theta 1)\text{-}(\sin 2\theta 2-sin\theta 1)\}$$

$$= \frac{Pmax{*}30{*}55{*}40}{4\sin 90}{*}\{2(1.57079-0)\text{-}(\sin 180-sin0)\}$$

=Pmax*16500*(3.15158-0)

=Pmax*51836.07 N-mm

$$MFT = \frac{\mu * Pmax * b * R}{4 \sin \theta max} \{4R (\cos \theta 1 - \cos \theta 2) - h (\cos 2\theta 1 - \cos 2\theta 2)\}$$

$$= \frac{0\ 4 * Pmax * 30 * 55}{4 \sin 90} \{4 * 45 (\cos 0 - \cos 90) - 35 (\cos 0 - \cos 180)\}$$

=Pmax*165*140

=23100*Pmax

Actuating Force,

F*L = MNT + MFT

$$F = 95.7869 = \frac{51836.07 * Pmax + 23100 * Pmax}{90}$$

P max = 0.115 N/mm2

Braking Torque

$$= \frac{\mu * Pmax * R^2 * b * (\cos \theta 1 - \cos \theta 2)}{\sin \theta max}$$

$$= \frac{0.4 * 0.115 * 55^2 * 30 * (\cos 0 - \cos 90)}{\sin 90}$$

= 4174 .56 N-mm

TbT=4.1745 N-m

Total Braking torque Capacity,

Tb = TbL + TbT

= 10.89+4.1745

= 15.0645 N-m

Single acting pneumatic cylinder

Given date:

Cylinder: 20 * 50

Volume of air exhaust =stroke * area of piston

=100 * π/4 * 20^2

=31415.92 m^3

Area of piston = π/4 * 20^2314.15 mm^2

Outstroke force (F) = pressure * Area of cylinder

=0.4 * 314.15

=125.66 N

Piston rod area A1 = π/4 * d^2

= π/4 * 7^2

=38.48mm^2

Effective area= piston area - piston rod area

= 314.15 3838.48

= 275.66 mm^2

In stroke force= P * A

=0.4 * 275.66

= 110.26 N

7. ADVANTAGES

a) Simple in operation
b) Minimize a passenger injuries
c) Less power consumption

8. LIMITATION

a) Additional coast is require to fit system.
b) In city system is not full proof for its working.

9. CONCLUSIONS

Behind the designing of this system, our main aim is to improve safety of passenger's and minimize a damage of a vehicle. We observed that our work is able to achieve all the objectives which are necessary. Air bags are helpful to provide internal safety to people sitting in vehicle, whereas in our project we will be giving internal plus external safety to car from damage and by this project we conclude that besides of rigid bumper moving bumper is more reliable for vehicle.

10. REFERENCES

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