

# Design and Development of Automatic Handbrake System for Four Wheeler

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**Abstract:**-Safety in automobile is most important parameter on which every car user concentrate. Researchers also put efforts to increase safety in car. Handbrake (or parking brake) is one of the system in vehicle, which incorporated for safety when the car is parked or stopped on hill road, to stop the car. It is also essential in this system is that, when the car moves hand brake system must disengage. Conventional handbrake system has a hand lever for control which works manually. In this system due to manual errors, it is observed that the system may remain engaged when car is moving. And it is harmful to system components and for safety also. Our aim is to increase the safety by using modified parking brake system named as Automatic Handbrake engagement and release system. In this modified system, we are going to control Handbrake automatically without manual interface. This system works on the input by ignition key position. As when the ignition switch turned ON, handbrake must disengage and vice versa when ignition switch is OFF, handbrake must engage. System may work electro-pneumatically using solenoid and pneumatic circuits.

**Index Terms**— Automatic Handbrake, Caliper, Conventional System ,Gear ,Microcontroller.



## 1 INTRODUCTION

In cars the hand brake is a latching brake usually used to keep the car stationary. Automobiles emergency-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 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 of 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. Brakes are one of the most important safety systems in a motor vehicle.

The main function of brake system are to decelerate the vehicle, to maintain the vehicle's speed during downhill operation and finally to park the vehicle stationary either on a flat or slope road condition. The first two functions are related to the service brakes, while the last function is referred to the secondary or parking brakes.

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.

## 2 PROBLEM STATEMENT:-

Handbrake (Parking brake) is the system used for safety in automobiles; Conventional system for operating handbrake is manually by lever. Due to manually operating, sometimes the brakes remain engaged when vehicle is moving. This condition may cause damage the system components. So to avoid it we are going to control handbrake automatically without manual interface.

## 3 OBJECTIVE OF PROJECT:-

Following objectives are going to be achieved from this work:

- To reduce the effort of the driver that leads in conventional one..
- To increase the comfort and safety for the driver by using modified parking brake system named as automatic handbrake for engagement and release system.
- In this modified system, we are going to control Handbrake automatically without manual interface.
- As when the ignition switch turned ON, handbrake must disengage and vice versa when ignition switch is OFF, handbrake must engage.
- System may work electro pneumatically using solenoid and pneumatic circuits.

## 4SCOPE

The scope of the work is defined as:

- It can be used for automating overall braking system in an automobile.
- This system can be useful in driverless cars.
- It can be developed to use in case of failure of main Braking System of the vehicle. That is if the foot brake fails this system may take over to retard the vehicle to safe speed and ultimately stopping it.

## 5ANALYTICAL STUDY:-

A recent variation is the electric parking brake. First installed in the 2001 BMW 7 Series (E65), electric parking brakes have since appeared in a number of vehicles. Two variations are available: In the more-traditional cable pulling type, an electric motor simply pulls the parking brake cable on the push or pull of a button rather than a mechanical pedal or handle in the cabin. A more complex unit first seen on the 2003 AUDI A8 uses a computer controlled motor attached to each of the two rear brake calipers referred to as the motor on caliper system. It is expected that these systems will incorporate other features in the future. Jaguar, Land rover, BMW, Renault already has a system where the parking brake engages when the engine is stopped and is released when gas pedal is pressed.

## 6DESIGNCALCULATIONS:-

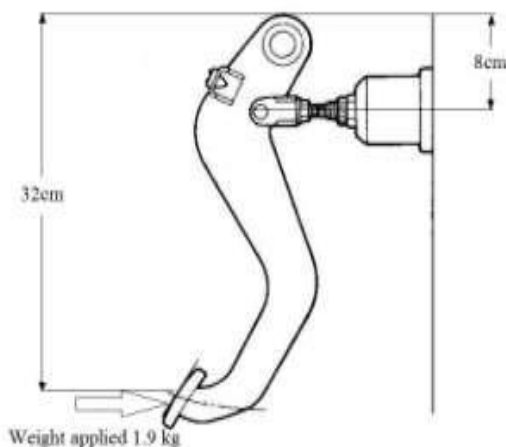


Fig. 1 : Brake foot

### Force Calculations for Foot Brake:-

Weight applied on the lever = 2.91 kg

By lever Principal

$$F \cdot 8 = 32 \cdot 2.9$$

$$F = 93.12/8$$

$$F = 11.64 \text{ kg}$$

$$F = 114.1884 \text{ N}$$

### Force Calculation for Handbrake:-

Now for hand lever , we can assume that the pull force applied on lever during applying handbrake is approximately 30N.

