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INTELLIGENT FOOTBOARD ACCIDENT PREVENTION SYSTEM IN BUSES

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***Abstract*—The Intelligent Footboard Accident Prevention System in buses is the system developed with an aim to prevent the footboard accidents in buses. In cities thousands of people commute in buses. And many of them travel by standing on the footboard, which risks their own life. Even though there as buses with Automatic doors, the negligence of both drivers and passengers often results in tragedy. Hence such an automated system which detect passengers' presence on the footboard and restricts the driver from moving the bus. We designed this system from the scratch in such a way that the whole system is quite modular so that we can easily add extra features to the system such as tamper-proofing, extending the system with retarder etc." We sincerely hope our system can save many precious lives in their day to day commutation.**

Keywords- Braking, Footboard, Microcontroller, Passenger Safety, Retarder, Sensors etc.

I. INTRODUCTION

Intelligent Footboard Accident Prevention System is an Automated Accident Prevention system to prevent the accidents occurring due to footboard travelling in buses. A major portion of the population depends upon the public transport system especially buses for their daily commute and a large number of accidents take place almost every day. Every year a large number of passengers die due to accidents caused by footboard travelling in buses. The negligence of either driver or passenger can result in a tragedy. So by developing an intelligent system in buses the passenger safety is assured. With the help of sensors placed on the footboard the presence of passenger is detected by the microcontroller and the circuit actuates the retarder which is coupled with the drive of the bus. The retarder slows the bus by when signal is received by the microcontroller. When the passenger presence is detected on footboard by the sensor, the acceleration pedal is deactivated, thereby preventing the driver from accelerating the bus. Thus the bus comes to rest smoothly when passenger is present on the footboard. The system will be deactivated when the doors are closed. The risk of sudden braking is eliminated by the use of the retarder. The retarder can be either Hydraulic or Electrical which is a secondary braking. System that enables braking without using the frictional forces thereby damages to the primary braking system.

When passenger is away from the footboard, the retarders are deactivated and fuel supply is switched on. Thus the safety of passengers are ensured by the system and the accidents due to footboard travelling can be prevented effectively.

II. DESCRIPTION

A. Detecting the Passengers on Footboard

The first step and the basic function of this system is to detect the passengers' presence on the footboard. For detecting the passengers standing on the footboard sensors are employed. The different types of sensors employed are:

1. Ultrasonic Sensors 2. Passive Infrared Sensors
3. Pressure sensors.

Among the above sensors, Passive Infrared sensors are more effective for detecting passenger presence on footboard. The Passive Infrared sensors is a sensor which measures infrared light waves radiating from objects. All objects including human with temperature more than absolute zero that is 273K emits heat energy in the form of radiations. These radiations are in the Infrared region and not visible to human eyes. When a passenger stands on the footboard, the Passive Infrared Sensors detects the temperature variation from temperature of the steps to the human body temperature. This variation in temperature is converted to voltage which is can be used to activate the microcontroller system. This Passive Infrared Sensors is placed on a position in such a way that the detecting area of the sensor covers the footboard.

Fig. 1. Passive Infrared Sensor

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B. Microcontroller Circuit Working

The Microcontroller circuit is the processing circuit which controls the braking mechanism by using the signals from the Passive Infrared sensors as the input. The circuit is programed to actuate the retarder and disengage the accelerator when the sensor detects the presence of passenger on the footboard. The microcontroller also sounds alarm to warn the passenger and the bus crew along with this. When the signal from the sensor is received by the microcontroller circuit, as preprogrammed the circuit disengages the accelerator and actuates the retarder and sounds the alarm.

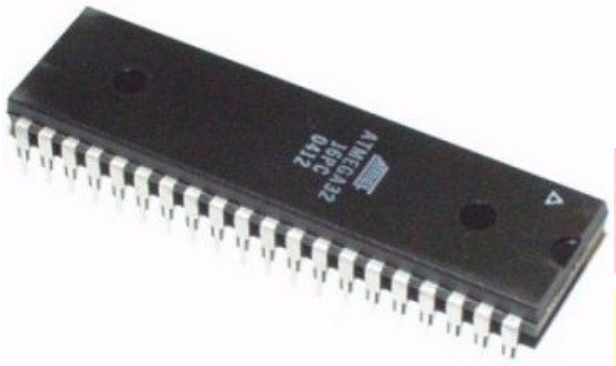

Fig. 2. Microcontroller

C. Accelerator Disengagement Mechanism

The accelerator disengagement mechanism is used to deactivate the accelerator and thereby preventing the acceleration of the bus when passenger presence is detected on the footboard. This mechanism thus assures that the bus is not accelerated when the passenger is present on the footboard. This mechanism works by using a secondary spring connected to the accelerator pedal which prevents the transmission of accelerator motion to the fuel injection controlling mechanism.

