Rectification of Sudden Brake Failure in Automobiles

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Abstract - Braking is bringing a moving vehicle or moving body to stop. Nowadays safety is an important feature in the automotive industry. The existing braking system has produced lot of problems and is prone to human error. Hence facilities have been incorporated in braking system so that it brakes automatically when an brake fails. The aim is to design and develop a control system based electronically controlled automotive braking system. The electromagnet breaking system is used to brake the system.

Keywords - Electromagnetic brake, brake sensors, wheel motion sensor, LCD display.

I. INTRODUCTION

The principle of braking in road vehicles involves the conversion of kinetic energy into heat. This high energy conversion therefore demands an appropriate rate of heat dissipation if a reasonable temperature and performance stability are to be maintained. While the design, construction, and location features severely limit the heat dissipation function of the friction brake, electromagnetic brakes work in a relatively cool condition and avoid problems that friction brakes face by using a totally different working principle and installation location. By using the electromagnetic brake as supplementary retardation equipment, the frictions brakes can be used less frequently and therefore practically never reach high temperatures. The brake linings thus have a longer life span, and the potential “brake fade” problem can be avoided.

It is apparent that the electromagnetic brake is an essential complement to the safe braking of heavy vehicles. Electromagnetic braking system is a modern technology braking system used in light motor & heavy motor vehicles like car, jeep, truck, buses, etc., [2].

This system is a combination of electro-mechanical concepts. The frequency of accidents is now-a-days increasing due to inefficient braking system. Electromagnetic brakes (also called electro-mechanical brakes or EM brakes) slow or stop motion using electromagnetic force to apply mechanical resistance (friction). The original name was "electro-mechanical brakes" but over the years the name changed to "electromagnetic brakes", referring to their actuation method.

II.PROBLEMS IN EXISISTING METHOD

When the drums are heated by hard braking, the diameter of the drum increases slightly due to thermal expansion, so the shoes must move farther and the driver must press the break farther. The properties of the friction material can change if heated, resulting in less friction. This can be a much larger problem with drum brakes than disc brakes, since the shoes are inside the drum and not exposed to cooling ambient air. The loss of friction is usually only temporary and the material regains its efficiency when cooled [1], but if the surface overheats to the point where it becomes glazed the reduction in braking efficiency is more permanent. Surface glazing can be worn away with further use of the brakes, but that takes time. Excessive brake drum heating can cause the brake fluid to vaporize, which reduces the hydraulic pressure applied to the brake shoes [1]. Therefore, the brakes provide less deceleration for a given amount of pressure on the pedal. The effect is worsened by poor maintenance. Brake fluid that is old and has absorbed moisture has a lower boiling point, so brake fade occurs sooner.

III. PROPOSED METHOD

To overcome the above disadvantages electromagnetic braking is used to brake the wheels under brake failure condition. By going for electromagnetic braking the following advantages can be obtained.

1. Quick operation
2. Better accuracy
3. Smooth braking
4. Less maintenance
5. Reduces manual effort.

IV.SIMULATION RESULT

The simulation is carried out using photo shop cs6 software. 5V DC supply is given to the control unit, sensors and LCD display unit. Using crystal oscillator, the clock pulse is generated and it is given to the microcontroller. Brake lever sensor is used for checking the brake condition of a vehicle and also to give input signal to the microcontroller for braking the wheel, under brake failure condition with the help of speed sensor and brake sensor.

The microcontroller analysis the input from the sensors and turn ON the transistors in the driver unit to activate the relay via RD_0 and RD_1. When relay is activated the electromagnets gets magnetized and stops the rotating wheels.

