

Automatic Pneumatic Bumper and Smart Braking System

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Abstract – The Pneumatic technology plays a vital and major role in the area of automation and modern shops of machine, space robot, etc. This develops an aim to develop or design a fully controllable system depends upon electronically intelligent activation of bumper system and is termed as AUTOMATIC PNEUMATIC BUMPER AND SMART BRAKING SYSTEM BEFORE THE COLLISION. Our project contains Ultrasonic sensor containing both transmitter and receiver terminals, pneumatic bumper, control unit and automatic braking system. The ultrasonic sensor sense the obstacle from a distance of nearly 15 cms and gives command to the automation part of bumper and braking system.

Keywords – Automatic pneumatic bumper Ultrasonic Transmitter Receiver, Compressor, Flow control valve, Mechanical structure, Arduino.

I. OBJECTIVE

1. To decreases the rate of car accident.
2. To increases the response of breaking system.
3. To increases the sureness of people who fear from accident.
4. We are trying to protect car damage from road accident.

II. INTRODUCTION

We have pleasure in introducing our new project. AUTOMATIC PNEUMATIC BUMPER which is fully equipped by IR sensor circuit and pneumatic bumper activation circuit. Vehicles accident is most common. The system include sensor arrangement for sensing an object in front of the vehicle that generates an object recognition single unit it sense an object within the range the bumper opens and protect the car from damage. The sensor arrangement include passive IR sensor or reflected pulse sensor such as radar sensor on the front a control generates an accident prevention response signal and receiving an object recognition signal from the sensor.

III. LITERATURE REVIEW

The crowd on the highways day by day increasing due to the population growth . Which causes accident chances may more so to avoid this problem comes an idea about this project which we have developed and the name is “ AUTOMATIC PNEUMATIC BUMPER AND SMART BRAKING SYSTEM BEFORE COLLISION “ smart braking system have been well known in automobile

industry. This braking system is combination of different unit that play major role in applied brakes.

reflection on all the principles, components, sensors, actuators, regulation, etc., can lead to important improvements in these fields, as in others.

IV. PROBLEM FORMULATION

There are various mechanism operated for braking the system like ABS, pneumatic breaking, hydraulic breaking etc. but all this mechanism which given above its totally manually operated. Whenever the obstacle come in front of vehicle the man press the brake pedal by which the car stop that is all breaking mechanism receive input from the driver so it called manual operated. But man is fail to give power input because whenever the obstacle come in front of vehicle the man is unable to stop the car.

He becomes mazy and he unable to judgment therefore the breaking mechanism is unable to work properly and the car driver is unable to decreases the car damage. Now we use the pneumatic bumper. The pneumatic bumper having a specific capacity when the force of accident is very high that time bumper is unable to protect the car damage.

V. COMPONENTS

Single Acting Pneumatic Cylinder Flow control valve
DC Motor 12volt 100rpm Mechanical Model Wheels
Ultrasonic Sensor Connecting Wires Arduino
Microcontroller Single Acting Pneumatic Cylinder:
Pneumatic cylinder(s) (sometimes known as air cylinders)

are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion. Like hydraulic cylinders, something forces a piston to move in the desired direction.

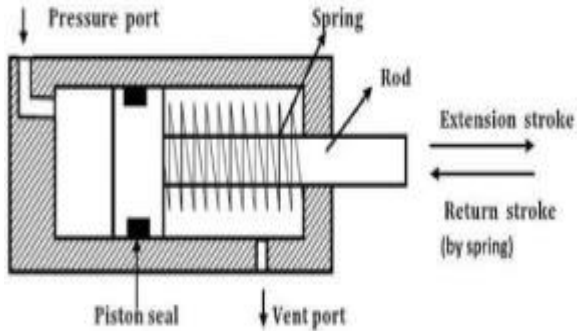


Fig.1. Single Acting Pneumatic Cylinder.

1. Flow Control Valve:

Control valves are normally fitted with actuators and positioners. Pneumatically-actuated globe valves and diaphragm valves are widely used for control purposes in many industries, although quarter-turn types such as (modified) ball and butterfly valves are also used.



