Design and fabrication of combined Pedal for brake and accelerator

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Abstract:
The paper deals with the development and working of Accelerator and Brake worked by one pedal, which might be a strategy for decreasing street mishaps. The fundamental target of this advancement is to wipe out the administrator's danger of squeezing the wrong pedal at the season of crisis and in addition decrease in the driver's response time to change from acceleration pedal to brakes or the other way around. This new system is composed such that it can be utilized as a part of a car vehicle. The system utilized for consolidated brake and acceleration is straightforward and can be received helpfully. Right now, vehicles are outfitted with autonomous pedal controls for working the acceleration and brake, these pedals being worked by right foot, and since the two capacities are contradicted and contrary it is important to abandon one pedal free keeping in mind the end goal to work the other. It can in this way be gathered that a few drivers experience issues in expelling their foot from the acceleration pedal also, exchanging it to the brake pedal rapidly in crisis circumstances. To take care of this issue, another brake pedal also, acceleration framework is planned.

Keywords: Accelerator, Brake, Automobile, Fabrication

1. Introduction:
Pawar et al stated these days the augmentation in the demise rate of India is 20 percentage as a result of the mishaps on the thruways consequently this development can enable us to decrease the passing to rate by 7% to 10% since we can use this in any four-wheeler vehicles.[1] Nilsson et al described This development innovates with various enhancements for the developing in mechanical parts and it uses a combined pedal foot operation for both brake and accelerator. Basically, it comprises the combined pedal for operating the braking and acceleration, it is organized in a frame in which the point where pedal activity to influence either work is completed without one capacity meddling with the other. [2] Gaspar et al mentioned as the normal pedal is using these days comes with brake pedal in center where the accelerator pedal is on right and clutch pedal is on left side of brake pedal. But in this new combined pedal with single foot operation for braking and acceleration. [3,6] Lee et al told this development reduces the brake response time, stopping distance will be improved and accessible for physically challenged people. It is also safe for exploited the pedal in emergency conditions instead of switching pedal might have chance to press wrong pedal but in combined pedal is intended to work for both operations such as brake and accelerator.[4] At present times during driving the car, the driver always keeps the foot at a distance from
the brake and continuously placed on accelerator pedal. But if we make pedal that works both as an accelerating one as well as braking pedal, that can save lives and reduce the number of accidents. Zhang et al explained the normal pedal used these days comes with brake pedal in center where the accelerator pedal is on the right and clutch pedal is on the left side of brake pedal. It's been reported that some accidents happening because of pressing the accelerator instead of brake pedal by mistake. [5] Now a days the increase in the death rate in India is 27% because of the accidents on the highways hence this innovation can help us to reduce the death rate by around 10% as this can be used in the any 4 wheeler. This development of new combined pedal with single foot operation for braking and acceleration reduces the brake response time, stopping distance will be improved and accessible for physically challenged people.

2. Methodology:

Wang et al explained the Study of different methods of functioning of combined pedal which has good performance for both the braking as well as acceleration.[8] The most effective way is considered and a design is made by optimizing different types of actuation methods. This project uses the combined pedal working operation where both braking and accelerating can be done with single pedal.

3. Combined pedal:

A pedal in which the both operations can take place such as throttle and braking In this project we introduced this mechanism to reduce the reaction time of driver between changing of pedals and to reduce the stopping distance of vehicle. In this the throttle and brake pedals are assembled in single pedal using the TIG (Tungsten Inert Gas)

![Figure 1. Complete set up.](image)

welding and mounted to the pedal assembly in the frame. For this prototype we constructed the frame on the basis of go cart small scale model in which the working can be shown (throttle and braking)
4. **Working principle:**

In this combined pedal the actuation of brake and accelerator operated by single pedal function. The brake can be squeezed from the bottom side of the pedal, which get actuated by pushing motion. Brake actuation can be shown by actuation of rotor.

The acceleration is placed just above the brake by using pivot mechanism for actuation of acceleration, the throttle body is connected to the accelerator through throttle cable and the working of acceleration is shown by actuation of throttle body butterfly valve.

