PERFORMANCE INVESTIGATION ON INTELLIGENT BRAKING ASSISTANCE IN AUTOMOBILE APPLICATION

[1]A.MOHAN

[2]S.SNEYHAL, [3]R. KRISHNAN, [4]A.MANIKANDAN, [5]M.SIVA MUKESH VENNO

mohan@veltechengg.com, sneyhalsri@hotmail.com

[1]Assistant Professor [2,3,4,5] UG students, Department Of Mechanical Engineering,

Vel Tech, Avadi – Chennai 600062, Tamil Nadu, India.

ABSTRACT

Brakes are the second most important mechanism which is in need to stop a vehicle or to slow down according to the drivers will with the help of this thing the riding environment can be safe But generally brakes are applied manually to slow down or stop the vehicle in accordance with the drivers will and primarily the drivers attention towards the road and the driving skill of the driver so whatever be the brakes provided considering these two factors the vehicle can be bought to a safe stop This paper is about the scenario when the driver becomes inattentive to road or there is some sudden interruption where the driver is unable to react to such situation, the vehicle itself takes over the full control and brings the vehicle to a safe stop by calculating the minimum safe braking distance with the help of ultrasonic sensor and hall effect sensor to measure the distance of obstacle and speed of the vehicle.

Index Terms— ultrasonic sensor, hall effect sensor, Arduino uno R3,

I INTRODUCTION

The automobile has become a very important part of today's society. It is a necessity to own or to have access to a motorbike or a car in order to keep up with all of the competition of the business world, and also one's social demands and so automobiles is an unavoidable thing in our daily life. Particularly, cars become our basic need in this modern society.

Generally, brakes provided with automobiles are used for slow down or to stop a vehicle when needed, this plays a vital role in keeping our riding environment safe but these all work based on the driver who is actually goanna work it out at the time to act if he is not attentive to the riding environment then it's going to be a disaster. India is witnessing about 36% accidents because in attentiveness to the road It is surveyed that 1 in 15 road accidents are of this issue. To lower these types of accidents an automatic braking system with an alerting system to the behind come driver has been proposed where even if the driver is not attentive to the road the vehicle will respond to the upcoming obstacle with help of some sensors and notify it to the behind come driver about action to be taken.

OBJECTIVE:

To subsidence the road accidents which have the root cause of inattentiveness to the road and some sudden interruptions where the driver cannot act as perfect as a machine.

PRIME MOVER FOR THE ROAD ACCIDENTS:

The frequency of traffic collisions in India is amongst the highest in the world. A National Crime Records Bureau (NCRB) report revealed that every year, more than 135,000 traffic collision-related deaths occur in India. About

Year	Accidents	Casualties
2000	8,269	9,300
2001	8,579	9,571
2002	9,012	9,939
2003	8,393	9,275
2004	8,733	9,507
2005	8,844	9,760
2006	10,055	11,009
2007	11,034	12,036
2008	11,813	12,784
2009	12,727	13,746
2010	14,241	15,409
2011	14,359	15,422
2012	15,072	16,175
2013	14,504	15,563

75% of road accidents is mainly occurs due to or between pedestrians and the car owners.

In New Delhi, the capital of India, the frequency of traffic collisions is 40 times higher than the rate in London, the capital of the United Kingdom.

India stands out miserably in the latest Organization's (WHO) "Global Road Safety Report-2015" with an estimated 207,551 deaths on roads. [3] discussed about a disclosure which is made regarding a driving alert system which is designed in the form of a neck cushion which has the capability to sense the posture of the drivers neck position so as to identify whether the driver is alert and if he is dozing of. The system is made intelligent to obtain data from the movement so as to produce triggers to alert the user and to keep him/her awake to avoid accidents. The system is also linked to a mobile computing device so as to provide a report of the analysis done. The drivers location can also be tracked using the same.

