



Design and Manufacturing of an Automatic Bumper for four wheeler for vehicle safety

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Abstract : The automobile and passenger safety initiative is the pneumatic bumper and headlight. In fact, two different projects in one set-up exist within our project. The pneumatic term originates from Greek, meaning breathtaking winds. The word pneumatics is used to investigate the motions of air and its phenomena are pneumatic. The pneumatic system is utilised in industry expensively, and plants are usually filled with compressed air or compressed inert gas. Firstly, the pneumatic bumper enhances passenger and automobile safety. This safety may be achieved using pneumatic configuration. The airbag in the automobile is equal to the pneumatic bumper. However in the crash there is both a pneumatic bumper and a reduction in automobile damage. The second concept of the steering wheel rotates automatically. This idea focuses on headlight when the car rotates. The mechanical links are used to achieve it. As the headlamp driver rotates, it gets more comfortable while turning

Keywords : Pneumatic, Bumper, IR Sensor, Vehicle, Driver

I. INTRODUCTION

The population of our country has been increasing rapidly which indirectly increases the vehicle density and leads to many road accidents. The aim of the project is to minimize the road accidents which causes the loss of invaluable human life and other valuable goods. Safety is a necessary part of man's life. It is expected that if such a device is designed and incorporated into our cars as a road safety device, it will reduce the incidence of accidents on our roads and various premises, with subsequent reduction in loss of life and property. Over 1, 51,000 people were killed in road accidents in the last year alone, that is more than the number of people killed in all our wars put together. The obtained results show that high rate of accident is reported each year. One serious road accident in the country occurs every minute and 17 die on Indian roads every hour. 1317 road crashes occur every day in India. A lot of cases reported is as a result of drivers sleeping off while driving, and when he/she eventually woke up, a head on collision might have taken place. Not many have had the fortune to quickly avert this. It is therefore imperative to consider the advantages of an early warning system where the driver is alerted of a possible collision with some considerable amount of time before it occurs. 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 system called "development of an automatic bumper and braking system for vehicles using pneumatic system to avoid collision". This system consists of IR transmitter and receiver circuit, control unit, pneumatic bumper system and braking system. The IR sensor is used to detect the obstacle. There is any obstacle closer to the vehicle, the control signal is given to the bumper activation system. The pneumatic bumper system is used to protect the man and vehicle. Automotive safety is intentionally to avoid vehicle accident or reducing the effect of accident especially to the human body including the driver, passengers and pedestrians moreover, some of the safety features are also purposely to reduce vehicle damages in order to minimize the repairing cost. Active safety in vehicle system uses the information of vehicle external environment and the system will respond accordingly to the situation during the phase of pre-crash or during the crash event. This will either avoid the crash from happening or increase the safety of the vehicle by reducing the crash effect. Passive safety in the other hand is a system that only works to prevent injury but not change the vehicle action in response to crash scenario. The examples of the passive safety are like airbag, crumple zone, seat belt and passive automotive bumper. A metal or plastic shell that is filled with a foam energy absorbing block of polypropylene or foam normally used in an automotive low-impact absorbing bumper construction, and is mounted to the vehicle on a relatively rigid beam. The kinetic energy from the collision will be absorbed by the foam energy absorbing material through the deformation of the bumper structure. Many researches have been made regarding the bumper deformation characteristic and absorption capability. Usually, the research is concentrating on the selection of the bumper material like aluminum and composites. Which are dependable, require lower conservation and have lower specific fuel consumption.

II. PROBLEM STATEMENT

In almost all of the cases of vehicle accidents, the basic reason cited is failure to apply the brakes at the right time. If brakes are applied at the right time, accidents can be prevented. Automation can assure higher reliability of braking as compared to fully manual braking. The use of this system can prove to be useful in automation due to its simplicity and ease of operation. So, the aim is to design and develop a system based on automatic control of vehicle in order to reduce accidents on roads and offer a safer driving experience.

III. OBJECTIVE OF PROJECT

- To increase the safety during pre-crash.
- To increase the crashing distance during accident
- To decrease the level of passenger injury by use of external vehicle safety device
- To decrease the damage to the vehicle.

