

AUTOMATIC PNEUMATIC BUMPER ACTUATION BEFORE COLLISION

Utkarsh R. Nandurkar¹, Venugopal R. Joshi², N.R.Deshmukh³

¹utkarshnan123@gmail.com, Amravati, India

²nikhi_204deshmukh@rediffmail.com, Amravati, India

³venugopaljoshi@gmail.com, Amravati, India

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 before collision with help of IR sensor is called “AUTOMATIC PNEUMATIC BUMPER ACTUATION BEFORE COLLISION”. This project consists of IR transmitter and Receiver circuit, Control Unit, Pneumatic bumper system. The IR sensor senses the car who is going to collapse from behind and release the bumper simultaneously. The pneumatic bumper is used to protect the vehicle. The bumper is actuated when the speed of car is comparatively same or more. This vehicle speed is sensed by the proximity sensor and this signal is given to the control unit and pneumatic bumper system.

Index Terms— IR transmitter, IR sensor, bumper and Proximity Sensor.

I. INTRODUCTION

We have pleasure in introducing our new project AUTOMATIC PNEUMATIC BUMPER which is fully equipped by IR sensor circuit and pneumatic bumper activation circuit. Vehicles accident is most common. The system include sensor arrangement for sensing an object in rear of the vehicle that generates an object recognition single unit it sense an object within the range the bumper opens and protect the car from damage. The sensor arrangement include passive IR sensor or reflected pulse sensor such as radar sensor on the rear a control generates an accident prevention response signal and receiving an object recognition signal from the sensor arrangement. The project involves whenever the vehicle comes into the car. The sensor senses the vehicles and command to the bumper extended out by which we can avoid damage of car. The road accident is caused by human. The cause of road accident is rash driving, over speed, and caused of injury and death are non-wearing seat belt. There are various steps taken by the experts to reduce the probability of accident.

A. PNEUMATICS

The word ‘pneuma’ comes from Greek and means breather wind, for automation. Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When the pneumatic system is being adopted for the first time,

however it will indeed be necessary to deal with the question of compressed air supply.

B. BUMPER

A bumper is a structure attached to or integrated with the front and rear ends of a motor vehicle, to absorb impact in a minor collision, ideally minimizing repair costs. Stiff metal bumpers appeared on automobiles as early as 1904 that had a mainly ornamental function. Numerous developments, improvements in materials and technologies, as well as greater focus on functionality for protecting vehicle components and improving safety have changed bumpers over the years. Bumpers ideally minimize height mismatches between vehicles and protect pedestrians from injury. Regulatory measures have been enacted to reduce vehicle repair costs, and more recently impact on pedestrians.

C. IR SENSOR

A sensor is a transducer used to make a measurement of a physical variable.

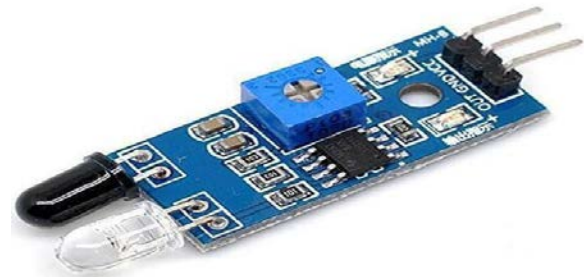


Fig. no 1 : Sensor

Types of sensor:

Passive sensors detect the reflected or emitted electromagnetic radiation from natural sources, while active sensors detect reflected responses from objects which are irradiated from artificially generated energy sources, such as radar.

The most popular sensors used in remote sensing are the camera, solid state scanner, such as the CCD (charge coupled

device) images, the multi- spectral scanner and in the future the passive synthetic aperture radar. Laser sensors have recently begun to be used more frequently for monitoring air pollution by laser spectrometers and for measurement of distance by laser altimeters.

D. I R TRANSMITTER AND RECEIVER

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. 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 bumper system.

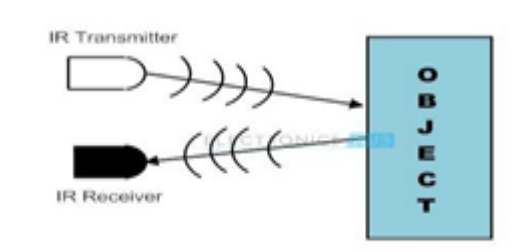


Fig no 2: IR Sensor Ray

II. COMPONENTS

A. Single Acting Pneumatic 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.



Fig no.3: Single acting cylinder

B. Solenoid valve with control unit

A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid in the case of a two-port valve the flow is switched

on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports.



Fig no 4 : Solenoid valve

C. I R Transmitter & Receiver

An infrared sensor is an electronic device that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it is called as a passive I R sensor.

D. Frame

This is a supporting frame and made up of mild steel.



Fig no 5 : Frame

E. Proximity Sensor

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal.



Fig No 6 : Proximity Sensor

III. WORKING

The compressed air from the compressor at the pressure of 5 to 7bar is passed through a pipe connected to the Solenoid

valve with one input. The Solenoid Valve is actuated with Control Timing Unit. The Solenoid valve has outputs and input. The air entering into the input goes out through the two outputs when the timing control unit is actuated. Due to the high air pressure at the bottom of the piston, the air pressure below the piston is more than the pressure above the piston. So these moves the piston rod upwards which move up the effort are, which is pivoted by control unit. This force acting is passed on to punch/rivet which also moves downwards.

