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SMART AUTOMATIC BRAKING WITH PNEUMATIC BUMPER

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Abstract—The aim is to design and develop a control system based on a smart controlled automatic bumper activation system called "Smart Braking With Active Pneumatic bumper". This system consists of IR Transmitter and Receiver , control unit , pneumatic bumper and Braking unit .In which the IR sensor senses the obstacle .If there is any obstacle closer to vehicle ,the control unit gives signal to bumper and brake activation system , due to this the brake and actuation of bumper acts simultaneously .

This system acts only when the vehicle speed is beyond 40 km/hr. This system is an innovative project for the purpose of preventing accidents on road ways . This system improves the response time of vehicle braking to keep safe distance between two vehicles.

Keywords—IR sensor, bumper,automation

1. INTRODUCTION

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Today India is one of the most important developing countries in the world. The Indian auto industry is one of the largest in the world. The demand of various type of vehicles is increasing day by day in India. But the all braking system in the vehicles are manually operated that means when the operator applies brake then and then the brake is applied .The percentage of accidents in India is also more due to the improper skill of driving. When a driver drives a vehicle, they do not fully concentrate on driving due to listening songs, talking on mobiles etc. After accident the maintenance cost of vehicle is more.

In this paper we have designed a control system based on smart controlled automatic bumper activation. This system consist of IR transmitter & receiver , control unit, pneumatically operated bumper, braking unit.

2 LITERATURE SURVEY

Nivesh Thepade , Lakhan Thombare , Pritish Varude , Ashish Umbarkar

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

J. T. Wang

An extendable and retractable bumper (E/R bumper) is presented in this paper. The extendable and retractable bumper is intended to automatically extend in situations in which there is a high risk of frontal impact to prepare the vehicle for crash and bumper is retracted when the risk subsides. A functional model vehicle were built with the E/R bumper. Analytical and nonlinear finite element models were used to aid in the design of these vehicles, and to predict their crash performance in full, offset and oblique impact tests. While the functional demonstration vehicle was used to study its control and operation sequences, the experimental vehicles were crashed in a 56kph rigid barrier impact test and a 64kph 40% Offset Deformable Barrier impact test. These crash tests, together with nonlinear finite element analysis, showed that the additional crush space realized by extending the bumper could reduce the severity of the crash pulse and the amount of structural intrusion to the vehicle.

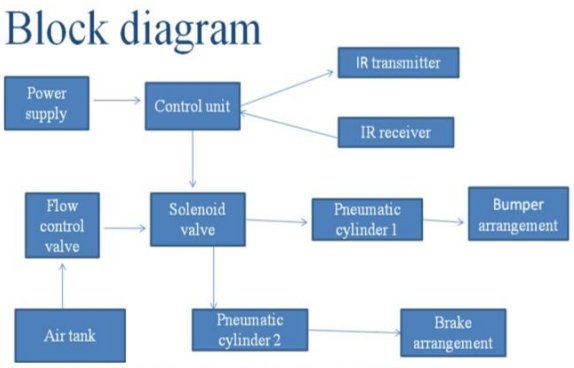
Benet , F. Blanes , J.E. Simo , P. Perez

Reflected amplitude of the surrounding objects is non-linear and depends on the reflectance characteristics of the object surface defines amplitude response of infrared (IR) sensors . As a result, the main use of IR sensors in robotics is for obstacle avoidance. Though, their inherently fast response is very important for improving the real-time operation of a mobile robot , for instance, map building tasks. Thus, it seems that the development of new low-cost IR sensors able to accurately measure distances with reduced response times is worth researching. A new IR sensor based on the light intensity back-scattering from objects and able to measure distances of up to 1 m is described. Also, the sensor model is described and the expected errors in distance estimates are analyzed and modeled. Finally, the experimental results obtained are discussed

3 OBJECTIVES

- To Enhance safety of the passenger
- To reduced the damage of vehicle after the accidents
- To increase the pre-crash safety of vehicle