IV. LITERATURE SURVEY

Javad Marzbanrad. et al., Design and analysis of an automotive bumper beam in low-speed frontal crashes, studied the most important parameters including material, thickness, shape and impact condition for design and analysis of an automotive front bumper beam to improve the crashworthiness design in low-velocity impact. The simulation of original bumper under condition impact is according to the low-speed standard of automobiles stated in FMVSS and IIHS. The bumper beam analysis is accomplished for Stamping and Roll form to compare the weight and impact behavior. The strength in elastic mode is investigated with energy absorption and impact force in maximum deflection situation. A good design of this part of automobiles must prepare for the safety of passengers; meanwhile, should have low weight.

Andersson R et.al emphasized that to increase crash performance in automotive vehicles it is necessary to use new techniques and materials. The components that are linked to crash safety should transmit or absorb energy. The energy absorbing capability of a specific component is a combination of geometry and material properties. The chosen material should have high yield strength and relatively high elongation to fracture. These demands lead to increase interest to use of high strength stainless steels.

In this paper, O. G. Lademo et.al discusses about a Roll form bumper beam is presented for potential application in vehicle bumper. Through numerical simulation of the bending behavior under impact loads, the Roll form bumper beam is compared with Stamping beam in crashworthiness. The effects of the shape of the Roll form beam and the shape optimization design is performed for increasing energy absorption and reducing the initial peak force. The bumper system is a structural component, which contributes to the crashworthiness or occupant's protection during a front or rear collision. There is an interest among the researchers to move from Stamping to Roll form beam. Minaudo et al. (1997) developed a Roll form bumper system with impact protection. Clark et al. (1991) described their extensive work on bumper beams using Bumper standards over the last few years.

V. COMPONENTS

1. Pneumatic single acting cylinder
2. Solenoid valve
3. Flow control valve
4. Wheel arrangement
5. Stand
6. IR sensor

PNEUMATIC SINGLE ACTING CYLINDER:

Pneumatic cylinder consist of

A) PISTON B) 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.



One hose take the output of the directional Control (Solenoid) valve and they are attached to one end of the cylinder by means of connectors. One of the outputs from the directional control valve is taken to the flow control valve from taken to the cylinder. The hose is attached to each component of pneumatic system only by connectors.

IR Sensor:

A sensor is a transducer used to make a measurement of a physical variable. Any sensor requires calibration in order to be useful as a measuring device. Calibration is the procedure by which the relationship between the measured variable and the converted output signal is established.

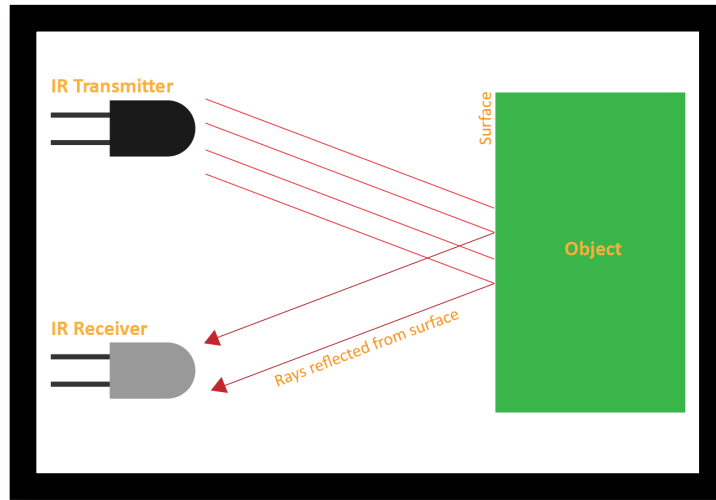


Care should be taken in the choice of sensory devices for particular tasks. The operating characteristics of each device should be closely matched to the task for which it is being utilized. Different sensors can be used in different ways to sense same conditions and the same sensors can be used in different ways to sense different conditions.

In our project IR transmitter and IR receiver are used to detect the obstacle. These sensors are fitted at the front side of the vehicle.

- **IR TRANSMITTER:**

The IR transmitting circuit is used in many projects. The IR transmitter sends 40 kHz (frequency can be adjusted) carrier under 555 timer control. IR carriers at around 40 kHz carrier frequencies are widely used in TV remote controlling and ICs for receiving these signals are quite easily available.



