

# AUTOMATIC HAND BRAKE SYSTEM

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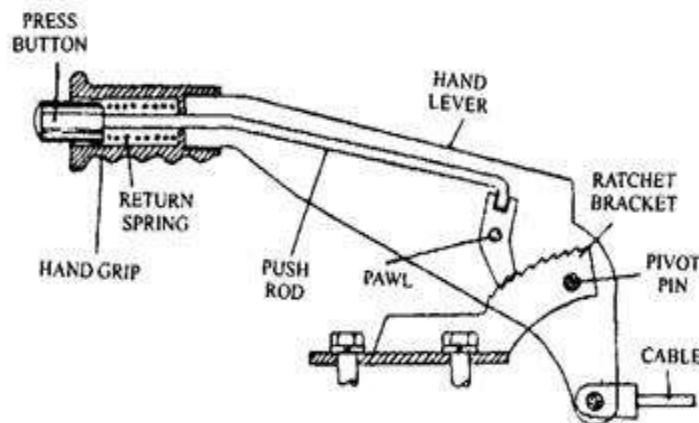
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**Abstract**— Hand brake is one of the most important components in vehicles. In general the hand brake is operated manually in our project, We are developing Automatic Hand Brake System for safety purpose. The hand brake engagement and disengagement is done with the help of proximity sensors and rack & pinion

**Keywords**— sensors, motor, microcontroller, rack & pinion, IR sensors, relays, hand brake

## INTRODUCTION

In cars the hand brake is a latching brake usually used to keep the car stationary. automobiles e-brakes usually consist of a cable directly connected to a brake mechanism on one end and to some type of mechanism that can be actuated by the driver on the other end .the mechanisms is often a hand –operated lever, on the floor on either side of the driver, a pull handle located below and near the steering wheel column, or a pedal located far apart from the other pedals.

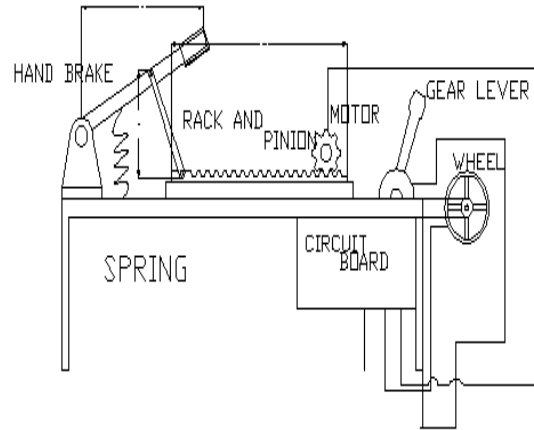


Although sometimes known as an emergency brake, using it in any emergency where the footbrake is still operational is likely to badly upset the brake balance of the car and increase the likelihood of loss of control of a vehicle for example by initiating the rear – wheel skid. Additionally, the stopping force provided using the hand brake or in addition to the footbrake is usually small and would not significantly aid in stopping the vehicle, again because it usually operates on rear wheel while braking .the emergency brake is instead intended for use in case of mechanical failure where the regular footbrake is inoperable or compromised, hopefully with opportunity to apply the brake in a controlled manner to bring the vehicle to a safe. If gentle half before seeking service assistance The most common use for an automobile emergency brake is to keep the vehicle motionless when it is parked, thus the alternative name, parking brake .car emergency brake have a ratchet locking mechanism that will keep them engaged until a release button is pressed . on vehicles with automatic transmission, this is usually used in concert with parking pawl in the transmission .automotive safety experts recommended the use of both system is required by laws in some jurisdictions .yet many individuals use only the park position on the automatic transmission and not the parking brake.

**WORKING PRINCIPLE:**

A rack is a toothed bar or rod that can be thought of as a sector gear with an infinitely large radius of curvature. Torque can be converted to linear force by meshing a rack with a pinion; the pinion turns; the rack moves in a straight line. Such a mechanism is used in automobiles to convert the rotation of the steering wheel into the left-to-right motion of the tie rod(s). Linear actuation is used to engage the hand brake lever and disengagement is done by spring tension.

**Line Diagram:**



**EXPERIMENTAL DETAILS:**

There are three proximity sensors used to know the perfect state of vehicle is in rest.