The IR TRANSMITTER circuit is to transmit the Infra-Red rays. If any vehicle is going to impact, 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 explain in introduction.

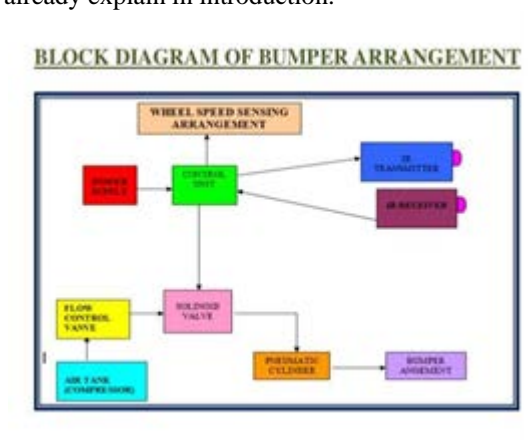


Fig no 7 : Circuit Dig

If the solenoid valve is activated, the compressed air passes to the Single Acting Pneumatic Cylinder. The compressed air activates the pneumatic cylinder and moves the piston rod. If the piston moves forward, then rear bumper arrangement activated. When the vehicle is going to impact it ensure that the causes of accident should be less or negligible after avoiding the accident Cylinder releases air and piston moves backward (to the front side of car) and bumper is set at its position.

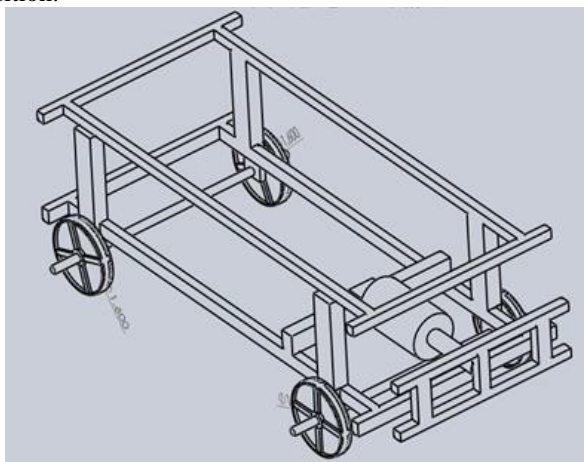


Fig no 8 : Frame

IV. DESIGN PROCEDURE

We should design this bumper piston cylinder assembly according to the stroke length and weight of bumper which has to be lift.

Weight and area calculation for bumper: 2 flanges of 260mm×20mm

Frame of bumper has 3 flanges as follows: 2 flanges of 70mm×20mm

$$\text{Area of bumper} = (2 \times (280 \times 20)) + (2 \times (80 \times 20)) \\ = 14400 \text{mm}^2$$

So we have to design cylinder piston which can pull 3.5 kg load.

Specifications of bumper as follows:

- Weight of bumper: 5kg.
- Required stroke length must be up to: 30 mm Now we should design piston cylinder as it fulfills above requirement.

V. ADVANTAGE

- To Avoid the percentage of passenger injury by using pneumatic bumper system
- System able to increase the pre-crash safety
- System plays an important role to save human life in road accident

VI. DISADVANTAGE

- System has no provision to prevent and cure the accident from front side of vehicle.
- It cost more to apply this system in car.

VII. CONCLUSION AND FUTURE WORK

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. We are able to understand the difficulties in maintaining the tolerances and also quality.

We have done to our ability and skill making maximum use of available facilities. There is lot of scope for future development in vehicle. 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 an intelligent electronically controlled automotive bumper activation system is called "Automatic Bumper System". This system is consists of IR transmitter and Receiver circuit, Control Unit, Pneumatic bumper system. The IR sensor is used to detect the vehicle.

There is any obstacle closer to the vehicle (within 4 feet) the control signal is given to the bumper activation system.

REFERENCES

- [1] Pneumatic Control System----Stroll &Bernaud, Tata McGraw Hill Publications, 1999
- [2] "Automobile Engineering" William H. Crowse.
- [3] "Automobile Engineering", G.B.S. Narang, Khanna Publishers, Delhi, 1991, pp 671.
- [4] Dr..V.Singh, IJSRD -International Journal for Scientific Research Development Vol.3 Issue 06, 2015 pp.357-361
- [5] Wang J.T. & Browne, A.L. ,"Extendable & Retractable Knee Bolser ," Paper No.323, the 2003 ESV Conference
- [6] G.B.S. Narang, "Automobile Engineering", Khanna Publishers, Delhi, 1991, pp 671
- [7] Dr. Kripal Singh, "Automobile Engineering- Vol.1", Standard Publishers Distributors New Delhi-110 006.
- [8] S. P. Patil, "Mechanical System Design", Second Edition, JAICO Publishing House, Mumbai 400001.
- [9] Dr.Sanjy.K.Bhatia, Dr.George.M.Lacy, "Infra-Red Sensor Simulation", Missouri,(2009)
- [10] Srinivasa Chari., Dr. venkatesh P.R,IRJE, Engineering College Bangalore, Karnataka, India
- [11] Fig. no. 1,2,3,4,5,7,8 are from Wikipedia from pneumatic bumper 2014 paper india
- [12] Fig.no.6 is from automatic pneumatic bumper actuation before collision 2019 india.