Fabrication Of Automatic Braking System By Automatic Movable Bumper

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Abstract - Automation technology increases the chance of getting safe environment in number of domains, especially in industry and transportation. This technology guides the operators towards the reliability, accurate working of systems and also has the good potential in the automobiles particularly in the passenger vehicles. To avoid the accidents particularly on roads has to be used. Already airbag system, Anti-lock breaking system (ABS) and some other devices are used to prevent the accidents and also to provide safety to the passengers. In addition to these technologies, an automatic impact reducing and automatic vehicle stopping systems can be implemented. The main objective is to create model using NXCAD10.0, develop, fabricate an automatic vehicle bumper activation system and automatic braking system. In this Automatic pneumatic bumper system, infrared sensor (IR) is used for sensing the obstacle in front of vehicle that may cause the accidents. When an obstacle comes close (within 10metres), the controller sends the signal to the relay and it energizes the pneumatic system then system pushes the bumper to absorb the impact and stops the obstacle coming near to the vehicle body. For automatic braking system, piston-cylinder arrangement is used to apply the break, whenever the relay energizes the pneumatic system the compressed air comes from the solenoid valve to the piston-cylinder arrangement and compressed air pushes the piston to apply brakes. This type of system stops the vehicle from the collision without the involvement of operator and improves the vehicle braking to stay a secure distance between two vehicles.

Key words: - Infrared sensor, Anti-lock breaking system (ABS), NXCAD10.0.

I. INTRODUCTION

Highly populated countries like India are using a huge number of diverse vehicles now-a-days and transportation plays a vital role in the service and other sectors. Transportation facility plays a major role in the growth of GDP of countries like India. Sea routes, rail routes, air and road routes involved in the transfer of goods and passengers. The road routes are more important because still road routes are well connected than other routes within the country. The majority of accidents are happening on the road routes. The methods to improve the road quality and accidents prevention technologies in vehicles are being developed to increase safety on the road routes. According to the report of the Ministry of road transport and highways, 1317 road accidents are happening every day in India and 1,50,785 people expired in 2016. Diverse mechanisms (Hydraulic, pneumatic, mechanical systems) are using to apply brakes. These all mechanisms need to take input from the operator and operator needs to apply the force on the brake pedal to stop the vehicle. If the operator fails to apply the brake he may lose control over the vehicle, leading to accidents. And in night journeys it is impossible to pay attention completely for operators. There are many reasons for accidents. Reasons may be different in accidents but proper technology of braking system, proper passenger safety system and proper damage reduction system should be developed. The following are the new implementations in the vehicles to reduce the vehicle impact and guide the operator in severe conditions to avoid the collision and these are taken as the reference to develop automatic braking system by automatic movable bumper model.

Poongodi.P [1] In this paper, the author proposed a safety system. PIC 16F877 microcontroller was used to assist in breaking the vehicles. He observed the driver's risk of sensing the obstacle from the certain distance and inability of stopping the vehicle in specific circumstances. He observed that this situation can be managed without any disturbing the throttle actuation system of vehicle. He designed a system which will take control over the acceleration pedal itself if the brake is not applied within the predetermined range.

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Takahiro Wada[2] The writer observed that the to lessen rear-end crash of automobiles, it is necessary to judge necessity of deceleration assistance as while possible and initiate the assistance naturally earlier. However, we've derived a mathematical model of driver's perceptual threat of proximity in car pursuing situation and effectively derived driver deceleration model to spell it out deceleration patterns and break initiation timing of expert driver. In this paper, a smart braking program for incident avoidance will become proposed predicated on the developed brake profile model and brake initiation style of professional driver to understand smooth, protected brake assistance naturally. Furthermore, experimental results utilizing a driving simulator shall show validity of the proposed system based on subjective evaluation.

EUNG SOO KIM [3] the proposed Field programmable and gate array (FPGA) and VHSIC Hardware Description Language (VHDL) technologies are used to design the automatic braking system. The system was placed on a mini car and examined. When the distance was finding closer, the auto-braking program was functioning and the speed shall decelerate if a driver will not decrease the speed of automobile. The automatic braking system also attached to the model. The author insisted that replacement of the sensor with radar in real applications provides better protection.

