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IoT BASED ELECTROMAGNETIC BREAKING FOR E-BIKE

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Abstract: This study has been undertaken to create a new braking system that is automatic and requires less human attention. Most accidents happen due to the delay of the driver to apply the brake, so in this project, we develop a model which uses a brake depending on the obstacle sensed by sensed and speed of the bike. In this, we used an ultrasonic sensor to detect the obstacle. The proximity sensor gives the speed of the vehicle.

The ultrasonic sensor is placed on the front side of a vehicle. the transmitter emits the waves, that wave travels and collapses on an obstacle and then returns to the sensor. At this point receiver which is also placed on the front side of the vehicle captures the waves. Then this data is then sent to the microcontroller. At, the microcontroller the speed and distance are calculated, and with calculation, a brake is applied if necessary. Wi-Fi model sending data to IoT.

Index Terms – Ultrasonic sensor, proximity sensor, IoT, Wi-Fi model, obstacle.

I. INTRODUCTION

The Breaking system is always an important factor of any vehicle. Faulty or late braking may result in a problem or sometimes an accident. In the traditional vehicle, pneumatic braking is used. The performance of this type of vehicle can be enhanced with the help of ABS (Automatic Braking System). This can be done with the speed of precision offered by electronic abilities. This type of braking is used in e-bikes in which combinations of disc brakes are used. In the vehicle, where 'the brake fading' problem is occurring rapidly and affecting the total control of the vehicle, in that case, electromagnetic brakes are used .so with the benefit of the heavy vehicle, the same concept is created for a lighter vehicle. We made just a prototype of this concept and this electromagnetic braking system can be used as a supplementary or an auxiliary system in concert with the regular braking system to enhance the safety of driver and vehicle as well as to avoid rolling of the bike and crashing on something and also brake failure

Sometimes a complex & critical situation may come across drives that are difficult to handle. This braking system has more potential app applications, especially in developed countries where research on the smart vehicle is receiving great reaction. In the future driver will become passengers with this journey will be optimized for time, cost, efficiency & comfortability bike's control is not only related to vehicle speed but also lateral acceleration together with significantly reducing the chances of a vehicle rolling over. Such a critical task is imposed to system breaking can't be done on drivers' ability only and need to perform independently driver.

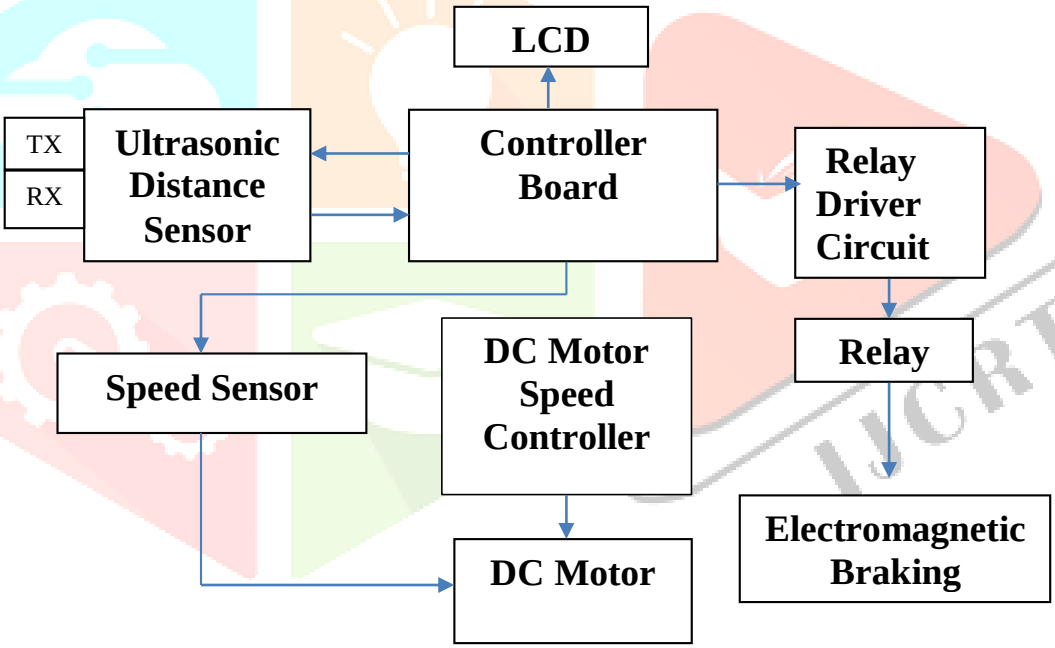
This project will fulfill the need for a contemporary system that required the driver of the vehicle to include advanced technology, especially in the smart sensor area. The system when combined with other systems like automatic traction controlling, auto cruise system, and intelligent throttle system. Then it will result in high safety and comfort. The use of electromagnetic braking will take the conventional system to another higher level.