Fig.2.Flow Control Valve DC Motor 12volt 100rpm:

DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances.



Fig.3. DC geared motor 12V,100rpm

Ultrasonic Sensor: It is a type of acoustic sensor divided into three broad categories:

transmitters, receivers and transceivers. Transmitters convert electrical signals into ultrasound, the receivers convert ultrasound into electrical signals, and transceivers can both transmit and receive ultrasound wave.



Fig.4. Ultrasonic Sensor.

2. Arduino Microcontroller:

Arduino Microcontroller:

Board designs use a variety of microprocessors and controllers. So this boards are equipped with sets of digital and



Fig.5. Arduino Microcontroller.

3. Design and Calculations:

Frame design

Material used- mild steel, square pipe
Area=1*1inch=25.4*25.4=645.6mm² Length of link=30 inch=762 mm

Weight of project=3.5 kg= 15*9.81 =34.335 N

Solution

Effective length

Effective length, when both end fixed, $L_e = L/2 = 51/2 = 25.5$ mm
Internal Area Internal width and depth, which have 3 mm thickness,
 $d = b = 51 - 2 * 3 = 45$ mm $45 * 45 = 2025$ mm² Moment of inertia
 $I = (BD^3 - bd^3) / 12$ $I = (51 * 51^3 - 45 * 45^3) / 12$ $I = 2664576$ mm⁴

To find the maximum load capacity of the material (Ultimate load) $P_c = (\pi^2 * EI / L_e^2)$ $P_c = 326.711$ KN

Pneumatic cylinder

For Bumper, Assumption:-

Maximum force acting on bumper = 100 N

Factor of Safety = 1.25 Pressure = 4bar

Total force acting on bumper = $100 * 1.25 = 125$ N For outstroke

$F = P * A$

$125 = 0.4 * A$

$A = 312.5$ mm²

We know that

$A = (\pi * D^2) / 4$

Consider standard diameter is equal to 20mm Instroke force = Outstroke force Effective area = $\pi E / 4(D^2 - d^2)$

Where d = Piston rod area

$F = P * A$

$125 = (0.4 * \pi / 4)(D^2 - d^2)$

$d = 1.47$ mm

Select standard diameter = 7mm

To increase the crashing distance in case of accident, we increase the stroke length of cylinder to extend the bumper. So Stroke length is equal to 100 mm.

Outstroke force (F_o) = Pressure * Area of cylinder

$r = 0.4 * 312.5$

= 125N

Instroke force (F_i) = $P * A$

= $0.4 * 275.66$

= 110.26N

Stopping distance calculation

Breaking distance = $v^2 / 2 * \mu * g$

μ = coefficient of dry friction

= 0.7

Consider model velocity = 2 m/s

$D_{\text{breaking}} = v^2 / 2 * \mu * g$

= $22 / (2 * 0.7 * 9.81)$

= 0.29m

Vehicle stopping distance after applying the brake = 290mm

Total stopping distance

= Breaking distance + Bumper stroke

= 290 + 100 = 390 mm

Total stopping distance = 390 mm Impact force calculation Consider Velocity of our model = 2m/s

By equation of motion $2as = v^2 - u^2$ Where

s = Breaking distance, v = Final velocity,

u = Initial velocity, $2 * a * 0.39 = 0^2 - 2^2$ $A = \pm 5.128$ m/s²

We know that

Force = mass * acceleration

= $15 * 5.128$

Impact force = 76.92 N

VI. BLOCK DIAGRAM

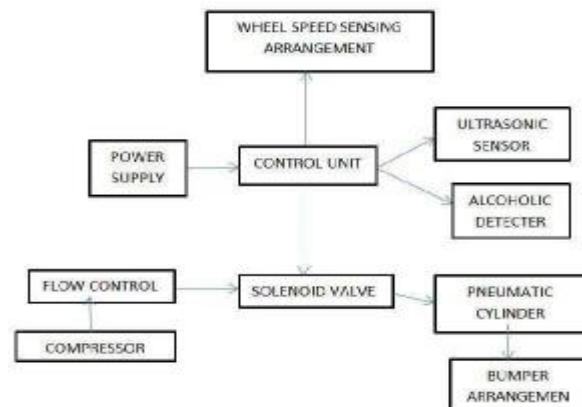


Fig.6. Block diagram.

