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# Pneumatic Bumper Activation System

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**Abstract:** Population of the world is increasing drastically day by day. As the population increases production of automobiles does increase. Due to increase of automobiles accidents too increase. To avoid such accidents or to avoid much damage to the automobile or the passengers there are many safety features that have been invented by automobile industries. Some of them are the abs, ebs, automatic braking systems, etc. We have come up with one such idea that is “pneumatic bumper activation system”. Basically, the main intension of the project is to avoid huge damage on the car and also to the passengers. When an automobile is on go with a speed of 60-70kmph and an obstacle or any other automobile in front applies sudden brake, the sensors in the automobile detects the obstacle and the crash guard or the extra bumper protrudes further so as to avoid direct collision to the front part of the automobile so as to avoid much damage to the car or the passengers.

**Keywords:** Pneumatic bumper activation system, single acting cylinder, solenoid valve.

## I. 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 forms an attractive medium for low cost automation. Thus, automation can help prevent accidents at higher reliability.

### A. Automated Systems Have Following Advantages Over Manual Systems

- 1) Safer system
- 2) Higher reliability
- 3) Convenient design
- 4) Simpler operation processes
- 5) Reduction in work

The project is combination of the mechanical and Electronics, which is 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 after collision, 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 all vehicles mainly SUV's. The technology of pneumatics plays a major role in the field of automation and modern machine shops. Our 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.

## II. NEED FOR AUTOMATION

Automation is the technology of the moment which every other field is embracing in order to minimize the manual errors and simultaneously reducing the cost. The main advantages of all pneumatic systems are economy and simplicity. Automation plays an important role in mass production at a lesser cost. For mass production of the product, the machining operations decide the sequence of machining. The machines designed for producing a particular product are called transfer machines. The components must be moved automatically from the bins to various machines sequentially and the final component can be placed separately for packaging. Materials can also be repeatedly transferred from the moving conveyors to the work place and vice versa. Nowadays almost all the manufacturing process is being atomized in order to deliver the products at a faster rate. The manufacturing operation is being atomized for the following reasons.

- A. To achieve mass production
- B. To reduce man power
- C. To increase the efficiency of the plant
- D. To reduce the work load
- E. To reduce the production cost

- F. To reduce the production time
- G. To reduce the material handling
- H. To reduce the fatigue of workers
- I. To achieve good product quality

### III. BACKGROUND

Road accidents is a negative externality associated with expansion in road network, motorization and urbanization in the country. Road traffic injuries are recognized, globally, as a major public health problem, for being one of the leading causes of deaths, disabilities and hospitalization, imposing huge socio-economic costs.

In order to reduce the damage caused to the lives of passenger and driver it is important to increase the safety features of the vehicle itself meanwhile reducing the damage to the body of the vehicle thus reducing the cost of repairs too. In the current Indian automobile scenario it is promptly observed that incremental number of vehicles are coming on road every year with increasing features, but it is observed that the safety features in place are all focused on safety of the commuters rather than focusing on safeguarding both commuters and vehicles.

### IV. MARKET SCENARIO

As the per capita income of the people is increasing the ability of the people to spend on safety features is also increasing. In order to feel secure people are ready to shell out money for newer technologies that increase the safety.

Also, as people are becoming smarter, the vehicle insurance companies too are imposing stringent guidelines so as to claim insurance. All in all, it is a great time to be in the field of vehicle security technology. It is also likely that road transport ministry will mandate the vehicles to undergo thorough quality test and include the essential safety features to the vehicles.

### V. OBJECTIVES

- A. To decrease rate of impact on automobile during an accident.
- B. To decrease or avoid direct impact on front passengers during a collision.
- C. To increase external safety to the automobile.
- D. To reduce expenditure on external safety devices like air bag, etc.
- E. The design also increases the crashing distance by providing extra space due to extension of the bumper, decreasing the chances of injuries to the commuter.

