International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072

ELECTROMAGNETIC ACCIDENT AVOIDING SYSTEM

N. Kumaresan[1], M. Alain Frederic[2], P. Thamil Selvan[3], S. Vijay[4]

[1]Assistant Professor, Automobile Engineering, SNS College of Technology, Coimbatore,
[2,3,4]Students, Automobile Engineering, SNS College of Technology, Coimbatore,

---

Abstract - *Safety is a vital piece of human's life. More than 1,50,000 individuals were slaughtered in road mishaps in 2018 alone, that is more than the quantity of individuals murdered in the entirety of our wars set up. The point of undertaking this project is to limit the road mishaps which causes the loss of significant human life. In this system we use an electromagnetic cylinder as an actuator to control the bumper. Initially the bumper attached to the piston rod of the cylinder is in the retracted position. If the Ultrasonic sensor senses any obstacles in front of the car it will immediately send the signal to the PIR sensor to check whether the detected obstacle is a living thing or a non-living thing. If the detected obstacle is a living thing then, the actuator does not actuate. If the detected obstacle is a non living thing then, the actuator begins to actuate. With the help of this system, the bumper of the car alone moves forward to withstand the force that is going to be created while the collision occurs. It is expected that, if this gadget is structured and joined into our vehicles as a road security gadget, it will lessen the frequency of mishaps on our roads.*

***Key Words*: Road Mishaps, Human life, Electro Magnetic Cylinder, Ultrasonic Sensor, PIR Sensor, Security gadget.**

1. INTRODUCTION

Road mishaps in India slaughter practically 1.5 lakh individuals yearly. In this manner, India accounts for practically 11% of the mishap related passing in the World [1]. The State of Tamilnadu recorded the most noteworthy number of road mishaps (63, 920) in 2018 alone. This state kept up its lead towards mishaps regardless of the few street wellbeing activities taken by both the Central and State Government. The mishaps occurred state wise in India is shown in chart 1.1. Among the mishaps caused due to the several types of vehicles in the year 2018, the mishaps due to jeep/van/taxi /truck/lorry/bus alone accounts to around 43.2 % of total mishaps. Chart 1.2 represents the mishaps occurring by several types of vehicles. The major cause of this accidents are due to several types of collision of one vehicle towards another vehicle. There are three types of a major Collision:

Case 1: Head on Collision.

Case 2: Hit from Side.

Case 3: Hit from back.

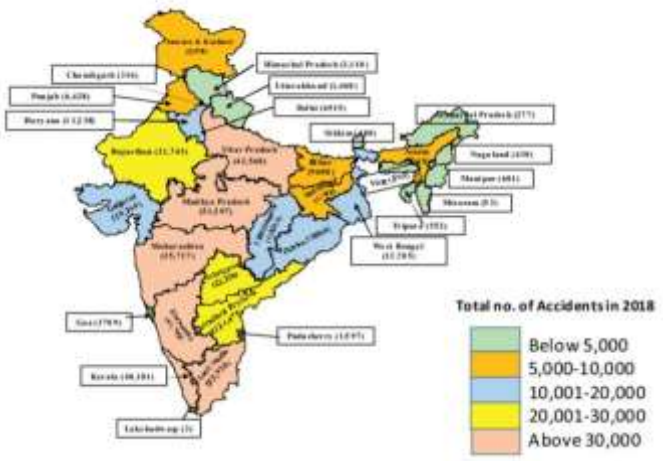

Chart -1.1: Mishaps occurred state wise in 2018 in India.

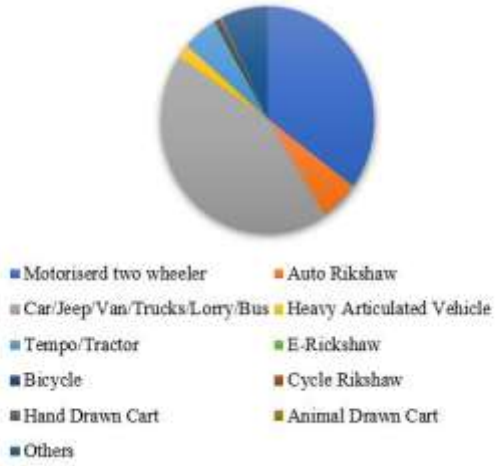

Chart -1.2: Mishaps due to several types of vehicles.

