

Automatic Hand Break Release

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Abstract— An automatic hand brake system for a vehicle consists of an electric motor, associated with the motor for transmitting motion from the motor to a brake lever, which pushes the brake pads. This project provides a new concept design of the EMPB (electro mechanical parking brakes) system that has simple and low-cost characteristics and deals with the designing and fabrication of EMPB system. Electromechanical parking brake system also referred to as brake by-wire, replace conventional parking braking systems with a completely electrical component system by replacing conventional linkages with electric motor-driven units. The braking force is generated directly at each wheel by high performance electric motors and auto control, which are controlled by an ECU. This system provides the following benefits over the conventional handbrake: Ease of use-the parking brake can be applied fully regardless of the strength of the driver and Safety- the electric parking brake applies automatically when the key is removed from the ignition.

Key words: EMPB, ECU, Hand Brake, Motor, Safety

I. INTRODUCTION

In cars, the parking brake, also called hand brake, emergency brake, or e-brake, is a latching brake usually used to keep the vehicle stationary. It is sometimes also used to prevent a vehicle from rolling when the operator needs both feet to operate the clutch and throttle pedals. Automobile hand brakes usually consist of a cable directly connected to the brake mechanism on one end and to a lever or foot pedal at the driver's position. The mechanism is often a hand-operated lever, on the floor on either side of the driver, or a pull handle located below and near the steering wheel column, or a (foot-operated) pedal located far apart from the other pedals. Conventional parking brake actuation involves the human interference. Without pulling or pushing the lever, the parking brake will not work. Also, sometimes due to negligence or in emergency conditions, we humans often forget to apply parking brakes. This may lead to rolling of vehicle in case of slopes and collision with other vehicles in parking area. Constant enhancements in active safety and improvements with respect to the reliability and comfort of operation mean that mechanical handbrakes are increasingly being replaced by electromechanical systems. This gave birth to ideas of electric parking brake techniques. The fundamental function of the electric parking brake (EPB) is to activate and release the parking brake when the vehicle is at a standstill. In first generation of electric parking brake fitted, a switch on the instrument panel replaces the traditional handbrake lever used to operate the mechanical parking brake. This switch utilizes an electronic control unit (ECU) to trigger electromechanical actuators within the wheel brakes or central actuator that operates the rear wheel brake via a Bowden cable. Further, for reducing driver's effort and reminding for application of parking brake, there was a demand for a completely automated

parking brake system. This paper is based on the development of one such system, involving the concepts of automobile, mechanical and electronics, known as Electromechanical parking brake. It is composed of one electro-mechanical actuator integrated into the disc brake caliper and a controller with redundant connections to the power supply, which is controlled inside the vehicle's cabin by a simple rocker switch. Hence, there is great demand for an electronic applied mechanism, with automation for actuation of the parking brake. It should also save space, reduce overall weight, complication in linkages, less mechanical parts prone to wear and tear, good responsive technique, high durability, very less or no involvement of human and economic. It eliminates the need for a parking brake lever or pedal and improves vehicle styling, space management and crashworthiness.

II. LITERATURE SURVEY

A. Novel design of the integrated Electric Parking Brake system [1]

Yan-Sin Liao, Chien-Tai Huang, Chien-Tzu Chen, Shou-Yi Cheng, Bo-Ruei Chen and Fu-Yen Huang Automotive Research & Testing Center (ARTC)

A new design of integrated Electric Parking Brake system, called iEPB and integrated in the brake caliper, is introduced in this paper. It consists of an electrically operated brake unit and a hydraulically pressed unit independently, and uses a special self-locking mechanism instead of a screw device to increase the efficiency and the working speed. With all conventional EPB system's advantages, it also provides a stronger brake performance and a faster reaction time. In this paper, we describe the working principle of this new design at first, and then introduce the arrangement of the testing system, followed by a discussion of experimental data. The testing results prove the feasibility of this design. The conclusion paragraph summarizes the key points about the design of the iEPB system.

B. Synthesis and characterization of magneto-rheological (MR) fluids for MR brake application [2]

Bhau K. Kumbhar, Satyajit R. Patil, Suresh M. Sawant

Magneto rheological (MR) fluid technology has been proven for many industrial applications like shock absorbers, actuators, etc. MR fluid is a smart material whose rheological characteristics change rapidly and can be controlled easily in presence of an applied magnetic field. MR brake is a device to transmit torque by the shear stress of MR fluid. However, MR fluids exhibit yield stress of 50e90 kPa. In this research, an effort has been made to synthesize MR fluid sample/s which will typically meet the requirements of MR brake applications.