D. Braking by Retarder

The braking system that works automatically when passenger presence is detected on the footboard should have some special characteristics. They are:

1. The braking should be smooth and gradual.
2. The braking should not cause any discomfort to passengers.

Fig. 3. Retarder installed on drive

Retarder is used in the secondary braking system. The above mentioned properties is often difficult to obtain in a bus by using the actual braking system, while moving. So a secondary braking system is introduced to overcome this effect. And retarder is used in the secondary braking system since it is very compact and easy to install on buses. Retarders are widely used as a secondary braking system in heavy trucks and other heavy vehicles to prevent overheating and wear of the primary braking system when carrying heavy loads. Retarder is installed on the output shaft of the gearbox. The retarder when switched on generates opposite torque to the output shaft resulting in the gradual slowing of the vehicle.

The retarder along with the acceleration disengagement mechanism gradually slows the bus and the bus become idle. Thus the combination of the retarder and the accelerator disengagement mechanism provides a safe braking of the bus when passenger presence is detected on the footboard. There are mainly two types of retarder, and retarder is selected based on the braking torque required and the space. The two types of retarders are:

1. Hydraulic Retarders
2. Electric Retarders

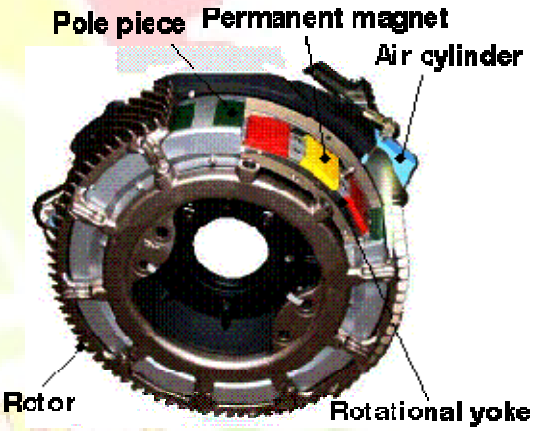

Fig. 4. Electric retarder

III. WORKING

The working of the Intelligent Footboard Accident Prevention System can be explained in two stages.

Stage 1

The first stage can be called as the detection stage in which the passenger presence is detected. The PIR sensors placed near the footboard is active once the vehicle is started. The PIR sensors measures the radiation from the view area. When a passenger steps on the footboard, a very large variation in the infrared radiation takes place and this large variation is detected by the PIR sensor. The PIR sensor generates a voltage proportional to the change in the radiation to the Microcontroller. When the footboard is free from passengers, the radiation incident on the PIR sensor is normal.

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Stage 2

The second stage is the reaction stage. In this stage the microcontroller takes necessary actions to prevent the motion of bus when idle and to bring the bus to idle during running. When the bus is idle and a passenger presence is detected on the footboard, the microcontroller activates the accelerator disengagement mechanism and the retarder to prevent the movement of the bus. When the bus is moving and a passenger steps on the footboard, the system sounds the alarm to warn the passengers and the crew for a few seconds. Then it activates the accelerator disengagement mechanism and the retarder and brings the vehicle to stop. The system deactivates the retarder and the accelerator disengagement mechanism once the passenger steps away from the footboard.

IV. CONCLUSION

The Intelligent Footboard Accident Prevention System is definitely a promising system that assures the safety of bus passengers and ensure a very safe and comfortable journey. The system is designed in such a manner that the system can be easily installed on buses and affordable. The system is very efficient in preventing the footboard travelling in buses and the most important feature of the system is that it is completely automatic and the bus crew cannot do anything other than allowing the bust to stop when passenger is present on the footboard. The system if made tamper proof, then we can assure that footboard traveling in buses is prevented completely.

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