Design and Development of Electro Magnetic Braking System with Ultrasonic Sensor

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Abstract : Braking system is used to reduces the rotational speed of the vehicle .Electromagnetic brakes operates electrically but transmit torque mechanically to decelerate the vehicle At present automobiles are usually have an active safety systems to avoid the risk of accidents most of which happen in non-rural areas. The present work involves design and development of a electromagnetic braking system using ultrasonic sensor, the present available electromagnetic braking systems are bulky, power to weight ratio is less. The present electromagnetic braking system is advancement in technology and vary different distances with different braking pressure using ultrasonic sensor which yields to control effective braking distances. This system uses ultra-sonic sensor to reduce the speed of the moving vehicle where this sensor is controlled through the Arduino microcontroller, this sensor emits the sonic signal through emitter when is intercepts with the obstacle then the signal travels back to the receiver this will calculate the distance of the obstacle and sends signal to the electromagnet to activate the brake. Ultrasonic sensor is attached with a program and that gives indication at 100 cm and 50 cm and activates when the distance is 25 cm away from the vehicle and vehicle stops within 3 seconds

Keywords: Electromagnetic Braking system, ultrasonic sensor, Arduino microcontroller

I. INTRODUCTION

Brake is a mechanical device which is used to control the speed by absorbing energy from a moving system. Basically there are two types of brakes. They are disc brake and drum brake. In this system we use drum brake Electromagnetic brakes operate electrically but that transmit torque mechanically this is why that called as electromechanical brakes because of there actuation method electromechanical are known as electromagnetic brakes. These brakes where popular since 60th years. The application and design of brakes increased dramatically but the operation remains unchanged. Electromagnetic brakes are used as supplementary retardation equipment along with friction brakes on heavy vehicles. To update the present electromagnetic system we use ultra-sonic sensor. This sensor emits the sonic signal through emitter when is intercepts with the obstacle then the signal travels back to the receiver this will calculate the distance of the obstacle and sends signal to the electromagnet to activate the brake. This whole automation is depend on the Arduino microcontroller whit the Embedded C language. electromagnetic braking can withstand load of more then 1000kg.

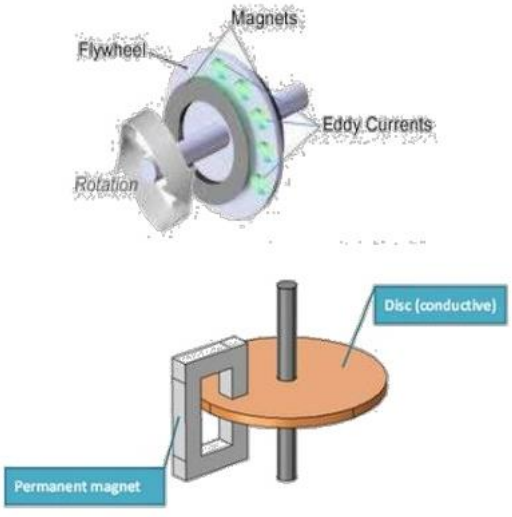

Figure 1: Braking system

Electromagnetic brakes are used as supplementary retardation equipments in addition to the regular friction brake.

Omkar S. Mohite : This paper aims to make an electromagnetic braking system model capable of applying brakes without any loss of energy supplied and friction loss .electromagnets which are normally run by the power supply from the circuit is used in this sysytem. Also,we use a wheel which is connected to the motor rotates when power is supplied to it. We also used a fan which is attached near to electromagnets to cool the electromagnets from over heating. A metallic bar is in the vicinity of the electromagnets and wheel so when the electromagnets produces eddy currents which stops the rotating wheel or rotor.This model will be helpful in a way to be a used a retardation equipment in vehicles.

Sunil Prashanth Kumar S eta.l(2017):In this current work, to reduce the drivers effort an attempt is made to design and fabricate an electromagnetic actuating mechanism for a drum brake which required during braking action. An electromagnetic actuating brake is a type of an auxiliary braking system which has been designed to function apart from the regular brake, it can be operated without disturbing the regular brake. With the help of An experimental setup the breaking response is calculated.

Problem identification-In previous braking system it's not possible to apply the brake automatically but in this braking system brake will be applied automatically at a certain distance away from the body.

