

Automatic Pneumatic Bumper with Intelligent Braking System.

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Abstract: The technology of pneumatics plays a major role in the field of automation and modern machine shops and space robots. The aim is to design and develop a control system based intelligent electronically controlled automotive bumper activation and automatic braking system which is called as AUTOMATIC PNEUMATIC BUMPER AND BRAKING SYSTEM FOR FOUR-WHEELER. This project consists of Ultra-sonic transmitter and receiver circuit, Control Unit, Pneumatic bumper system and braking system. The Ultra-sonic sensor senses the obstacle. If there is any obstacle closer to the vehicle (within specified distance), the control signal is given to the bumper activation system and also braking system simultaneously. The pneumatic bumper and braking system is used to protect the man and vehicle.

keywords - Ultrasonic sensors, Pneumatic bumper, Automatic braking system.

I. INTRODUCTION

Automobile vehicles have become integral part of our lives. With growing number of vehicles on road, the numbers of traffic accidents are also increasing. It is important to prevent the chances of accidents and to protect the passengers when accidents occur. Air bags provide safety, but they are costly. Safety, being a matter of prime importance, cannot be compromised for cost. Hence our attempt is to provide a reliable and safe system at low cost.

Though there are different causes for these accidents but proper technology of braking system and technology to reduce the damage (such as pneumatic bumper with intelligent braking system) during accident can be effective on the accident rates. So, in today's world, implementation of proper (automatic) braking system to prevent the accidents is a must for vehicles. Therefore, pre-crashing system is demanded. Such a system will prevent accidents on roads with poor visibility by using ultrasonic sensors to detect other vehicles, or any other obstacle in the path.

II. OBJECTIVES

Intelligent Braking System approach represents considerable shift from the traditional approach to safety, by considering safety in terms of firstly, avoiding the possibility of accidents, and secondly, protecting occupants when a crash is unavoidable, we can prevent more accidents, save more lives, decrease material damage to vehicles and reduce medical costs to society. Following are the main objectives of Automatic Braking System with Pneumatic Bumpers:

- To ensure the braking of vehicle in time.
- To increase the crashing distance during accident.
- To increase the safety during pre-crash.
- To increase external safety to vehicle body.
- To decrease the level of passenger injury by use of external vehicle safety device.
- To reduce the requirement of internal safety devices like air bags

III. CURRENT TRENDS

In conventional vehicles there are different mechanism operated for braking system like use of hydraulic, pneumatic, or mechanical system. But all these braking mechanisms receive the input signal directly from the driver by application of force on brake pedal. Thus, braking of vehicles is totally manual operated. So, if the driver fails to see the obstacle in front of his driving vehicle or fails to apply proper braking force on the brake pedal, he may lose the control of his vehicle, leading to accident. Also, the driver may not able to pay complete attention when driving at night. So, there are many chances of accidents. Urgent application of brakes can result in damage of the vehicles due to skidding of tyres. Also due to sudden application of brakes there are chances of other vehicles dashing from back. Hence, there is no provision to minimize the damage of vehicles. Thus, the current designed system only fairly reduces the damage of vehicle and/or passengers.

A. Comparison of Air Bags with Pneumatic Bumper System

1. Air bags provide safety in case of severe accidents only, whereas, the pneumatic bumper can provide safety even in case of minor accidents.
2. Air bags can provide only internal safety, but pneumatic bumper system provides safety to external body of cars as well as internal safety.

3. Air bags can be deployed only once, whereas pneumatic bumper can be used many times. Even if the bumper is damaged, it can be replaced easily.
4. The cost of air bags is higher than pneumatic bumper system.

Hence, our project can meet the required objectives satisfactorily.

IV. CAD MODEL OF PROTOTYPE

The cad model of the prototype was created using CATIA V5R20 software. The cad model is used only for visualization of the system design, and hence, dimensions are not the same as used in the actual prototype. The screenshot of created cad model is shown below.

