# AUTOMATIC FIRE CONTROL SYSTEM IN RAILWAYS

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**ABSTRACT:** This paper discusses the use of more sophisticated methods to reduce fire incidents in the railroad sector. Although it has improved over the last few years, the state of railroad maintenance is still not satisfactory. The frequent train fire incidents, which were UN preventable, are one of the causes. In order to solve this issue and improve safety, a prototype has been presented. This Arduino Uno-controlled device aids in putting out the fire before it has a chance to spread. Wireless sensor network technology is the foundation of a system that uses fire extinguishers, fire alarm warnings, and autonomous sensor monitoring to combat fire. This system has the ability to track relevant parameters in real time, such fire in every coach. Precautions are taken to suppress the fire and expel smoke from the AC compartment based on the data that is transferred from the sensor to the Arduino Uno.

**KEYWORDS: FIRE, RAILWAYS, SENSOR, ARDUINO, ACCIDENTS.**

**I.INTRODUCTION:** The trains are vehicles used for transporting people and goods, goods which are highly inflammable and flammable materials. Though, it is suggested to avoid such materials but the train itself has fire conducting and expanding materials within, moreover the train moving at high speed gives air as a source for the expansion of fire, as air comes under one of the important elements of the fire triangle. This prototype has been made by a group of college students using basic microcontroller-based devices and wireless communication system. It has the ability to resolve the problem and bring down the train fire accident causality ratio in the future. This is a device which requires no man power after the installation of the prototype on the roof top of every compartment of the train. Along with the bi-monthly inspection which is done by the Indian Railways in every coach this prototype could also be considered for inspection to avoid loose connections and short circuit errors. Fires have long been regarded as a dangerous disaster that may cause destruction, property loss, and even death. The resident region was hit by one of

these disasters. In several disasters, fires have been a recurrent, catastrophic, and most significant calamity when compared to other hazards. With the rapid rise of urban development, the risk of major fires and other extreme disasters has increased year after year. Early detection of flames and prudence are two essential methods for swiftly putting out fires and preventing major losses and property damage. As a result, having a reliable fire alarm system is critical, especially in buildings with a large number of people or valuable goods.

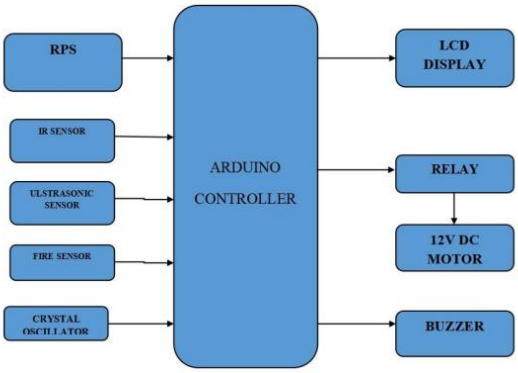
The concept is based on "automated fire control and detection system." According to a study, many homes do not have a fire detection system. Fire and smoke are the most common causes of accidental harm. Fire detection is critical because fire has a significant impact on human life and non-living property. The majority of homes do not have fire alarm systems, posing a serious danger of fire to inhabitants. In the absence of occupants, a fire outbreak may occur. The majority of fire alarm systems on the market are wired and do not meet the new standards for an automated smart home. As a result, an intelligent wireless fire detection and alarm system that is safer, easier to operate, and cost-effective is required. One of the most important aspects of fire safety is the early detection of the onset of a fire emergency and the notification of individuals and fire services. Alarm systems and fire detection are responsible for this. Depending on the expected fire scenario, the kind and number of inhabitants, their criticality, and the content and tasks, these systems can play a variety of significant roles. First, they provide a method for manually or automatically detecting a fire, and second, they alert construction workers to the presence of a fire and the need to evacuate. Similar common purpose is sending an alert message to the fire department or another emergency response agency. There are various devices connected to fire detection and control systems available on the market today, but none of them give complete security or notify fire services in a timely manner. To address this issue, researchers gathered all data relevant to the development of fire systems and then built a prototype of an autonomous fire detection and control system based on IoT and Arduino that is low in cost and can be readily placed anywhere, including homes, hospitals, and hotels. This system includes a temperature sensor, a smoke sensor, a carbon monoxide (CO) sensor, and a flame/heat sensor, as well as an Arduino UNO, automatic windows with

an electric motor attached to the sensor, and an LED light module.

