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Safety Braking System

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ABSTRACT
Now a day's accidents due to brake failure are increasing in a high margin, so safety has acquired a greater priority. In order to control this sudden brake failures we have modified the conventional braking systems in automobiles by adding an extra safety brake to the engine shaft. The idea of the work is to improve the safety parameters regarding the brakes. Engagement of the secondary brake without the assistance of driver is an advantage for this system. As it would make the vehicle to stop without any lag. A Hall effect sensor is used to detect the motion of wheel by noting the magnetic field. The signals given out from the sensor directs the microcontroller to operate the relay and hence to actuate the solenoid and thereby actuating the secondary brake.
Keywords: Alternate safety braking, Hall effect sensor, Brake failure.

I. INTRODUCTION

In this modern world, the automobiles have been developing in various aspects such as speed ,design and luxury. Rather than any of the above stated, safety is the major concern according to passengers. But now a days safety is given fewer importance compared to the luxury and performance of the vehicle .Even though there are various safety gadgets such as seat belts and air bags the braking system must be given a greater importance.

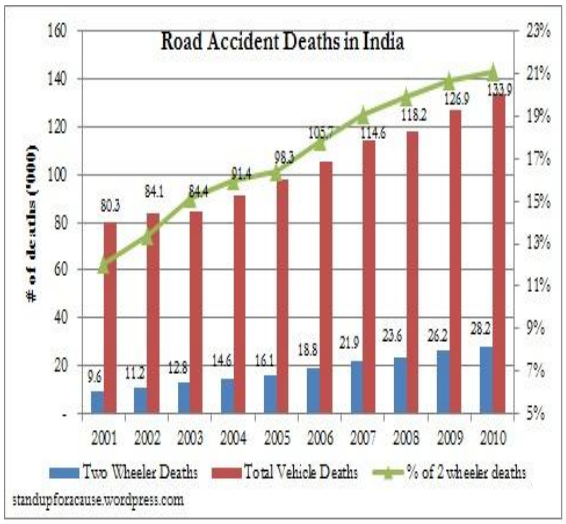

Fig 1: Graph

In the current situations, road accidents are increasing at a huge margin .According to a report released by the Kerala police in 2013, there were a total of 15,563 fatalities in 14,504 recorded accidents. The corresponding number of people sustaining grievous injuries in 4,715 accidents was 6,513, and the number of people who sustained minor injuries was 69,168 in 44,158 accidents. A total of 2,861 people escaped injuries. The state also topped the list of most accidents among all states for all previous ten years from 2002 to 2012. It was estimated that were around eight accidents every hour and a total of 15 percent of all accidents in the country occurred in the state. The data from National Crime Record Bureau indicated that the state capital, had 9,663 accidents, the most of any city in India in 2012.As per the report published by the State transport authority in 2013, out of 66,238 accidents, two-wheelers were involved in 22,496 accidents, cars, jeeps, taxis and tempos in 18,658, trucks in 9,192, government buses in 3,765, private buses in 3,564, three-wheelers in 2,983 and others in 5,580. As per the same report, 20,686 accidents occurred in national highways, 20,984 in state highways, 17,401 in district roads and remaining 7,167 in village roads.

According to Mrs. R Nirmala[3] almost 70% of these accidents are caused due to over speeding .Remaining 30% accidents are caused by the brake failures. Brake failure may be caused due to various factors such as leakage of brake fluid, malfunctioning of the brake calipers and also due to the wear and tears on the disc of the brakes. Brake failures in the cars is the major concern. There is no alternative system to prevent this scenario. Leakage of the brake fluids and wear and tear of the calipers are the major factors concerning with the brake malfunctioning in the automobiles.

In this work we are fabricating a prototype that reduce the accidents due to brake failures. Development of an alternative braking system which actuates automatically when the main braking

system fails will solve this problem. And hence increase the safety of the passengers.

II. METHODS& MATERIALS

The main components used to manufacture this system are given below;

1. Magnet

A commonly available magnet is used to prepare this braking system. The magnet is attached on the wheels so that the sensor may detect the motion of the wheels.

SLNO	COMPONENTS	MATERIAL
1	MAGNET	NEODIUM
2	HALL EFFECT SENSOR	PTYPE SEMICONDUCTOR
3	BEVEL GEAR	CAST IRON
4	SOLENOID	STEEL
5	BATTERY	LITHIUM-ION BATTERY
6	BEARINGS	STAINLESS STEEL
7	WHEELS	IRON

2. Sensor

A Hall Effect sensor is a transducer that varies its output voltage in response to a magnetic field. Hall potential difference – Hall voltage depends on both magnitude and directions of magnetic field and electric current (power supply). The magnetic field is sensed by the Hall plate and a "Hall" voltage is developed across the biased Hall plate proportional to the induced magnetic flux.

3. Gears

Bevel gears transmit power between two intersecting shafts at any angle or between nonintersecting shafts. They are classified as straight and spiral tooth bevel and hypoid gears. The size and shape of the teeth are defined at the large end, where they intersect the back cones. Pitch cone and back cone elements are perpendicular to each other. Bevel gear teeth are inherently non - interchangeable. The working depth of the teeth is usually 2mm, the same as for standard spur and helical gears, but the bevel pinion is designed with the larger addendum (0.7 working depth).

