Braking System with Pneumatic Bumper

Mr.Piyush Walke[1], Mr.Shubham Ankolikar[2], Mr.Ajinkya Mahajan[3],Mr.Rishiekesh Karanjkar[4],Prof.G.B.Firame[5]

[1]Student, Department of Mechanical Engineering, Smt.KashibaiNavle Collage of Engineering ,piyushw1519@gmail.com
[2]Student, Department of Mechanical Engineering, Smt.KashibaiNavle Collage of Engineering, shubhamankolikar@gmail.com
[3]Student, Department of Mechanical Engineering, Smt.KashibaiNavle Collage of Engineering, ajinkyamahajan155@gmail.com
[4]Student, Department of Mechanical Engineering, ,Smt.KashibaiNavle Collage of Engineering, rishikarankkar007@gmail.com
[5]Assistant Professor,Department of Mechanical Engineering,Smt.KashibaiNavle Collage of Engineering iciime.metx@sinhgad.edu

ABSTRACT

Automobiles have been used to move human beings or things and the automobile technology has been developed within the last few years.The traffic accidents are increasing as automobile production has been increasing. The number of casualties during the vehicle accidents is very large as compared to the other causes of death. It is important to prevent accidents and to protect the driver and pedestrian when accidents occur.

Though there are different causes for these accidents but proper technology of braking system and technology to reduce the damage during accident (such as pneumatic bumper system) can be effective on the accident rates. Therefore, pre-crashing system is demanded. Automotive safety has gained an increasing amount of interest from the general public, governments, and the car industry. The pre-crash system is to prevent accidents on roads with poor visibility by using sensor network to find invisible vehicles, which are to be detected by autonomous on-vehicle sensors. The pre-crashing system is processing the sensor data and controlling the vehicle to prevent accidents and accidents caused by careless driving. The pneumatic system is simple and easy in operation and hence can be used in automation industry.

Keywords: Pneumatic bumper, cylinder, bumper, sensor, braking etc.

---

1. INTRODUCTION

The upcoming world is full of Automation so we need to develop a system which is fully automatic. Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources, pneumatics form an attractive medium for low cost automation. Automation aims to overcome the mistake made by the drivers and at the time of accidents. The system takes control of the vehicle and brings the vehicle to stop before colliding. Thus, automation can help prevent accidents at higher reliability.

Automated systems have following advantages over manual systems:

- Safer systems
- Better precision
- Higher reliability
- Convenient design
- Simpler operation process
- Reduction in the work / load

- Lesser chances of human error

The project is combination of the mechanical and Electronics, which is fairly known as the Mechatronics. The main advantages of an all-pneumatic system are usually economy and simplicity, the latter reducing maintenance to a low level. It also has outstanding advantages in terms of safety.
To overcome the problems of manual braking system, we are going to develop a system which is helpful for the reducing the impact of road accidents. It is the project which has been fully equipped and designed for auto vehicles. The technology of pneumatics plays a major role in the field of automation and modern machine shops and space robots. Our Intelligent Braking with Pneumatic Bumper safety concept provides a glimpse into the future of automotive safety, and how much more advanced these individual systems can be for avoiding accidents and protecting vehicle occupants when they are integrated into one system.

2. Objective

There are many causes of accidents. Some of them are

- Ignoring traffic rules
- Drunken driving
- Dream driving
- Mechanical failures in the vehicle
- Mistakes of the drivers

In all these cases the basic reason cited is failure to apply the brakes at the right time. In all the above cases if the brakes are applied at the right time, the accidents can be prevented. 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. Thus, braking of vehicles is totally manual operated.
When the driver fails to observe the obstacle or any vehicle in front of his driving vehicle, he may fail to give the proper input to braking system and proper working does not occur, leading to accident. Also the driver may not able to pay the full attention during night travelling so there are many chances to accidents. There is no provision to minimize the damage of vehicles. Currently, bumpers used in vehicles are of rigid types. These bumpers have specific capacity and when the range of the accidental force is very high then the bumpers fail and these forces are transferred to the passengers. So, the current designed system only fairly reduces the damage of vehicle and/or passengers.
To overcome with all of these challenges, we have designed of Braking System with Pneumatic Bumper. Hence the main objective to design a automatic system having pneumatic bumper.