AMIR SYED [4] the vehicle damage reduction system is proposed to reduce the impact of the collision when the obstacle is hit by the vehicle. The automatic bumper system is designed to stop the opposite obstacle coming too close to the vehicle. The proposed system uses the infrared sensor unit to detect the obstacle. The IR sensor unit is placed on the bumper. The designed system depends on the pneumatic power to actuate the bumper system. A microcontroller in this system controls all the activities of the various components in the prototype. The signals given by the IR sensor unit send to the microcontroller to estimate the distance between the vehicle and the obstacle. If the estimated distance is too low, then microcontroller gives signal to the solenoid valve. Then solenoid valve transfers the compressed air to the pneumatic cylinder to push the bumper forward. The solenoid valve sends the compressed air through the flow channels and this compressed air is guided by the flow control valve.

Whenever the obstacle comes nearer to the vehicle the IR sensor gives the signal to the microcontroller and then microcontroller energizes the solenoid valve. The solenoid valve transfers the compressed air to force the bumper advance. The anticipated system has the excellent characteristic to lessen the vehicle damage in collisions.

BANKAR. M [5] the proposed system has the ability of reducing the vehicle damage when the vehicle is collided by the obstacle. To meet the set objective the author designed and developed an automatic bumper system. The bumper is designed from the result of the orthogonal array. Limit switches are used in this proposed system to give signal to the solenoid valve of the pneumatic system. The solenoid valve transfers pressurized air to the piston-cylinder arrangement to energize the bumper system. The working of model is a lot simpler that whenever driver applies brake a lot more than its optimum braking limit it closes the limit switch contact points and generates output transmission then it sends signal to path control valve and it gets actuated. The solenoid direction control valve is utilized in this operational system. When it gets transmission and opens the pneumatic valve consequently it pushes the piston ahead along with flexible bumper.

SHUBHAM WASNIK [6] studied and anticipated system is set by means of automatic bumper system which is energized by the pneumatic power. The IR sensor unit is located on the bumper to recognize the obstacles present in front of the vehicle. The sensor unit sends the signal to the microcontroller about the gap between obstacle and vehicle. If the gap is too little then microcontroller disconnect the power to the engine ignition or injection, so the vehicle will be gradually retarded and at the same time it energizes pneumatic system to move the bumper in forward direction to reduce the impact or collision.

Matthew L. Brumbelow[7] There are two consumer evaluation programs of vehicle frontal crashworthiness in the United States. The National Highway of Traffic Safety Administration (NHTSA) gives occupant protection ratings of 1 to 5 superstars for the drivers based on vehicle overall performance in a full-width check into a rigid wall at 35 mi/h (56 km/h). The Insurance Institute for Highway Protection (IIHS) assigns vehicle ratings of good, suitable, marginal, or poor predicated on efficiency in a 40 mi/h (64 km/h) test in which 40% of the vehicle front impacts a deformable barrier. These programs were introduced the structural and restraint system designs have improved substantially, and high test functionality now could be treated as a de facto standard. Among vehicles rated in the IIHS frontal offset test between January 2005 and May 2008, 85% received good rankings, with the rest receiving the second highest rating of appropriate. In this NHTSA's frontal Car Assessment Plan (NCAP), 95% of model year 2008 vehicles attained a 4- or 5-star rating for both the driver and right entrance passenger. In this paper the author proposed that the new technologies are required and he proposed that with these implementations only the death rates can be reduced.

TEJSINH PISAL [8] the developed system is fitted with UV sensors to detect the obstacle. The UV sensor unit is placed on bumper for easy recognition of the obstacles. This bumper system can make to and fro motion when it is powered by the microcontroller. This system can halt the

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vehicle without the drivers involvement and has the capacity of stopping the vehicle automatically.

OBJECTIVES

The following are the objectives of the project:-

- To lower the accident rates.
- To improve the response time of the breaking system.
- To improve the safety factors in the vehicle.
- To lower the vehicle damage.