2. LITERATURE SUMMARY

1. Hydraulic cylinder is used in the area where there is more weight acting.
2. Pneumatic cylinder is used in the area where there is a requirement for sudden action.
3. Electromagnetic cylinder is used to react quickly for the force applied.
4. On behalf electromagnetic waves produced by the electromagnets. The electromagnetic cylinder is actuated only when it is necessary.

3. COMPONENTS DESCRIPTION

3.1 ELECTROMAGNET

It comprises of a length of conductive wire normally copper, wounded over a bit of metal. A current flow is presented, either from a battery or an adapter and it flows through the wire. This creates a magnetic field around the curled wire and changes the metal to magnet. This device can be magnetized when the power supply is on and can be demagnetized when it is off. In additional, the poles of an electromagnet can be changed by changing the direction of current. In this system, an 24V electromagnet is used for attraction and repulsion purpose.

Fig -3.1: 12V DC Electromagnet

3.2 PERMANENT MAGNET

A permanent magnet is a type of magnet which has its own magnetic properties, naturally. It must not be kept in a high temperature because it loses its magnetic properties if it gets heated. In this system, it is fixed to the piston rod.

Fig -3.2: Permanent Magnet

3.3 TRANSFORMER

A Transformer is a static electrical device, with no moving parts, which changes electrical force starting with one circuit then onto the next with changes in voltage and flow and no adjustment in frequency. There are two sorts of transformers based on their capacity:

- Step up Transformer
- Step down Transformer

A Step up Transformer is a gadget which changes over the low primary voltage to a high secondary voltage. A Step down Transformer is a gadget which changes the secondary voltage less than the primary voltage. In this system this step down transformer is used to convert the 240V power supply to 24V DC.

Fig -3.3: Step Down Transformer

3.2 ARDUINO

The Arduino Uno is an open-source microcontroller board dependent on the microchip ATmega328P microcontroller, created by Arduino.cc. It consists of 14 digital input/output pins out of these 6 pins are for PWM outputs. In this system it is used to control the actuators based on the input signal feed by the sensors.

Fig -3.4: Arduino UNO

3.3 BATTERY

It is an electrical device which stores electricity in the form of chemical energy. It comprises of at least one electrochemical cells with outer associations for the purpose of providing power supply to the electronic devices. In this system, a 12V 1.3Ah battery is used.

Fig -3.5: Battery 12V

3.6 RELAY

A relay is an electromagnetic switch that is utilized to kill on and off where a few circuits must be constrained by one signal. It is utilized to control high voltage circuits with the assistance of low voltage signals. And also they are utilized to control high current circuits with the assistance of low

current signals. Here, it is used to actuate the cylinder with respect to the control fed by the controller.

Fig -3.6: Relay 12V

3.7 LCD DISPLAY

A LCD is an electronic presentation module which utilizes fluid precious crystal to deliver an obvious picture. The 16×2 LCD show is an essential module usually utilized in DIY's and circuits. Here, it is used to display the status of the detected obstacle.

Fig -3.7: LCD Display 16x2

3.8 PIR SENSOR

PIR sensors permit you to detect movement, quite often used to distinguish whether a human has moved in or out of the sensors. They are little, cheap, low-power, simple to utilize and don't wear out. Therefore, they are generally found in machines and contraptions utilized in homes or organizations. They are frequently alluded to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors. PIR's are fundamentally made of a pyroelectric sensor, which can recognize levels of infrared radiation. Everything produces some low - level radiation, and the more hotter something produces more radiation. Here, it is used to check whether the detected obstacle is living thing or non - living thing.

