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An Intelligent and Cost Effective Footboard Accident Prevention System

S. Rohit, Shriram K. Vasudevan, S. Lokesh, K. Ajeeth and Vineet Nair
Computer Science Department, Amrita University, Coimbatore, India

Abstract: This study aims to develop a system to prevent accidents occurring due to footboard travelling in buses. Tragedies resulting from footboard travelling in buses are one of the prominent examples of road accidents. A 16 year old student was travelling on the footboard of an over crowded MTC (Metropolitan Transport Corporation) bus at Velachery, Chennai, in September, 2010. The youngster was crushed to death under the wheels of the bus when he slipped and fell down. In another incident, a speeding bus, having passengers hanging on the footboard, was hit by a lorry on Rajiv Gandhi Salai, Chennai, in December, 2012. Four students were fatally caught between the bus and the lorry. The basic principle behind the working of the proposed system is to stop the bus from moving when someone stands on the footboard. Even though automatic doors are available, the negligence of the bus drivers to close the door before starting the bus makes the automatic doors moot. But the system ensures that the bus does not move unless the foot board has no passengers and more importantly, only when the doors are closed. In this way, human interference is completely removed there by reducing the number of deaths drastically.

Key words: Accident, death, footboard, safety, automatic, pressure pad

INTRODUCTION

This study proposes an automated system to prevent footboard traveling in buses that works on the simple concept that a bus should not be allowed to move if there is a person standing on the footboard or to put it in another way, unless the door is closed.

To implement this system, pressure pad sensor is used to detect the presence of a person on the footboard, a method to control the acceleration of the bus and a sensor to detect whether the bus is stationary or in motion. A switch that will allow the driver to open the door when the bus is stationary is also used. This switch will be void when the bus is in motion. Just a handful of switches, some batteries and some logic gates are enough to implement it and this makes the system highly efficient, cost effective and affordable.

The system makes sure that the bus moves only when the people clear the footboard. The doors will close automatically when the bus starts to move, since it is already ensured that the bus will move only when the passengers are safe (Strolz *et al*., 2009). Also, once the bus is in motion, standing on the footboard will not affect the moving of the bus, since, as previously mentioned;doors will remain closed as long as the bus is in motion. Using these factors, truth tables can be formulated. From these truth tables an architectural representation can be obtained using K-map (Lee, 1991). The detailed explanation about the working of the system will be provided in the following sections.

ESSENTIAL COMPONENTS INVOLVED IN THE FOOTBOARD ACCIDENT PREVENTION SYSTEM

The components used in the system can be explained using a block diagram as shown in Fig. 1. The components are pressure pad, accelerator switch/pedal and motion detector/sensor and door switch.

Pressure pad: The first component in the system is the pressure pad or pressure sensor. This works in a way similar to a push down switch, in the sense that it remains on when the pad is pressed down and becomes an open circuit the moment it is released. The circuit is left open such that it will close only upon pressing it. These pressure pads will be kept on the footboard of the bus

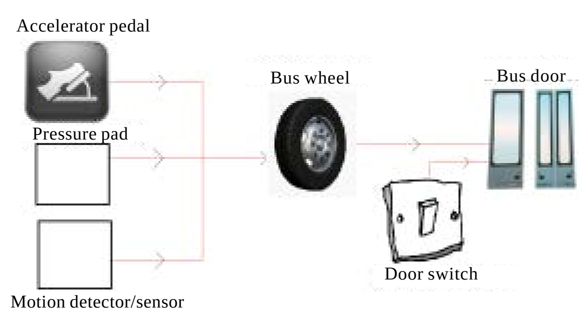

Fig. 1: Components involved in the working of the footboard accident prevention system

Corresponding Author: Shriram K. Vasudevan, Computer Science Department, Amrita University, Coimbatore, India

and will switch on if a person steps on it (Escudero *et al*., 2010). Once the passengers either climb up or get down and the footboard is empty, the pressure pad will revert back to its open state. This pressure pad component is a simple and effective way to detect human presence on the footboard of the bus for controlling the movement of the bus (Mutoh and Yahagi, 2006). It will ensure that the bus moves only when the foot board is empty.

Accelerator switch: The second component used in the foot board travel accident prevention system is the accelerator switch. This switch will get turned on when the driver of the bus increases the speed of the bus from the current speed. It will switch off if the bus moves at the same speed as before. In other words, it will get turned on if the driver presses the accelerator pedal and remain off if driver doesn't (Kameswari-Jyothi *et al*., 2011). This component does not give an indication of whether the bus is moving or not. That is, the bus can accelerate (increase speed) either from rest or even when it is moving. This switch is completely automated and not under the control of the driver or anyone else. This component is used to ensure that the bus does not move despite the driver pressing the accelerator pedal if a person is on the pressure pad. That is, if the pressure pad switch is set to 1 and the bus is trying to move from rest, the bus will not move unless the pressure pad resets back to 0.