II. METHODOLOGY

There is a requirement of impact reduction system and smart braking system to avoid the collision even when the operator is not in alert mode. To meet this requirement, an automatic braking system by automatic movable bumper system is proposed. This system can bring automation technology in the transportation vehicles to reduce the accidents and improve the safety of the passengers and goods. The following figure exposes the block diagram of the working model it can explain all the requirements of the working model.

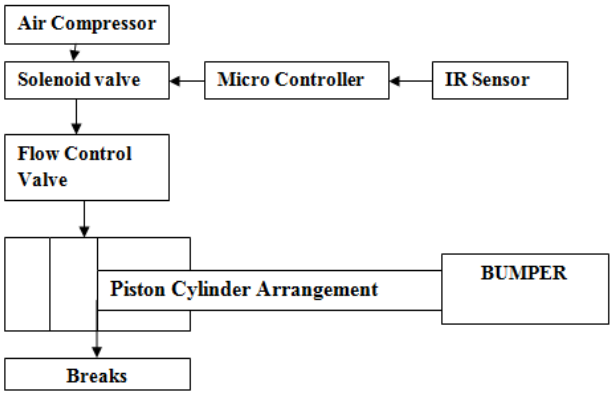

Fig. 1:-Block diagram of the working model.

The basic modeling is created virtually in the NXCAD10.0 to visualize how the proposed system exists to meet the objective. The modeling of the prototype explains how to assemble the components and where have to place the key components for getting the optimum results. The following figure is the virtual model of the prototype.

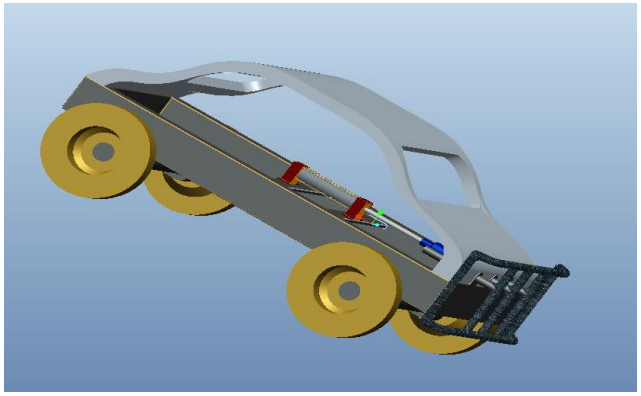

Fig 2: - 3D model of the Prototype.

The components are used to develop the prototype explained below.

1. ***Single-Acting Pneumatic Cylinder***

Two single-acting pneumatic cylinders are used in this project. In single-acting pneumatic cylinders, air pressure can be subjected only one side of the piston. The solenoid valve transfers compressed air from surge tank to the pneumatic cylinder by taking the signal from the controller.

Fig 3:-Single-Acting Pneumatic Cylinder

2. *Solenoid Valve*

Solenoid valve is used to change the direction of compressed air flow. Solenoid valve is used for transferring compressed air from the compressor to the end effectors (Piston-cylinder arrangement) through flow channels (flow pipes). 2/3 type solenoid valve is used in this project to guide the compressed air to the end effectors.

Fig 4:-Solenoid Valve

3. Electric Motor

Electric motors are used for the transformation of the electric energy to mechanical energy. Two motors are used in this project to propel the prototype. These two motors are arranged to rear wheels and these motors take power from the DC battery.

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Fig 5: - Electric motor

4. IR Sensor Unit

This unit contains IR transmitter and IR receiver. IR transmitter transmits infrared rays. If any obstacle presents in the range of transmitted rays then the obstacle reflects the transmitted rays. IR receiver receives the reflected rays and sends signal to the microcontroller. This IR sensor can detect the obstacle effectively up to 15feet distance but in this project, the IR sensor alerts the microcontroller whenever the obstacle comes within the range of 10metres.

Fig 6: - IR Sensor Unit

5. Microcontroller

Microcontroller regulates the sequence of operations involved in the project. 8051 Microcontroller with two line digital display is used for the purpose. It takes the signal from the IR sensor unit and energizes the solenoid valve in accordance with the signal given by the sensor unit.

Fig 7: - Microcontroller.

6. Relay

Relays are nothing but the switches, used for opening and closing of the circuit. In this project, Relay takes signal from the microcontroller and sends signal to the solenoid valve for allowing the compressed air to the end effectors (cylinder).

