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ELECTROMAGNETIC BRAKING WITH OBSTACLE DETECTION

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Abstract - *According to a study 20-30% of the road accident cases are caused due to less attentiveness of vehicle driver or the failure of brakes and vehicles have mechanical brakes which requires a high mechanical force that cause a problem to handicap person so to overcome above described problem we came up with the idea of intelligent braking system with obstacles detection which has 3 parts first is electromagnets to provide automation to the brakes and second part is ultrasonic sensor by sensing braking system can detect obstacles so that it can automatically send signal to Arduino and brakes can be applied third part is brake for which we used disc braking to provide smoothness and effective braking and the last and main part or brain of the system is Arduino chip which gets the signal from sensor and activates the brakes So from this braking system we can provide the automation to a mechanical braking system which can be further modify and can be implement to vehicles the brakes in which we can fully rely on and can also be used in vehicles for handicaps that aren't able to apply conventional braking.*

Key Words: **Electro-Magnetic Induction (EMI), Rotation Per Minute (RPM), Conventional Braking System (CBS), Anti-lock Braking System (ABS), Electro-Magnetic Brakes (EMB), Computer Aided Design (CAD)**

1. INTRODUCTION

Two main functions of a braking system are to maintain control of the car/vehicle at a vertiginous inclination or a declination and to stop the vehicle in the shortest distance possible. Conventionally, hydraulic circuits are used to accomplish the braking mechanism. When the driver sets foot on the brake pedal or pulls on the brake lever, it puts pressure on the piston that in turn pushes fluid through the master cylinder into the slave cylinder through the hydraulic circuit. This eventually gets converted into a pressure which pushes the brake pad against the wheel generating braking torque through friction. Initial mechanism was based on drum brakes on all four wheels where the braking drum is mounted on the wheel with brake shoes fixed inside the drum having face parallel to the drum inner surface. The hydraulic fluid in the slave cylinder presses the brake shoes towards the drum and this caused braking due to frictional force. Currently, vehicles come with disc brakes since they are more efficient during the process of braking and had an efficient heat dispersion mechanism. In this system, a caliper is placed on a wheel or a solid disc which is attached to the wheel. The calipers are pressed through hydraulics generating braking force by pressing the disc through brake pads.

New advances are landing in this world. Numerous enterprises got profited because of the entry of these innovations. The vehicle industry is one of them. As the brake is an essential piece of car innovation, there are developments in brakes as well. The generally used brakes in cars are drum and circle brakes. Different types of the slowing mechanism used are pressure-driven, pneumatic and so forth. Electromagnetic braking is an imaginative innovation and frames the premise of developing innovation. The slowing mechanism is for the most part grouped by their strategy for task. The two noteworthy kinds of brake are frictional and electromagnetic retarder. A brake is a mechanical gadget which includes the change of dynamic vitality into warm vitality (warm) by halting vehicle in a movement. While braking power is connected by brake to slow down the movement of the vehicle some of the motor vitality is disseminated as warmth vitality. The essential capacity of Brakes is to moderate the speed of a vehicle in a brief span regardless of speed. Therefore, the brakes are required to be able to create high reverse torque and engrossing vitality at high rates for brief timeframes. Brakes might be connected for a more extended timeframe in a few applications, for example, an overwhelming vehicle dropping in an incline at rapid. Brakes must have the capability to keep the warmth retention for delayed timeframes. The repetition of mishappening is currently a day expanding because of unnecessary stopping mechanism. Hence stopping mechanism should be improved for powerful and productive braking.

Electromagnetic brake is a new idea. It is discovered that electromagnetic brakes can build up a power which is almost double the most extreme power yield of a normal motor, and no less than three times the braking energy of a fume brake to stop the vehicle. These results of electromagnetic brakes make them essentially more focused possibility for elective hindrance hardware's contrasted and different retarders. This project expects to limit the brake inability to stay away from the street mis happenings. It additionally diminishes the support of stopping mechanism. Preference for this mechanism is that it can be used in any vehicle and is less problematic.

But along with these advantages of usability and reliability this type of system has disadvantages of its own. As we apply the brakes magnetism is produced and the vehicle stops but after releasing the lever some amount of magnetism remains in the electromagnets and leads to some problems. Due to residual magnetism present in electromagnets the brake shoe take time to come back to its original position. This is the problem that traditional electromagnetic brake face. So, in our hybrid system a spring was used to pull back the shoe. Along with this the installation of an electromagnetic brake is very difficult. This is one of the challenges of electromagnetic braking. So, in place of traditional electromagnetic brakes we used a hybrid system. These braking system relay on the electric power so in IC engine vehicle electric system is a secondary system so the braking system will not be as reliable as the conventional braking system.

2. Technical Description

The design was based off model found online. Many of these models lists the parts used. Based on these listed parts, motor, chips and chassis selection were made.

