Sensor based Automated Braking System

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ABSTRACT

The paper reports a Sensor based Automated Braking System for vehicles. A method and arrangement for emergency braking of a vehicle includes a detection system on the vehicle which detects obstacles located in or near the direction of motion of the vehicle and generate corresponding data, representing characteristics parameter of the condition of the vehicle, and an evaluating unit which determines, from the data on the obstacles and the parameters of the condition of the vehicle, target values for controlling the motion of the vehicle and, only upon determining that an impending collision of the vehicle with an obstacle is no longer avoidable by any action on the vehicle by steering or braking, trigger an automatic emergency braking for rapid deceleration of the vehicle.

Keyword: *Mild steel shaft, Active wheel, Battery, Chassis, DC motor, Arduino board, Relay, IR sensor,Solenoid,Brakes*

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1. INTRODUCTION

Braking systems of business vehicles were continually given the best importance regarding questions of safety and specially active safety. In acceptable braking of those vehicles could cause serious accidents because of comparatively longer stopping distances and better energy output of brakes significantly within the case of auto mixtures. The traditional medium used for brake system can be now controlled with the speed and precision offered by modern electronic abilities. Sensor based automated breaking system introduced in commercial vehicles providing rapid brake response and release for every single wheel therefore ensuring safety. The very fast interval provided by the electronic management will be used for crucially shortening the braking distance by introducing advanced management of the braking system operation. Such a posh task obligatory to the management of braking system cannot be supported the motive force skills and wish to be done severally of the motive force. An improved SBS braking forces management would certainly enable to reach the given task. The advanced strategy for the braking forces distribution between the front and rear shaft of powered vehicle and between Rowling combination and between tractor or semi-trailer. Sensor based automated braking system has lot of potential applications especially in developed countries where research on smart vehicle and intelligent highway are receiving sample attention.

2. BACKGROUND SURVEY:

Hemalatha et al [1] have proposed system is based on microcontroller technology for collecting data related to speed and transmitting it through a transceiver to a base station that analyzes the transmitted data and takes appropriate decisions related to speed limit and control requirements. The Electromagnetic brakes are excellent replacement for conventional automobile brakes. The use of Electromagnetic brakes can be done for lighter vehicles also. With some modification, a regenerative braking system can be equipped with the Electromagnetic brakes. The Electromagnetic brakes are the future of automobile brakes.

Aniruddha et al [2] proposed sensor based automated braking system which provides a glimpse into the future of automotive safety, and how much more advanced these individual systems can be for avoiding accidents and protecting vehicle occupants when they are integrated into one system. Sensor based automated braking system approach represents a significant shift from the traditional approach to safety, but it is fundamental to achieving the substantial benefits.

S. N. Sidek et al [3] have proposed sensor based automated braking system has a lot of potential applications especially in developed countries where research on smart vehicle and intelligent highway are receiving ample attention. The system when integrated with other subsystems like automatic traction control system, intelligent throttle system, and auto cruise system, etc will result in smart vehicle maneuver. The driver at the end of the day will become the passenger, safety accorded the highest priority and the journey will be optimized in term of time duration, cost, efficiency and comfort ability. The impact of such design and development will cater for the need of contemporary society that aspires quality drive as well as to accommodate the advancement of technology especially in the area of smart sensor and actuator. The emergence of digital signal processor enhances the capacity and features of universal microcontroller.

Ashwin et al [4] proposed the innovative idea of implementing intelligent braking system is discussed and thereby analyzed its various parameters for regular realistic application. Intelligent braking is one of the smart options which can be implemented in various applications for stopping a moving body without jerky motion.Sensor based automated Braking System (SBS) is an efficient and modern method to reduce the number of accidents by governing speed in cities, highways and other urban areas hence making our roads safer for everybody, as it uses GPS coordinates to locate the present zones that are the most accident prone like schools and hospital areas.

Aleksendric, D.et al [5] proposed intelligent modeling, prediction and control of the braking process are not an easy task if using classical modeling techniques, regarding its complexity. In this paper, the new approach has been proposed for easy and effective monitoring, modeling, prediction, and control of the braking process i.e. the brake performance during a braking cycle. The context based control of the disc brake actuation pressure was used for improving the dynamic control of braking process versus influence of the previous and current values of the disc brake actuation pressure, the vehicle speed, and the brake interface temperature. For these purposes, two different dynamic neural models have been developed and integrated into the microcontroller.

3. METHODOLOGY

Systems are extended over the body of the vehicle used, a communication module that supports to provide a one halt control of the vehicle by means of the master controller of the digital driving system. Accident prevention is one of the most important areas of research today. Our paper is designed to stop/control accidents caused by loss of control, drunken driving and rash driving, by means of circuitry aided by a microcontroller kit. In our work, braking distance and the distance of the hurdle are taken into consideration along with the speed of the vehicle.

The speed of motion of the vehicle and the distance of the object in front are analyzed by means of the ultrasonic sensor. These sensors give real time inputs to the microcontroller coding. Using the Hall sensor the system will analyze the speed of the vehicle with the microcontroller, the distance required to bring the vehicle to a complete stop for that speed is been calculated. Braking motors are included to activate the brakes thereby attaining automatic braking procedures. The system helps in coincidence with the driver judgment if the driver doesn't sense the obstacle and applies the brake at the right time then the microcontroller initiates braking motor to reduce speed automatically, if driver will not taken an action for a particular. Our future work deals with incorporating real time brake shoe wear system to provide enhanced feature for the intelligent braking system.

