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AUTOMATIC BRAKING SYSTEM

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***Abstract*—** The braking system was designed and applied on a car to make the driving process safety using embedded system design. Most of the accident occurs due to the delay of the driver to hit the brake, so in this project work braking system is developed such that when it is active it can apply brake depending upon the object sensed by the ultrasonic sensor and speed of vehicle. Currently, vehicles are often equipped with active safety systems to reduce the risk of accidents, many of which occur in the urban environments. The most popular include Antilock Braking Systems (ABS), Traction Control and Stability Control. All these systems employ different types of sensors to constantly monitor the conditions of the vehicle, and respond in an emergency situation. An intelligent mechatronic system includes an ultrasonic wave emitter provided on the front portion of a car producing and emitting ultrasonic waves frontward in a predetermined distance. An ultrasonic receiver is also placed on the front portion of the car operatively receiving a reflective ultrasonic wave signal. The reflected wave (detected pulse) gives the distance between the obstacle and the vehicle and RPM counter gives speed of vehicle. The microcontroller is used to control the braking of the vehicle based on the detection pulse information to push the brake pedal and apply brake to the car stupendously for safety purpose.

***Keywords* --** Peripheral Interface Controller (PIC) Microcontroller, Infrared (IR) sensor, Solenoid, Permanent Magnet Direct current (PMDC) motor.

I. INTRODUCTION

The objectives of this project is to design the automatic breaking system in order to avoid accidents . In the foreign country this system is used in the vehicle in night.In this system we use a sensor based technology in which when vehicle will move on the road and any object or obstruct comes in front of the vehicle then sensor senses the obstruction and immediate offer a braking system**.**

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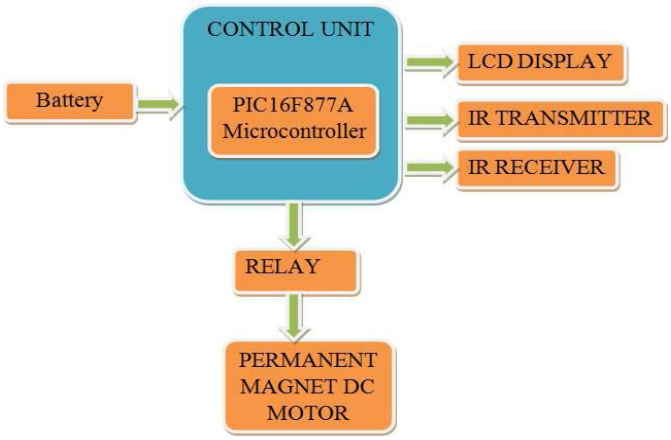

Figure 1

Braking is basically a mechanical action applied for slowing down of vehicles or even making the vehicle coming to halt depending upon the circumstances.

II. METHODOLGY:

An intelligent mechatronic system includes an ultrasonic wave emitter provided on the front portion of a car producing and emitting ultrasonic waves frontward in a predetermined distance. An ultrasonic receiver is also placed on the front portion of the car operatively receiving a reflective ultrasonic wave signal. The reflected wave (detected pulse) gives the distance between the obstacle and the vehicle. The microcontroller is used to control the speed of the vehicle based on the detection pulse information to push the brake pedal and apply brake to the car stupendously for safety purpose. The extremely rapid response time provided by the electronic control can be used for crucially shortening the braking distance by introducing advanced control of braking system operation. The control of commercial vehicle's braking system operation is related not only to vehicle speed but also to lateral acceleration together with the yaw moment control and significantly reducing the possibilities of the vehicle rolling over. Obviously, such a complex task imposed to the control of braking system cannot be based on the driver abilities and need to be done operated independently of the driver

- Development of an idea
- Needs for ABS
- Components of ABS
- Load distribution analysis
- Braking force and pressure analysis
- Experimentation
- Conclusions

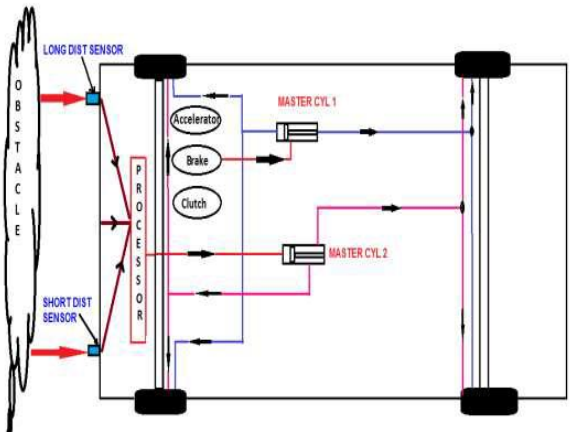

Figure 2 Concept model

NEED FOR BRAKING SYSTEM

- It must stop the vehicle with in a smallest possible distance.
- It must strong enough to sustain sudden braking force.
- It must neither slip not should cause any skid to the vehicle.
- It must operate with least effort by the driver.
- Braking living should have longer life.

