MICROPROCESSOR BASED FIRE PROTECTION SYSTEM IN TRAIN

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Abstract: This paper is about how fire accidents in railway industry can be controlled by more advanced method. In the past few years it has been seen that the railway maintenance scenario has been improving but still not up to the mark. One of the reasons behind it is the often-occurring train fire accidents which were un avoidable. So, a prototype has been introduced to overcome this problem and provide safety in a better way. This prototype, which is controlled by a microcontroller helps to stop the fire even before it starts spreading. To overcome fire, a system which is having automatic sensor monitoring, fire alarm warning and fire extinguishers are based on wireless sensor network technology [1]. This system can monitor real-time related parameters such as temperature and humidity in each coach. From the information being transferred from the sensor to the microcontroller, precautions for suppression of fire and sending the smoke out from the AC compartment are made.

***Index Terms*: Microprocessor devices, train fire accidents, Bi-monthly.**

1.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 require 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.

1.1. LITERATURE SURVEY:

While working back at Southern Indian Railways, Lallaguda as an intern the author saw the need of understanding that the current railway scenario has to be changed because the fire accidents in train have been increasing recently [4]. The temperature in middle eastern and Asian countries are reaching heights, in such cases a small fire can also reach to point where it can take hundreds of lives. At the railway workshop under the guidance of various railway officers the author learned that every accident has its own root cause and a hierarchy is to be followed to overcome any accident. Here the fire hierarchy control is followed. In this the fire is eliminated first, suppress fire using extinguisher, move people to safe place, make an emergency squad and provide essentials to affected people.

1.2. BACKGROUND:

Fifteen cases of fire-related accidents have been reported in trains in the last five months primarily due to improper maintenance of rolling stock and lack of supervision, a Railway Board letter has said, instructing zonal railways to take corrective measures to minimize such incidents in the future. In early time the railway failed to overcome such problem and stats showed how terrible cases could go. Few articles read the bad, saddening news of many people losing their lives.

To stop fire from expanding and costing lives, we have to understand different types of fire. There are basically 5 types of fire, Class A, B, C, D, K. These are differentiated on the basis of their factor of expansion of fire. Each need a different type of extinguisher to stop it from spreading. In this case we have come to conclusion of using an extinguisher termed as DCP type fire extinguishers.

TYPE	DESCRIPTION	
3.1 Class A	Class A fires are fires in ordinary combustibles such as wood, paper, cloth, rubber, and many plastics.	
3.2 Class B	Class B fires are fires in flammable liquids such as gasoline, petroleum greases, tars, oils, oil-based paints, solvents, alcohols. Class B fires also include flammable gases such as propane and butane. Class B fires do not include fires involving cooking oils and grease.	
3.3 Class C	Class C fires are fires involving energized electrical equipment such as computers, servers, motors, transformers, and appliances. Remove the power and the Class C fire becomes one of the other classes of fire	
3.4 Class D	Class D fires are fires in combustible metals such as magnesium, titanium, zirconium, sodium, lithium, and potassium.	
3.5 Class K	Class K fires are fires in cooking oils and greases such as animal and vegetable fats.	
◆Some types of fire extinguishing agents can be used on more than one class of fire. Others have warnings where it would be dangerous for the operator to use on a particular fire extinguishing agent.		

2. PROPOSED METHOD:

The authors propose to plant the prototype on the roof top of all the compartment of a train so that the fire when sensed the buzzer alarms and all the passengers get alerted. As each compartment has its own system this will help the people to understand whether they have taken an action or not, as several times its seen that the people die because of stampede first and later because of the fire burns. This will also help the authority to act quick and fast as they help those compartments first where the fire accident has occurred and later the others.

3. CIRCUIT DIAGRAM:

The whole project can be divided into three parts for ease of understanding.

i. Temperature and smoke sensing
ii. Extinguishing in Non-AC compartment
iii. Extinguishing in AC compartment.

3.1. SENSING OF FIRE:

In most of the states the temperature usually crosses 40^0 C. Under normal operating conditions the temperature, humidity and amount of smoke in the compartment are being monitored time to time, the values are also monitored in a website that has been created using IBM cloud. When the temperature or the humidity or the smoke reaches or crosses the threshold value a signal is sent though the microcontroller [3] and Nordac Radio Frequency (NRF) set to nearby stations and the engine driver.