5. **Bell crank mechanism:**

It is a mechanism which is used to prevention of the wrong pedal actuation of the vehicle. As not using electronically we are using mechanically controlled component which bell crank. It works in this way.
Figure 4. Ball crank mechanism to prevent from wrong pedal pressing.

When the acceleration is actuates the throttle, pedal is moving forward at the same time the bell crank also moving in same direction of throttle but the other end of bell crank moves in reversal direction which prevents the actuation of braking by hold the crank of brake pedal and it works vice versa for braking too.

6. Designing of pedal:

The pedal assembly and the frame of project is designed using the SOLIDWORKS 2017 software in the way to use in the combined pedal mechanism.

Figure 5. Side view of the pedal.
6.1 Assumptions taken:

Pedal ratio of the pedal is 3:1 and the pedal ratio is also called as mechanical advantage or leverage.

Material used for combined pedal are mild steel of 2.5 mm thickness and aluminium of 5 mm thickness.

Figure. 6. Front view design.

The basic structured of frame is assumed to provide enough space for mounting a combined pedal setup, master cylinder, brake rotor, caliper, throttle body and driver seat.

Figure. 7. Top & back view of the pedal.
7. Fabrication process:

It is a process in which the raw stock material used to manufacturing. At the time of making this project it undergoes various processes such as:

1. Cutting
2. Machining
3. Grinding
   Cutting is used for finishing by sawing and etching
   Grinding is an abrasive machining process that uses a grinding wheel as the surface smoothening or surface finishing. Machining is the removing process of unwanted material from the given metal to get the required shape. This work take place on lathe machine or cutting tool where it is rotating and easy to cut material.

7.1 Arc welding:
It is a procedure that is used to join metal to metal by using power to make enough heat to dissolve metal, and the softened metals when cool outcome in an authority of metals. We used this arc welding to construct frame and to mount the pedals.
7.2 TIG welding:
It is also called Tungsten gas welding and it is used to weld the accelerator pedal of aluminium material. In the TIG procedure the weld is framed between a pointed tungsten anode and the work piece in a latent air of argon or helium.

7.3 Frame construction:
It is constructed using rectangular pipes which the material is mild steel. Frame is designed in SOLIDWORKS and welded using arc welding process.

![Figure 10](image1.png)

**Figure 10.** Final product after welding has done.

7.4 Components used in project:
1. Mild Steel used for frame and brake pedal

![Figure 11](image2.png)

**Figure 11.** Master cylinder, Rotor, Caliper used in brake assembly.

2. Master cylinder, Rotor, Caliper used in brake assembly

![Figure 12](image3.png)

**Figure 12.** Master cylinder, Rotor, Caliper used in brake assembly.
3. Throttle body and throttle cable used for accelerator assembly
4. Aluminium used for accelerator pedal

Figure 13. Throttle body and throttle cable used for accelerator assembly.

8. Constructive dimensions of brake and pedal:

- Brake pedal – MS Plate 2.5 mm thickness.
- Throttle pedal – Aluminium 6 mm thickness.
- Throttle body – KTM motorcycle spare part.
- Master cylinder – TVS single cylinder, single output, master cylinder bore with 10.05 mm.
- Master cylinder mount – MS plate 5 mm thickness.
- Brake pedal mounts – MS plate 2.5 mm thickness.

9. Conclusions:
With the detailed study above, we can conclude that this new mechanism result in avoiding interference of braking during acceleration and vice versa. Also, it is advantageous over conventional brake pedals. This combined pedal mechanism thus provide a driving control which permits the quick and smooth transition from acceleration to braking, without needing to transfer the foot from one pedal to another. The rapid increase in the number of vehicles on roads nowadays, high demand in exploring such mechanism to get rid of driver's effort is much required to reduce road accidents. Therefore, we conclude that this new innovation will help reduce the driver's effort as he no longer required to shift his leg from pedal to another pedal. Thus reaction time is reduced and hence the number of accidents.

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