Automatic Brake Failure Detection with Auxiliary Braking System

Avirat Kshar
Veermata Jijabai Technological Institute (VJTI), Mumbai

***Abstract*- The need for the innovative ideas in the automobile sector is highly demanded. Nowadays accidents are increasing, so safety has acquired a priority. Improper usage of brakes is also one of the problems for accident. The projected idea is to improve the safety parameters regarding to brakes. Sudden recognition of any object in front panics the driver and at situation, even skilled drivers fail to use brakes correctly and this leads to accidents. Taking the driver reaction time into account we developed a working model of Automatic Failure Detection along with the Auxiliary Braking System with which the safety of driver and reduction in accidents can be achieved easily and simultaneously add to the increase in safety of the vehicle. In the system incorporated if the primary braking system brake fails to operate, the secondary braking system can be successfully brought into use with nominal efforts.**

The entire system is developed taking into consideration the human tendencies, minimum efforts and efficient use of the entire braking system. The system consists of a very few components and requires least amount of space. A buzzer is used to give the indication to the driver in the form of sound and simultaneously alternative braking system start their working with the help of microcontroller unit and apply the secondary brakes. This system is highly cost effective and efficient in purposes in Automobile Industry.

***Index Terms*- Braking, Safety, System.**

I. INTRODUCTION

Today accidents occur due to lot of reasons; one of the main reasons is brake failure. It is caused due to poor maintenance as well as product defect. The accident monitoring of brake is very important thing in automobile. Vehicle safety is the avoidance of automobile accidents or the minimization of harmful effects of accidents, in particular as pertaining to human life and health. Considering the stated factors for safety, the braking system is designed and modelled simple in construction and working as well. The system is equipped by pneumatic braking unit and microcontroller unit which in turn senses the signal received by the roller assisted unit switch. The system consists of two braking system Disc and Drum in which Disc braking system is already shown failed. Drum brake system come into application after failure of primary brake (Disc).

As soon as the primary brake stops working the driver presses the primary lever three to four times and the roller switch gives an output signal through it to the microcontroller unit. As soon as the microcontroller receives the signal it tends to switch the solenoid valve into action. The solenoid valve allows the compressed air from the reservoir to flow through the piston cylinder arrangement. The piston pushes the secondary lever to get attached to the primary lever by exerting force on it and hangs over the bolt over primary lever. This causes the secondary braking system to get actuated and allows efficient braking. The time required for complete action is two to three seconds. The system can provide an overall safety of the vehicle and thus lead to proper braking system in operation.

II. LITREATURE REVIEW

Air brake systems are designed with a dual brake system spill; generally the front brakes form one circuit and the rear brakes the other. In isolated cars, owners had driven their vehicles without adequate brake maintenance so that ventilated front brake rotors had swell surface of brake drums had separated from the hub. A review of the individual case reports showed that most brake malfunctioning was caused by faulty maintenance and repair, or lack of maintenance efforts by the owners of the vehicles. Of the 2% brake-related accidents, 89% were associated with brake malfunctioning and 11 % will brake imbalance.

Studies from road safety surveys have asserted that even the skilled drivers fail to apply brakes completely during emergency situations. The main reason is that the stopping distance of the vehicle depends on the deceleration when the driver applies brakes. Due to insufficient braking force applied, the stopping distance is more and hence this leads the vehicle to crash or collide with an obstacle.

The work for modelling the system began with the method to detect the issue by considering the reaction time; hence detect the driver intention and capability to apply full brake during emergencies, detection of failure of primary brakes so that activation of secondary brakes is achieved in the shortest possible time. The shortest and achievable time to engage the secondary braking system after failure detection through the sensing elements were taken into account considering the above reasons observed in the surveys. The trails are made to eliminate any shortcoming in achieving of successful and efficient braking in the described model.

III.ELEMENTS OF THE MODEL

A. Wheel: A wheel is a circular component that is intended to rotate on an axle bearing. The shaft is supported in pedestal type of bearings on each side. The wheel is one of the key components of the wheel and axle carrying the primary disc brake assembly and the secondary drum assembly or system.

B. Pneumatic double acting cylinder: A double-acting cylinder is a incorporated in which the working fluid acts alternately on both sides of the piston. In order to connect the piston to an external mechanism i.e. the secondary lever to get actuated, the cylinder piston arrangement can be efficiently used.

*C. Solenoid Valve :*A solenoid valve is an electro-mechanically operated valve. The valve is controlled by an electric current through a solenoid: in the case of a two-port valve the flow is switched on or off. The compressed air from the reservoir flows through the solenoid valve as soon as it receives signal from the microcontroller unit and the piston-cylinder arrangement operates to engage the secondary lever to the primary one.

D. Roller type Limit switch: A limit switch is an electro-mechanical device that consists of an actuator mechanically linked to a set of contacts. When an object comes into contact with the actuator, the device operates the contacts to make or break an electrical connection between the microcontroller unit and the mechanical system. Here the limit switch is mounted on a wooden plate whose one end is connected to the microcontroller and the other end is actuated by the operating brake pedal. In case of failure of the primary brakes the secondary brakes are actuated by roller switch by pressing the secondary lever for two or more times depending upon how the controller is programmed.