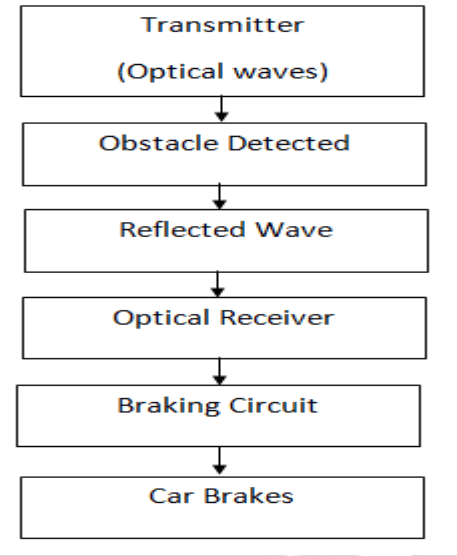

Figure 1: Working Flowchart

4. Calculations

A**.** Calculation for Force to operate Brake shoe (F)

$$F = (m + M/C)$$

Allowable pressure for Asbestos = 0.7b N/mm²

i. Total moment of Normal force (M)

$$M = ½ \, p \, br \, OA \, [(Ø_2-Ø_1) + ½ (\sin 2Ø_1-\sin 2Ø_2)]$$

$$= ½ \times 0.75 \times 5 \times 97 \times 85 \, [(1.83 – 0.175) + ½ (\sin 20-\sin 216]$$

$$= 39959.47 \text{ N-mm.}$$

ii. Total momentum of the friction force (M)

$$M = \mu \, pbr \, [r (\cos Ø_1-\cos \theta_2) + OA/4 (\cos 2\theta_2-\cos 2\theta_1)$$

$$= 31947.52 \text{ N mm.}$$

Therefore Force (F) = (M + M)/C

$$= (39959.47-31947.52)/155$$

$$= 51.69 \text{ N.}$$

Force to operate brake shoe = 51.69N.

iii. Calculation for Diameter of shaft

Subjected to torque

Material = Carbon steel (C14)

Force = 51.69 N = 5.269 kgf.

Radius = 0.097 m.

Torque = Force x Radius (kgfm)

= 5.269 x 0.097

= 0.511 kgfm

iv. dia of the shaft = 20.5 mm (From PSG-Design Data book)

B. DESIGN OF BALL BEARING

Bearing No. 6202

Outer Diameter of Bearing (D)	=	35 mm
Thickness of Bearing (B)	=	12 mm
Inner Diameter of the Bearing (d)	=	15 mm
r_1	=	Corner radii on shaft and housing
r_1	=	1 (From design data book)
Maximum Speed	=	14,000 rpm (From design data book)
Mean Diameter (d_m)	=	(D + d) / 2 = (35 + 15) / 2 = 25 mm

C.WAHL STRESS FACTOR

$$Ks = \frac{4C - 1}{4C - 4} + \frac{0.65}{C}$$

$$= \frac{(4 \times 2.3) - 1}{(4 \times 2.3) - 4} + \frac{0.65}{2.3}$$

Ks = 1.85

D.RELATION OF STOPPING DISTANCE

It can be represented by the equation,

$$f = F\, g/w$$

Where,

f = acceleration (m/s^2)

F = force acting on the body

W = weight of the body

g = acceleration due to gravity m/s^2).

The deceleration of a moving mass may be considered as negative acceleration. When the vehicle is brought to rest by the application of its brakes, the maximum value at decelerating force can be represented by

F = μ w

Where,

W = weight of the vehicle

u = coefficient of friction

The max braking force is available only if the brakes are applied on all the four wheels. The value of the coefficient of friction between the tread of a rubber tire and a clean dry concrete road lies between 0.6 x 0.85 under ideal conditions. It is reasonable to assume value of as 0.6.

The rate of deceleration can be represented as,

f = μ wg/w.

= μg.

If the speed of the vehicles is v km/hr. its velocity is,

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$$V = \frac{}{3600} \times V = \frac{}{18} \times v \text{ (m/s).}$$

To bring the vehicle to stop from an initial velocity of V = (5/18) x v (m/s). When the rate of deceleration is ug (m/s^2), the time

$$t = \frac{(5/18) \times v}{ug}$$

When the deceleration is constant the mean velocity is half of initial velocity

i.e., (5/36) x v (m/s)

stopping distance = mean velocity x time

= (5/36) x v x (5/18) x v/ug

Stopping distance = $25/648 \times v^2/(0.6 \times 9.81)$

= $0.00656\ v^2$

5. CONCLUSION

This project is an experimental effort to demonstrate a new type of Electromagnetic braking system using a solenoid coil. The necessity for this brake arises from the fact that there is a time lag even in the case of air brakes between the pressing of the brake pedal and the applier action of the brakes. In electromagnetic brakes there is practically no lag.

In this report the innovative idea of implementing sensr based automated braking system is discussed and thereby analyzed its various parameters for regular realistic application. Intelligent braking is one of the smart options which can be implemented in various applications for stopping a moving body without jerky motion. Sensor based automated Braking System (SBS) is an efficient and modern method to reduce the number of accidents by governing speed in cities, highways and other urban areas hence making our roads safer for everybody, as it uses GPS coordinates to locate the present zones that are the most accident prone like schools and hospital areas. By the implementation of this 'Intelligent Braking System' in automobiles, we are looking at a reduction in almost 15% of road accidents and related fatalities in the designated areas. We can also control rash driving to a certain extend and help in the enforcement of speed limits.

6. REFERENCES

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