

# Seat Belt Assisted Automatic Hand Brake

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**Abstract** – Hand brake is the most significant safety features in an automobile vehicle. An individual vehicle having two brakes, one used to retard the speed of moving vehicle and other is to keep the vehicle motionless or parked on slant area. It is essential to engage and disengage the hand brake with the help of lever before starting the vehicle from rest position, but due to human error the brakes gets engaged which led to ineffective after certain period. To overcome this limitation as well as people's tendency to avoid usage of wearing seat belt, we proposed the new automatic handbrake system for safety of the vehicle and the human itself. This system uses Microcontroller, electric motor and four bar linkage mechanism for engaging and dis-engaging the hand brake. Engaging of hand brake takes place when ignition is off and the seat belt is removed, and dis-engaging of hand brake takes place when the ignition is ON and seat belt is fastened and also foot brake pedal is pressed.

**Key Words:** Seat belt, Hand brake, Microcontroller, Four bar linkage, Ergonomics, Push button, etc.

## 1. INTRODUCTION

Automotive safety experts recommend the use of both systems to immobilize a parked car, and the use of both systems is required by law in some places yet many individuals use only the "Park" position on the automatic transmission and not the parking brake. It's similar with manual transmission cars: They are recommended always to be left with the handbrake engaged, in concert with their lowest gear (usually either first or reverse). The use of both systems is also required by law in some jurisdictions. However, when parking on level ground, many people either only engage the handbrake (gear lever in neutral), or only select a gear (handbrake released). If parking on a hill with only one system results in the car rolling and damaging the car or other property, insurance companies in some countries, for example in Germany, aren't required to pay for the damages. Conventional hand brake feat involves the human interference. While not pull or pushing the lever, the hand brake won't work. Also, generally as a result of negligence or in emergency conditions, we have a tendency to humans usually forget to use parking brakes. 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 new other systems and this giving birth to new ideas of parking brake techniques, such as electric and pneumatic

hand brake techniques. The elemental operates of the electrical hand brake (EPB) is to activate and unharnessed the hand brake once the vehicle is at a standstill.

In 1st generation of electrical hand brake fitted, activate the control board replaces the standard handbrake lever accustomed operate the mechanical hand brake. This switch utilizes associate degree electronic management unit (ECU) to trigger mechanical device mechanisms among the wheel brakes or central actuator that operates the rear wheel brake via cable.

Seat belt is one of the primary safety feature used in vehicle to avoid major injuries to the driver driving the vehicle. Even after the government norm that is wearing of seat belt is mandatory, accidental injuries increase due to negligence of occupants in vehicle of wearing seat belt. If seat belt is not buckled correctly than the chances of accidental injuries increase.

## 1.1 Problem Statement

In automobile, Handbrake (Parking brake) is the system used for safety. Conventional system works by operating handbrake lever manually. And in conventional system, it is observed due to manual errors the brakes remain disengaged when vehicle is stopped or vehicle can be operated forcefully when its engaged unknowingly leads to tire wear, brake liner wear and tear and engine damage with pollution too. The manual errors sometimes cause safety hazards.

Also it is same in case of seat belt avoiding and neglecting seat belt to wear is also dangerous and sometime cause very dangerous accidental injury and sometime leads to death of the people

## 1.2 Scope

This study included different type of automatic hand brake system and choosing right one with eliminating errors for different types of other automatic hand brake like pneumatic and hydraulic one. This system can replace current working conventional hand brake system with some modification which will definitely provide more safety as well as more convenience and ease to driver for handling a vehicle.

The use of automatic hand brake system is avoiding manual interaction with the hand which ultimately safe for the vehicle and people. And also seat belt play major role in safety and we add seat input to releasing hand brake which enhance the safety of driver and avoid major accident injury and death.

## 2. LITRATURE REVIEW

Literature review is an assignment of previous task done by some authors, scientists, engineers and collection of information and/or data from research paper published in journal to progress our task.

[1] Prof. D.L. Shinde, Mr. Attarde Varad, International Journal of Advanced Research in Science and Engineering vol.no.5, issue No. 05, June 2017 ISSN:2321-9653.

