

Embedded Based Railway Train Safety System

Anjitha KB

Student

Department of R&D Engineering

Tenxer Technologies Pvt Ltd. Bengaluru, Karnataka, India

Corresponding Author's E-mail: anjithabalakrishnan@gmail.com

Abstract

By every new day, alternative technologies are being developed, which in turn are helping to increase the speed of trains. Indian Railways aims to increase the speed of its passenger trains to 140/180 km/h on conventional tracks. Thus it can be seen from the trending aspects of railways that they are primarily focusing on increasing the speed rather than the safety of the passengers. The primary focus should be the safety of passengers. Generally, it is seen that when a train compartment catches fire due to any reason, it's not easy to detect the fire initially and react to it. Due to this, the train does not stop instantly, which results in casualties and heavy damage to the train.

The objective of this paper is to design an Embedded Based Railway Train Safety System. This system consists of an Arduino, motor, fire and smoke sensor, alarm, and alert system. This paper proposes an embedded system that will be used to alert people so that life and damage can be minimized. If the train coach catches fire, the smoke sensor will sense it and send a signal to the Arduino. This activates the motor to pull the chain and activates an emergency alert system that sends an alert message to the train driver and guard room and activates the alarm. If the chain system to stop the train does not work properly, then even in that case, this system is very effective. So this system is useful to protect the precious lives of passengers and minimize the heavy damages due to fire accidents.

Keywords: *Arduino, Embedded System, Fire, Passengers, Railway, Safety, Smoke sensor*

INTRODUCTION

From its discovery in ancient times, humans have been in awe of and frightened by fire. An uncontrolled fire is a risk to which we are all exposed and manage daily. Steam trains, of course, depend on a well-controlled fire for their very operation, although their emissions often cause uncontrolled fires on the lineside. As with much of railway safety, lessons have been learned from accidents over the years. Many fires, often with tragic consequences, have led to significantly improved fire safety. However, we could still be caught out, and we must never be complacent. Accidents which include fire, are one of the most dangerous incidents possible in trains.

The rapid detection of a fire and its control can save several lives, thousands of injuries, and millions of rupees in property loss. The purpose of this paper to propose an 'Embedded based fire alert system for train' is to detect an occurrence, alert the control panel and proper authorities, and notify the occupants to take action and make the train stop instantaneously. As per the present braking system used in Indian trains, it can be stopped either by the

driver by applying brakes or, in case of emergency, the passenger by pulling the chain.

LITERATURE SURVEY

Sumit Pandey et.al, titled "Automatic Fire Initiated Braking and Alert System for Trains", deals with a remedy to reduce the death loss occurring due to fire accidents in trains is presented. Fire on a running train is more catastrophic than on a stationary one since fanning by winds helps spread the fire to other coaches. When these accidents occur in remote areas or during night times, the loss or damage being caused is at higher rates. The damage is heavier due to improper reach of service at the right time due to improper communication. This time delay is causing heavier damage. Thus, eliminating the time between an accident and first responders are dispatched to the scene decreases the damage. These projects help in notifying the passengers and emergency services.[1]

Suresh.S et.al titled "Home Based Fire Monitoring And Warning System" describes an automated Fire monitoring and warning system that plays an

important role in maintaining and monitoring safe environments and situations using Arduino Uno R3 is economical and affordable by all. The system here detects fire during the existence of smoke or flame at a particular level and also towards alerting the property owner efficiently.[2]

SYSTEM OVERVIEW

The proposed design of the Embedded Based Railway Train Safety System is described. When there is ignition in the train, the sensor (four sensors per coach) near the ignition point detects the smoke and the heat produced during the fire and activates the fire alarm. There is an Arduino interfaced with the sensor that activates the motor, which pulls the chain and activates the alarm. Pulling of the chain tends to stop the train, and the alarm alerts the passengers so that they can evacuate the train quickly. The system also

activates an emergency alert system which sends an alert message to the train driver and guard room. If the chain system that stops the train does not work properly, also it sprays water into the compartment where the fire is sensed. So this system is useful to protect the precious lives of passengers and minimize the damages due to fire accidents.

A. Hardware Specifications

- Arduino Microcontroller
- GSM Modem
- Smoke Sensor
- Temperature Sensor
- Motor Driver
- DC Motor
- Buzzer