Objectives-

Design of an electromagnetic braking system using solid works

To design and fabricate electromagnetic braking system replacing conventional braking system with good performance

To achieve brake system with lesser friction

To achieve distance controlled electromagnetic braking system with ultrasonic sensor

II. METHODOLOGY

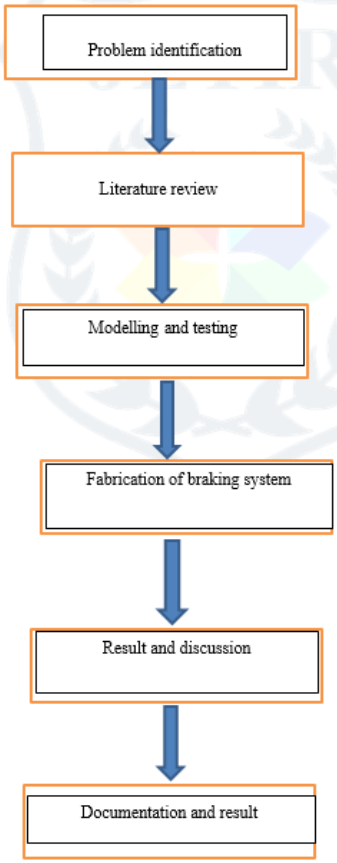

Figure 2: Methodology

Table 1: Components

SL.NO.	NAME OF PARTS	MATERIAL	QUANTITY
1	Electromagnetic Coil	Aluminium	1
2	Wheel	Rubber	1
3	Breaking Lever	M.S	1.5 meter
4	Brake Arrangement	Aluminium drum	1
5	A.C. Motor (Single Phase 230 Volt)	Aluminium	1
6	Frame Stand	M.S	1
7	Battery (12V)	Lead-acid	1
8	Connecting wire	Cu	1 meter

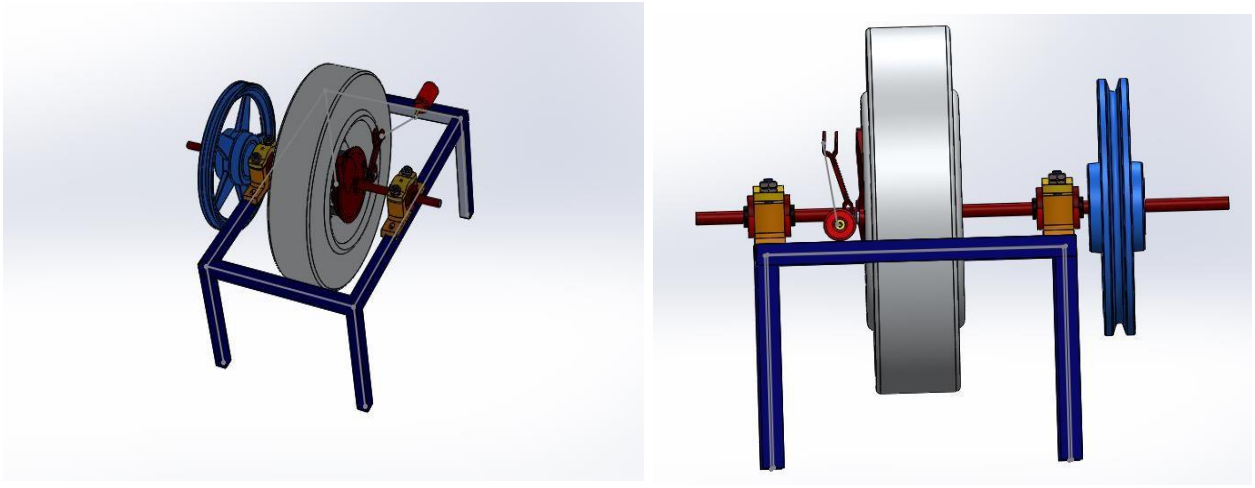

Figure 2: 3-D model

Arduino Uno

Figure 4: **Arduino Uno**

Arduino Uno is a microcontroller board based on the ATmega328P . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller;

Simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

Relay Module

A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5 V provided by the Arduino pins. Controlling a relay module with the Arduino is as simple as controlling any other output as we'll see later on.

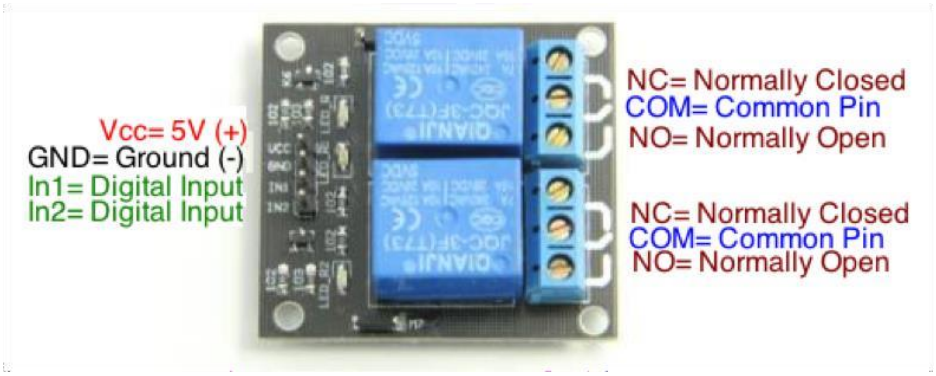

Figure 5: Relay

This relay module has two channels (those blue cubes). There are other models with one, four and eight channels. This module should be powered with 5V, which is appropriate to use with an Arduino. There are other relay modules that are powered using 3.3V, which is ideal for ESP32, ESP8266, and other microcontrollers.