4. Solenoid

A spring connected lever which is used in the starter of the automobiles. As the current from the battery enters the spring it contracts, pushing the lever in wards .This large force created is used in the application of the secondary brakes

5. Brakes

Hydraulic brakes are commonly used in automobiles as they are more efficient than the friction brakes. It involves a mass cylinder, brake tube, brake lever, disc and calipers. These works on principle of Pascal's law, i.e when a force is applied on the brake pedal it will be transmitted to the calipers with a larger pressure. This pressure will be enough to control the motion of the automobiles.

6. Battery

A 12v car battery is used to actuate the circuit and the solenoid.

7. Bearings

From small and large motors to car axles to electric fans and hard disc drives (HDDs), ball bearings are used in a wide array of machines for rotary motion. Ball bearings support rotary parts and reduce friction to facilitate the smooth operation of machines. The size of ball bearings can range from smaller than a grain of rice — small enough to fit inside a wristwatch—to over one meter in diameter for factory and power plant applications.

8. Wheels

Medium size cycle wheels are used for the experiment purpose of view.

III. WORKING

Hall effect sensor placed near the wheels consist basically of a thin piece of rectangular p-type semiconductor material such as gallium arsenide (GaAs), indium antimonide (In Sb) or indium arsenide (In As) passing a continuous current through itself. When the device is placed within a magnetic field, the magnetic flux lines exert a force on the semiconductor material which deflects the charge carriers, electrons and holes, to either side of the semiconductor slab. This movement of charge carriers is a result of the magnetic force they experience passing through the semiconductor material. As these electrons and holes move side wards, a potential difference is produced between the two sides of the semiconductor material by the build-up of these charge carriers. Then the movement of electrons through the semiconductor material is affected by the presence of an external magnetic field which is at right angles to it and this effect is greater in a flat rectangular shaped material. The effect of generating a measurable voltage by using a magnetic field is called the hall effect.

This sensor senses the magnet in the wheels when the switch is activated. As the brake lever is in its maximum reachable position the switch is turned on. Hence the sensor checks for motion in the wheels. If it detects the magnet still moving it turns on relay and hence allows the current to pass through the solenoid. This solenoid hence actuates the secondary brake by pressing the brake lever by a link attached to it.

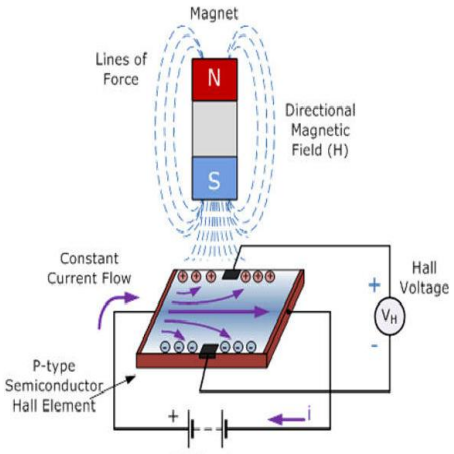

Fig 2: Working Of Hall Effect Sensor

IV. DESIGN

The frame was welded together to a height of 500 cm and a width of 100 cm. The pipes which represents the engine shaft and the axles was attached to the frames by using three ball bearings. A bevel gear was used to connect the two pipes. The primary brake disc was attached to the pipe on which the wheel is mounted. The secondary brake disc was mounted on the pipe coming from the handle. The brake callipers was welded to the frames on the corresponding positions of the discs. The disc was placed in such a way that it won't touch the callipers on the free rotation.

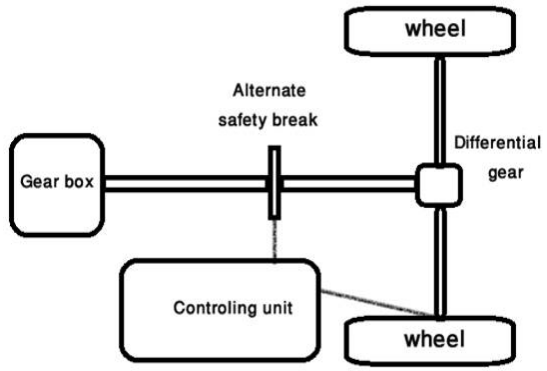

Fig 1 Layout

The brake fluid was filled in the mass cylinder and was ensured that there is no air trapped in the brake fluid. The magnet was placed on the wheels so that they are detected by the hall effect sensors. The secondary brake lever was welded to the bottom of the plate so that it could be actuated by the solenoid which is attached near the brake lever. Smooth operation is maintained by proper lubrication in the bearings and other moving parts. The bevel gear which is screwed to the joint helps to transmit power from the engine shaft to the axles. Medium size wheels were attached to both the ends.

Fig 2 Top View

V. CONCLUSION

The following comments could be concluded that, the hall effect sensor effectively senses the magnet within 5mm range. Its efficiency declines as the range exceeds 5mm, and is non effective at 8mm range. The time limit of actuation of secondary brake was observed as 3 seconds, which is found quite effective. The secondary brake was continuously actuated by the solenoid for 10 seconds. This period is enough to make the vehicle to come to rest.

VI. FUTURE SCOPE

This system can be extended to enormous possibilities in future. The magnet used can improved to higher quality and hence larger sensing range can be obtained. This increases the possibilities of using the sensor in the automobiles. Usage of more precise actuation system instead of solenoid would make this system usable in high speed vehicles.

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