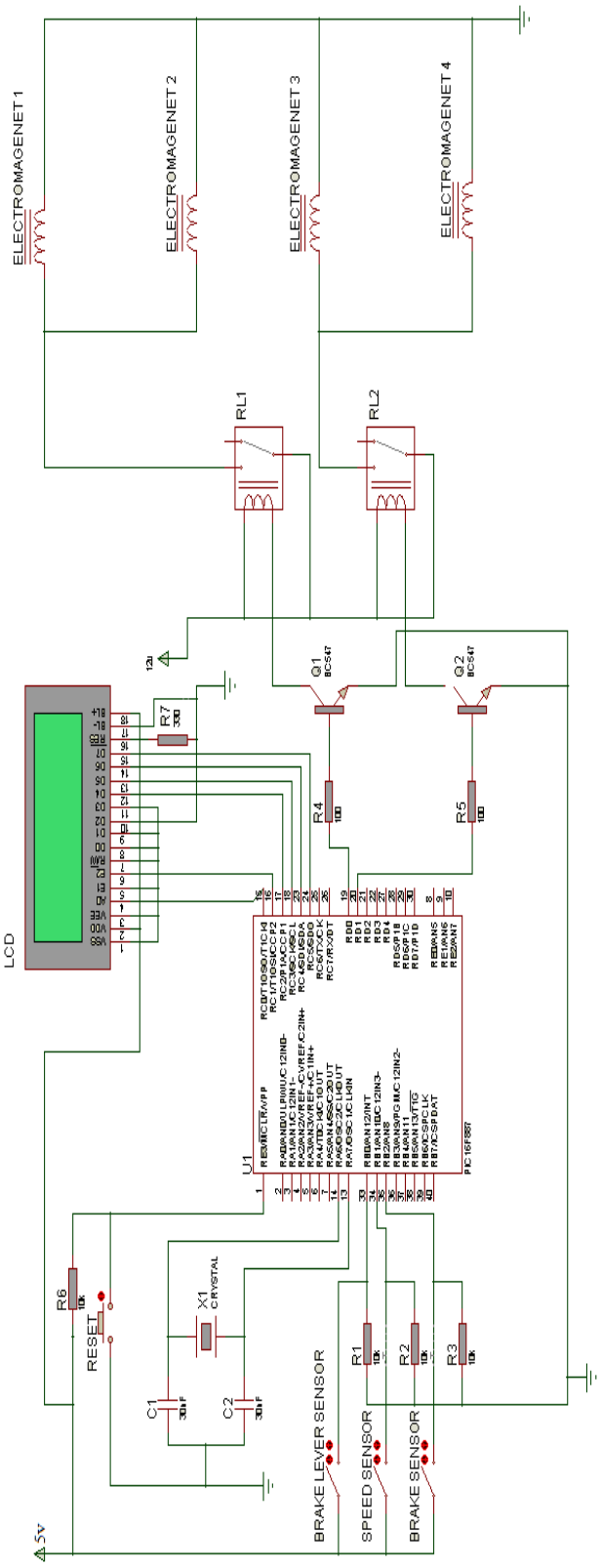

Fig.1 Simulation Diagram

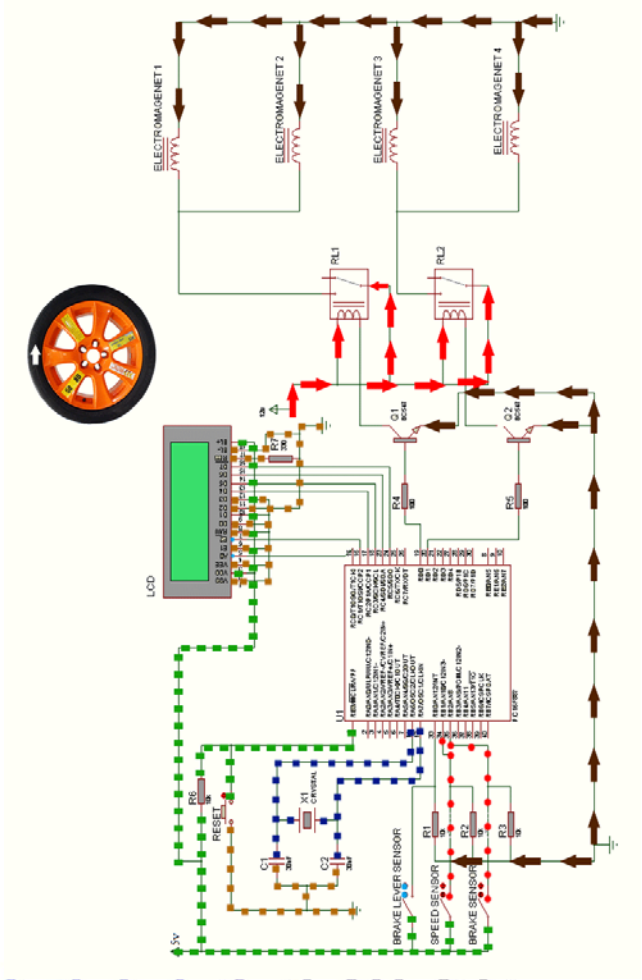

Fig. 2 Animated Simulation Diagram

V. EXPERIMENTAL SETUP

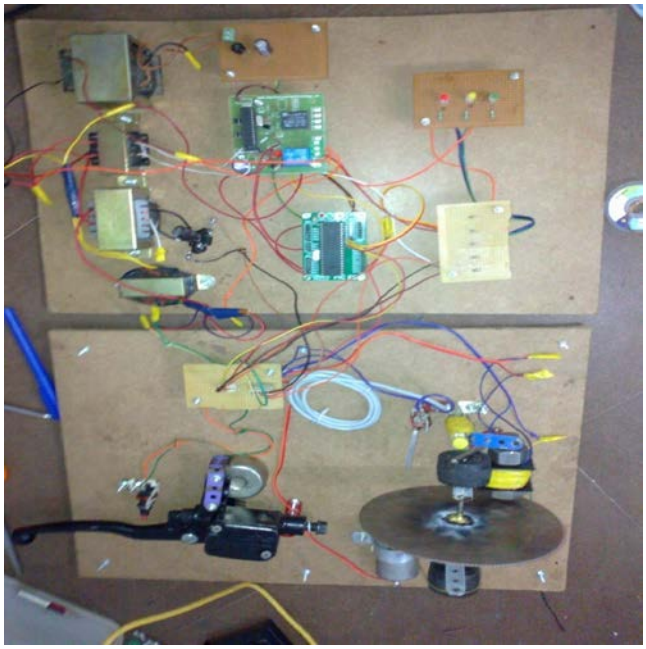

Fig. 3 Experimental set up

HARDWARE MODULE & SPECIFICATIONS:

POWER SUPPLY:

- Four 1N4001 diodes.
- LM7812 and LM7805 regulator.
- Transformer that has an output of 12V AC with an output current of 2A, depending how much power will need.

BRAKE DISK OR SHOE SENSOR:

- DC - 3 WIRE GL SERIES
- VOLTAGE : 5-12V
- DC CURRENT : 1A

BRAKE LEVER SENSOR:

- AC/DC - 2 WIRE VERSA PROX STANDARD SERIES,
- LIMIT STYLE -Polyamide
- VOLTAGE :12-25V AC/DC, CURRENT : 1A

ELECTROMAGNETIC BRAKES COIL:

- Voltage : 12-24 Volt
- Current : 2-5 Amps.

WHEEL MOTION SENSOR:

- Supply voltage 8-30V DC , 1-5Amps
- Pulse out 0.06-4.95V, typical(2.5 V at zero field strength)
- Frequency range 0 Hz-30 KHz
- Air gap depends on field strength up to 0.1mm

CONTROL UNIT:

- Oscillator -11.0592 MHZ
- Power-Saving Sleep mode
- Wide Operating Voltage Range (2.0V - 5.5V)

VII.CONCLUSION

Thus the electromagnetic breaking system proves effective in providing smooth braking using sensors and controllers. Implementing this braking scheme helps to reduce accident.

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