2.1 Motor

Motor used in this project is a 220Volt, 500RPM, 1/10HP. Motor is mainly used to run the axle or is the main drive of the prototype. It will be powered through external supply through a relay that can be switched using an Arduino.

2.2 Frame

Initially, it was proposed that a custom frame be built for the final product. Material considered for this is iron. As the rigidity does not matter in this project so, the material does not play a major role in the functioning of the prototype.

2.3 Sensor

In this project ultrasonic sensor is used as the distance measuring device. Device name is HC-SR04. It emits an ultrasound at 40000HZ which travels through the air and if there is an object or obstacle on its path it will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance. The HC-SR04 module has 4 pins, Ground, trig and echo. The Ground and VCC pins of the module needs to be connected to the ground and the 5 colt pins on the Arduino board respectively and the trig and echo pins to any digital I/O pin on the Arduino

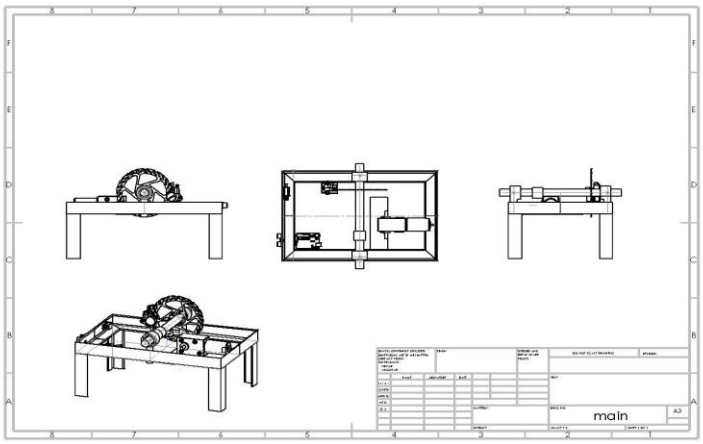
2.4 Relay

The SR-05VDC SL-c relay has three high voltage terminals (NC, C and NO) which connect to the device you want to control. The other side has three low voltage pins (Ground, V and signal) which connects to the Arduino. Inside the relay is a 120-240V switch that's connected to an electromagnet. When the relay receives a HIGH signal at the signal pin, the electromagnet becomes charged and moves the contacts of the switch.

2.5 Electromagnet

An electromagnet is a type of magnet in which the magnetic field is produced by an electric current. The magnetic field vanishes when the current is switched off. Electromagnets usually consist of isolated wire wound into a coil. A current in the wire creates a magnetic field which is concentrated in the hole in the center of the coil. The wire turns are wound around a magnetic core made mostly from a ferritic or ferrimagnetic material such as iron; the magnetic core concentrates the magnetic flux and makes a more powerful magnet. The electromagnet we used is a 12V DC electromagnet. In this magnet changing the polarity of the DC supply changes the direction of the push pull functionality and can be used to derive the brakes i.e. disk brakes in this system.

Fig -1: CAD sketch of the system



3. Driving Unit

3.1 Electric Motor

An electric motor converts electrical energy into mechanical energy that can be used. In simple motoring mode, electric motors operate through the interaction between a magnetic field and winding currents to generate force within the motor. Electric motors are classified by electric power source type, rotor and stator construction, application and type of motion output.

3.2 Wheel

The wheel is rotated with the help of a 12V DC motor. Both motor and wheel are connected with the help of belt and chainring.

3.3 Power control

This division consists of a power supply to the whole system and a separate power control system to control the motion of motor.

4. Braking Unit

4.1 Electromagnet

An electromagnet is a type of magnet in which the magnetic field is produced by an electric current. The magnetic field vanishes when the current is switched off. Electromagnets usually consist of isolated wire wound into a coil. A current in the wire creates a magnetic field which is concentrated in the hole in the center of the coil. The wire turns are wound around a magnetic core made mostly from a ferromagnetic or ferrimagnetic material such as iron; the magnetic core concentrates the magnetic flux and makes a more powerful magnet**.**

4.2 Stopping disc

It is a magnetic disc that will slow down once electromagnet is turned on and will stop the main wheel. The electromagnet is used to pull the wire that pushes the caliper towards the surface of disk leading to friction and finally the stop in wheels motion.

4.3 Ultrasonic transducers

Ultrasonic transducers are used to emit the ultrasonic waves with high frequency. These transducers are operated by using electrical current. In this project 12V battery is used switch on the source

5. CONCLUSION

Using a traditional electromagnetic brake introduces a lot of problems regarding the power usage and reliability. Due to these reasons we opted for hybrid electromagnetic braking system. As, the motor we used, didn't have enough torque for our system due to this the system wasn't working as expected. So, we opted for a high torque low RPM motor. Our electromagnet provided enough force to stop the axle at a certain point of time. The ultrasonic sensor was providing enough coverage.

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