3. Proposed System

The Warning systems are integrated with safety systems which warn the user about the potential threat.The warning system detects the potential threat level and decides whether a warning should be issued to the user through auditory and/or visual signals. Many accidents can be avoided if proper braking is applied in right time. The assesses the potential threat level and decides whether a warning should be issued to the driver. In the project, the proximity sensors (Sharp IR sensors used in the project) detects the distance of nearby obstacles from vehicle, and gives signal to the comparator circuit (LM 358) which gives output to the transistor circuit. If the obstacle detected by the proximity sensors is within the limit,the braking of the system takes place with the help of pneumatic brakes.. Thus, the chances of possible collision of vehicle are greatly reduced.

4. Components

A. Pneumatic Circuit
1) Compressor a) Pressure 2-3 bars – Used to provide compressed air
2) Solenoid Valve – Used to actuate the pneumatic circuit
3) Pneumatic Cylinders –for braking and extend/retract the bumper.
4) Connecting Cables and hoses – for connecting compressor with solenoid valve and pneumatic cylinders.

B. Mechanical Circuit
1) Body Frame Material- Mild steel
2) Extendable bumper a) Material- Aluminium sheet mounted on square pipe of mild steel.
3) Chain No. of links- 102
4) Wheels a) Wheels of TVS Scooty ES.
5) Bearings no.- 6201
6) Shafts Diameter- 12.2mm Material- C30.
7) Other parts a) Nuts and bolts for fitting. b) Wooden support to mount circuit on
8) Sprocket Pitch circle diameter- 60.4mm

C. Electronic Circuit

1) Sharp IR Sensor -Range: 10 cm to 70 cm. – Used to detect presence of obstacle
2) Transistor DC 547 – Used as input to the relay.
3) Motor – Used to provide power to drive the vehicle
4) Adaptor - 12V, 5 Amperes –to reduce voltage supply from 230V ac to 12V dc supply.
5) Voltage Regulator LM 358 – to reduce 12V dc
6) Resistor 1 Kilo-Ohms –used to limit current in transistor
7) Capacitor Electrolyte capacitor – Used to rectify the fluctuations in pulsating dc.
8) Relay – Used as a switch between the motor and pneumatic circuit.

5 Calculation details

V. B. Bhandari and Design Data book were used as reference material. Standard values in certain cases were taken directly, as per the empirical relations, from standard values and from the internet. The calculations and formulae are stated

5.1Design of frame:

Material used –mild steel, square pipe

Area=1.5*1.5inch=38.1*38.1=1451.61 mm^2

Length of link=26.4 inch=670 mm

Weight of project=30 kg= 30*9.81 =294.3 N

1. Effective length

Effective length,when both end fixed,

$L_e = \frac{L}{2} = \frac{900}{2} = 450$ mm

2. Internal Area

Internal width and depth, which have 3 mm thickness,

d=b=38.1-2*3 =32.1 mm

3. Moment of inertia

$I = \frac{BD^3 - bd^3}{12} = \frac{38.1*38.1^3 - 32.1*32.1^3}{12} = 87118.902\ mm^4$

5.2 Calculation of cylinder dimensions

Cylinder bore = 20 mm

Cylinder stroke=50 mm

Vol. of air exhaust from piston and cylinder = stroke area= $50x\frac{\pi}{4} \times D^2$

V = 15707.96 mm^3

For out-stroke

$F_{o/s}$ = P x A = 0.4 x 314.15= 125.66 N

For in-stroke,

Piston rod area = $\frac{\pi}{4} \times d^2 = \frac{\pi}{4} \times 7^2$

Effective area = $\frac{\pi}{4} \times (D^2 - d^2) = 275.66\ mm^2$

$F_{i/s}$= 0.4 x 275.66= 110.26 N

5.3 Bumper

Cylinder bore = 20 mm

Cylinder Stroke=100 mm

Vol. of air exhaust from piston and cylinder = stroke X are= $100x\frac{\pi}{4} \times D^2 = 31415.92\ mm^3$