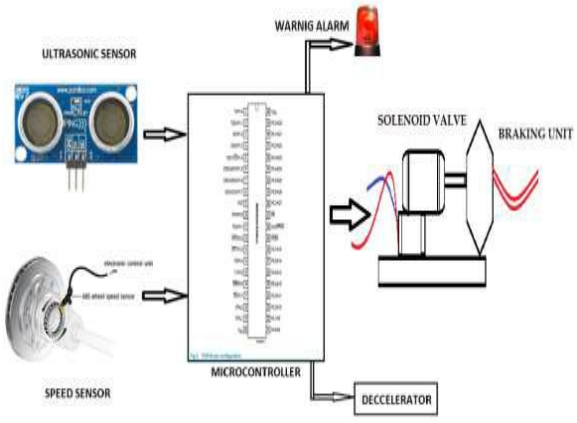

Figure 3 System layouts

III. COMPONENTS OF ABS

1) IR SENSOR:

Infrared (IR) light leaving an LED reflects off an object. The reflected light travels back to an IR receiver. The IR receiver "detects" the presence of the object. The object does not need to move to be detected.

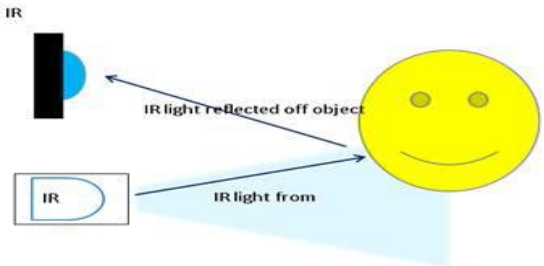

Figure 4

This sensor provides the system with ability to detect the presence of object position. The theory is the IR emitter emits infrared light. If an object presence the signal will be reflected back to the receiver. Then, the IR detector implemented will detect the reflected light. Then, the correspondence signal sends to the Micro Controller for being analyze.

2) DIODES:

The most common function of an diode is to allow an electric current to pass in one direction , while blocking current in the opposite direction. This unidirectional behaviour is called rectification, and is used to convert AC to DC.However, diodes can have more complicated behaviours than this simple ON-OFF action

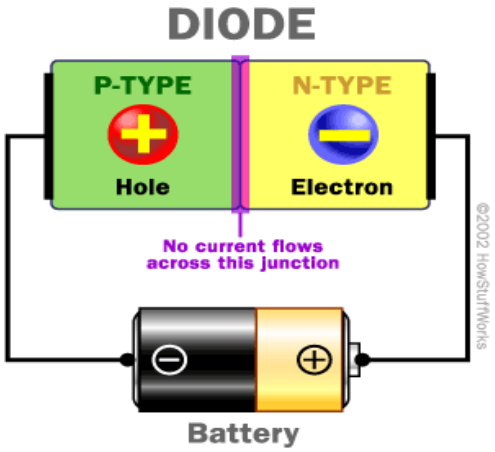

Figure 5

3) PHOTO TRANSISTOR

Phototransistors are solid state light detector or that possess internal gain. This makes them much more sensitive than photodiodes of comparably sized area.These device can be used to provide either an analog or digital output signal. The photo transistor has much larger base and collector areas than would be used for a normal transistor.

Figure 6 Phototransistor

4) BASICS OF THE IC 555

The 555 timer IC was 1st introduced around 1971 by the signetics corporation as the SE 555 / NE 555 and was called

'the IC time machine' and was also the very 1st and also only commercial timer IC available. The past 10 years some manufactures stopped these timer because of competition or other reason.

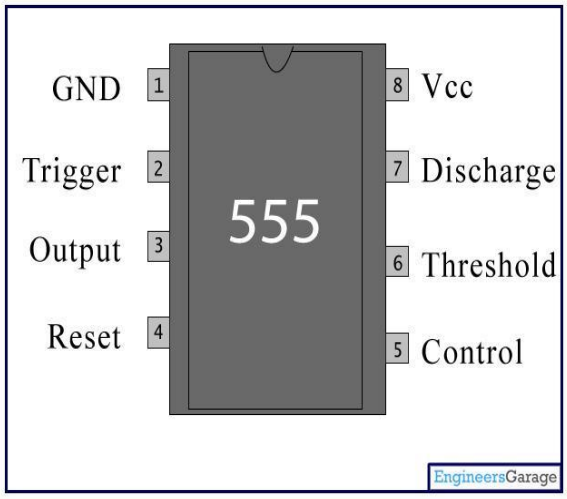

Figure 7

5) LIGHT EMITTING DIODE

A LED is a semi conductor device that emits in coherent monochromatic light when electrically biased in forward direction.When a junction diode is forward biased, energy is released at the junction due to recombination of electrons and holes. Such a junction diode called LED.