The World Health Organization (WHO) identified the major causes of traffic collisions as driving over the speed limit, driving under the influence, not maintaining lane or yield to oncoming traffic when turning are prime causes of accidents on The "Global Status Report on Road Safety" published by four lane, non-access controlled National Highways. The report noted users of cars and trucks constitute the second largest group of traffic collision deaths.

Tamil Nadu records the highest road accidents for a decade and its capital Chennai has more accidents than any other city in India. The main cause for this as follows,

- Not obeying traffic rules,
- Inattentive to the route,
- Over speeding

India is witnessing about 36% accidents because in attentiveness to the road It is surveyed that 1 in 15 road accidents are of this issue. To lower these types of accidents an automatic braking system has been proposed where even if the driver is not attentive to the road the vehicle will respond to the upcoming obstacle with help of some sensors

- **Arduino UNO-** a electronic processing unit

- **Ultrasonic sensor**- device used to measure distance of obstacle

- **Hall effect sensor**-device used to measure speed of vehicle

- **Relay**-breaks or makes the circuit and also amplifies the circuit.

- **brakes-** used to slow down or stop the wheel

ARDUINO UNO R3:

Arduino is a open-source electronics platform based on easy-to-use hardware and software. It is able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output like activating a motor, turning on an LED, publishing a data online. We can teach the board or command what to do by sending a set of instructions to the microcontroller on the board. for commanding or teaching the Arduino programming language or general C-language is used in the Arduino Software (IDE).The software, too, is open-source, and it is growing through the contributions of users

worldwide. [5] discussed about a disclosure which is made regarding a wallet safety where a locking system is designed along with an automatic credit –debit card eject system. The wallet is provided with a screen display to select the card and to provide finger print authentication to access the wallet and to select the card which needs to be ejected out of the wallet for usage. The wallet is connected to a mobile device which can remotely monitoring its usage and location in case wallet is lost.

ULTRASONIC SENSOR:

This device works on the principle of ultrasonic sound navigation to be precise it works like BATS where this sensor sends an ultrasonic sound wave which travels and hits on the obstacle if any in the front and returns where the deflected wave is received by a receiver in the sensor and calculates the distance of the obstacle by the velocity of the wave and the time taken to receive it by co-relating these two factors the distance is measured.

LLAH EFFECT SENSOR:

Is a transducer that varies its output voltage in response to a magnetic field. Hall effect sensors are used for proximity switching, positioning, speed detection, and current sensing applications.

In a Hall effect sensor, a thin strip of metal has a current applied along it. In the presence of a magnetic field, the electrons in the metal strip are deflected toward one edge, producing a voltage gradient across the short side of the strip

(perpendicular to the feed current). Hall effect sensors have an advantage over inductive sensors in that, while inductive sensors respond to a changing magnetic field which induces current in a coil of wire and produces voltage at its output, Hall effect sensors can detect static (non-changing) magnetic fields.

In its simplest form, the sensor operates as an analog transducer, directly returning a voltage. With a known magnetic field, its distance from the Hall plate can be determined. Using groups of sensors, the relative position of the magnet can be deduced.

BRAKES:

It is well-know that the automobile brake system is the most important system in vehicles. If the brake fails, there may be a crash, people may be injured and even die. In order to guarantee personal safety, the driver should have some basic knowledge about brake system and inspect the brake regularly, make sure it is in good condition.

In addition, automobile brake system is an essential element to measure the performance of an automobile. The performance of brake system directly affects the other properties of the vehicles.

The target of this thesis is to people get more information about automobile brake system and study some basic maintenance methods.

THEORETICAL BACKGROUND:

At first, this chapter introduces the basic physics principle used in brake system and the basic components of brake system.

DEFINITION OF AUTOMOBILE BRAKE SYSTEM:

A **brake** is that inhibits motion by absorbing energy from a moving system. It is used for slowing or stopping a moving vehicle, wheel, axle, or to prevent its motion, most often accomplished by means of friction.