II. LITERATURE SURVEY

For the survey, we took references from different groups. our team goes through different papers who have done the work in a similar field of automatic braking

--SANDDEP RAMRAO ASUDE, MANDAR ANANT DABHOLE
In this paper, an attempt has been made that, they present a model which decreases the chances of failure of the brake to d the accidents. in this paper, they suggest that scheduled maintenance and proper lubrication should be provided to operate brake safety. The traditional braking system is bulky and late but the electromagnetic brake system is a modern system that will work in heavy and also small vehicles. The project works on the principle of electromagnetism.
--PROF. N. B. TATALA, PRIYA BHOSLE, SEEMA JARHAD.
This paper reviews the conventional method of braking, in this paper limitations of drum brakes, pneumatic brakes, and hydraulic brakes are mentioned. The electromagnetic brake system is better and more affordable. This paper contains the installation method which is not difficult to install. It offers better output than the current design. More budget and research will give even better performance
-- MUBASHIR MURSHED, MD SANAULLAH CHOWDURY
This project deals with IoT working with vehicle accident detection, reporting, and navigation. For this project, they create automatic vehicle accident detection and massaging system using GSM and GPS modem. This model ascertains the accident by a vibration sensor and sends a message.
--YASH GANDHI, DIPAM MODH, NYEE KISHAN, RAJAN PARMAR.
This article keeps focuses on eddy current electromagnetic brakes. According to this paper, with the help of electromagnetic brakes, the life of the main braking unit is increased. In this project when eddy current and electromagnetic flux are cut by the rotor then eddy current will induce in the rotor. This eddy current run in the opposite direction of a rotor which results in slowing down the speed and then stopping.

III. BLOCK DIAGRAM



IV. COMPONENT USED IN PROJECT

1. Metallic Stripe
2. Nut bolt
3. Foam disc
4. Metallic sheet

1. Metallic Stripe:

We used stainless steel metallic strip. We this strip on the base of the mounted project model. The strip is placed exactly in front of the wheel. We used stainless steel especially because of its high mechanical strength. On this strip electromagnet as well as proximity sensor are situated. On this strip, an electromagnet is placed on the top of the strip and a proximity sensor is situated in the middle of the strip

2. Foam Disc:

The foam disc is placed at 25 cm in height from the base. The foam disc is used to joint the Al metallic sheet on both sides of it. On both sides of this disc, a metallic sheet is placed. So basically, foam disc is a strong base for a metallic sheet with which we are creating a wheel. Two nut bolts are inserted in the disc when supply is provided then the disc start rotating and due to electromagnetic force on the metallic sheet, it stops rotating when obstacles are detected.

3. Metallic Sheet:

An aluminum metal thin sheet is placed on both sides of the foam disc. Al sheet is active for electromagnetism when an obstacle is detected then the relay gives a signal to the electromagnet. Which is placed exactly in front of the wheel, then electromagnetism occurs at the electromagnet and metallic sheet. This electromagnetism will trigger electromagnet to attract the metallic sheet towards it. This result in lowering the speed and eventually this will end up with the stopping of the wheel.

The electromagnetism electromagnet will oppose the moment of the disc. So here the kinetic energy of the wheel is converted into heat. Then the wheel starts slowing and then stops.