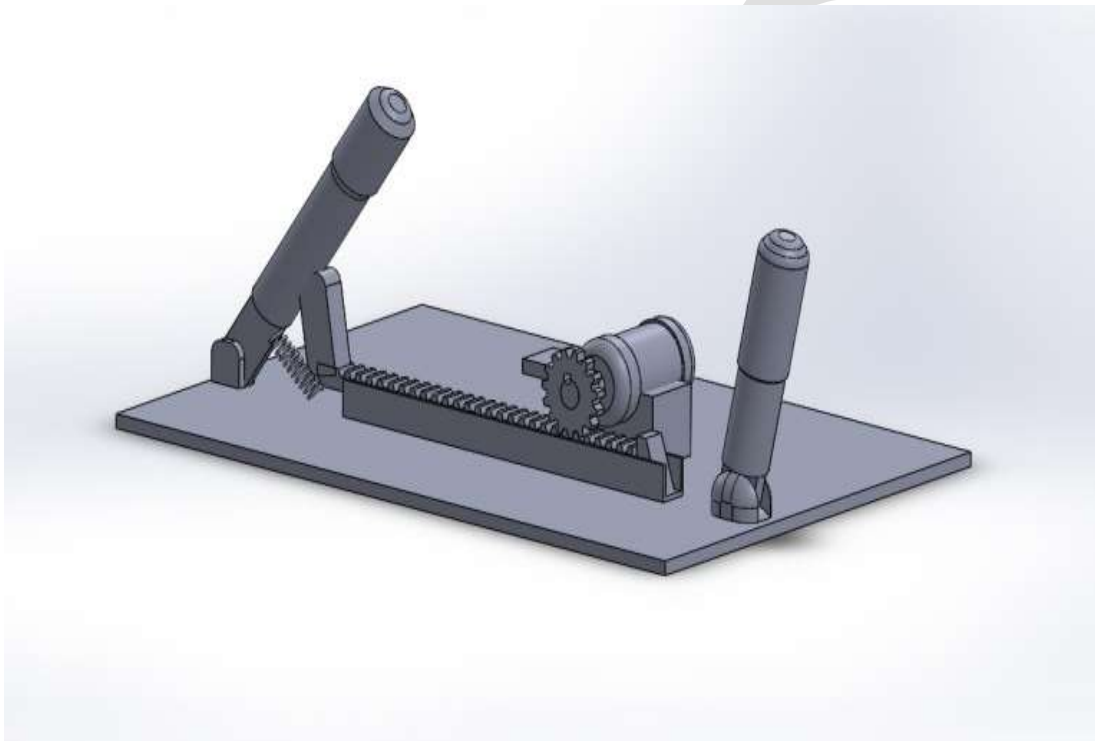
**BRAKING CONDITIONS:**

WHEEL	GEAR	IGNITION	HAND BRAKE
REST	NEUTRAL	ON OR OFF	ENGAGE
RUNNING	NEUTRAL	ON	DISENGAGE
REST	ON GEAR (ANY)	ON	DISENGAGE
REST	ON GEAR OR NEUTRAL	OFF	ENGAGE

Emergency braking is possible by pressing push button.

## **AUTOMATIC HAND BRAKE:**

The Hand brake lever is coupled with rack and pinion setup. A motor used to apply and release the hand brake through Rack. Motor driven by the control unit (Micro controller) using sensors. Sensors give a signal to control unit when the vehicles is in rest stage. One sensor placed near gear lever to find lever in neutral position and another sensor placed near any one wheel of vehicle to confirm the wheel is not running state the last sensors is used to detect whether the ignition is ON or OFF. Control unit attach the Hand brake when vehicle is in idle stage that is confirmed by the sensors. Also control unit will release the brake when gear lever is changed from neutral.