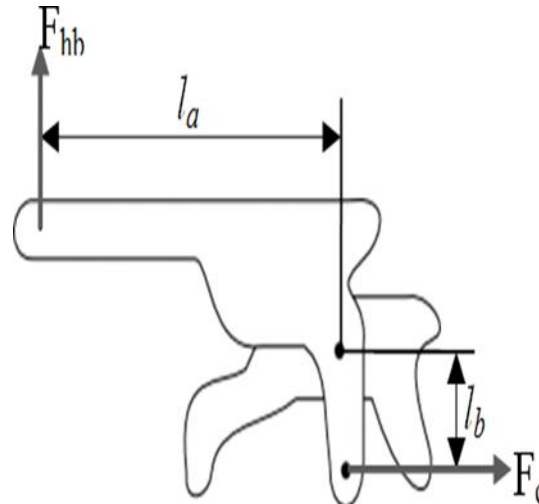


Fig. 2 : hand brake

By considering  $F = 114.1884 \text{ N}$  From above calculations, We will calculate  $F_{hb}$ .

Considering dimensions of Hand lever

$$l_a = 25 \text{ cm},$$

$$l_b = 8 \text{ cm},$$

$$F_c = 93.75 \text{ N},$$

In case of handbrake, generally 60% of Handbrake we use while braking instead of total brake so force required for handbrake is 60% of total Force.

$$0.6 \times 114.1884 = 68.51304 \text{ N}$$

Now for automatic handbrake system, we have to choose an actuator which produce nearby 69N of force.

But for our calculation and safety, we are assuming that the braking force required is 100N.

## 7 PROTOTYPE :-

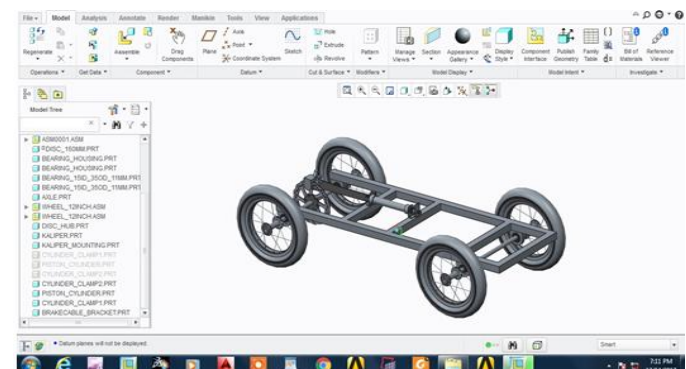


Fig.3 Design of Actual System on Catia

## 8 HARDWARE COMPONENTS REQUIRED:-

- Caliper
- Gears
- Motor
- Lead screw and thrust nut 5
- Microcontroller
- 2-Channel Relay
- Ignition switch and keys for operation
- Wiring and harness
- 12V DC supply source
- Brake disc
- IR Sensors

### ■ Relay

## 9 FIGURES and TABLES:-

### 9.1 Braking conditions

When the vehicle is at the rest and the ignition is kept off in neutral gear the handbrake will stay engaged that is vehicles Wheels will be locked. When the vehicle is at the rest for certain period with ignition on, irrespective of gear position the handbrake will stay engaged. When the vehicle is moving in certain with ignition on the handbrake will be disengaged and wheels will be free to move.

**Braking Conditions Table:-**

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

## 10 CONCLUSION

- Thus the use of conventional hand brake system can be eliminated using this system and the error occurring due to operator can be eliminated completely.
- It can clearly be seen that this system is completely full proof and we may use this system in automobiles even in the lower price range as this system is not extremely expensive.
- This can even allow using the system in high end cars instead of the expensive electronically controlled system they use for automatic parking brakes to reduce the overall cost of the vehicle.
- Use of Pneumatic system allows fast engagement and disengagement of the handbrake and it makes the vehicles safer.
- By using the system we have reduced the manual load on the operator and eliminated the error that operator may induce while operating the system.

## 11 FUTURE SCOPE:-

- It can be used to automate overall braking system in an automobile.
- It can be developed to use in case of failure of main Braking System of the vehicle.
- That is if the foot brake fails this system may take over to retard the vehicle to safe speed and ultimately stopping it
- It can be developed to operate these brakes remotely using a remote key or a Smartphone.

This system can be useful in driverless cars.

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