4. Nut Bolt:

Two nut bolts are inserted into the metallic sheet wheel. These nut bolts are inserted 180 degrees apart means opposite to each other this bolt is placed exactly in front of a proximity sensor. On each rotation of the wheel, the proximity sensor senses the nut bolt and counts it. So if the wheel completes one cycle or one rotation then that time proximity sensor counts two readings as in one rotation both nuts pass from the front of the proximity sensor. The speed is measured in RPS which is Rotation Per Second and speed is calculated by the reading of the sensor divided by two.

Fabrication Material (Electrical & Electronic Components)

1. Microcontroller (89s52)
2. Ultrasonic Distance Sensor
3.. Inductive Proximity
4. Electromagnet
5. Relay
6 Wi-Fi module
7. DC Motor
8. LCD Display
9. I

1. Microcontroller (89s52):

The AT89s52 belongs to the 8051 microcontroller family. The AT89s52 requires low power and gives high performance. It is a CMOS 8-bit microcontroller having 8k bytes of in-system programmable flash memory and also RAM of 256 bytes. This can be operated at a maximum frequency of 33Mhz with the help of an oscillator that has GPIO pins, three different timers16 bit, and one full-duplex UART communication port furthermore it has 40 pins on-chip oscillator. This microcontroller can be used in domestic devices as well as industrial level.

2. Ultrasonic Distance Sensor:

The module used is HC-SR04. This module has a non-contact measurement system that can provide sensing ranging from 2cm to 400 cm. 3mm of the accuracy of ranging can be achieved. This module consists of three main parts known as an ultrasonic transmitter, an ultrasonic receiver, and a control circuit. It can give a stable reading from 1 to 13 feet. The sensor head called Tx means the transmitter sends an ultrasound by using an IO trigger for a minimum of 10 ultrasonic signals which is a high level. The sending of Tx is 4KHz. After that sensor head is known as Rx, which means the receiver listens to the echo if the wave has touched the obstacle.

Test distance = High-level time*velocity of sound /2
Working voltage =DC 5v
Working current=15mA
Working frequency=40 Hz
Maximum range =4m
Minimum range=2cm
Measuring angle=15 degree

3. Inductive Proximity Sensor:

This is a solid device. The name of our IPS is M18DPO and its manufacturing company is Advance Tech. We choose this IPS because this gives higher quality and durability with very good dimensional accuracy. The IPS works independently with 9v power. The placement of this sensor is projected in the metallic strip and front of the metallic wheel. The placement has been made in such a way that, the nut bolts which are inserted in the metallic wheel at 180 degrees each other, pass through exactly in front of the IPS.

Supply voltage = 5 to 30 v DC
Frequency = 1KHz
Maximum load current = 300 mA
Maximum Range = 5mm
Contact = no
Output indication = through LED

4. Electromagnet:

For this project, we used DC 12v KK-P40125 35Kg lifting solenoid electromagnet. In this, an iron core of the coil is present which attracts magnetic substances. It is just a coil wound around an iron core. Electromagnet gets energized when supply is provided. So, this creates an electromagnetic field that attracts a metal or metallic substance just like a permanent magnet. High power magnetic field with Hight efficiency is produced. This magnet provides a High attractive force (Strong pull). We are also

able to adjust push force by varying input power. Residual magnetic force decrease After power is turned off then also there is some magnetic force remained. By this electromagnetic residual magnetic force is released hence force is minimized

5. Relay:

We used 2 channel 5V optical Isolated relay module. Both channels require a 15-20 MA drives current is required on both channels. This has a wide range of demand in different equipment applications which have a large current. This is worth under AC 250V, 10A or DC 30V, 10A. The interface of this can be controlled directly by the microcontroller. This relay can be isolated from a high voltage scale as well as also resistance ground loop for safety purposes with the help of an Optocoupler.

This relay is an SPDT relay. This is a high-quality low-noise relay

.6. Wi-Fi Module

It is a Module name ESP8266. It is self-contained So having an integrated ICPLIP protocol stack with providing Bange availability to the Wi-Fi network. This module is pre-programmed which means you just have to connect it with Arduino or Microcontroller. This module is so affordable with such advanced features. It has a high degree of on-chip integration which permits for minimum external circuitry. This module contains high onboard processing and storage capability. The ESP8266 gives acceptance to APSD for VOIP acceptance as well as Bluetooth acceptance it has self-calibrated RF working with all operating conditions as well as it doesn't have to provide any external RF parts.

