Asian Journal of Applied Science and Technology (AJAST)
Volume 1, Issue 2, Pages 17-20, March 2017

Fire Accident Avoider in Locomotives through WPAN by Using GSM and GPS

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Article Received: 17 February 2017 *Article Accepted: 27 February 2017* *Article Published: 01 March 2017*

ABSTRACT

Fire accidents are very dangerous and cause harm to human life and property. If these types of accidents occur in some public transport, then it's a matter of concern. In the recent times we have seen a lot of accidents occurring in trains, and a major part of it is due to fire accidents in the compartments. This fire is not confined to just one compartment. In case the train is moving then there are chances of the fire spreading to other compartments too. To avoid such incidents, there are different methods that are in use. Most of the present day systems use detectors in the compartments to detect any fire accidents. In case of any such occurrences, the information is passed on to the driver, so that he can take necessary decision. Hence we propose a system wherein we incorporate wireless sensors and WPAN to carry out similar operations. We have also designed some extra features which cater to the safety of the passengers. At the end we are sure to get a more reliable system which also has advanced safety features incorporated in it.

Keywords: Fire accidents, microcontroller, proximity sensor, de-clamping, WPAN, GSM and GPS.

1. INTRODUCTION

Every day, new technologies are being developed to improve the railways and other systems related to it. Generally the railway department seems to increase the speed of the trains for better connectivity. As per recent records, the Indian railways are planning to of trains increase the speed to about 140-180 km/hr. Apart from increasing the speed, we also have to consider the safety of passengers. Fire Accidents are one of the most dangerous incidents possible in trains. Generally when a compartment catches fire, it is hard to identify the occurrence of the fire and take initiatives to control it. Hence we need an automated system to reduce the casualties.

Here we propose an automated system which not only detects any fire or explosion, but also carries out necessary operations for the safety of the passengers like sprinkling the water in all over the compartments. In this system we use a fire sensor to detect any fire accidents and a smoke detector is used to detect any explosions. A WPAN module is used to transfer the alert message to the driver compartment. Simultaneously we use a motor to slide open the doors.

2. LITERATURE SURVEY

Most of the fire accidents are due to the lack of passenger knowledge. Fire accidents can be stopped by educating the people about the safety measures, but in case a fire accident occurs, then we have to take measures to control the fire. In the event of a fire accident, the first step is to identify it. Parameters such as temperature, humidity can be collected in real time to identify the fire. This collected data can be used for fire-fighting and alerting the people. In the previous attempts, it has been proposed that these parameters can be used to send a signal to the driver through Bluetooth transmission, so that he can take necessary steps. In the compartment, we can develop various steps like water sprinkler, automatic sliding doors and an alert system to save the lives of passengers. Wireless sensors are used in many applications; hence it can be used in many situations. Monitoring the parameters in real time help we to obtain accurate results due to the high precision sensors used [2]. We can also use rescue systems in case of a fire. By detecting fire using flame sensors, we can use zigbee to send a signal to the nearest centre. Once signal is received then it sends a message to the station and help will be sent immediately [1]. Another way of saving live during a fire is by designing a braking system which is initiated by the fire accidents. Normally the brake control will be with the driver, but during fire accidents he may not know about the accident. Hence we make use of a fire sensor to detect the fire and when it is detected, we can use automatic braking system. Once the train stops, the passengers can get themselves out of the train and hence they are safe from the fire, which reduces the loss of lives [3].

3. PROBLEM DEFINITION

As we know that fire accidents are very dangerous and fire in moving trains may have a catastrophic effect. It may leads to a lot of problem. In the previous systems we have seen that after identifying the fire, the train can be stopped immediately. This is not an suitable method for controlling the fire. In case the train is travelling over a bridge then there is no use in stopping the train automatically. The passengers cannot move out of the train. This system is useful only when the passengers can go out in a safe way. But any system should be useful in all the conditions.

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Hence we propose a system which works in all conditions. Moreover there are a few advantages to it compared to the previous system which makes it more useful in helping out passengers when there is a fire accident. Comparing with the old systems, we make use of automatic sliding doors to make sure the passengers can go out without hindrance.

4. EXISTING SYSTEM

Railways are one of the best modes of transport; the development of railways in our country took place rapidly. Still there are numerous unsolved problems like fire accidents, train collisions, etc., the railway department has taken measures to stop the problems. The inner parts of the train are mostly made of less prone to catching fire materials. Most of the materials are fire resistant. Even after all these, a fire can arise due to a short circuit of wires or if any passenger carrying any flammable material.