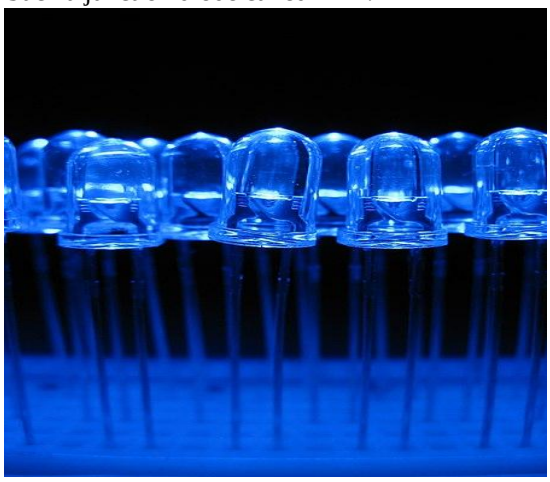

Figure 8

6) RELAY

A relay is an electrically operated switch. Relays are used where it is necessary to control a circuit by a low-power-signal(with complete electrical isolation b/w control and controlled circuits), or where several circuits must be controlled by one signal.A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relay control power circuits with no moving parts, instead using a semiconductor device to perform switching.

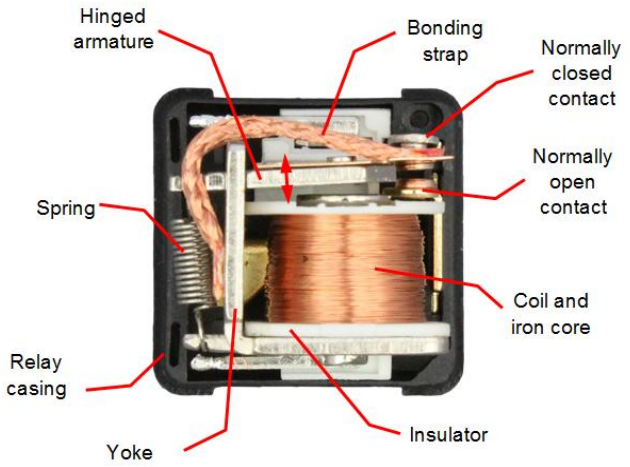

Figure 9

IV. THE BASIC PRINCIPLE OF WORK AND METHAMATICAL MODELING

Using IO trigger for at least 10us high level signal. The Module automatically sends eight 40 kHz and detect whetherthere is a pulse signal back. If the signal back, through high level, time of high output IO duration is the time from sending IR sensor to returning. It is ABS IR sensor, phototransformer, relay, one types of brake ,IC555 and etc.,

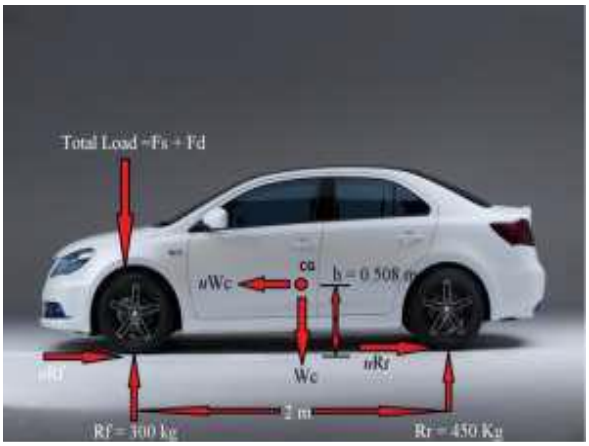

Figure 10 Force distribution

Assumptions regarding vehicle

1. Weight of vehicle : 1500 kg
2. Frictional coefficient of wheel : 0.6
3. Frictional coefficient between disc &cylinder : 1.5
4. Wheel base: 2 meter.
5. C.G. of vehicle from ground: 0.508 meter.
6. Dia. of tire : 0.5 m
7. Inner diameter of disc (Di): 100 mm
8. Outer dia of disc (Do): 200 mm

1) LOAD DISTRIBUTION ANALYSIS

Load distribution is as follows:

- 40% of total load on front 2 wheels
- 60% of total load on rear 2 wheels

Load on each wheel:

- On front wheel: 300 Kg.
- On Rear wheel: 450 Kg.