In old hand brake are simply pulling the lever old actuated by a drum shoes and brake will apply. In some vehicles separated drum or hand brake so that hand brake is separately calliper or disc are required. And after that the new parking brake are introduced is fully electronic. In mechanical brake are same lever or wires and linkage when the driver can leave to without pulling the lever the vehicle is collision or more and in case the accidents. This hand can unsafe to use in hilly areas and the replaced this brake are introduced like, electro-mechanical (EMPB) and Electric parking brake system (EPM).

[2] Prof P.K. Satav, Prof. S.B. Tuljapure International Journal of Advanced Research in Science and Engineering vol.no.5, issue No. 05, July 2016 ISSN:2319-8753.

In the new brake parking system involves dc motor, spur gear and worm gear. In power transmitted on motor and spur gear and brake will have actuated, the pushing and pulling problem hand brake will eliminate completely. In any instant some time we need an emergency brake in the sometime foot brake are in optional in the balance of vehicle control is loose and then the emergency brake is need and emergency brake is called hand brake.

[3] Prof. S. Thivagar and Prof. C. Nantha Kumar, International Journal of Advanced Research in Science and Engineering vol.no.5, issue No. 05, may 2016 ISSN:2319-8354.

In this system micro-controller, stepper motor, push button and battery are component are used. In this system the auto braking system the response of time in the system is less compared to mechanical hand brake and brake are more efficient and stronger brake to the testing of the brake lever in Ansys software and then can be applied on model and after model than the used in automobile.

[4] Mr. Rohan E. Dalvi, Prof. Jitndra B. Satpute and Mr. Ramesh G. Sutar, GRD Journals- Global Research and Development Journal for Engineering | Volume 2 | Issue 6 | May 2017 ISSN: 2455-5703.

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 calliper for the handbrake.

[5] Prof. Ravindra K. Ambekar, Prof. Amit V. Pawaskar And Mr. Akash D. Singh International Journal of Advanced Research in Science and Engineering vol.no.5, issue No.03 , march 2018 e-ISSAN:2395-0056, p-ISSAN:2395-0072.

Later electronic parking brake replaces this mechanical system with an electrical one. By pressing the switch, motors on each brake calliper squeeze the pads into the disc. We are trying to make hand brake mechanism even simpler using rack & pinion and proximity sensors.

## 3. DESIGN SPECIFICATION

- Handbrake push rod force = 1kg
- Theoretical Displacement = 12mm
- Solenoid push button selected = 1kg-mm torque
- Actual Displacement = 15mm, Fitted in 3mm away from push button
- Handbrake operating force required = 2kg
- Motor torque selected = 3 kg-cm,
- Motor RPM = 30 rpm
- Motor Specification = 12V dc powered
- Hand lever operating angle = 45 deg
- Frame = 1000 X 600 X 800 mm (M.S)

## 4. CONCEPTUAL DESIGN

The seat belt assisted automatic handbrake system consists of nine major parts shown in schematic diagram. The electric cable connections setup as shown is majorly determined from microcontroller unit then with the help of motor converts into mechanical energy.

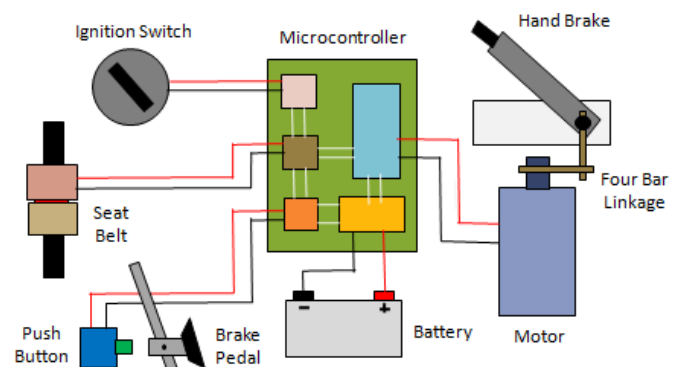


Fig -1: Schematic Diagram

## 5. COMPONENT SELECTION

### 5.1 Ignition Switch

Ignition switch is used to start the engine of a vehicle.



Fig-2: Ignition Switch

### 5.2 Push Button

Push Button is used to operate an electrical device.



Fig-3: Push Button

### 5.3 Hand Brake Lever

Hand Brake lever is used to apply and remove brake. It is not used in running vehicle, only used in park vehicle.