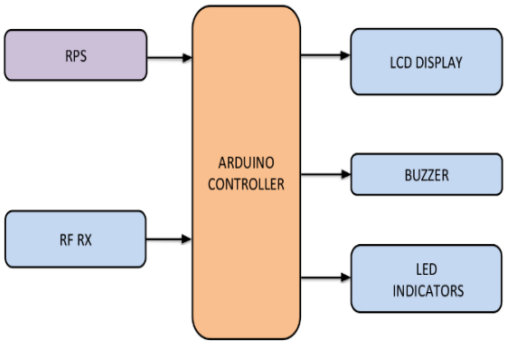
**II.EXISTING SYSTEM:** Railways are one of the best modes of transport and the development of railways in our country took place rapidly. Still there are numerous unsolved problems like fire accidents, train collisions, etc., the railway department has taken measures to stop the problems. The inner parts of the train are mostly made of less prone to catching the materials. Most of the materials are fire resistant. Even after all these, a fire can arise due to short circuit of wires or if any passenger carrying inflammable material. Keeping all these problems in mind, the railway department has installed fire extinguishers in all the compartments. Hence, the use of fire extinguisher doesn't flash to them immediately. 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, they are using the aspiration based smoke detector. These mechanisms are one of the fastest to detect any change in the scattering part of the air. The automatic fire-initiated braking and alert system consists of ATMEGA microcontroller and motor driver.

**III.PROPOSED SYSTEM:** A single-phase 240V, 50Hz AC supply is provided to the ATMEGA328P Microcontroller. The microcontroller receives a 5V supply from an adapter. An HC-05 Bluetooth Module is connected to the microcontroller as an input, facilitating the transfer of text messages from a mobile application to the microcontroller. To send text messages from an Android mobile device to the Bluetooth module, a Serial Communication app is used. Two LED boards are connected in series and linked to the microcontroller as an output. An additional power supply is required to enhance the brightness of the display on the LED boards. For this purpose, a single-phase 230V, 50Hz AC supply is directed to a transformer. The transformer converts this input into a 12V AC supply. The output from the transformer is then directed to a rectifier, converting the 12V AC into a 12V DC supply. This stabilized supply is subsequently provided to the LED boards through a regulator, ensuring stable

operation. Whenever a text message is received to be displayed on the LED boards, a buzzer will give an alert sound twice.



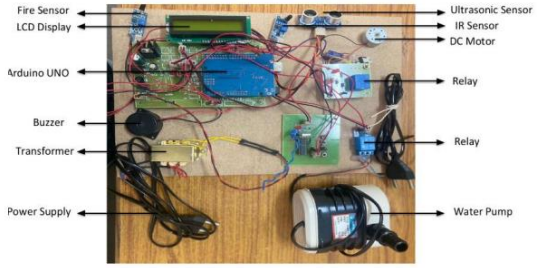

3.1 TRANSMITTER SIDE BLOCK DIAGRAM




3.2 RECEIVER SIDE BLOCK DIAGRAM

In an automatic fire control system used in railways. The receiver plays a critical role in detecting and responding to the incidents. Signal reception: The receiver first captures incoming signals related to fire detection, these signals could come from various sources could come from various sources like fire sensors placed in different parts of train. This block diagram represents the core functionalities of a receiver in an automatic fire control system for railways, emphasizing the critical role of early detection and response to fire incidents to ensure passenger safety and operational integrity.