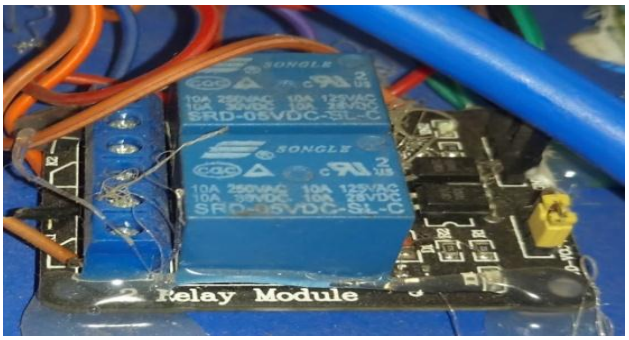

Fig 8: - Relay Module

III. PROTOTYPE MODEL

The chassis of the prototype was made by the mild steel L angle. The four L angles were welded to make rectangular shape chassis. Two polymer wheels were attached at the front and another two polymer wheels were attached with motors for propulsion. And all the required components were fixed on the chassis near to rear wheels.

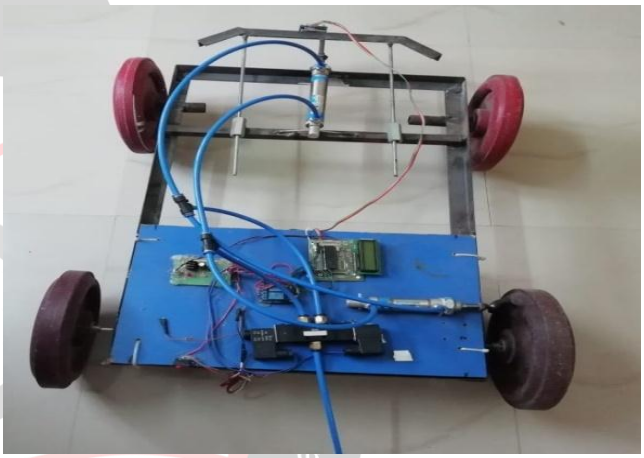

Fig 9: - Final assembly of the prototype.

BRAKING SYSTEM

An automated braking system is installed with the help of a pneumatic piston-cylinder arrangement. With this driver involvement in the application of brakes is not required. Whenever the microcontroller energizes the solenoid valve, the valve transfers pressurized air. That pressurized air flows to the two cylinders directly. In these two cylinders, one cylinder for the bumper movement and another for the application of brakes.

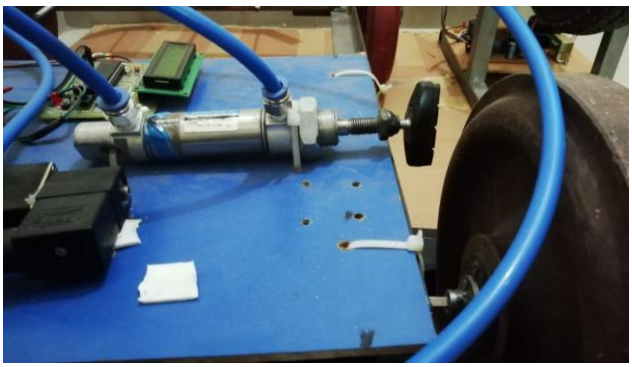

Fig 10: - Brakes arrangement.

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IV. PROTOTYPE WORKING

IR sensor is placed on the bumper to detect any obstacle. If an obstacle comes near to the vehicle it will be detected by the sensor. The sensor sends a signal to the microcontroller relating to the distance between vehicle and obstacle. The microcontroller takes the signal from the sensor and energizes the solenoid valve. The solenoid valve transfers compressed air to push the bumper forward and at the same time, it also energizes the breaking system. Both operations are done simultaneously.