Keeping all these problems in mind, the railway department has installed fire extinguishers in all the compartments. But it doesn't seem to be a good idea. In case of a fire accident, the passengers will get panic and they don't know what to do. Hence, the use of fire extinguisher doesn't flash to them immediately. Moreover, if the fire extinguisher doesn't work properly or if the person is not well educated on how to use it, then it is a waste of keeping the fire extinguishers in the compartments.

At present, the railway department is using aspiration based smoke and flame sensors. In this system, there is a chamber where the air present inside the compartment is pulled into a chamber. In this chamber the light is subjected to a test, if there are any suspended particles it will scatter the light rays, which is emitted by the laser. Once the scattering is above the threshold level, the alarm alerts the passengers. During a fire accident, the suspended particles will be more in the air compared to normal. Hence we use an aspiration based smoke detector. These mechanisms are one of the fastest to detect any change in the scattering pattern of the air.

5. PROPOSED SYSTEM

The trains are used for transporting people and goods. Mostly, the people prefer the train journey for longer distance as it is cheaper. The fire accidents in train are not catered seriously by Indian railways. The notices showing "do not smoke", "do not carry inflammable material" are the only precautionary warnings about the fire in each compartment. However, because of poor maintenance or illegal activities of social elements, the fire accident in train occurs frequently.

We have to take certain steps to control and prevent the fire. In case of fire, we first have to alert the passengers. Even the driver needs to be alerted. The transmission of message should be done using a wireless system so that any wires used does not burn. In our proposed system, we make use of a PIC 16f877A microcontroller for the basic computation process. At the compartment section, we make use of a flame sensor for flame detection, smoke detector to detect the smoke, a buzzer for alerting the passengers, a DC motor to automatic slide opening the door. A water sprinkler is used to sprinkle water all over the compartment and reduce the fire and control the temperature to normal. To transfer the signal to the drivers end, we make use of a WPAN (Wireless Personal Area Network) module [1]. This wireless module eliminates the use of wires.

At the drivers end we again make use of a PIC16f877A microcontroller to control various components. Here a WPAN transceiver is again used to receive the signal and passes it on to the PIC. An LCD display is used to display the warning message about the compartment number at which the accident has occurred. We also make use of an automatic de-clamping mechanism to separate the compartment under fire. This can be done to avoid the spreading the fire to other compartments too.

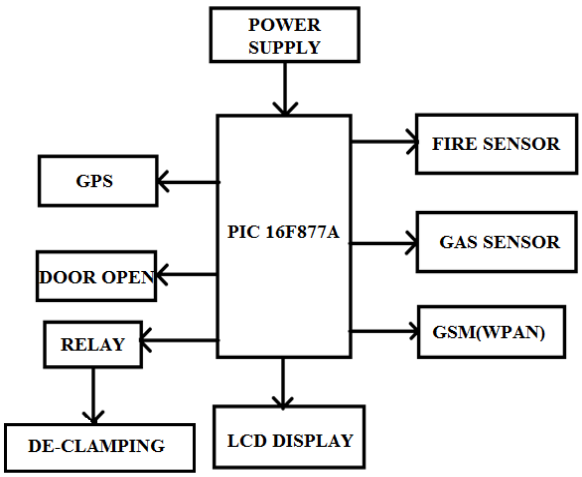

Fig.1. Block diagram

In case of a fire accident, the flame sensor (IR sensor) detects the fire and if there is any change in its threshold value, and then it sends a signal to the driver section through the WPAN module. At the compartment section, Firstly, the buzzer goes on alerting the passengers. Next the water sprinkler is used to sprinkling the water so that the fire is extinguished and the temperature becomes normal. Simultaneously the door of the train will be automatically slid opened, making it convenient for the passengers to move out. This can be done only when the train stops completely.

Once the compartment sends the signal to the driver, the WPAN transceiver takes the signal and sends it to the PIC16f877A microcontroller. This controller then sends the message to the digital display. Here IO expander is used to convert the digital message into readable alphabets. Later the buzzer at the drivers end also goes on alerting the

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driver. The LCD display then displays the compartment number at which the accident has occurred. The moving train is stopped now. Then the de-clamping mechanism is put into effect by detaching the affected compartment.