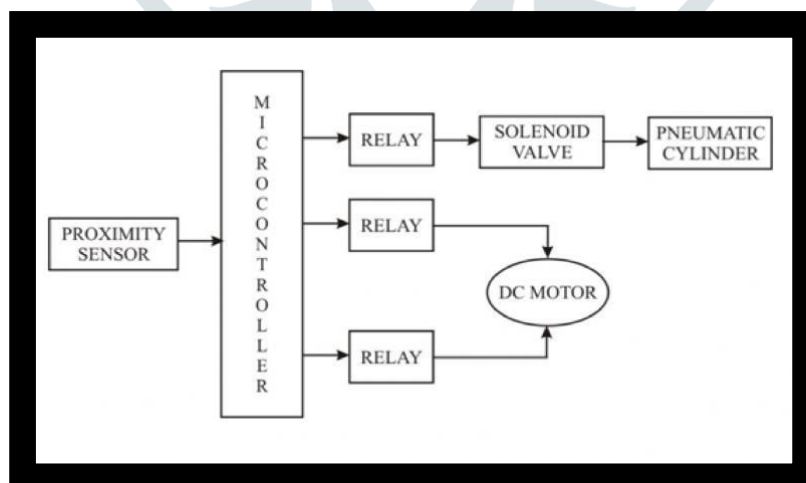
- **IR RECEIVER:**

The transmitted signal reflected by the obstacle and the IR receiver circuit receives the signal and giving control signal to the control unit. The control unit activates the pneumatic breaking system, so that break was applied.

VI. WORKING OPERATION

The important components of our project are,

- ✚ IR TRANSMITTER
- ✚ IR RECEIVER
- ✚ CONTROL UNIT WITH POWER SUPPLY
- ✚ SOLENOID VALVE
- ✚ FLOW CONTROL VALVE
- ✚ AIR TANK (COMPRESSOR)



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 breaking arrangement is used to break the wheel gradually or suddenly due to the piston movement. The breaking speed is varied by adjusting the valve is called "FLOW CONTROL VALVE". In our project, we have to apply this arrangement in one wheel as a model. 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