TESTING OF THE SETUP:

The prototype is connected to the compressor surge tank for the compressed air. The compressed air at 1 bar pressure is used to energize the pneumatic cylinders of braking and bumper systems. The obstacle is placed in-front of the vehicle. The distance between the vehicle and the obstacle is changed at regular intervals of 1meter and at each interval the braking response is identified. Distance between the object and the vehicle is taken from the controller display board and the time taken for applying the brake is observed in the stop watch. Experiment is conducted in two trails and all the values are noted and plotted in a graph. The following graph shows the braking time versus object distance.

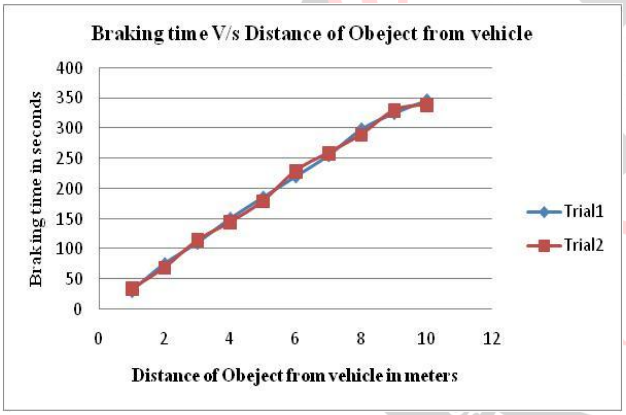

Fig 11: - Graph between braking time and distance of object.

Another test is conducted to know the braking response of the prototype. The obstacle is placed as same as the first test. The obstacle is first placed at 1m distance in front of the vehicle and the 1kg weight is placed on the prototype. The braking response is identified as same in the first test. Then load on the prototype is increased to 2kgs and obstacle is placed at 2m. The distance between the vehicle and the obstacle is changed at regular intervals of 1meter and weight on the prototype is increased at regular intervals of 1kg. At each interval the braking response is identified. Experiment is conducted and all the values are noted and plotted in a graph. The following graph shows the braking time versus object distance.

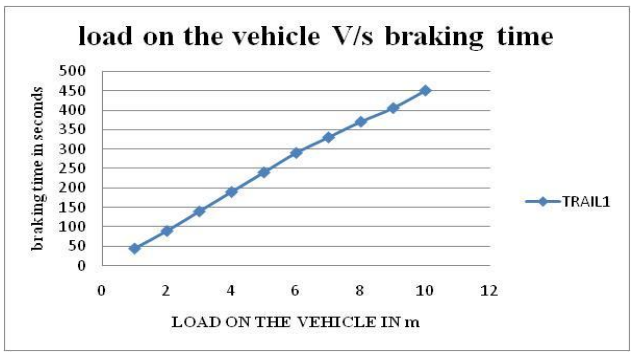

Fig 12: - Graph between braking time and distance of object

ADVANTAGES

- This system improves the response time of braking system.
- It can avoid the accidents and reduce vehicle damage.
- This system increases the passenger's safety.

V. FUTURE SCOPE

The following are the suggestions; which can implement further to improve the safety of passengers.

- Speed governors can be used to avoid the bumper movement in low speed conditions particularly in traffic.
- Eye blinking detection sensors can be used to avoid the accidents when the driver sleeps.

VI. CONCLUSION

Behind the designing of the operational system, the primary goal is to enhance the avoidance technique of accidents and in addition reducing the hazard from accidents like damage of automobile, injury of human beings, etc. Modeling is done to develop an automatic vehicle bumper with automatic braking system using NXCAD10.0 and fabricated with the required components. In this, IR sensor is used to sense obstacles around 10m. The prototype works on the controller sends the signal to the relay and it energizes the pneumatic system then system pushes the bumper to absorb the impact and stops the obstacle coming near to the vehicle body. For automatic braking system, piston-cylinder arrangement is used to apply the break, whenever the relay energizes the pneumatic system the compressed air comes from the solenoid valve to the piston-cylinder arrangement and compressed air pushes the piston to apply brakes.

Proposed suggestions have implemented, installed in the prototype and also tested by placing the obstacle in front of the vehicle at various distances. This system is fabricated and developed with low cast automation to reach the requirements of avoiding the accidents. This system gives the optimum features to the operator in the application of brakes. These implementations improved the vehicle response in braking and also reduced the

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vehicle damage by stopping the vehicle within the safe distance.

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