E. Microcontroller unit plate: The microcontroller unit is used to reduce the size and cost by compared to a design that uses a separate microprocessor, memory, and input/output devices. The various components used on the microcontroller plate are

a. Transformer
b. Capacitor
c. Transistor
d. Oscillator
e. Voltage regulator
f. Inductor
g. LED Bulb
h. Relay
i. Resistors

IV. OPERATIONAL PROCESS

1) The primary braking system in this project operation is already shown failed to account for the major operation of secondary braking system.
2) As the brakes can fail in actual situation due to accidental reasons, improper maintenance, leakages in braking fluid, etc. we cannot specify the reasons in this scope of project but on the contrary can be done if implemented.
3) As soon as the driver notices that the primary braes are failed, he is bound to press the pedal for many times to account the braking operation.
4) After repeated pressing of pedal and as programmed into the controller the pressing can be limited to two or more times.
5) As soon as the brake pedal is pressed for five times (programmed controller is for 5 times in this case) the roller switch actuated and send signal to the microcontroller unit.
6) The microcontroller beeps and blows LED for signal to the driver and further tends to provide signal to the solenoid valve which is a one by one pneumatic solenoid valve.
7) The solenoid functions to control the inlet of compressed air and the other end connected to the piston cylinder arrangement.
8) The piston cylinder arrangement is responsible for the engagement of the secondary lever with the primary one by the means of a dowel pin attached on the primary braking pedal.
9) The spring keeps the compressive force maintained so both the levers are engaged with each other till the braking is successfully done.
10) The spring can be then detached from the primary braking pedal manually. This system provides safety and instant braking.
11) The entire Braking actuation may require just fraction of seconds ranging from 3-4 seconds.
12) In short the operation is fast, safe and reliable in operation with ease of actuation of secondary braking system.

V. ADVANTAGES

1) Circuit can be powered from the vehicle's battery itself other than any external source.

2) Energy consumption is less for the actuation of secondary or auxiliary braking system.
3) It is not dependent on any other controllable factors like environment, working conditions, etc.
4) Operating principle is very easy and convenient for use.
5) Initial investment is simplified very much.
6) The safety of driver is ensured.
7) Brake failure is notified to the surrounding traffic via buzzer and to the driver by means of LED ensuring more safety.

VI. DISADVANTAGES

1) Maintenance cost may increase at the cost of safety.
2) The Dry weight of vehicle increases by installing the auxiliary braking system.

VII. APPLICATIONS

1) Four wheeler and Two wheeler application
2) Mechanical Systems at shop-floor
3) Mechanical Cranes and hoisting applications

VIII. COST OF PROJECT

SR.NO	DESCRIPTION	QTY	COST (Rs)
1	Wheel with drum brake	1	1000
2	Disc Braking System	1	1200
3	Pedestal Bearing	2	400
4	Pneumatic Cylinder	1	1900
5	Solenoid Valve	1	600
6	Dowel Pin, Foot Pedal and Lever	1	300
7	Microcontroller unit	1	1200
8	Frame, Flats & angles	1	700
9	Spring	2	100
10	Nut and Bolt	10	200
11	Shafts	2	800
	TOTAL		8400/-

OPERATION COST

The operation cost of our project is Rs.1350

Total Cost = Raw material cost + Operation Cost

= 8400 + 1350

= Rs.9750

IX. FUTURE SCOPE

1) Triggering or actuation mechanism for secondary braking can be changed to various means viz. using cam and follower arrangement, Magnetic arrangement, etc.
2) Means of actuating the secondary system can be changed from pneumatic to any energy transmitting fluid or forms of energy
3) Sensor monitoring can be used instead of using two levers; a single lever may serve the purpose.

VII. CONCLUSION

This project setup reduces the chances of accidents and prevents loss of life. It improves the efficiency of vehicle and in turn decreases the chances of failure of mechanical systems. Auxiliary braking gives additional capability to the driver and to ensure prevention of damage to life and property. Brake failure indicating system is an early warning system. It constantly monitors the condition of the brake and gives audio as well as visual signal to the driver as well as the people around to get safe. This system can prove to be advancement in mechanical and automotive industry.

REFERENCE

[1] Ayumu Doi's, 'Development of a rear-end collision avoidance system with automatic brake control'-Mazda Motor Corporation, 3-1. Shinchi. Fuchu-cho, Aki-gun, ttiro~hima. 730-9I Japan
[2] AUTOMATIC BRAKE FAILURE INDICATOR AND BRAKING SYSTEM Radhakishan Maske, Satesh Surwase , Balbhim Moharir, Vrushabh Mahajan , Vijay Kedar , Prof.Amol Adkine .
[3] T.D. Barkand, "Investigation of the Accident and Installation and Testing of Dynamic Braking on the Main Elevator at Duquesne Light, Warwick Mine, #3 North Portal," MSHA, Mine Electrical Systems Division Investigative Report C-052287-12, May 1987.

[4] J. C. McCall and M. M. Trivedi, "Driver behavior and situation aware brake assistance for intelligent vehicles"
[5] Automatic Brake Failure Detection with Auxilary Braking System ,Prof. Pandit Biradar1, Jitendra Baravkar, Komal Bhujbal, Avi Bhapkar, IJSART - Volume 2 Issue 3 –MARCH 2016 ISSN: 2395-1052.
[6] A book on automobile engineering by 'Kripal Singh'