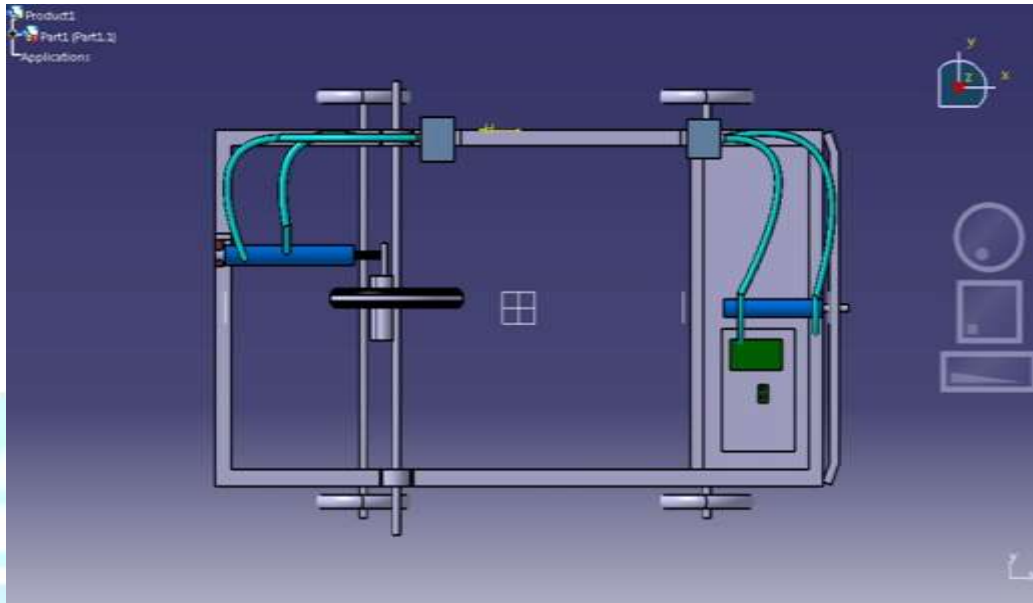


Fig.1 Cad Model of Prototype.

V. ACTUAL PROTOTYPE OF MODEL



Fig.2 Actual Prototype of Model

The above shown figure is of the model that we have produced for our system it works on the pneumatic system. It is similar to the hydraulic system. In hydraulic system the input mechanical energy is given to the oil by pump. Whereas in pneumatic systems the working fluid is air & the air is compressed by a compressor.

Hydraulic system usually operates at very high pressures to transmit the large force and power. While pneumatic system operates at lower pressures of about 5 to 7 bar. Compressed air is used as force medium for this operation. This air is taken from the air receiver of the vehicle & used in air brake system. The control unit consists of a relay circuit. It is a photo-sensor switch. It has two outputs.

The solenoid valve is of $\frac{1}{2}$ solenoid valves. $\frac{1}{2}$ indicates two ports and one-way operation. Compressed air enters through first solenoid valve and expelled to atmosphere through second solenoid valve.

When driver is driving the vehicle at that time, the ultrasonic sensor is in open mode. So current cannot pass to relay circuit through the switch. When driver press the brake pedal, ultrasonic sensor senses and sends electric current to relay circuit. One of the relay output sends a voltage to first solenoid valve and now it is in opened position so the compressed air enters to break chamber and these time relay stop the current engine coil or motor current. Additional emergency switch is provided in emergency. If the driver needs bumper, then the emergency switch can also be used. It gives the bottom of break paddle and provide voltage to the solenoid valve. So, the urgent brake is applied. Moment gives extra of paddle these time limit switch is on and pneumatic bumper is operated in forward direction This can be used in the case of extreme condition.

VI. SELECTION OF MATERIAL

The materials used in this project are detailed as follows

A. Ferrous Materials

1) Mild Steel

(EN – 4 to EN – 6)

Carbon – 0.15% to 0.35%

Tensile strength – 1200/1420 MPa

Yield strength – 750/1170 MPa

2) C30

Carbon – 0.25% to 0.35%

Tensile strength – 620 MPa

Yield strength – 400 MPa

Izod Impact Value – 55 Nm

% Minimum Elongation – 21

Typical composition — Carbon – 0.25% to 0.3

Manganese – 0.60% to 0.90

BHN – 207

C30 material is generally used for cold formed levers, hardened and tempered tie rods, Cables, Sprockets, Hubs and Bushes – Steel Tubes.

3) 40c8

Carbon – 0.25% to 0.35%

Tensile strength – 620 MPa

Yield strength – 400 MPa

Izod Impact Value – 55 Nm

VII. ADVANTAGES AND DISADVANTAGES

A. Advantages

1. Simple in operation.
2. Free from wear adjustment.
3. Less power consumption.
4. Lesser noisy in operation due to pneumatic system.
5. System prevents accidents & provides safety to the passengers.
6. System has fast response.
7. System able to increase the pre-crash safety.

B. Limitations

1. Additional cost is required to use the system.
2. Vehicle speed above 40-50 km/hr.
3. System have few limitations in densely traffic road.
4. System has no provision to prevent accidents from rear side of vehicle.

VIII. APPLICATIONS

1. For Automobile applications.
2. For Industrial applications.
3. Passenger car vehicles.

4. This system also successfully installed in cars, Rickshaws, Tempos & heavy vehicles like buses, trucks, trailers,

IX. CONCLUSION

Our main aim behind the designing of this system is to improve the prevention technique of accidents and also reducing the hazard from accidents like damage of vehicle, injury of human etc. We observed that our system is able to achieve all the objectives which we have determined.

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