The Smart Brake

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Abstract— In this project work conventional brake has been converted in pneumatic brake by the help of compressed air and pneumatic cylinder. This air compressor is connected to the flow control valve and it is use to actuate the pneumatic cylinder which is connected with brake lever. There is a Ultrasonic Sensor on front side of the vehicle, the sensor detect the obstacle and sends a signal to the flow control valve to actuate the air supply to apply the brake. In this project there is DC electrical energy is required in operation of Infrared Sensor. The main advantage of this project is less comfort and safety with a emergency brake system.

Key words: ABS, Intelligent Brakeing system, Smart Brake

I. INTRODUCTION

Generally diving a vehicle is a common thing nowadays, peoples generally use automobile to travel from one destination to other. The number of automobiles are increasing day by day. Nowadays, number of accident are maximizes. Accidents happened frequently and it cause serious injury and death also. This accidents are generally causes due to slow response to apply the brake. The main objective of this project to design speed control & automatic braking system in the vehicle. That the driver may not brake it manually but the vehicle can stop automatically due to obstacle.

The main objective of this project automobile can run automatic braking due to obstacle when obstacle is to be detected by the sensors. The function of braking circuit is to apply the brake after detection of obstacle.

The basic objective of these paper is to developed and smart braking system using ultrasonic sensor and to design a vehicle with less human attention to the driving and to increase the safety of the driver and passengers.

II. OBJECTIVE OF WORK

1) To increase the sureness of braking Application.
2) To reduce the requirement of internal safety devices like air bags.
3) To provide safe parking.
4) To avoid damage of vehicle.
5) To provide comfort for driver with regarding driving purpose.
6) To provide additional brake in addition to conventional brake.
7) To provide automatic braking system.
8) To provide mind free ride for the motorist

III. LITERATURE REVIEW

Dhanya K. R. [1] has proposed a technology of an advance automatic braking system with sensor fusion concept. In this they uses the properties of both capacitive &ultrasonic sensor for detecting the obstacle & also for calculating the distance between the vehicle & the obstacle and this distance measurement is used to control automatic braking system for safety application. In this system they use the 32-bit microcontroller with ARM processor(LPC2138) as the brain of this system for controlling process. The programming is done by using c-language. The additional feature included in the system are automatic retarding & automatic horn disabling in restricted area, this is done through RF signal communication. The RF transmitter is placed in restricted area, where the speed is limited & horn is restricted. RF transmitter placed in the traffic signal, transmit the value of limited speed in km/hr & a signal corresponding for disabling horn and then automatically reduce speed into particular rate & horn is disabling in that area.

S. P. Bhumkar [2] presents a system of about accidents avoidance & detection on highways. This system is about advance technology in cars for making it more intelligent & interactive for avoiding accidents on roads.

ARM7 is using for making this system more efficient, reliable & effective. In this system, they have described real-time online safety prototypes that control the vehicle speed under driver fatigue. The purpose of this system is to avoid accidents. The main component of this system consist of number of real time sensor like gas, eye blink, alcohol, fuel impact sensor & a software is interface with GPS & Google maps APIs for location. Through this research work, they have proposed an intelligent car system for accident prevention & making the world a much better & safe place to live.

Vidyadhar M. [3] presents a system that can enhance the safety of vehicle. This system give solution can assist the driver by warning the driver about impeding obstacle & approaching vehicle that may lead to collision in addition to this they are also implementing & auto retarding system which helps in avoiding accidents. In this system ultrasonic sensor, motor driver and LCD are used. In addition to this, they have implemented an automatic wiper speed control which control speed of wiper is based on the intensity of rainfall. In the wiper speed control system the IR sensor is very sensitive & can detect very small quantities of moisture. In case even slight rainfall the system will get activated, in higher amount of rain the motor faster & will implies the wiper runs faster & save the driver from distraction & provide convenience & safety.

IV. METHODOLOGY

The concept was proposed with development of braking efficient electro pneumatic system with maximum intensity, in this case individual advantages of systems such as ultrasonic sensor is used to achieve high distance of obstacle sensing.

1) Obstacle detection.
2) Signal transmission.
3) Activation of pneumatic braking system

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After studying the different techniques of braking system it is clear that electrical supply & compressed air supply is the source require for braking application. The distance from obstacle where vehicle is supposed to be stop, compressed air supply, stroke of pneumatic cylinder, speed of vehicle and deceleration of the vehicle are the important parameters.