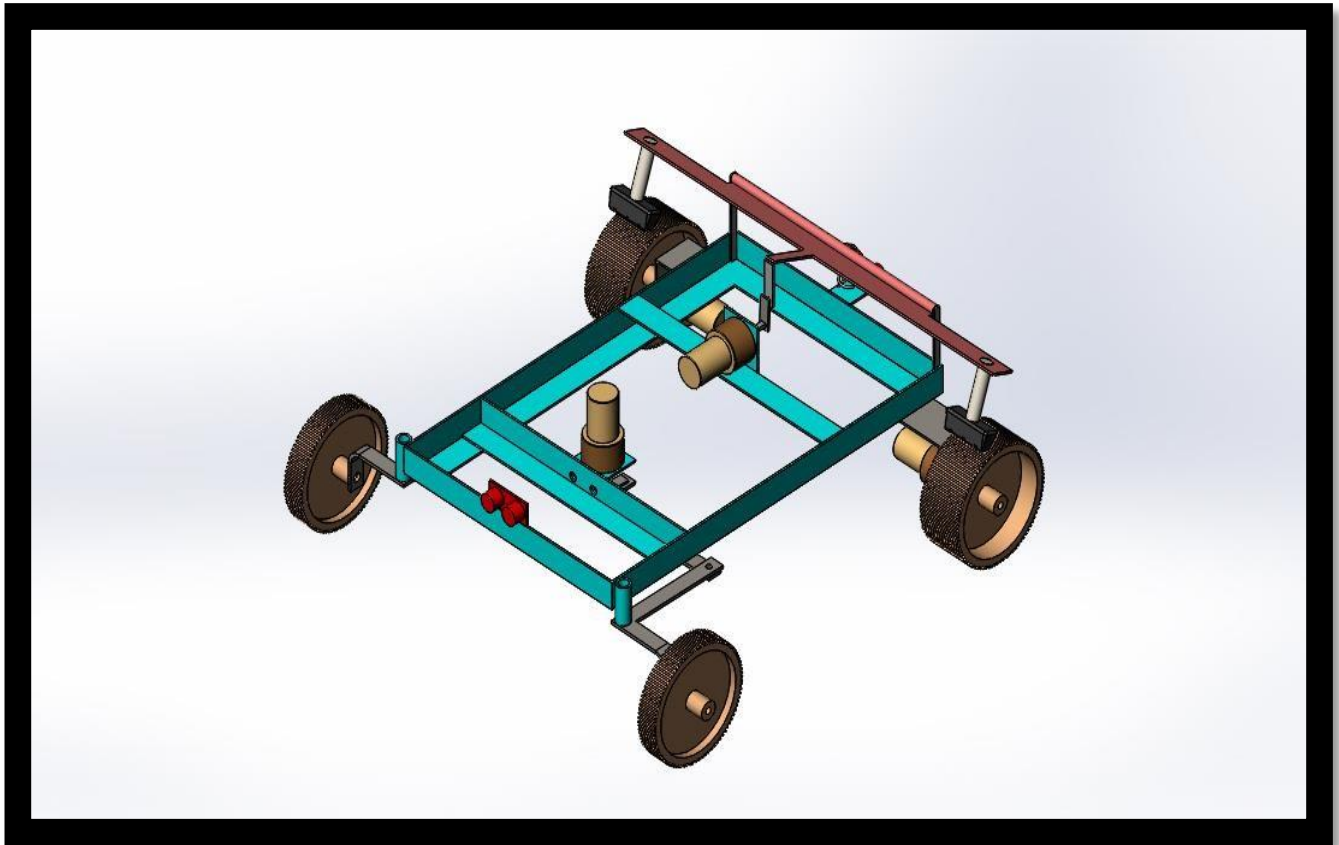


Figure :Pneumatic bumper

VII. APPLICATIONS

- ✚ For automobile application
- ✚ Industrial application

VIII. ADVANTAGE & DISADVANTAGE

- ❖ ADVANTAGE:
 - ✚ Free from wear adjustment.
 - ✚ Less power consumption
 - ✚ It gives simplified very operation.
 - ✚ Installation is simplified very much
- ❖ DISADVANTAGE:
 - ✚ Additional cost is required to install this arrangement in the vehicle .

IX. FUTURE SCOPE

- ✚ To reduce damage of vehicles
- ✚ To increase safety of passengers
- ✚ To provide internal plus external safety

X. CONCLUSION

When employing this system on the main cars the functions of the system are specified below:

1. The minimum car speed should be 50Km/hr. else the system won't be working.
2. The Pneumatic bumper system will only work if there will be any major obstructions such as a tree or another vehicle or any other obstruction that could lead to accident.
3. When the obstruction is a human being, the only function that will happen is the immediate braking and not the bumper actuation as the bumper actuation could harm the human being on the road.
4. In actual model, the range at which the brakes and bumper will be activated is calculated by a computer (approximately <40 m at a speed of 80-90Km/h), also the sensor will warn the driver at an appropriate distance (according to speed) at which the driver could act and if not responded, the system would take the handles on its own.

The project "Development of an Automatic Bumper and Braking System for Vehicles Using Pneumatic System to Avoid Collision" is working in satisfactory conditions. This project enables to understand the difficulties in maintaining the tolerances and also quality. The project fabrication and testing have been done to the ability and skill making maximum use of available facilities. In conclusion remarks, few more lines about the impression project work,

1. The application of pneumatics produces smooth operation.
2. By using more techniques, they can be modified and developed according to the user.
3. This project is reliable; hence the passengers can rely upon their safety.
4. This project consists of the various parameters which the consumer of the car seeks during the purchasing of new car which should be under his budget and should provide continuously consistent result and should be reliable as well.
5. The project will not only protect the car from accident but also if the other car during the accident doesn't controls itself from the impact of accident, the bumper of the car will eject automatically to prevent the effects of the accident.
6. Other from the aspect of the use of the project in a specific location of application, it can also be used in many other places. In the industries where there is use of manual labors near the machines such as power plants, manufacturing industries, etc.
7. Also, when we will be using our project in the real environment i.e., in the automobiles we have to place a computer such that it could adjust the working range of the sensors according to the real time conditions.

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