### VI. ADVANTAGES AND LIMITATIONS

#### A. Advantages

- 1) Simple construction of the prototype vehicle.
- 2) It provides safety to passengers in the vehicle as well as to the vehicle body.
- 3) It reduces accident intensity and impact.
- 4) This system increases the response time of vehicle braking by keeping safe distance between two vehicles.
- 5) The design also increases the crashing distance by providing extra space due to extension of the bumper, decreasing the chances of injuries to commuters.

#### B. Limitations

- 1) IR sensor range is small.
- 2) Proximity sensors may sense obstacle due to presence of dirt
- 3) Sensors may stop working due to random reasons

### VII. COMPONENTS & DESCRIPTION

#### A. Pneumatic Circuit

- 1) Compressor with pressure 4 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, hose & hose collar - for connecting compressor with solenoid valve and pneumatic cylinders.

#### B. Electrical circuit

- 1) Control unit - consists of Aurdino board, relay switch, step-down transformer, AC to DC converter.
- 2) IR sensor - used to detect obstacle.

#### C. Mechanical Circuit

- 1) Body Frame Material- Mild steel
- 2) Extendable bumper - Stainless steel
- 3) Wheels – plastic

#### D. Solenoid valve



Fig.1 SOLENOID VALVE

A solenoid valve is a electro-mechanical component which has two inputs and a single output. One input is the electrical input and the other input is from the compressor. The output is connected to the single acting cylinder. Solenoid valve basically receives signal from the control unit, after receiving signals from the control unit the input valve of the compressor inlet opens and further the output valve to the single acting cylinder also opens.

#### E. Single Acting Cylinder



Fig.2 SINGLE ACTING CYLINDER

The cylinder is a Single acting cylinder one, which means that the air pressure operates forward and spring returns backward. The air from the compressor is passed through the regulator which controls the pressure to required amount by adjusting its knob. A pressure gauge is attached to the regulator for showing the line pressure. Then the compressed air is passed through the single acting 3/2 solenoid valve for supplying the air to one side of the cylinder.



#### F. Ir Sensor



Fig.3 IR SENSOR

The IR transmitter and IR receiver circuit is used to sense the obstacle. It is fixed to the back side of the frame stand with a suitable arrangement. The pneumatic cylinder is controlled by the flow control valve, single acting solenoid valve and control unit.

#### G. Working operation

The IR TRANSMITTER circuit is to transmit the Infra-Red rays. If any obstacle is there in a path, the Infra-Red rays reflected. This reflected Infra-Red rays are received by the receiver circuit is called "IR RECEIVER".

The IR receiver circuit receives the reflected IR rays and giving the control signal to the control circuit. The control circuit is used to activate the solenoid valve. The operating principle of solenoid valve is already explained in the above chapter.

If the solenoid valve is activated, the compressed air passes to the Single Acting Pneumatic Cylinder. The compressed air activate the pneumatic cylinder and moves the piston rod.

If the piston moves forward, then the breaking arrangement activated. The braking speed is varied by adjusting the valve is called "FLOW CONTROL VALVE".

In our project, the compressed air drawn from the compressor in our project. The compressed air flow through the Polyurethane tube to the flow control valve. The flow control valve is connected to the solenoid valve as mentioned in the block diagram.