7. DC Motor:

Ball-bearing DC motor which has a built-in cooling fan. It has high torque and also a wide operating voltage of like 6-20 VDC which is suitable for tool application. We supply DC motor which is mounted on the metallic strip the output of DC motor is provided to the wheel. The speed of the rotating wheel can be controlled by a DC motor.

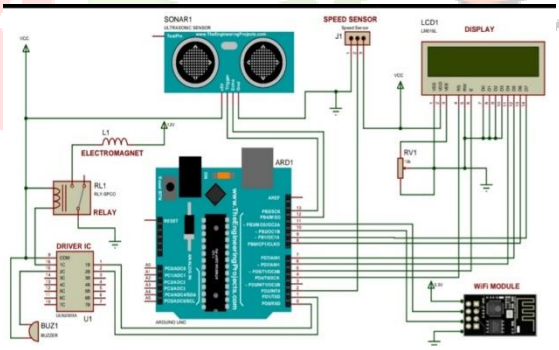
8. LCD Display:

LCD means Liquid Crystal Display their work is to show different parameters of the system. The LCD we used here is16*2 display. That means with this display we can show 16 characters to each line and there are two such lines with the same application. In this LCD every characteristic is displayed in a 5*7 pixel matrix. This LCD can process 224 types of various characteristics and symbols. The two types of resisters are provided here which are command and data.

9. IOT: -

IoT means the Internet of Things. IoT is a site on the internet with no. of the channel as we create. It is used to provide a wireless internet connection to the microcontroller. IoT connects with the nearby internet connection. With the help of a Wi-Fi module and IOT, we can send data such as the speed distance in this project over the internet and can display it on a website. We have created our channel on a website named" Thing Speak" the name of our channel on that site is "Electromagnetic Braking". So, we can send and store the data like speed and distance on this site. This data can be monitored from anywhere in the world by using a smartphone or PC or Tab.