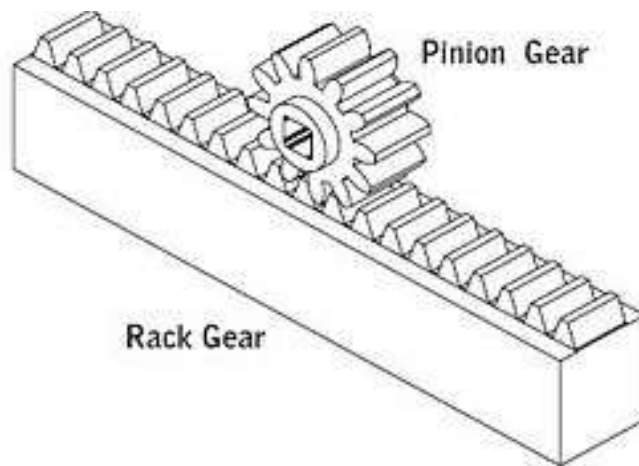
**3D DIAGRAM OF AUTOMATIC HAND BRAKE**

## **MAJOR COMPONENTS:**

- Rack and pinion setup
- IR Sensors
- Relay
- Microcontroller
- 12V DC motor

## **RACK AND PINION:**

A **rack and pinion** is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion causes the rack to move, thereby translating the rotational motion of the pinion into the linear motion of the rack. Thus the linear motion is used to actuate the hand brake with the help of small link.



[Source: [www.vexrobotics.com](http://www.vexrobotics.com)]

### **MICROCONTROLLER:**

A Micro controller consists of a powerful CPU tightly coupled with memory (RAM, ROM or EPROM), various I / O features such as Serial ports, Parallel Ports, Timer/Counters, Interrupt Controller, Data Acquisition interfaces-Analog to Digital Converter (ADC), Digital to Analog Converter (DAC), everything integrated onto a single Silicon Chip.

It does not mean that any micro controller should have all the above said features on chip, Depending on the need and area of application for which it is designed, the on chip features present in it may or may not include all the individual section said above.

Any microcomputer system requires memory to store a sequence of instructions making up a program, parallel port or serial port for communicating with an external system, timer / counter for control purposes like generating time delays, Baud rate for the serial port, apart from the controlling unit called the Central processing unit.

### **IR SENSOR:**

An infrared sensor is a device (usually with supporting circuitry) that can detect infrared light (which is below the optical spectrum) for use to a purpose.

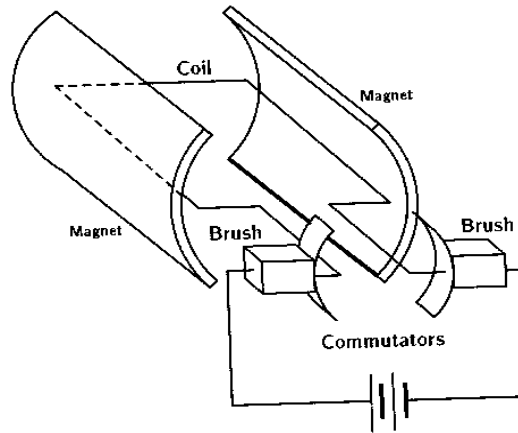
Most of the remote controls for TVs and other entertainment equipment use infrared energy as the transmission medium to carry information between the control unit and the equipment to be operated.

Infrared sensors also have important scientific, military, security and rescue applications since they can "see" the "radiant heat energy" which is infrared radiation. This electromagnetic energy is in the wavelengths from about 750 nm.

There are three infrared sensors are used in wheel, gear lever and engine.

## MOTOR:

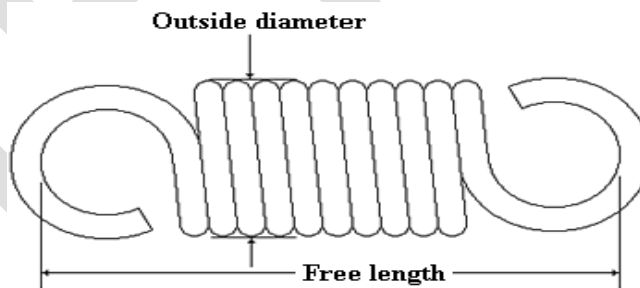
A dc relies on the fact that like magnet poles attract each other. A coil of wire with a current running through it generates an electromagnetic field aligned with the center of the coil. The motor is used to drive the pinion which drives the rack so that circular motion is converted into linear motion. The source of current is obtained from the 12 v dc battery from the car.