4 BLOCK DIAGRAM



5 CAD MODEL

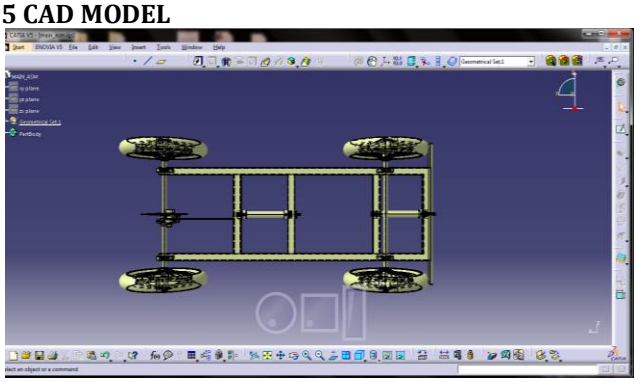


Fig. 1 Top View

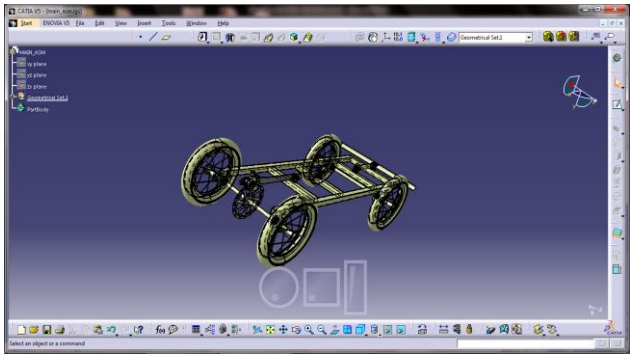


Fig 2. Bumper and Braking Sytem

6 DESIGN

6.1 Frame design:

Material used –mild steel, square pipe

Area=1*1inch=25.4*25.4=645.6mm^2

Length of link=30 inch=762 mm

Weight of project=15 kg= 15*9.81 =147.15 N

Solution

1.1.1 Effective length

Effective length, when both end fixed,

$$L_e = \frac{L}{2} = \frac{711.2}{2} = 355.6 \text{ mm}$$

1.1.2 Internal Area

Internal width and depth, which have 3 mm thickness,

d=b=38.1- (2*3) =32.1 mm

1) Moment of inertia

$$I = \frac{B D^3 - b d^3}{12} = \frac{25.4*25.4^3 - 19.4*19.4^3}{12}$$

$$= 22882.048$$

1.1.3 Crippling load by Euler's formula

$$P_c = \frac{\pi^2 EI}{Le^2} = \frac{\pi^2 \times 210 \times 10^3 \times 22882.048}{355.6^2} =$$

375.05 KN

2 Double acting pneumatic cylinder

Given data:

Cylinder: 20*50

2.1.1.1 Volume of air exhaust = Stroke *Area of piston

$$= 100 \frac{\pi}{4} * 20^2$$

$$= 31415.92 \text{ m}^3$$

2.1.1.2 Area of piston = $\frac{\pi}{4} * 20$

a) = 2314.15 mm^2

2.1.1.3 Outstroke force (F) = Pressure *Area of cylinder

=0.4*314.15

=125.66 N

2.1.1.4 Piston rod area (A1) = $\frac{\pi}{4} d^2$

$= \frac{\pi}{4} 7^2 = 38.48$ mm^2

2.1.1.5 Effective area= Piston area- Piston rod area

=314.15-38.48

=275.66 mm^2

2.1.1.6 Instroke force= P*A

=0.4*275.66

=110.26 N

CONCLUSION

In this paper the Design of braking control system is shown. Due to the use of pneumatic system the operation is smooth. By using more techniques, the system can be modified and developed according to the applications. The main advantage of the system is that the actuation of bumper and the application of brake is simultaneous, when the facing the obstacle. The prototype which we made is in working condition and all the necessary objective is achieved.

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