B. Software Specifications

- Arduino IDE
- C Programming

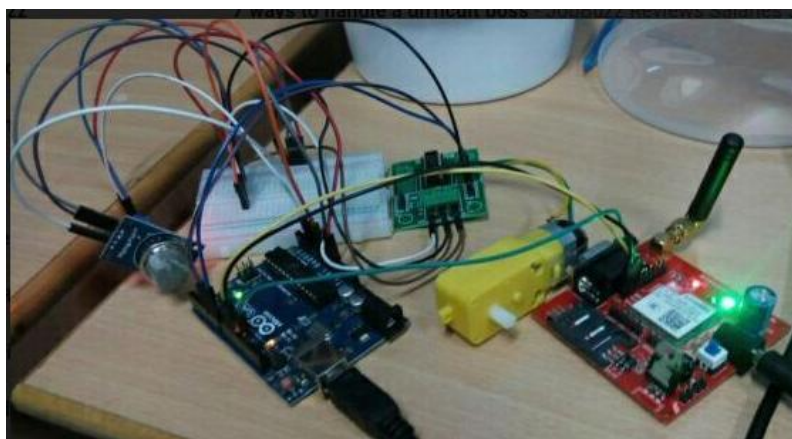


Figure:- 1

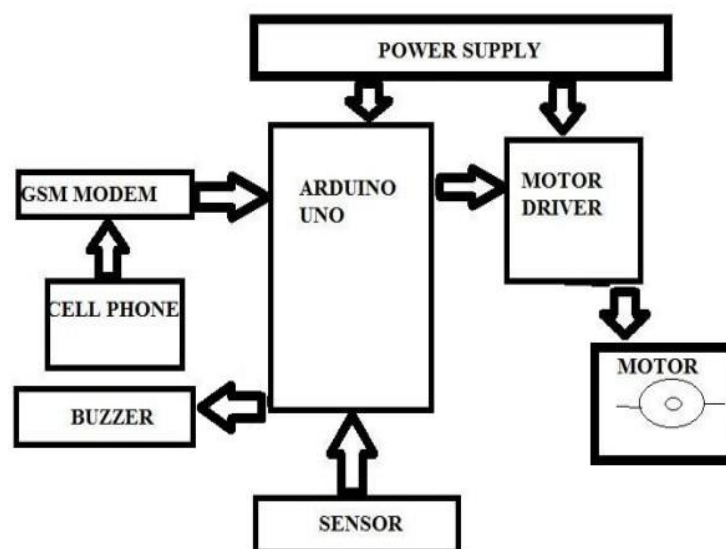
PROPOSED SYSTEM

In modern trains, as soon as the passenger pulls the chain, the vent locks the air in the braking system, and the pipe gets open, resulting in pressure dropping significantly. But it has a drawback that it takes little time to stop the train. During a fire accident, every single second is important to save lives.

The proposed system overcomes this drawback. It saves time and lives both. If the train coach catches fire, the smoke sensor will sense it and send a signal to the microcontroller. This microcontroller activates an emergency alert system which sends an alert message to the train driver and Guardroom and activates the alarm. The microcontroller also activates the motor to pull the chain. Pulling the chain

results in tightening the block-piston assembly below the coach(s), then start pressing the brake shoes on the wheels of the entire train. This process happens throughout 01.00 to 01.50 minutes on a train running at 110km/hr.

The driver also gets to see the air pressure drop in his gauge (earlier locomotives had vacuum gauge), and the driver then uses his engineering skills and helps the train stop comfortably. The guard's compartment also has the air pressure gauge, which gives him an indication as soon as there is a pressure drop, the driver whistles in "two short one long" mode to indicate to the guard and the train TTEs that there has been AC(alarm chain) pulling.



(a) Block diagram

RESULTS

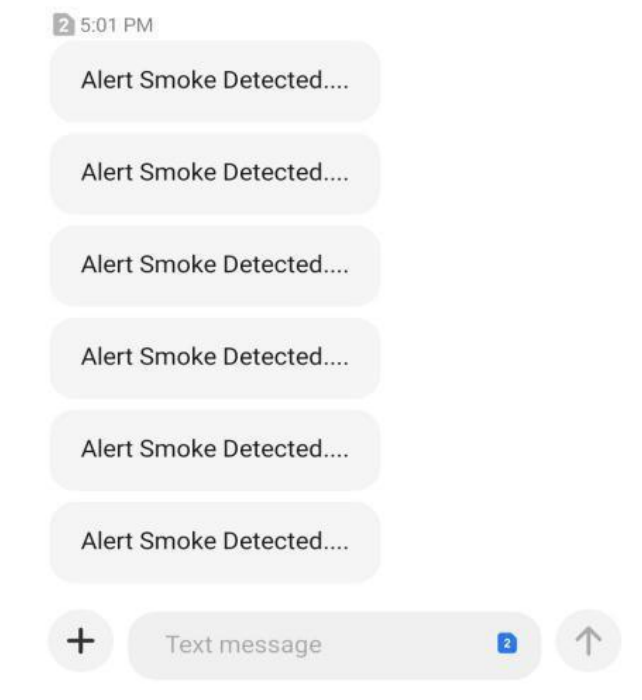
The Working of the proposed system can be understood in the following three steps:

- **Step 01.** Fire on the train coach is sensed by fire and smoke sensors.
- **Step 02.** The sensor sends a signal to the Arduino microcontroller.
- **Step 03.** The microcontroller sends a signal to the communication system, alarm, GSM

Module and side by side will also activate the alarm system, activate the motor to pull the chain and activate the GSM to send an alert message to railway guards.

The simulation results of the Automatic Railway Train Safety System are given below.

- Simulation No.01: When no sensor is activated, then there will be no changes in the output voltage circuit it will remain zero.
- Simulation No.02: when the sensor is activated and it is higher than the threshold value, then the buzzer beeps, and side by side motor starts rotating. The motor will pull the chain, and the buzzing sound of the buzzer will indicate to passengers, to alert the driver and guard the alert message will be sent through GSM to the registered number. The output voltage will be different (not zero).



CONCLUSION

This paper presents an “Embedded Based Railway Train Safety System”. The main focus of the paper is ensuring the safety of the passengers on the train. As soon as the fire or smoke is detected, the system stop the train by pulling the chain and sending messages to the driver and the guard so that they can take the necessary measures. It also activates the alarm so that the passengers can evacuate the place before the fire spreads. The speed of fire spread also gets reduced as the train is stationary, which is the main advantage over the today used trains in India.

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