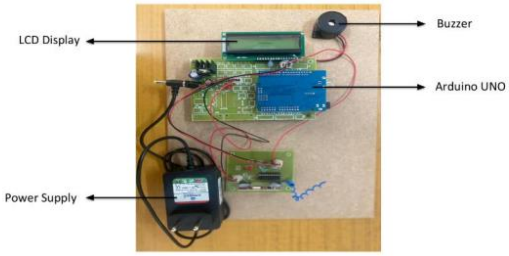
## IV.RESULTS:




### 4.1 HARDWARE SETUP

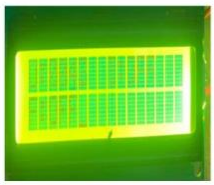
RECEIVER In railways, the automatic fire control system typically incorporates a transmitter as part of its setup. The transmitter plays a crucial role in detecting and communicating information about fire or smoke occurrences within train compartments or critical areas such as engine rooms or baggage compartments. Here's how it generally works: Detection: The transmitter is equipped with sensors that can detect signs of fire or smoke. These sensors could be optical (detecting smoke particles), thermal (detecting abnormal temperature rise), or a combination of both. The hardware module includes fire detection sensors such as heat sensors, smoke detectors, or flame detectors. These sensors are designed to quickly identify the presence of fire or smoke within the railway compartment. All components within the

hardware module must comply with stringent safety standards and regulations applicable to railway systems to ensure reliability and performance under various conditions. The integration of reliable sensors, robust communication, and compliant design are key aspects of its functionality. They are sensitive to the byproducts of combustion and are highly effective for early fire detection.




4.2 Receiver End Setup

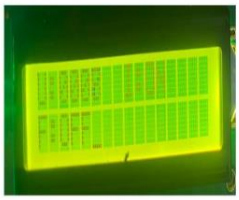
In an automatic fire control system in railways, a receiver plays a crucial role in detecting and responding to fire incidents swiftly and effectively. This system typically involves sensors strategically placed in different areas of a train to detect signs of fire, such as smoke or heat. These sensors continuously monitor their respective areas for any abnormal changes that could indicate a fire hazard. The receiver is the component responsible for receiving signals from these sensors. It gathers information about the detected anomalies and processes them to determine whether there is a fire threat. Once a potential fire is identified, the receiver triggers an alarm to alert the train crew and passengers, enabling them to take necessary actions to mitigate the risk. Additionally, the receiver may be connected to other systems within the train, such as fire suppression systems or emergency communication systems, allowing for automated responses to fire incidents. This integration ensures a rapid and coordinated reaction to fire emergencies, enhancing passenger safety and minimizing damage to property. The receiver in an automatic fire control system in railways needs to be highly reliable and responsive to ensure timely detection and intervention in case of fire outbreaks, thus preventing potential disasters. The receiver module is equipped with the necessary communication interfaces to receive signals from different components of the fire control system, including sensors distributed throughout the train compartments.



4.3 ANY OBSTACLE IS THERE OR NOT

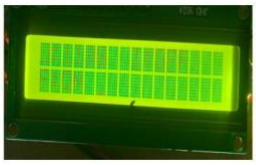
In Automatic fire control system if there is any obstacle occurs during the motion of the train then the fire sensor will be in off position and infrared sensor will be also in

off position. In transmitter side it displays the distance and in receiver side it shows the obstacle message.




4.4 PROTECTION OF TRAIN FROM COLLISION

The IR Sensor is attached in front of the Train. This sensor is used to protect the train from collision. When the IR sensor is active Transmitter side it displays the Distance between two trains on the same track.




4.5 FIRE HAZARDS

| S.no | Case | Ultrasonic Sensor | IR Sensor | Fire Sensor | Buzzer | Water sprinkler |
|---|---|---|---|---|---|---|
| 1 | Any Obstacle | ON | OFF | OFF | ON | OFF |
| 2 | Collision | OFF | ON | OFF | ON | OFF |
| 3 | Fire Hazard | OFF | OFF | ON | ON | ON |

4.6 VARIOUS CONDITIONS

**V.CONCLUSION:** The paper's primary goal is to assist railroads in lowering accident rates by offering improved safety measures. There is no need for regular maintenance with this model. Real-time parameter monitoring is possible, and a computer can be used to modify or reset the parameters' threshold values. In order to improve safety and reduce the risks connected with fire occurrences, railways have to install automatic fire control systems. In order to promptly identify and put out fires, these systems usually make use of sensors, detectors, and automatic reaction mechanisms.

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