C. Design and Fabrication of Electromechanical Parking Brake System [3]

Sumant Ashok Nayak, Kiran G, Kushal P S, Madhu B V and Dr. Ravishankar M K

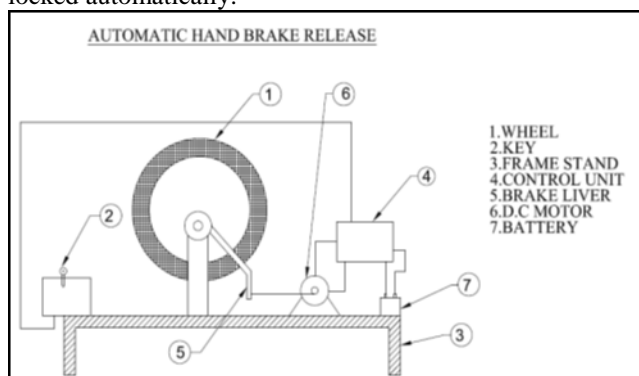
An electromechanical parking brake system for a vehicle consists of an electric motor, reduction gear train associated with the motor for transmitting motion from the motor to a lead screw, which pushes the brake pads. This project provides a new concept design of the EMPB system that has simple and low-cost characteristics. This paper deals with designing, analysis and fabrication of EMPB system. Electromechanical parking brake system also referred to as brake by-wire, replace conventional parking braking systems with a completely electrical component system. This occurs by replacing conventional linkages with electric motor-driven units. The braking force is generated directly at each wheel by high performance electric motors and gear reduction, which are controlled by an ECU.

D. The Electronic Parking Brake Module: Range Rover Sport and Land Rover Discovery[4]

The Electronic Parking Brake Module, also known as the EPB actuator, is fitted to the Range Rover Sport from 2005 onwards and the Land Rover Discovery 3 & 4. If the parking brake will not release, or appears not to have released when moving off, a loud screeching noise may be heard from the rear of the vehicle. This combined with a parking sensor flashing on the dashboard could indicate the EPB module has failed. The parking brake can be released manually: in the Discovery 3 and 4 by removing the small rectangular plastic cover situated just behind the parking brake lever. On the Range Rover Sport the EPB lever needs to be removed by unscrewing 2 screws. Inside the console there is a wire cable loop, pulling this will release the parking brake.

III. SYSTEM DESCRIPTION

The parking brakes or the hand brakes must be locked every time when the vehicle is parked. While travelling in hilly areas, these brakes are highly useful. Hence our project incorporates the feature of the automatic hand brake release system. That is every time, the key is inserted in its slot for ignition, the control unit senses and sends signals to activate the motor, the motor releases the hand brake through a cable. On the other hand, when the key is released after parking, the motor is controlled by the control unit and is rotated in the reverse direction such that the hand brakes are locked automatically.



A. Circuit Design

As shown is below figure, microcontroller is always supplied with 5V DC and sends the actuating signal of range

0V to 5V to relay based on the ignition condition of engine. Relay is supplied with 12V DC and switches the motor to rotate either clockwise or anticlockwise. As the motor rotates, it produces some electrical noises and high voltage. So to prevent microcontroller components from damage due to this noise and high voltage, we are using opto-coupler in between microcontroller and relay board.

IV. SYSTEM DESIGN

A. Arduino Uno Microcontroller

Arduino is an open-source physical computing platform based on a simple i/o board and a development environment that implements the Processing/Wiring language. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer (e.g. Flash, Processing, MaxMSP). The open-source IDE can be downloaded for free (currently for Mac OS X, Windows, and Linux).

Microcontroller: ATmega328

Operating Voltage: 5V

Input Voltage (recommended): 7-12V

Input Voltage (limits): 6-20V

Digital I/O Pins: fourteen (of that 6 give PWM output)



Fig.: Arduino Uno Microcontroller

B. Relay

2 channel Relay driver project can be controlled by feeding 2-12V trigger voltage, Very useful project for application like Micro-Controller based projects, Remote controller, Lamp on off, and any circuits which required isolated high current and high voltage switching by applying any TTL or CMOS level voltage. Two LED works as operation indicator while in, 3 pins screw terminals to connect load and provides both normally open and normally closed switching.

Input: 12 VDC @ 84 MA

Output: Two SPDT relay

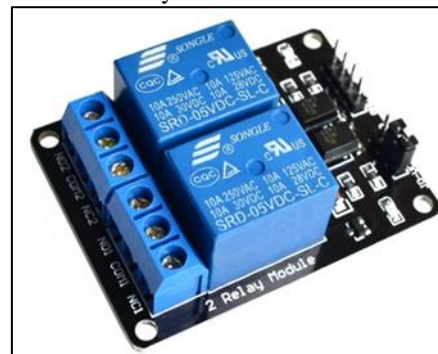


Fig: Two Channel Relay

B. Wheel Arrangement

The simple wheel and braking arrangement is fixed to the frame stand. Near the brake drum, the pneumatic cylinder piston is fixed. This wheel arrangement is setup for showing the successful working of our project. But the real implementation can be done in the automobile and the brakes can be applied to all the four wheels.

1) Moped wheel (Honda Activa)

Tyre size 90/100-10

Rim size 10 inch

Brake type & size Drum 130mm

C. DC Motor

The A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor.



Fig: 12 volt, 10 rpm geared DC motor

V. CONCLUSION

The automatic hand braking system i.e. electromechanical parking brake help with automatic parking brake application based on engine ignition condition. This will provide safe braking is assured in slopes and hill starts with the help of "HOLD" function. The working of project is as per expected as the brake is applied by switching off the key and brake is released when key is on. This will reduce human efforts and human errors while parking or starting the vehicle. This system has complete automatic operation for easy drivability and safety. This system also gets some advanced options like hold function in head to head traffic and inclined roads, which would promise the drivers and vehicle owners with a safe pleasure drive and stops. The system has greater relative advantages over the conventional parking system and will find maximum application in the future because of its significance. The system is less costly and more effective hence can be adapted to any vehicle.

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