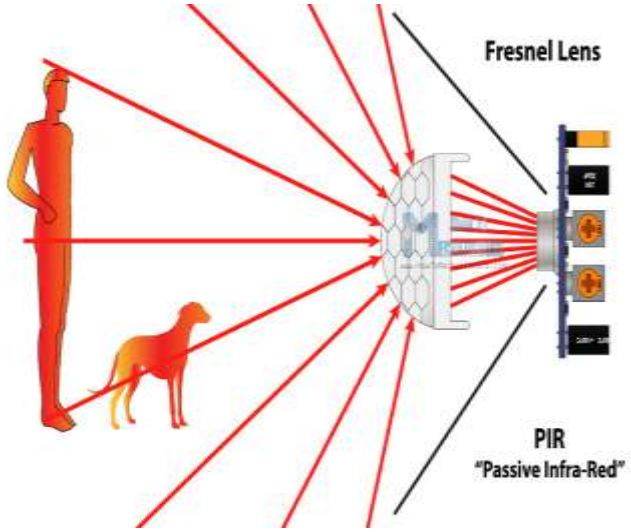

Fig -3.8: PIR Sensor

3.9 ULTRASONIC SENSOR

Ultrasonic/level sensors measures the distance by utilizing ultrasonic waves. The sensor head emits a ultrasonic wave and gets the wave reflected back from the object. ultrasonic/level sensors measure the distance to the object by estimating the time between the emission and reception. It consists of a transmitter and a receiver the transmitter emits the ultrasonic waves continuously and these waves are received by the receiver. Based on the time waves are emitted and received this sensor calculate the distance between the obstacle and the sensor.

Fig -3.9: Ultrasonic Sensor

4. WORKING

4.1 WORKING OF ELECTROMAGNETIC CYLINDER

An electromagnetic cylinder is a electrical actuator that is utilized to give a bidirectional power through a bidirectional stroke. It consists of a cylinder barrel, inside which an permanent magnet attached to the piston rod is allowed to move in a linear motion. Where one end of the cylinder barrel is attached to the rear end cover. In this rear end cover an electromagnet is fixed in order to attract and repel the permanent magnet attached to the piston rod. On the

other end of the piston rod the bumper is fixed to move along with it. So that the electromagnetic cylinder actuates when the current is passed.

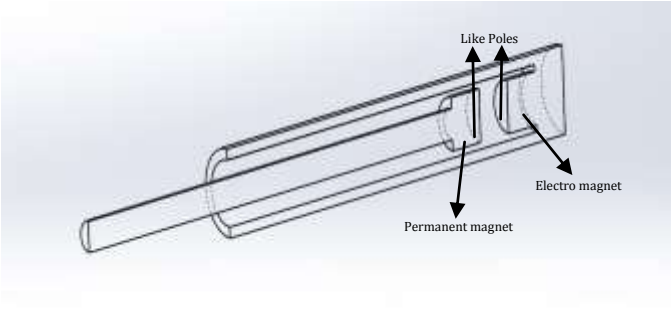

Fig -4.1: Electromagnetic Cylinder

4.2 WORKING OF OVERALL SYSTEM

Initially the power supply of 240V is fed to the step down transformer which converts it into 24V after this process the relay is placed in between the actuator and the transformer to control the actuator with respect to the feedback given by the controller. This controller is connected to the ultrasonic sensor which detects the distance of the obstacle based on the principle of doppler effect. Then the signal is passed on to the PIR sensor to detect the nature of the obstacle. And the relay is switched on and off depending upon the feedback given by the sensor. Parallel to this an LCD displays the status of the detected obstacle.

Fig -4.2: Overall Layout

Fig-4.2 represents the overall working of this system, that is the sensor senses the input given and feed the signal to controller to actuate the actuator. At first the bumper joined to the piston rod is in the withdrawn position. In the event, that the ultrasonic sensor detects any obstacle before the vehicle it will quickly impart the signal to the controller to check whether the recognized obstacle is a living thing or a non-living thing. On the off chance that the identified obstacle is a living thing, at that point, the actuator doesn't impel. In the event that the recognized obstacle is a non-living thing, at that point, the actuator begins to actuate. With the assistance of this framework, the guard of the vehicle alone pushes ahead to withstand the power that will be made while the impact happens.