V. CIRCUIT DIAGRAM



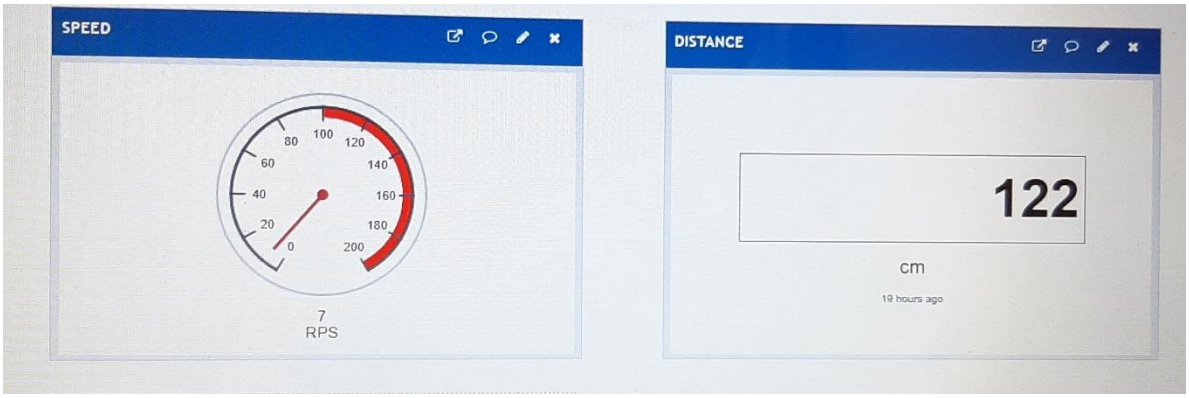
(Fig 1) Project circuit diagram

For the project, we used two separate supplies. One supply is provided to the DC motor an Electromagnet. This supply is provided through an adaptor pin which gives 12V DC with 2A current. This supply is then fed to a speed control module which controls the speed of the wheel. Another supply is 230V AC and it is given to the center tap transformer which gives 12V DC with 1A current. The main control board and electronic component work at 5V DC. So, the output of the transformer is given to regulator IC of 5V. then this supply is given to 6 different components like LCD, ultrasonic sensor, proximity sensor, Wi-Fi module, relay, and buzzer. one of the supplies is provided to LCD through buffer IC74245 which is a bi-directional IC. This IC is used because LCD is not placed on board so data may lose while sending. The second supply is given to the ultrasonic sensor which has three-pin and the third supply is provided to the speed sensor. The data of distance from ultrasonic sensor and data of speed from proximity sensor is fed to LCD via a microcontroller. The Wi-Fi module requires a 3.3V supply to work so a reduced voltage of 3.3V is given to the Wi-Fi module. the next supply is provided to Relay IC. The IC used is ULN2003. The maximum current needed to work the microcontroller is 15-20mA but the relay needs approx. 100mA current and buzzer need approx. 30-40mA so to increase the current Relay IC is used. buzzer and Relay are provided through Relay IC. In an emergency when the speed distance ratio goes below 10 then the buzzer gets ON as well as Relay is also activated which results in applying the brake. We stored all the data of speed, distance, and brake on a website called as ThingSpeak through IoT. On that site, we created a channel for this project named 'Electromagnetic Braking'. There are three fields are created. on field 1 we stored data on speed, on field 2 distance data is mentioned and on-field 2 brake data is stored.

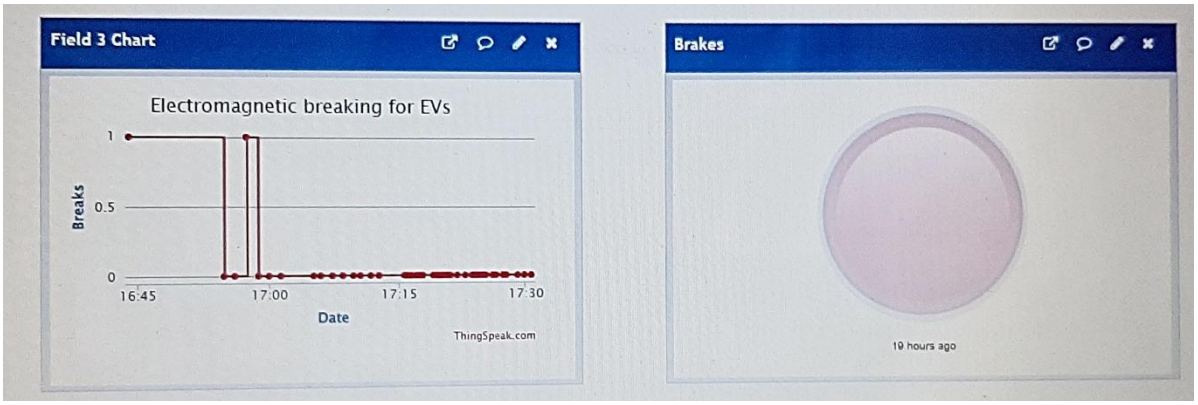
(Fig 2) Hardware Model of the project

VI. RESULT

(Fig 3) Feld 1 & 2 output chart



(Fig 4) Speed and distance status



(Fig 5) Field 3 chart and brake status

(Fig 6) LED Display

VII. ADVANTAGES

1. Maintenance-free life cycle.
2. Distance of obstacle can be detected and measured immediately.
3. Simple design with low cost, compact size, and lightweight.
4. Increase control of the vehicle.
5. Decrease the chances of losing control under panic conditions.
6. Significantly reduced risk of skidding.
7. Liquid vaporization and solidifying are dispended as no oil is used.

VIII. CONCLUSION AND FUTURE SCOPE

With the more budget provided for research and development then there is a wide future for the Electromagnetic Braking System. If high accuracy and higher sensing range sensors are provided then even faster and more accurate braking is accomplished. the skidding of the heavy vehicle can be controlled easily and more effectively. In countries where advanced road infrastructure is available there, these brakes are extremely helpful with extra features like regenerative braking and many more. Upcoming EVs can easily adopt this system.

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