For out-stroke force,

$F_{o/s}$= P x A = 0.4 x 314.15= 125.66 N

For in-stroke force,

Piston rod area = $\frac{\pi}{4} \times d^2 = \frac{\pi}{4} \times 7^2$

Effective area = $\frac{\pi}{4} \times (D^2-d^2) = 275.66\ mm^2$

$F_{i/s}$= 0.4 x 275.66= 110.26 N

6. ADVANTAGES AND DISADVANTAGES

A. Advantages

1) Simple construction of the prototype vehicle.
2) This system increases the response time of vehicle braking by keeping safe distance between two vehicles
3) It provides safety to the vehicle body.
4) The system reduces accident intensity and impact.
2) This system increases the response time and keeps safe distance between two vehicles and obstacle.

B. Limitations

1) The range of IR sensor is small.
2) Proximity sensors may get damaged due to water.
3) Sensors may stop working due to random reasons

7. CONCLUSION

Due to the use of pneumatic system the operation is smooth. The main objective is to improve technique of prevention of accidents and to reduce damaged caused to the vehicle.By using more techniques, the system can be modified and developed according to the applications. The use of extension bumper helps to reduce the vehicle damage.By implementing this project we can reduce cost of high end cars by giving similar kind of safety. The prototype which we made is in working condition and all the necessary objective is achieved.

ACKNOWLEDGEMENT

It indeed is a great experience and moment of immense satisfaction for us to complete the project of "Braking System with Pneumatic Bumper" and we take the opportunity to thank all those who provided us inspiring guidance and encouragement, we take the opportunity to give a vote of thanks those who gave us their indebted assistance.We feel that the project work is a good solution to bridge the gates between institution and industries.
In conclusion remarks of our project work; we have developed an **"Intelligent Braking System With Pneumatic Bumper For Four Wheeler"** which helps to achieve low cost automation. We are proud that we have completed the work with the limited time successfully

REFERENCES

1. Katore S. R., Kadlag S. C., Mane P. V., Pawar G.V., Prof. Londhe B. C., "*Automaticbraking with pneumatic bumper system*", International Journal Of Engineering, Education And Technology (IJEET), (2015), Volume 3, Issue 2.
2. Dr. P. Poongodi Mr. P. Dineshkumar, "*Automatic safety system for automobiles*" (2013), Volume: 03.
3. Erik Coelingh, Lottajakobsson, Henrik Lind, Magdalena Lindman, "*Collision warning with auto brake - a real-life safety perspective*", Volvo Car Corporation Sweden (2015), Paper Number 07-0450.
4. Dr. Eung Soo Kim, "*Fabrication of auto braking system using sensor*", International Journal Of Control And Automation, (2012) Volume-2, Issue No :1.
5. Takahiro Wada, "*A Deceleration control method of automobile for collision avoidance based on driver perceptual risk*", IEEE International Conference on Intelligent Robots and Systems, Oct (2012), PP 4881-4886.

6. Lee, *"A Theory of Visual Control of Braking Based on Information About Time to Collision*", PERCEPTION, (2015), Volume: 5, PP 437-459.
7. J. T. Wang, "A*n extendable and retractable bumper*" (2015).
8. Jadhav N. D., Gulmire S. M., Ghutukade R. S., Gaikwad A. S., Prof .Fegade S.G. "*Automatic braking with pneumatic bumper system*" (2015),IJSART Volume :1 Issue: 5.
9. Srinivasa Chari, Dr. Venkatesh P. R., Dr. Prasanna Rao N. S., Adil Ahmed S. "*Automatic pneumatic bumper and break actuation before collision*", International Research Journal of Engineering And Technology. (2015), Volume: 02, Issue: 04, PP1015-1023.