BRAKING FORCE AND PRESSURE ANALYSIS

Static load on wheel Fs = μf× Rn

= 0.6 × 300 × 9.81

Fs = 1765.8

Dynamic weight transfer Fd=(m × a × h)w

=(450×0.5×9.81×0.508)2×2 {For a = 0.5 g}

= 280.32 N

Total load FT= Fs + Fd

TABLE 1. DYNAMIC WEIGHT TRANSFER

SI NO	Acceleration	Dynamic weight transfer
1	0.5g	280.32 N
2	1.2g	672.76 N
3	2.0g	1121 N
4	3.7g	2074 N

TABLE 2. TOTAL LOAD

SI.no	Acceleration (a)	Total load (Ft) N	Torque (T)=Ft * r
1.	0.5g	2046.12	511.53
2.	1.2g	2438.56	609.64
3.	2.0g	2887	721.75

Clamp load:

C = Torque/μf × Re × n { Where Re =Ri + Ro/2=100 + 50/2}

=511.53/(1.5 ∗0.75 ∗2)

= 2273.46 N

TABLE 3. CLAMP LOAD

SI.No	Acceleration (a)	Clamp Load
1.	0.5g	2273.46
2.	1.2g	2709.51
3.	2.0g	3207.77
4.	3.7g	4266.84

System pressure required:

P = Clamping Load/Area

Area A =π/4× 0.0252 × 2

= 9.8174 × 10−4 m2

TABLE 4. SYSTEM PRESSURE REQUIRED

Sr. No.	Acceleration (a)	System pressure (bar)
1.	0.5g	23.15
2.	1.2g	27.59
3.	2.0g	32.67
4.	3.7g	43.46

V. EXPERIMENTATION

Our future course of action is to assemble a system on vehicle & perform various experimentations by varying different parameters. Those parameters are as follows:

- Vehicle Speed
- Obstacle distance
- Sensor Position
- Varying deceleration rate

In Order To Avoid Jerky Motion of the vehicle due to sudden braking, we can use combinations of different flow rates toachieve smooth braking and avoid vibrations and for faster response of system we can use electronically operated flow control valve which may add extra cost to the system.

VI. EXPERIMENTAL SETUP SCHEMATIC

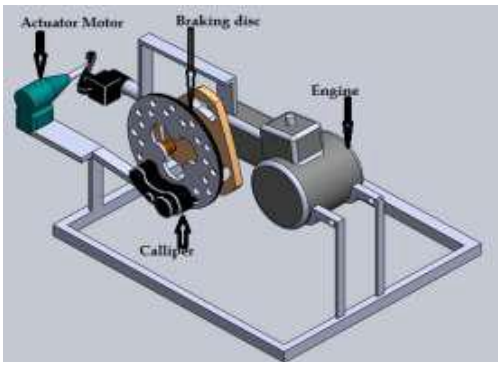

Figure 11 Schematic setup

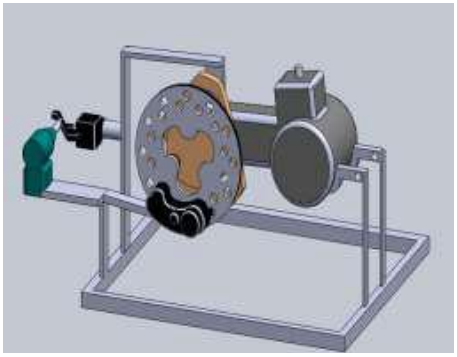

Figure 12 Schematic setup

VII. ACTUAL EXPERIMENTAL SETUP

Figure 13 Actual test bench

Figure 14 Sensors position

Figure 15 Rpm counter position

This is the experimental setup we created for the conclusions in our experiment the object is stationary where as the obstacle distance is varying in case of taking of reading when obstacle distance is varying.

ADVANTAGES:

- Avoid road accidents
- Safety of driver
- Stop the vehicle in shorten distance
- Prevent the damage of vehicle body
- Quickly sense the objects
- It acts instantaneously in case of emergency
- It operates with the least effort by the driver

VIII. CONCLUSIONS

In this report 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. The previous research study clearly explains that IR sensor and microcontroller action plays vital role in determining intelligent braking torque generated by brake actuation assembly.

In this system we use a sensor based technology in which when vehicle will move on the road and any object or obstruct comes in front of the vehicle then sensor senses the obstruction and immediate offer a braking system.

Figure 16 Top view of System model

Figure 17 Back view of System model

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