Fig-4: Hand Brake Lever

### 5.4 Brake Pedal

It is foot operated lever operated by foot when car is in running condition to stop the car as well as to reduce the vehicle speed. There are three types of pedals in vehicle Accelerator pedal, Brake pedal, Clutch pedal.



Fig-5: Brake Pedal

### 5.5 Electric Motor

Electric Motor is used to provide the movement to hand break lever for moving upward and downward direction, for engaging and dis engaging the hand brake as per the mechanism.



Fig-6: Electric Motor

### 5.6 Seat belt

Seat belt safety harness used in 4 wheel and above vehicle. It so important for the safety of driver and co passengers avoiding and neglecting this may cause serious injury and sometime death.



Fig-7: Seat Belt

### 5.7 Micro-controller and electric circuit

The Electric circuit consist of Microcontroller, wires, PCB, motor and all others electric components. The electric circuit is a structure and microcontroller is the brain of our system which gives order to different components of our system as per the requirement and desire settings.

In our case it passes the signal to motor to operate by taking input from three different things like seat belt, ignition switch, and foot brake pedal.



Fig-8: Micro-controller and electric circuit

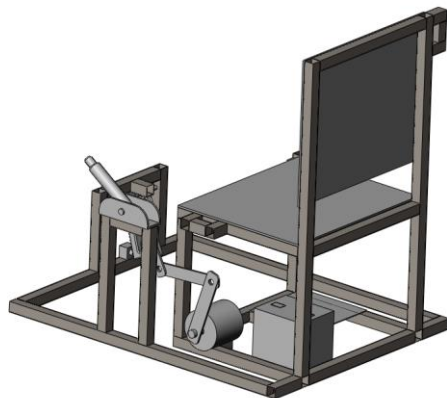
## 6. WORKING

This system uses microcontroller and electric motor powered by DC battery which transfers the power to four bar linkage mechanism to operate the hand brake lever shaft for engaging and dis-engaging the hand brake. Engaging of hand brake takes place when ignition is off and the seat belt is removed, and dis-engaging of hand brake takes place when the ignition is ON and seat belt is fastened and also foot brake pedal is pressed.

**Table -1:** Mode of Working

Seat Belt	Ignition Switch	Brake Pedal	Hand Brake
Fasten	ON	Pressed	Engage
Unfasten	OFF	Released	Disengage

Below 3D cad model is representation of actual seat belt assisted hand brake system, where electric battery transfers the current to microcontroller unit, this microcontroller unit having cable connections linked with components of vehicle like ignition switch, seat belt, and brake pedal via push button, when all these components cable connections meet the criteria as per above table. Microcontroller unit sends the signal to electric motor to rotate motor shaft clockwise and anti-clockwise accordingly.



**Fig -9:** 3D CAD Model

The electric motor shaft is been connected to four bar linkage mechanism. When motor rotate clockwise the four bar link push the linkage forward and converts to rotary motion, thus four bar linkage which is connected to the brake lever is pulled back to apply the brake. Similarly, when motor rotates counter clockwise direction four bar link is pulled backward and converts to rotary motion. As a result, hand lever is falling down, thus disengaging the brake.

## 7. CONCLUSIONS

Automatic hand brake mechanism is beneficial for operator's safety by reducing accident chances as well as disengaging chances of braking.

This system can also be used in commercial cars for ease of operating as well for reducing cost purpose. And by adding the seat belt for Moving the vehicles make system safer than ever. Along with it, we can also modify our system by using the spring at the power electric motor by using it as reverse purpose. Thus, our project is still a demonstration of it, no car has yet used such concept on ignition switch.

This project gives a new idea of automatic hand braking system which can be applied in car manufacturing industries as well as companies. The working is quite simple and doesn't require any extra effort to operator or driver.

Even though when any driver forgets to pull the hand brake in regular car, the driver can be in any critical situation but by using the concept of automatic handbrake system, there is no possibility of risk because by putting the ignition switch OFF, the hand brake system is automatically getting locked. The hand brake engages and dis engage mechanism provide safety as well as more comfort to the driver as result hassle free driving.

## ACKNOWLEDGEMENT

We would like to take this opportunity to thanks our thesis supervisor Prof. SEEMA RAUT for her support, directive & guidance.

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