### VIII. BLOCK DIAGRAM

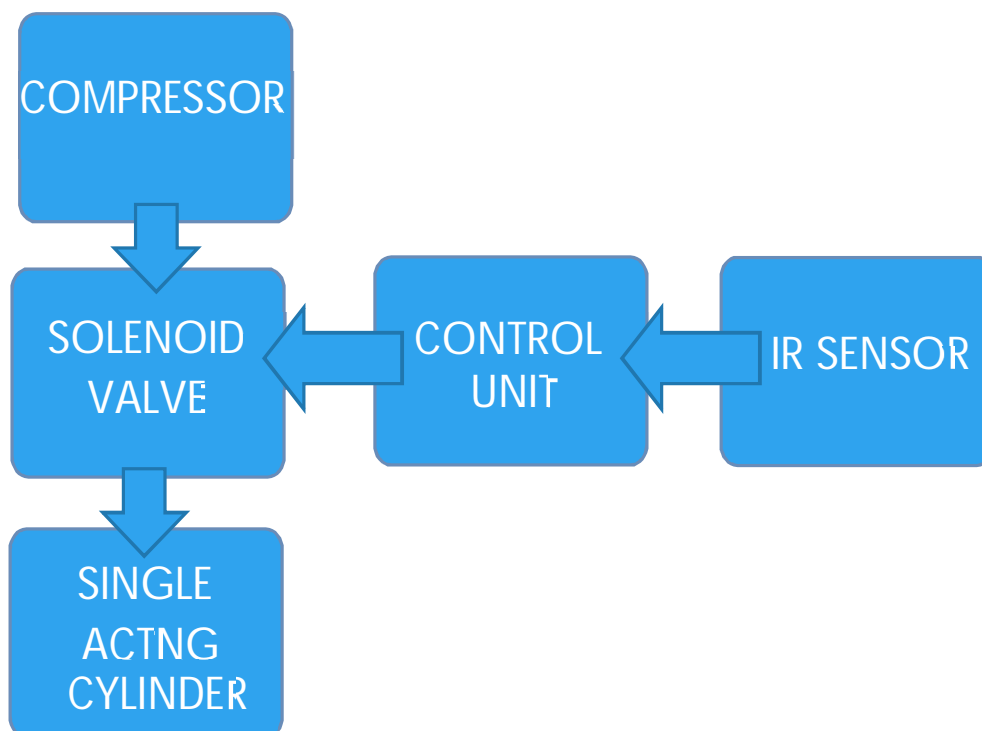


Fig.4 BLOCK DIAGRAM

## IX. DESIGN AND MODEL

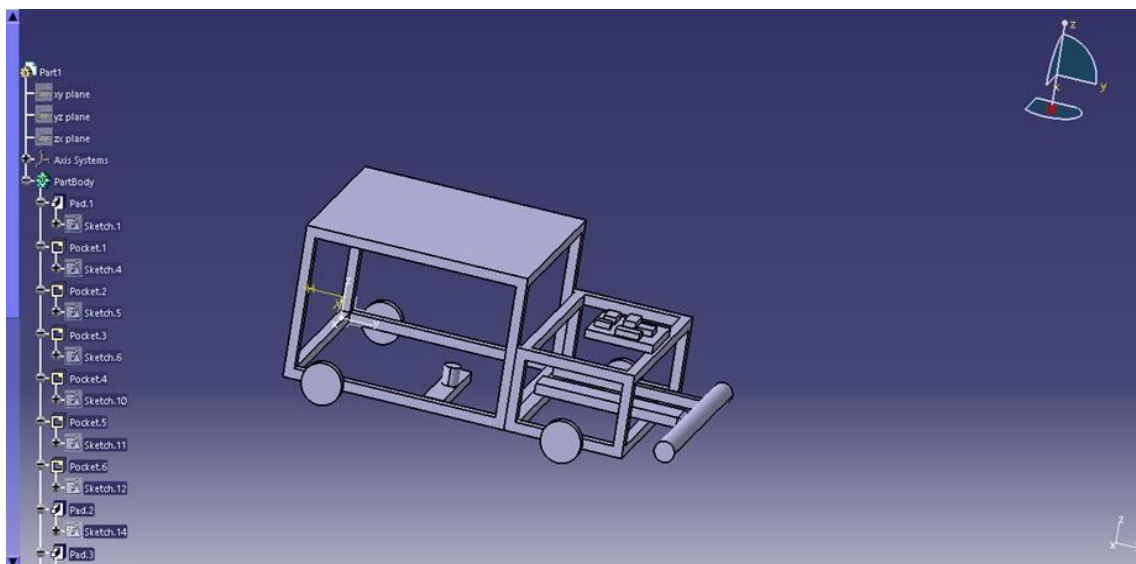


Fig.5 CATIA MODEL

## X. CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. 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, let us add a few more lines about our impression project work. Thus, we have developed an “PNEUMATIC BUMPER FOR FOUR-WHEELER” which helps to know how to achieve low cost automation. The application of pneumatics produces smooth operation. By using more techniques, they can be modified and developed according to the applications.

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