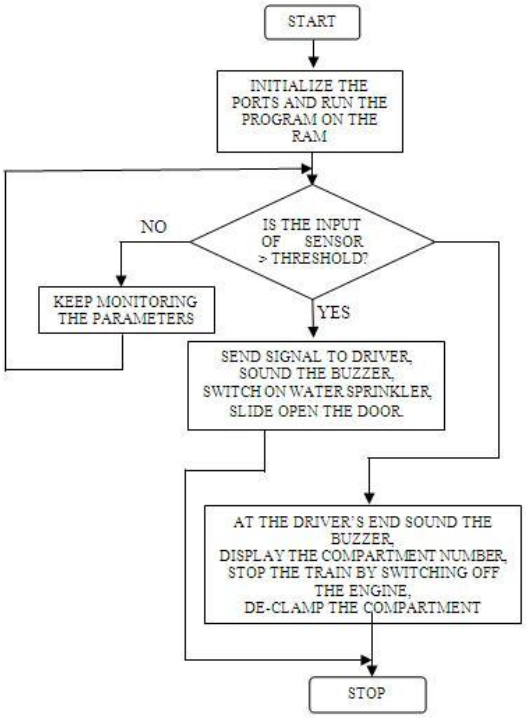

Fig.2. Flow chart of the system operation

Fig.3. Hardware of the module

In the above sections, we have explained the working system. Now we shall see the inner working of the system by the flowchart.

The PIC microcontroller takes the program from the flash memory to the RAM as soon as it is switched on. It then initializes all its ports and gets all the components to ready for operation.

The sensor then keeps sensing the light intensity. When it crosses the threshold, it sends a signal to the microcontroller. Once the program is initiated, the operations which are mentioned in the flowchart are carried out.

6. EXPERIMENTAL RESULTS

In the above sections, we have spoken about the various aspects about the safety system for trains. After research, we have come up with the prototype of this system.

We have a fire sensor to detect any fire in the coach. The WPAN module is connected to the port. The DC motor and the water sprinkler are connected to the motor driver. This is done to amplify the current so that the motor can rotate.

The motor is used for de-clamping. In case of the fire accidents, the buzzer switches on automatically alerting LCD display is given connection to the I2C port. One of the motors shows the train in running state and another motor the passengers. The train turns off and the de-clamping is activated automatically.

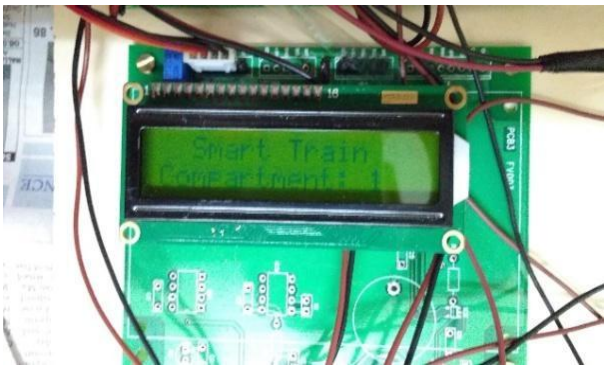

Fig 4. LCD display in case of any fire accident

Fig. 4 shows the message displayed at the driver section when there is any fire accident. The system not only alerts the driver, but also displays the compartment number where the fire accident has taken place. It also sends message to the nearby station about the accident.

Fig.5. Motor performing the de-clamping operation

Another special feature in our system is the de-clamping mechanism. The de-clamping mechanism is used to separate from one compartment to another under fire from the rest of the train. This mechanism can be operated manually or automatically. This operation is recommended for safety purpose.

Fig.5 shows the DC motor that has been used to illustrate the de-clamping mechanism. Since it is a prototype, it

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works automatically. In real time applications, this can be done manually. The wooden piece connected to the shaft is used to show the mechanism. The shaft moves around 180 degrees to show its operation. At the end we are sure to get a reliable system. Since we are using wireless technology, we can count on it. It helps in faster data transfer and also it is not affected by the fire accidents. All the components used are readily available and the whole system is cost effective. The system has few added features than the previous systems, which makes it more preferred.

7. CONCLUSION

Railways are one of the best modes of transport in the world and more comfortable for the passengers to travel. Around 20 million people in India travel by train/year. The development of railways in India took place rapidly, but still there are numerous unsolved problems in the path of steady growth like train fire accidents, train collisions etc. The death rate is increased due to these problems. The planning of accident prevention and emergency measures, are still an important issue of the railways.

This study analyses the technique of hazard identification in two stages, which clearly indicate the factors and direct hazard and the weaknesses in the system. Hence we have proposed a system which makes use of PIC microcontroller. This is designed to provide maximum safety towards fire accidents. We make use of sensors which act to detect the fire at the earliest. The module is designed in such a way that it provides complete details of the accident that took place. The use of wireless system for transmitting the signals has made it more reliable than wired systems and also most of the preset day systems. It would be a good step if this system is applied in reality.

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