It is decided to plan and proceed with Ultrasonic Sensor and Flow Control Valve made up of metal and with Air Medium and 230V A.C. and 50 Hz for its performance analysis involving experimental and necessary instruments for measurement of pressure in valves, hose and collector. Also high pressure compressed air is supply towards pneumatic cylinder. A separate compressor is used to compressed the air. The experiment is carried out on one wheel only.

The proposed method will automatically inform to driver about the obstacle in the path of the automobile on the LED display with the obstacle distance with ultrasonic sensor. The driver takes different actions based on these signals to create a safe drive. When the distance between two obstacle is reach upto it's limiting distance, means if accidents like situation are detected by ULTRASONIC sensor then the automatic pneumatic braking system is activated.

A. Obstacle Detection.

The objective of the obstacle detection is to control deceleration of the vehicle and secure the comfort and safety of the driver against different types of obstacle. To get these results ultrasonic sensors are attached on front sides of the vehicle. The ultrasonic Sensor has one transmitter and one receiver. The transmitter of the ultrasonic sensor will continuously transmit the signal. When these transmitting signals will collide with any hurdles and will be reflected back, the receiver of sensor will receive these reflected signals and forward them towards controller.

B. Signal Transmission.

The obstacle detected by ultrasonic sensor and it will transmit the signal to the driver. On the LED display driver will see the distance of obstacle. The controller will take the actions for the comfort drive if in any case the controller was unable to take the actions then the system will send signal to the flow control valve and it will open the compressed air flow.

C. Activation Of Pneumatic Braking System

The primary objective of braking system is to control the vehicle or stop the vehicle in case of emergency. The controller of the vehicle is not able to take action then, signal will transmit towards the flow control valve of 50 Hz and it will supply the compressed air supply. The compressed air supply is actuate the pneumatic cylinder which is attached to the brake lever and it will retard or stop the vehicle.

V. LIST OF COMPONENTS

There are various types of components such as ultrasonic sensor, flow control valve, double acting pneumatic cylinder are to be used while studying the subject.

A. Pneumatic Cylinder

Here we are using and double acting cylinder. DAC is a cylinder in which the working fluid acts alternately on both sides of the piston.

Here we are using the pneumatic cylinder of air medium and temperature limit up to 0°c to 85°c. of diameter 25mm and of bore diameter of 50mm.

The function of the piston is to move forward when flow control valve is open and to apply the brake and retard the vehicle.

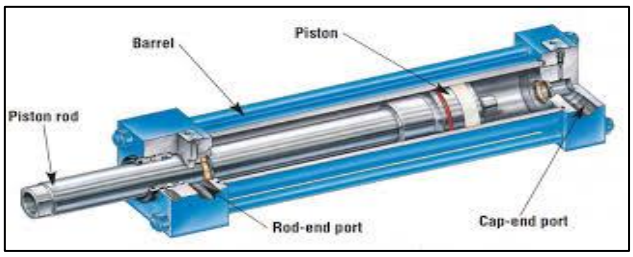

Fig. 1:

B. Ultrasonic Sensor

The range of ultrasonic sensor is upto 400cm so it will detect the object within it and it will show it on LED to the driver. The brake will apply within the limited distance which is has been setup by the controller. The sensor will contain the one is transmitter and other is receiver.

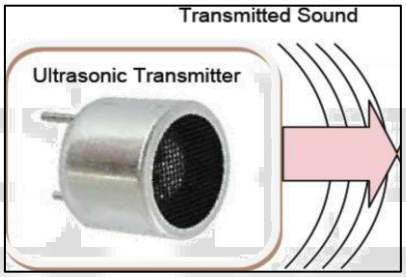

Fig. 2: Ultrasonic Transmitter

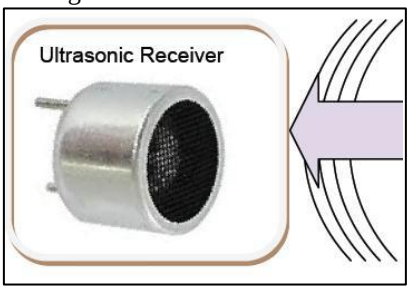

Fig. 3: Ultrasonic Recevies

C. Flow Control Valve

We are assembled here an flow control valve of 220V which is connected with hose collar, reducer and compressor. The flow control valve is of 50 Hz of size ¼" and upto pressure limit 0 to 10kg/cm².