CODE FOR TESTING ULTRASONIC MODULE

```
#include <LiquidCrystal.h>
// initialize the library by associating any needed LCD interface pin
// with the arduino pin number it is connected to
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2; LiquidCrystal lcd(rs, en, d4, d5,
d6, d7);

#define ECHOPIN 13                    // Pin to receive echo pulse #define TRIGPIN
10                                    // Pin to send trigger pulse #define buzzer  7
#define motor          8
#define relay          9

void setup()
{
      lcd.begin(16,2); Serial.begin(9600);
      pinMode(ECHOPIN, INPUT); pinMode(TRIGPIN,
      OUTPUT);
      pinMode(7, OUTPUT); pinMode(8,
      OUTPUT); pinMode(9,OUTPUT);
}
void loop()
{
      lcd.setCursor(0,1);
      // Start Ranging -Generating a trigger of 10us burst digitalWrite(TRIGPIN,
     LOW); delayMicroseconds(2);
     digitalWrite(TRIGPIN, HIGH);
     delayMicroseconds(10); digitalWrite(TRIGPIN,
     LOW);
     // Distance Calculation

     float distance = pulseIn(ECHOPIN, HIGH); distance= distance/58;
    /* The speed of sound is 340 m/s or 29 us per cm.The Ultrasonic burst travels out &          back.So to find the
    distance of object we divide by 58  */
     {
           lcd.setCursor(0,1);
           lcd.print("distval=");
```

RESULT AND DISCUSSION

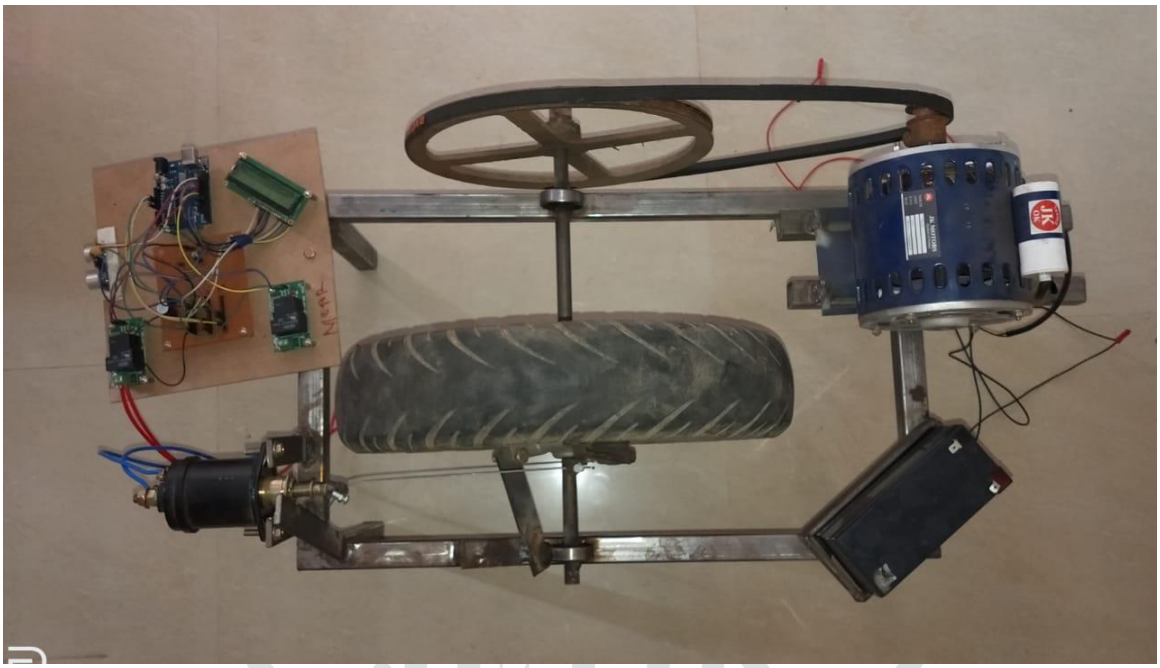

Figure 6: Final assembled model

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.

The brake was also successfully applied in the experimental setup for testing the arrangement.

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