PRINCIPLE OF BRAKING SYSTEM:

In this system, the **kinetic energy** is converted into **heat energy** due to friction between two mating surface of brake lining and brake drum. Then, the heat is dissipated into the atmosphere**.**

NEED OF BRAKE

It is Used to stop the vehicle

It is used to control the speed when and where required

It is used to control or guide the vehicle descending in a slope

REQUIRMENTS

It should work effectively irrespective of road condition and quality

❖ Retardation must be uniform throughout it application

❖ The pedal effort must be within the convenient capacity of the driver.

❖ It should have long life

❖ It should be easy to maintain and adjust

❖ It must be reliable and should not be affected by heat,
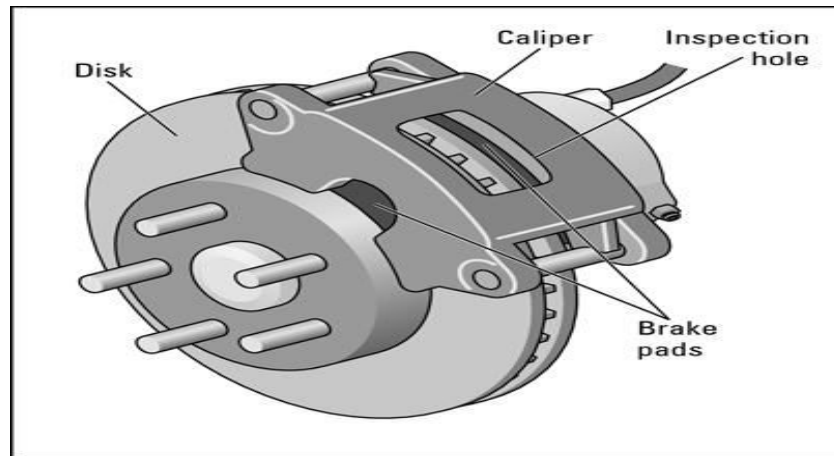
❖ Water and dust

MECHANICAL BRAKE

drum brake

disc brake

DISC BRAKES:

In a disc brake, the fluid from the master cylinder is forced into a caliper where it presses against a piston.
The piston in turn squeezes two brake pads against the disc (rotor), which is attached to wheel, forcing it to slow down or stop.

Components of disk break

Working of disk brake:

The brakes should respond instantly. When the driver presses the pedal, a piston inside the brake master cylinder pressurizes hydraulic fluid in the brake lines, which moves the pistons and pushes the pads into the rotor.

The harder the driver pushes on the pedal, the greater the pressure inside the brake lines will be, and the harder the pads will squeeze the rotor.

The distance the pads move is small – only a few millimeters – and should retract back into the calipers as soon as the driver lets off the pedal.

The piston in turn crushes two brake pads against the disc, that is being attached to wheel, making it to stop or slow

down.

Advantages of Disc brake system:

1.No adjustment required. So, no maintenance.

2.Better stopping performance

3.Fade-free braking in all conditions. So, no fading of brakes.

4.Can check wear without dismantling the unit

5.Easy & quick to replacement of pads compared to Drum brakes

Disadvantages of Disc Brake system:

1.High braking force needed compared to Drum brake

2.Low life of brake pads compared to brake shoes

3.Need separate hand-brake mechanism when fitted to rear wheels

RELAY:

A relay is an electrically operated switch. Relays are simple switches which are operated both electrically and mechanically. Relays consist of a n electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits. The application of relays started during the invention of telephones. They played an important role in switching calls in telephone exchanges. They were also used in long distance telegraphy. They were used to switch the signal coming from one source to another destination..

1 When a small current flow in the input circuit, it activates the electromagnet (shown here as a red coil), which produces a magnetic field all around it.

2.The energized electromagnet pulls the metal bar in the output circuit toward it, closing the switch and allowing a much bigger current to flow through the output circuit.

3.The output circuit operates a high-current appliance such as a lamp or an electric motor.

RELAY APPLICATIONS

☐ Relays are used to realize logic functions. They play a very important role in providing safety critical logic.

☐ Relays are used to provide time delay functions. They are used to time the delay open and delay close of contacts.