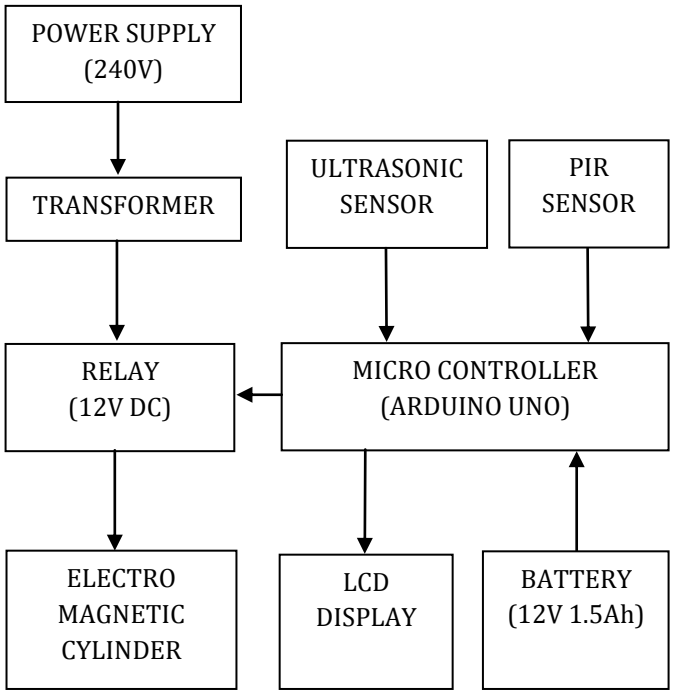

Fig -4.3: Block Diagram

5. DESIGN CALCULATION

5.1 IMPACT FORCE CALCULATION

Consider,
Velocity of our model = 2m/s
By equation of motion,

$$2as = v^2-u^2$$

$2*a*0.39 = 0^2-2^2$
$a = \pm 5.128 m/s^2$
Where,
s = Breaking distance
v = Final velocity
u =Initial velocity
According to Newton's Second law,

$$F = ma$$
$$= 15* 5.128$$

Impact force =76.92 N

5.2 STOPPING DISTANCE CALCULATION

Breaking distance= $v^2/2*\mu*g$

μ - coefficient of dry friction = 0.7 (Dry Surface)

g – acceleration due to gravity

v - Final velocity =2 m/s

$$D_b = v^2/2 \times \mu \times g$$

$= 2^2/ (2 \times 0.7 \times 9.81)$

= 0.29m

Vehicle stopping distance after applying the brake = 290mm

Stopping distance = Breaking distance + Bumper stroke

= 290 + 10

Total stopping distance = 390 mm

5.3 MAGNETIC FORCE CALCULATION

$F = (n \times i)^2 \times \text{Magnetic constant} \times a / (2 \times g^2)$

Where,

F = Force

I = Current = 24

g = Length of the gap = 1.5 m

a = Area = 40.8407 m

n = Number of turns in the solenoid = 1000

Magnetic constant = $4 \times PI \times 10^{-7}$

Force = $((10{,}000 \times 24)^2 \times 4 \times pi \times 10^{-7} \times 40.8407 / (2 \times 1.5^2)$

= 656.58 Newtons (N)

6. PROGRAM CODE

```
#include <LiquidCrystal.h>
#include <NewPing.h>
#define RELAY1 7
#define PIR 6
#define TRIGGER_PIN 9 // Arduino pin tied to trigger pin on the ultrasonic sensor.
#define ECHO_PIN 10 // Arduino pin tied to echo pin on the ultrasonic sensor.
#define MAX_DISTANCE 200 // Maximum distance we want to ping for (in centimeters). Maximum sensor distance is rated at 400-500cm.
LiquidCrystal lcd(A0,A1,A2,A2,A4,A5);
NewPing sonar(TRIGGER_PIN, ECHO_PIN, MAX_DISTANCE); // NewPing setup of pins and maximum distance.
int aa=0;
void setup()
{
pinmode(RELAY1,OUTPUT);
digitalWrite(RELAY1,HIGH);
Serial.begin(9600); // Open serial monitor at 115200 baud to see ping results.
lcd.begin(16, 2);
lcd.setCursor(0,0);
lcd.print(" ELECTROMAGNIC ");
lcd.setCursor(0,1);
lcd.print("BREAKING SYSTEM");
delay(3000);
lcd.clear();
}
void loop()
{
lcd.setCursor(0,0);
lcd.print("D:");
lcd.setCursor(2,0);
lcd.print(sonar.ping_cm());
if(sonar.ping_cm()>5 && sonar.ping_cm()<20)
 {
 if(PIR==1)
 {
 digitalWrite(RELAY1,HIGH);
 }
 else
{
digitalWrite(RELAY1,LOW);
}
}
else
{
digitalWrite(RELAY1,LOW);
}
}
```

7. COST REPORT

Table -1: Cost Estimation

Sl. No.	Product Description	Cost
1	Ultrasonic Sensor	₹ 100
2	PIR Sensor	₹ 104
3	12V Relay	₹ 70
4	Battery	₹ 325
5	Arduino UNO	₹ 380
6	Electro Magnet	₹ 11500
7	Permanent Magnet	₹ 2000
8	Transformer	₹ 3000
9	Aluminium	₹ 2800
10	Machining Cost	₹ 2000
TOTAL		₹ 22279.00

8. CONCLUSION

- If this "Electromagnetic Accident Avoiding System" is implemented in all the vehicles, majority of the accidents can be reduced.
- It will dissipate the impact force due to collision.
- The design is simple.
- Use of electromagnetic cylinder in this system reduces the number of components compared to hydraulic and pneumatic cylinder.