Motion detector: The third component used is the motion detector/sensor unit. Again, like the other two components, it is a switch. This switch is a means of measuring if the bus is in motion or not. Switch is set (1) if the bus is moving and goes to off state (0) if bus is at rest. It has nothing to do with the speed of the bus. If the bus wheel starts moving, irrespective of the speed it moves at, the motion detector switch closes (1) and when the wheel stops moving, the switch opens (0). It is not under the control of the driver. This component is used to know the current state of the bus; because if it is in motion, the pressure pad's effect should be null. A moving bus should not stop if a person stands on the foot board unless there is an emergency (This will be safe, since in a moving bus, doors will be closed, as explained in the introduction). A distinction should be made between a bus accelerating from rest and a moving bus accelerating further. Only in the first case, that is, a bus accelerating from rest, the system should kick in to action. It is precisely for this reason that this component is used, to prevent unnecessary deployment of the system.

Door switch: The final component in this system is the door switch. This is a switch used by the driver to open the doors. The door opens if the switch is on (1) and when the door closes the switch goes back to off state (0). However, the point to be noted with respect to this switch is that it will open the door only when the wheels of the bus don't move. If the bus is in motion, this switch will not affect the opening of the door. This component is used so that the driver can open the door when the bus reaches the bus stop. However, the driver cannot control the closing of the switch; it will automatically close when the bus starts moving (Sumbul *et al*., 2011). This door switch is used in tandem with the state of the wheels of the bus (moving or at rest) which in turn will depend on the first 3 components, to open or close the door accordingly.

TRUTH TABLE ARCHITECTURAL REPRESENTATION

Since it is not possible to get hold of the resources-bus, accelerator and automatic doors needed to implement this project, using Table 1 and 2, an architectural representation of the footboard accident prevention system using boolean function representation through the K-map technique is shown below in Fig. 2 (Solairaju and Periyasamy, 2011).

The key for the Fig. 2 is given below in Table 3.

FLOWCHART

The working of the architectural representation shown in Fig. 2 is explained through a flowchart as shown in Fig. 3.

The flow depicted in Fig. 3 is explained in the following lines.

Table 1: Truth table for state of the bus wheels

Accelerator	Motion detector	Pressure pad	Bus wheels
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

Bus wheel: 0 indicates that bus is not allowed to move, 1 indicates that the bus is allowed to move