☐ Relays are used to control high voltage circuits with the help of low voltage signals. Similarly, they are used to control high current circuits with the help of low current signals.

☐ They are also used as protective relays. By this function all the faults during transmission and reception can be detected and isolated.

EXISTING METHODS AND THEIR DRAWBACKS
BRAKING SYSTEM:

The braking system works with all mechanical links actuated with hydraulic or pneumatic pressure but these all work when the driver applies the pressure on the brake pedal where that pressure that is transferred through high pressure lines and actuates the brake pads against the drums or discs.

DRAWBACKS:

These work on driver's attentiveness

Totally dependent on driver's skill

II. PROPOSED MODEL:

WORKING OF AUTOMATIC BRAKING SYSTEM

As the vehicle starts to run the ultrasonic sensor and a hall effect sensor starts monitoring the distance and the speed of the vehicle and transmits the data to the Arduino board which is already pre-feeded with the speed vs. safe braking distance graph if the driver becomes unresponsive to the road the Arduino starts monitoring the distance and the speed of the vehicle if the vehicle does not slows down and reaches to a certain distance before minimum safe braking distance (i.e. 40 meters before the minimum braking distance where the vehicle has the own space for braking in accordance to the speed) the vehicles notify-es the driver in the instrument panel with an audio and a video output and flashes the tail lamp even if the driver does not applies the brake, to create an awareness about the obstacle detected and an invitation for the driver behind the car to make a safe stop. if the vehicle slows down the Arduino will be in continuous monitoring if the vehicle reaches the minimum braking distance the arduino takes over the control and brakes the vehicle and takes it to a safe stop.

Calculation of minimum braking distance
Stopping distance:

The distance required to stop the vehicle after applying brake is proportional to the square of speed at which brakes are applied. The stopping distance depends upon the following fact

   1. Grip between the tyre and road surface

   2. Tyre tread condition.

   3. Tyre inflation.

4. Nature of road surface.

The stopping distance is calculated by

$$d = v2/2a$$

where: d = stopping distance in meters

V=velocity of the vehicle in m/s

a = Deceleration in   m/s2 the stopping time is computed by

$$t = v/a$$

Where - t = stopping time in seconds

V=velocity of the vehicle in m/s

a = Deceleration in   m/s2.

Friction Resistance and Coefficient of friction: The frictional resistance (FR) Expressed between wheel and road surface is proportional to the vertical reaction (R) and it is related by,

FR = µR

Where µ = is the coefficient of friction between wheel tire and road surface

The maximum value of coefficient of friction can be unity for ideal case. In real case, it is less than 1. This value depends upon the following factors.

1.Road surface condition (dry, wet, slippery, muddy etc.)

2.Tire tread pattern

3.Inflation pressure, and Material of road surface.

If v =50 km/h

µ=0.60

V = 50 * (1000m/1KM) * (1hr/60min) * (1min/60sec)

V=13.89m

Calculation of stopping distance:(13.89 m/s)2

D = (2) (0.60) (9.80m/s2

D = 11.76m/s2

D = 16.40 m

CALCULATION OF STOPPING TIME

T = V/A

A = 50 / 1.6 * 1.467 fps

A = 45.84

T = 13.38 / 45.84

T = 2.9 seconds

III. CONCLUSION:

Hence after considering all the constraints of co efficient of friction to avoid hydro foiling between the tires and the road, and taking into account of the performance of the ultrasonic sensor and the hall effect sensor working together for finding the point where to brake and when, and have concluded that the vehicle bakes upon reaching the safe braking distance without any malfunction as because the constraints for co efficient of friction is taken in the worst case scenario of at most as if no friction is between tire and road in a rainy road and the system inherits an tech that helps a car behind which is not equipped with these feature generally for Indian road and tech conditions where the tail lamp flashes upon reaching a certain distance even if the driver in the car doesn't press the pedal so as to keep him out of danger hence we conclude that with this technology accidents cannot be avoided but the rate of accidents happening can be lowered

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