[Source:mechatronics.mech.northwestern.edu]

## SPRING:

Extension springs are attached at both ends of the components. When these components move apart, the spring tries to bring them together again. Extension spring absorbs and store energy as well as creates a resistance to a pulling force. It is initial tension that determines how tightly together an extension spring is coiled. The spring is interlinked with hand brake lever at center to the base to make the disengagement easier.



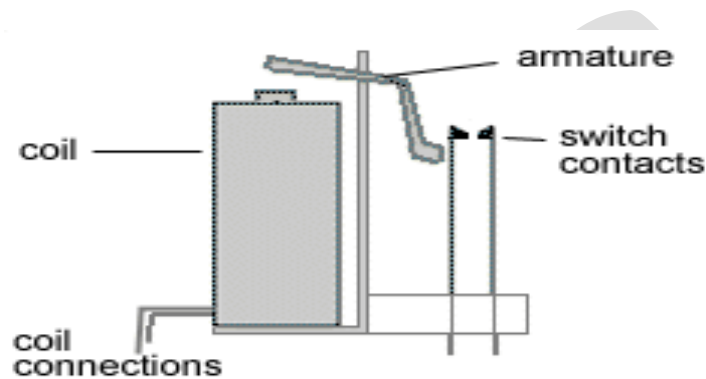
[Source:www.springhouston.com]

## LOCK SET:

A lock set is the hardware and the components that make up the locking or latching mechanism that is usually found in doors or other hinged object but can also include sliding doors and drivers. But we are using the lock for arrest the motion of rack at the one end. The push button will be released at the end when the rack exceeds the marked position and prevent the rack from sliding back. This button is directly coupled with gear lever so that when the gear is changed, the push button will be released.

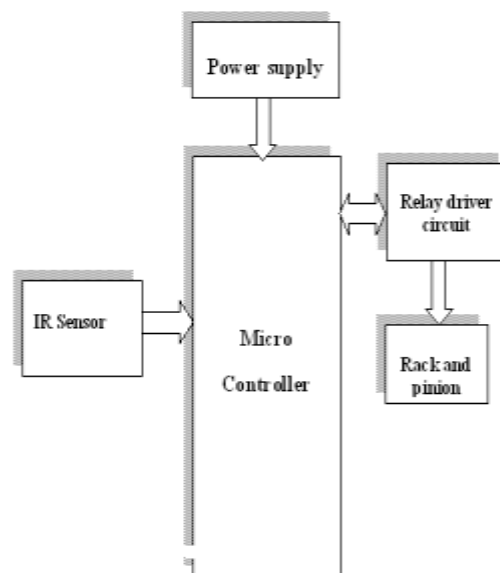
## RELAYS:

Relays are the electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principals are also used such as solid state relays. Relays are used where it is necessary to control a circuit by low power signal (with complete electrical isolation between control unit and controlled circuits). We are using the relays for switching the motor ON or OFF. For making **automatic hand brake** system more efficient, these relays should be operated perfectly in all driving and climatic conditions.



[Source:www.gloab.com]

## BLOCK DIAGRAM OF CIRCUIT:



## ADVANTAGES:

- Low cost.
- Improves parking experience in hills.
- Very compact.
- Emergency stop and start is possible.
- Sensing can be easily done using sensors.
- Reduces the manual interaction.

## LITERATURE SURVEY:

A traditional handbrake is very simple by pulling the lever up; you are pulling two cables which run to each of the rear brakes. By adding tension to these cables, this in turn causes the pads (or 'shoes' for cars with drum brakes) to squeeze against the discs (or drums) to hold the rear wheels firmly in place. Some cars with disc brakes have separate handbrake drum-brake shoes or even a separate disc-brake caliper for the handbrake.

Later electronic parking brake replaces this mechanical system with an electrical one. By pressing the switch, motors on each brake caliper squeeze the pads into the disc.

We are trying to make hand brake mechanism even simpler using rack & pinion and proximity sensors.

## CONCLUSION:

In our project, hand brake is actuated with the help of rack and pinion and proximity sensor based on some conditions. Sensors sense and provides signal to the circuit board which directly drives the motor. The rack and pinion gets activated and lifts the hand and disengages with the help of push lock and spring tension. In future, this could be developing by adding some of the additional features and also automatic hand brake will be used in all types of automobiles at low cost.

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