Table 2: Truth table for state of the door

Door switch	Bus wheel	Door
0	0	1
0	1	1
1	0	0
1	1	1

Door: 0 indicates that door opens, 1 indicates that door closes

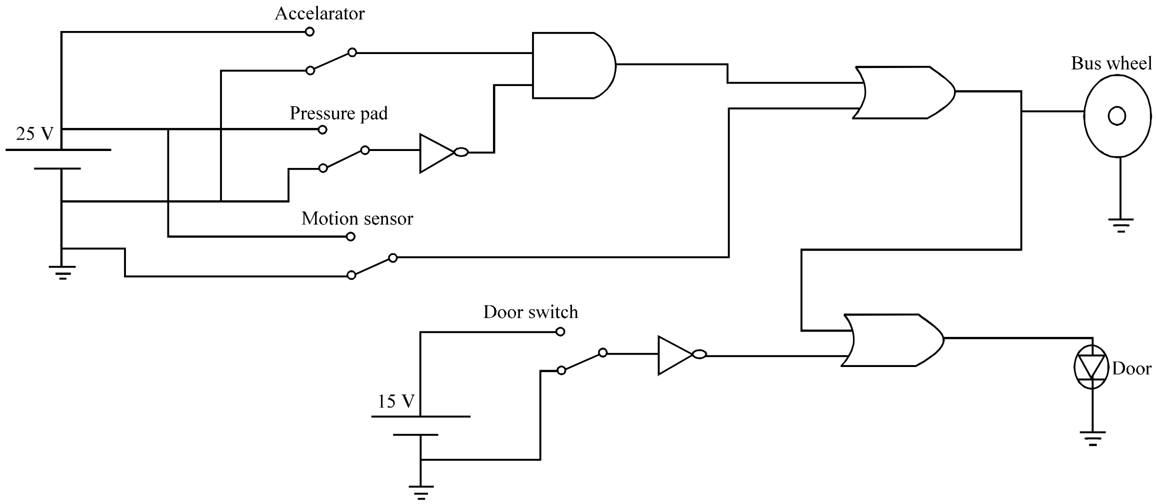

Fig. 2: Architectural representation of footboard accident prevention system

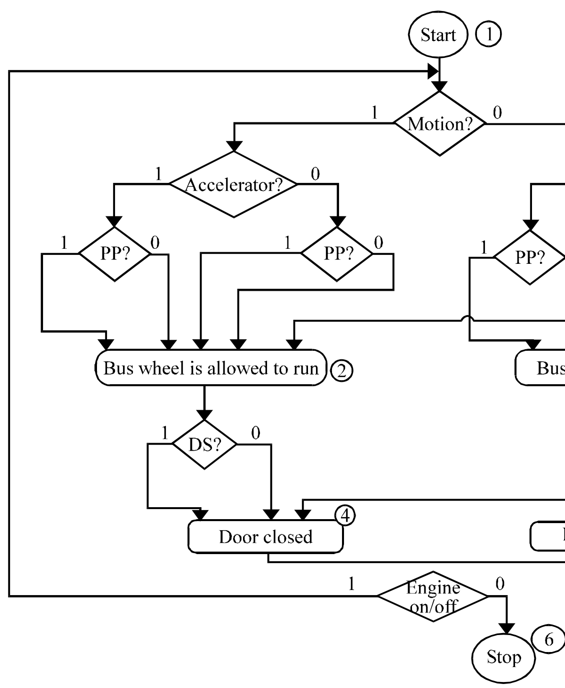

Fig. 3: Flowchart to represent the working of footboard accident prevention system

Table 3: Possible conditions and key for architecture design

Input	Status of accelerator	Status of pressure pad	Status of motion sensor	Status of door switch
0	Accelerator un-pressed	Pressure pad empty	Bus is stationary (idle)	Door-switch un-pressed
1	Accelerator pressed	Presence detected on pressure pad (someone is foot boarding)	Bus is in motion	Door switch is pressed

There are 6 states:

- Start
- Bus wheel is allowed to run
- Bus wheel is not allowed to run
- Door closed
- Door open
- Stop

From state (1): If motion detector, accelerator pedal are set to 0 and pressure pad is set to either 0 or 1, the flow moves to state (3), i.e., the bus wheel is not allowed to run.

If motion detector is set to 0, accelerator is set to 1 and pressure pad is set 1, again the flow moves to state (3), i.e., the bus wheel is not allowed to run.

If motion detector is set to 0, accelerator is set to 1, pressure pad is set to 0 then the flow moves to state (2), i.e., the bus wheel is allowed to run.

If motion detector is set to 1 and if accelerator is either 0 or 1 and pressure pad is either 0 or 1, the flow moves to state (2), i.e., the bus wheel is allowed to run.

From state (2): If door switch is 0 or 1, the flow moves to state (4), i.e., the door is closed.

From state (3): If door switch is 0, flow moves to state (4), i.e., the door is closed.

If door switch is 1, flow moves to state (5), i.e., the door is opened.

From state (4) and state (5), if Engine is off, it goes to state (6) or Stop and if Engine is 1, the flow goes back to state (1) and begins again.

CONCLUSION

The footboard accident prevention system is a very cost effective, affordable and an efficient system which as explained can be implemented using a combination of logic gates and switches. It is a simple way to prevent passengers from travelling on the footboard in buses. This system will be of use particularly in metropolitan cities where accidents caused because of passengers travelling dangerously on the footboard are common place. By implementing this system, loss of lives due to footboard travelling can be completely eradicated. After all, every human life is priceless and any system that can reduce human deaths due to negligence should be implemented.

FUTURE ENHANCEMENTS

This system can be enhanced further by making even the opening of the doors automatic. An intelligent sensor could be used to detect the arrival of a bus at a bus stop which would cause the doors to open and then close automatically when all passengers get in or climb out. This would make the system completely automatic and the drivers would not have to additionally do anything at all.

REFERENCES

Escudero, F., M. Alsina, V. Ferrandiz, S. Luengo and D. Badia *et al*., 2010. Carpet with presence detector. Proceedings of the International Conference on Industrial Technology. March 14-17, 2010, Vina del Mar, pp: 1303-1307.

Kameswari-Jyothi, U., M. Satwik and A. Lokesh, 2011. A design model for automatic vehicle speed controller. Int. J. Comput. Applic., 35: 19-24.

Lee, E.T., 1991. An expert system for Karnaugh map minimization. Proceedings of the International Conference on Industrial Electronics, Control and Instrumentation, Vol. 2. 28 Oct-1 Nov 1991, Kobe, pp: 1517-1520.

Mutoh, N. and H. Yahagi, 2006. Methods to control wheel locks and wheel spins for electric vehicleswith the structure having independently driven front and rear wheels. Proceedings of the 41st IAS Annual Meeting Conference Industry Applications Conference, Vol. 3. October 8-12, 2006, Tampa, FL., pp: 1598-1605.

Solairaju, A. and R. Periyasamy, 2011. Optimal booleanfunction simplification through k-mapusing object-orientedalgorithm. Int. J. Comput. Applic., 15: 28-32.

Strolz, M., A. Mortl, M. Graf and M. Buss, 2009. Development, control and evaluation of an actuated car door. Haptics, Transac., 2: 170-180.

Sumbul, H., A. Coskun and M. Tasdemir, 2011. The control of an automatic door using fuzzy logic. Proceedings of the International Symposium Innovations in Intelligent Systems and Applications. June 15-18, 2011, Istanbul, pp: 432-435.