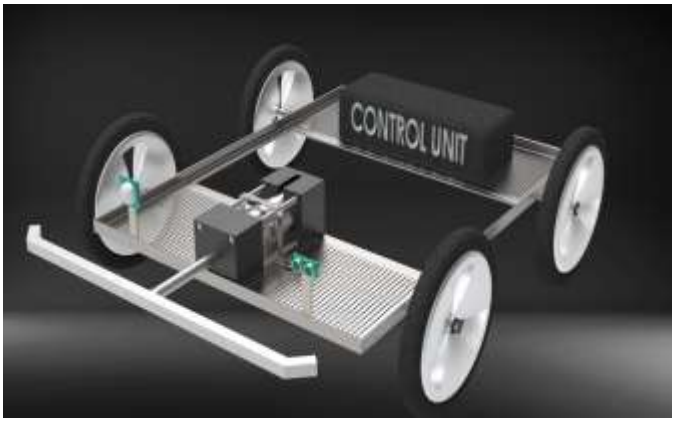

Fig -8: Proposed Design

REFERENCES

[1] P. Katore Koshal, R. Bhambare Rajesh, "Vehicle Accident Prevention System using GSM and GPS Technique". International Journal of Computer Trends and Technology (IJCTT) V29(2):92-96, November 2015. ISSN:2231-2803. www.ijcttjournal.org. Published by Seventh Sense Research Group.

[2] T.U. Anand Santhosh Kumar, J. Mrudula "Advanced Accident Avoidance System for Automobiles" International Journal of Computer Trends and Technology (IJCTT), V6(2):79-83 December Issue 2013, ISSN 2231-2803, Published by Seventh Sense Research Group.

[3] C. Anusha, Dr. P. Venkataratnam, "Collision control and collision avoidance using ultrasonic sensor" International journal of current engineering and scientific research (IJCESR), ISSN: 2393-8374, Volume - 2, Issue-7, 2015.

[4] Morla Raghuram, Dr. K. Kalyani Radha "Fabrication Of Automatic Braking System By Automatic Movable Bumper" International Journal for Research in Engineering Application & Management (IJREAM), ISSN: 2454-9150 Vol-04, Issue-05, Aug 2018.

[5] Valery G. Yakhno "An explicit formula for modeling wave propagation in magneto-electro-elastic materials" Journal of Electromagnetic Waves and Applications, Volume 32, 2018 – Issue 7.

[6] G.B.S. Narang, "Automobile Engineering", Khanna Publishers, Delhi, 1991.

[7] William H. Crowse, "Automobile Engineering".

[8] Venkataratnam, International Journal of Current Engineering and Scientific Research (IJCESR), Volume-2, Issue-7, 2015

[9] Jadhav N. D, Gulmire S.M, Ghutukade R.S, Gaikwad A.S, "Automatic Braking With Pneumatic Bumper System", International Journal for Science and Advance Research inTechnology, volume-1 Issue-5, May 2015.

[10] Rohit P. Jain, Dr.V.Singh, "Automatic Hydraulic Bumper and Speed Limiting System" International Journal for Scientific Research & Development, Volume 3, Issue 06, 2015.

BIOGRAPHIES

Kumaresan.N is the Associate Professor in Department of Automobile Engineering at SNS College of Technology, Coimbatore.

Alain Frederic. M is Pursuing Bachelor of Engineering in Automobile Engineering at SNS College of Technology, Coimbatore.

Thamil Selvan.P is Pursuing Bachelor of Engineering in Automobile Engineering at SNS College of Technology, Coimbatore.

Vijay.S is Pursuing Bachelor of Engineering in Automobile Engineering at SNS College of Technology, Coimbatore.