VII. WORKING

and this wave is received by the ultrasonic receiver after the reflection this receiving signal is gives to the control units (microcontroller, basically this control unit has code to activate the braking system on the basis of receiving information) the n control unit applied the brake with the help of braking system . And for the safety of vehicle engine here we provide the pneumatic bumper which moves in forward direction as a bumper to protect the engine by front view.

Solenoid Valve which will allow the flow of compressed air through it. Compressed air is provided as an Input to the Solenoid Valve which has two Outputs both connected to the Double Acting Pneumatic Cylinder. This pneumatic force of the compressed air through the Solenoid Valve is transferred to the Bumper System. The pneumatic force provides forward motion to the Bumper and it also retracts the bumper slowly reducing the impact. Hence, when the external body is kept safe, there will be no chance of internal damage.

VIII. FLOW CHART

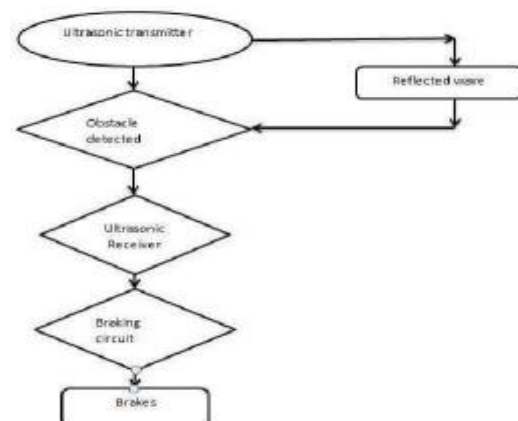


Fig.7. Flow Chart.

VIII. CONCLUSION

Behind the designing of this system, our main aim is to improve the technique of prevention of accidents and also reducing the hazard from accidents like damage of vehicles, injury to humans etc. This project work has provided us an excellent opportunity and experience, to use our limited knowledge.

REFERENCES

- [1] "Automobile Engineering" William H. Crowse.
- [2] "Automobile Engineering", G.B.S. Narang, Khanna Publishers, Delhi.
- [3]<https://www.irjet.net/archives/V5/i8/IRJET-V5I8183.pdf>
- [4] "Automobile Engineering", G.B.S. Narang, Khanna Publishers, Delhi.
- [5]. Takahiro Wada, "A Deceleration control method of automobile for collision avoidance based on driver perceptual risk" IEEE
- [6]. Lee, "A Theory of Visual Control of international Conference on Smart Robots and Systems, Oct 4881-4886
- Braking Based on Information about Time to Collision" Perception Vol 5 PP437-459
- [7]. J. T. WANG, "AN EXTENDABLE AND RETRACTABLE BUMPER"
- [8]. JADHAV N. D., GULMIRE S.M., GHUTUKADE R.S., GAIKWAD A.S., BRAKING WITH PNEUMATIC BUMPER SYSTEM" 2015, IJSART VOLUME 1 ISSUE 5,PP
- "AUTOMATIC BRAKING WITH SYSTEM", 2015,
- [9]. KATORE S.R., KADLAG S.C., MANE P.V., PAWAR G.V., PROF.LONDHE B.C., PROF.FEGADE S.G. "AUTOMATIC PNEUMATIC BUMPER INTERNATIONAL JOURNAL OF ENGINEERING, EDUCATION AND TECHNOLOGY (IJEET), VOLUME 3, ISSUE 2
- Lind, Magdalena Lindman, "COLLISION LIFE SAFETY PERSPECTIVE", Volvo Car
- [10]. Erik Coelingh, Lotta Jakobsson, Henrik WARNING WITH AUTO BRAKE - A REAL-Corporation