

AUTOMATIC PNEUMATIC BUMPER FOR FOUR-WHEELER

Prajapati Harikishanbhai Maheshbhai¹, Prajapati Hardikbhai Maheshbhai²

¹Mechanical Engineering Department, K.J Institute of Engineering & Technology, Savli, Gujarat, India.

² Mechanical Engineering Department, Arrdekta Institute of Technology, Khedbrahma, Gujarat, India.

Abstract - The technology of pneumatics has gained tremendous importance in the field of workplace rationalization and automation from old-fashioned timber works and coal mines to modern machine shops and space robots. It is therefore important that technicians and engineers should have a good knowledge of pneumatic system, air operated valves and accessories. The aim is to design and develop a control system based on an intelligent electronically controlled automotive bumper activation system is called "AUTOMATIC PNEUMATIC BUMPER". This system is consisting of IR transmitter and Receiver circuit, Control Unit, Pneumatic bumper system. The IR sensor is used to detect the obstacle. There is any obstacle closer to the vehicle (within 4 feet), the control signal is given to the bumper activation system. The pneumatic bumper system is used to protect the man and vehicle. This bumper activation system is only activated the vehicle speed above 40-50 km per hour. This vehicle speed is sensed by the proximity sensor and this signal is given to the control unit and pneumatic bumper activation system.

Key Words: IR transmitter and Receiver circuit, Control Unit, Pneumatic bumper system, Flow control valve, Solenoid Valve, Pneumatic single acting cylinder.

1. INTRODUCTION - We have delight in presenting our new research paper on "AUTOMATIC PNEUMATIC BUMPER FOR FOUR- WHEELER", which is completely prepared by IR sensors circuit and Pneumatic guard actuation circuit. It is a certified task which is completely prepared and intended for Automobile vehicles. This structures a vital piece of best quality. This item experienced strenuous test in our Automobile vehicles and it is great.

2. Working Operation - The Automatic Pneumatic Bumper system works in the following way:

- Sensing Obstacles:** The system uses an IR transmitter and receiver circuit to sense obstacles. If an obstacle is detected within a certain range (for example, 3-4 feet), a control signal is given to the bumper activation system.
- Activating the Bumper:** Upon receiving the control signal, the pneumatic bumper system is activated.

This involves the flow of compressed air through a solenoid valve, which activates a cylinder. The movement of the cylinder, in turn, activates the bumper.

- Speed Threshold:** The bumper is only activated when the vehicle speed is above a certain threshold (for example, 40-50 km per hour). The vehicle speed is sensed by a proximity sensor.

This system provides pre-crash safety to the vehicle by reducing the impact of a collision. The vehicle pace is detected by the nearness sensor. The vehicle speed is over the 40-50 Km for each hour, the control unit will enact the IR sensor Unit. The IR TRANSMITTER circuit is to transmit the Infra-Red beams. In the event that any hindrance is there in a way, the Infra-Red beams reflected. This reflected Infra-Red beams are gotten by the beneficiary circuit is called "IR RECEIVER". The IR beneficiary circuit gets the reflected IR beams and giving the control sign to the control circuit. The control circuit is utilized to actuate the solenoid valve. In the event that the solenoid valve is initiated, the packed air goes to the Pneumatic Cylinder. The packed air actuates the pneumatic barrel and moves the cylinder bar.

On the off chance that the pneumatic cylinder pushes ahead, then the pneumatic bumper enacted. The cylinder rate is fluctuated by conforming the valve is called "FLOW CONTROL VALVE". The compressed air is drawn from the air compressor in our prototype. The compressed air is passed through the Polyurethane tube to the stream control valve. The stream control valve is associated with the solenoid valve as specified in the piece chart.