Fig. 4:

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VI. DESIGN OF PISTON

A. Thickness of Piston

The thickness of the piston head is calculated from flat-plate theory
t = D (3/16 x P/f) ½
Where,
P - Maximum combustion pressure = 100 bar
f - Permissible stress in tension = 34.66 N/mm²
Piston material is aluminium alloy
.∴t = 0.050 (3/16 x 100/34.66 x $10^6/10^{5)½}$ x 1000
= 12 mm

B. Length of the Piston

Length of the piston = 1.625 x D
Length of the piston = 81.25 mm
Length of the piston skirt =Total length – Distance of first ring from top of
The first ring (No. of landing between rings x
Width of land) – (No. of compression ring x
Width of ring)
= 81.25 – 5 – 2 x 1.875 – 3 x 2.5
= 65 mm

C. Design of Pneumatic Cylinder

Force to be exerted is 40N
Force = pressure x Area
Pressure in the cylinder = 0.4 x105 N/m^2
Area of the piston, (πd^2)/4 = Force/pressure
= 40/ 40000
= 0.001m^2
Bore diameter = 0.0356m = 35.6 mm
From pneumatic products catalogue we have selected 40mm bore diameter cylinder
For Forward Stroke
For 40mm bore diameter
Corresponding rod diameter = 16mm
Area of the piston = (πd^2)/4
= (πx402)/4
= 1256.8mm^2
Force (modified) to be exerted = pressure ×area
= 0.4 x105 x1256.8
= 50N
For Return Stroke
On the return stroke, when the pressure is applied to the reverse direction, the force on
The Piston due to the pressure is
= P × (A-a)
Where,
P = Pressure in the cylinder (N/m^2)
A = Area of the piston (m2)
a = Cross sectional area of the piston rod (m^2)
Therefore
Area of the piston (A-a) = {(π× d^2)/4}-{(π× d_1^2)/4}
= {(π× 40^2)/4}-{π (×16^2)/4}
= 1256.6-201
= 1055mm^2
Force To Be Converted
On the reverse direction = Pressure Area
= 0.4× 105×1055
= 42.2 N
For working pressure of 0.4×105 N/m^2
Extending force = 50.3 N
Retracting force = 42.2 N

VII. ADVANTAGES AND DISADVANTAGES

1) Free from wear adjustment
2) Less power consumption
3) It gives simplified very operation.
4) Installation is simplified very much
5) Need separate air tank
6) In this system there is no speed controlling system
7) Addition cost is required to install this system to four wheeler.

VIII. FUTURE SCOPE

The future scope of these study give us benfits of reduction in stress, decreased in accidents and safe and secure drive for younger drive. The further study of these system will give us the better results in safety and comfortness of the vehicle. Drivers need to be better informed about situations in which their system is unlikely to react. Based on the potential safety benefits and problems more research is needed to determine the overall safety impact of these systems. The future scope of the system is implementation on hardware. These system can be improved by including the buzzer or light indicator and can be able to set the speed in the vehicle by using the keyboard and keyboard encoder in the system.

IX. CONCLUSION

In this paper work we have conclude that the pneumatic braking system has an wide effort on safety and comfort. Paper work suggests that there are safety benefits from using pneumatic brake as a technology, such as reduction in speed, applying brakes at safer distances. This technology also avoid the skidding of vehicles due it's speed controlling technology. As ultrasonic sensors can detect any kind of obstacle, this system can also prevent collision of the vehicle with pedestrians, or can at least reduce the injuries occurring.

Fig. 5:

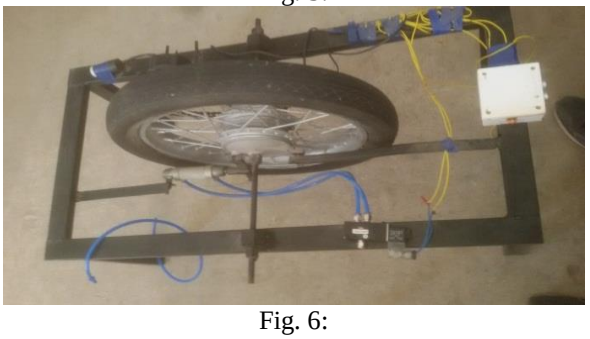

Fig. 6:

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