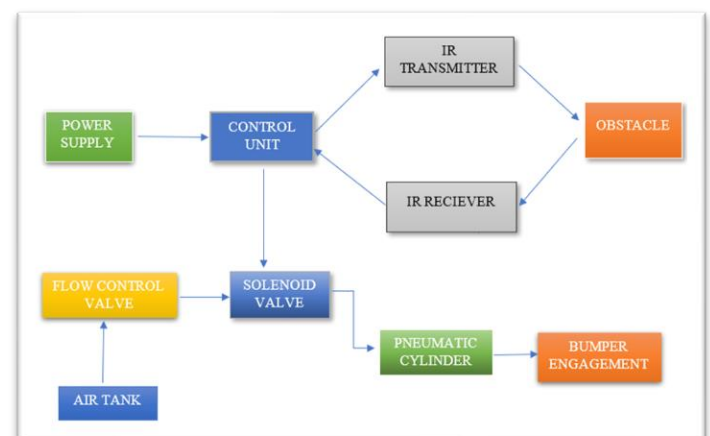


Figure 2.1 BLOCK DIAGRAM OF AUTOMATIC PNEUMATIC BUMPER

Aims and objective of the system: -

The Automatic Pneumatic Bumper system is designed with several aims and objectives in mind:

1. **Increase Safety During Pre-Crash:** The system is designed to enhance the safety of the vehicle and its occupants before a crash occurs.
2. **Increase Crashing Distance During Accident:** By activating the bumper system in response to an imminent collision, the system can effectively increase the distance over which the crash occurs, thereby reducing the impact.
3. **Decrease Level of Passenger Injury:** The use of an external vehicle safety device like the automatic pneumatic bumper can help to reduce the severity of injuries to passengers in the event of a crash.
4. **Reduce Requirement of Internal Safety Devices:** By preventing or mitigating the effects of a collision, the system can reduce the need for internal safety devices like airbags.
5. **Improve Response Time of Vehicle Bumping:** The system is designed to react faster than a human driver could, thereby keeping a safe distance between vehicles.
6. **Increase External Safety to Vehicle Body:** The system aims to protect the body of the vehicle from damage in the event of a collision.

These objectives contribute to the overall goal of the Automatic Pneumatic Bumper system, which is to enhance vehicle safety and reduce the severity of accidents.

Simulation and Analysis (Software modeling):

We are used Auto-cad software for design our model. With help of standard dimension, we generate our components 2D and 3D view as per our requirements.

(1) IR TRANSMITTER CIRCUIT:

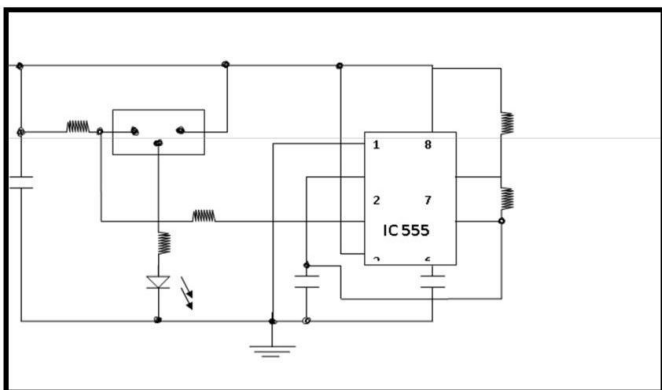


Figure 2.2 IR TRANSMITTER CIRCUIT

(2) IR RECEIVER CIRCUIT:

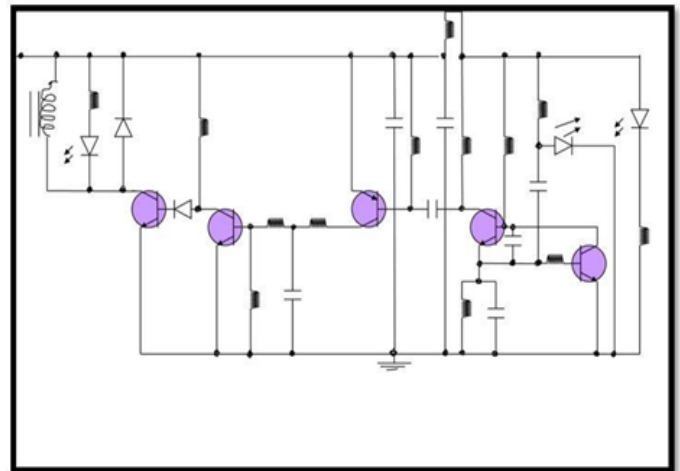


Figure 2.3 IR RECEIVER CIRCUIT

(3) Pneumatic Cylinder:

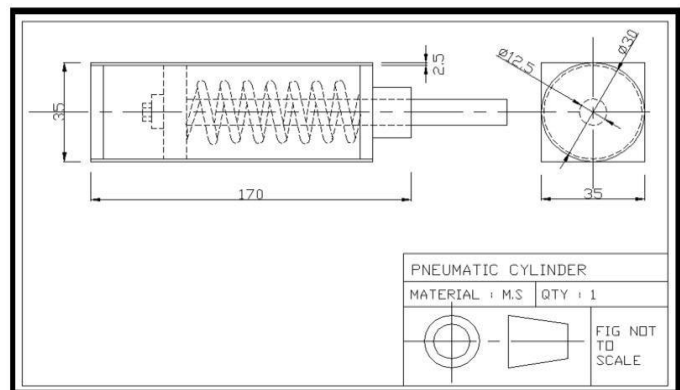


Figure 2.4 PNEUMATIC CYLINDER

(4) Circuit Diagram:

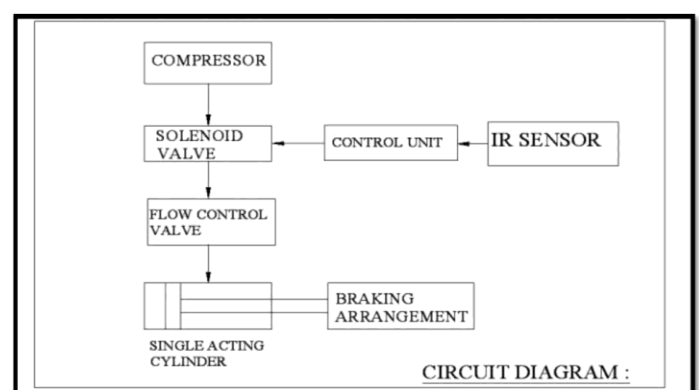


Figure 2.5 CIRCUIT DIAGRAM

(5) Hose Collar:

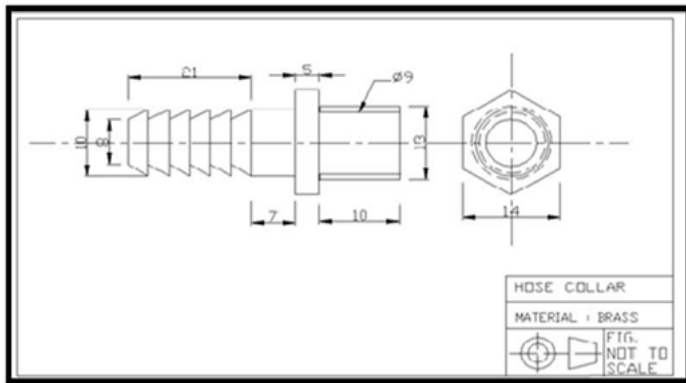


Figure 2.6 HOSE COLLAR

(6) Reducer:

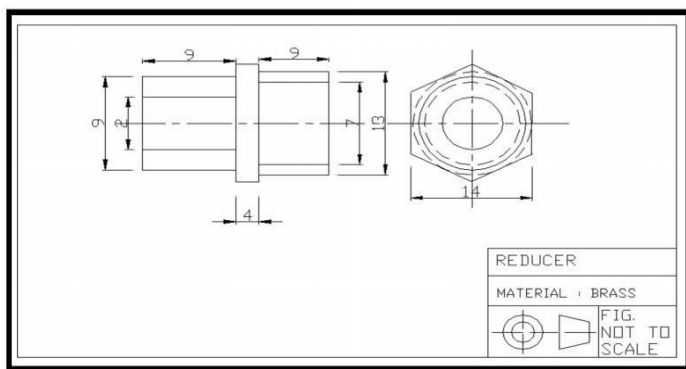


Figure 2.7 REDUCER

(7) Automatic Pneumatic bumper for four-wheeler:

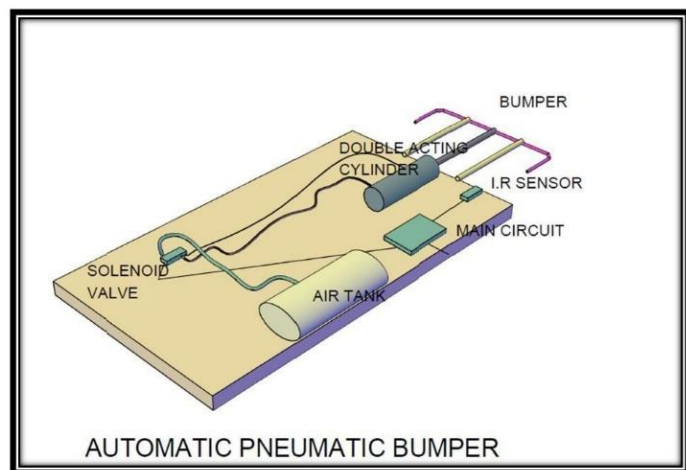


Figure 2.8 AUTOMATIC PNEUMATIC BUMPER

3. Plan of work

The plan of work for the Automatic Pneumatic Bumper system involves several steps:

1. **Design and Development:** The first step is to design and develop a control system based on an intelligent electronically controlled automotive bumper activation system.
2. **Integration of Components:** The system consists of an ultrasonic transmitter and receiver circuit, a control unit, and a pneumatic bumper system. These

components need to be integrated to work together seamlessly.

3. **Use of Sensors:** The ultrasonic sensor and IR sensor are used to detect obstacles. If any obstacle is detected within a certain range (for example, 3-4 feet), a control signal is given to the bumper activation system.
4. **Automatic Adjustment:** The bumper system is designed to automatically adjust its stiffness and damping characteristics based on the impact force. involves the selection of suitable materials, consideration of geometrical parameters, and integration of pneumatic components.
5. **Testing:** After the system is developed, it undergoes This strenuous testing in various scenarios to ensure its effectiveness and safety.

This plan of work contributes to the overall goal of enhancing vehicle safety and reducing the severity of accidents.

4. CONCLUSIONS

The conclusion derived from the implementation of the Automatic Pneumatic Bumper system is that it significantly enhances vehicle safety. The system's ability to automatically adjust its stiffness and damping properties based on the magnitude of the impact force allows for an adaptive response to varying impact forces, enhancing the overall crashworthiness and safety of the vehicle.

The system also improves pre-crash safety, reduces the likelihood of passenger injury, and increases the certainty of braking application. Furthermore, the use of this system can lead to a reduction in the need for internal safety devices like airbags.

Finite Element Analysis (FEA) simulations have provided valuable insights into the stress distribution, deformation, and energy absorption capabilities of the bumper design. These results have been used to optimize the bumper system design, ensuring adequate strength and durability under different impact conditions.

Overall, the Automatic Pneumatic Bumper system represents a significant advancement in vehicle safety technology.

REFERENCES

1. Accident Prevention System by Automatic Pneumatic Bumper, Asst. Prof. Aamir Sayed¹, Vipin Raut², Shubham Mashankar³, Shubham Lashkare⁴, Nikesh Khobragade⁵, Shantanu Ghodeshwar, International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 04 Issue: 03 | Mar -2017
2. Automatic pneumatic bumper for two wheeler G. kedar nath u. uday kiran, n.anilkumar, n.mahesh. Ijariie-issn, vol-3 issue-2 2017
3. Pneumatic systems- mcgraw hill