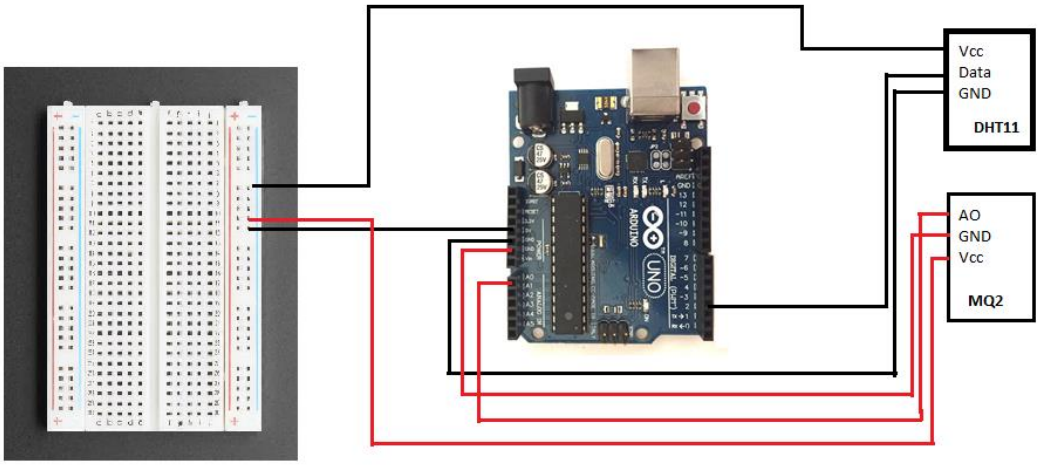


Figure 3.1.0

3.2. EXTINGUISHING IN NON-AC COMPARTMENT:

As the temperature, smoke and humidity in the compartment reaches or crosses the threshold value a signal is sent to the nearby station using the NRF transmitter and simultaneously red Light Emitting Diode (LED) glows in the engine driver compartment so that he gets alert about the incident and tries to halt the train so that the fire doesn't spread any further causing more damage [5]. The extinguishers placed on the roof top of the compartments will be sprayed all over the compartment so that to suppress the fire as soon as possible.

CIRCUIT DIAGRAM FOR A NON-AC COMPARTMENT:

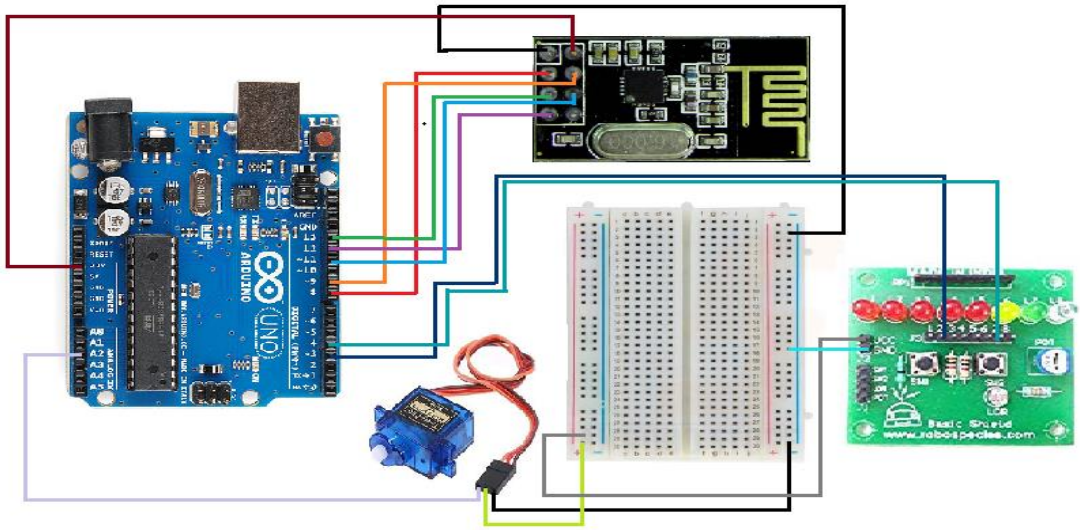


Figure 3.2.1

3.3. AC COMPARTMENT:

When the smoke content in the ac compartment reaches the threshold value or crosses the threshold value a dc motor runs in the opposite direction that is in the anti-clockwise direction to suck the smoke out from the compartment to avoid suffocation for the passengers and simultaneously the solenoid pushes the foam extinguisher button to suppress the fire in the compartment.

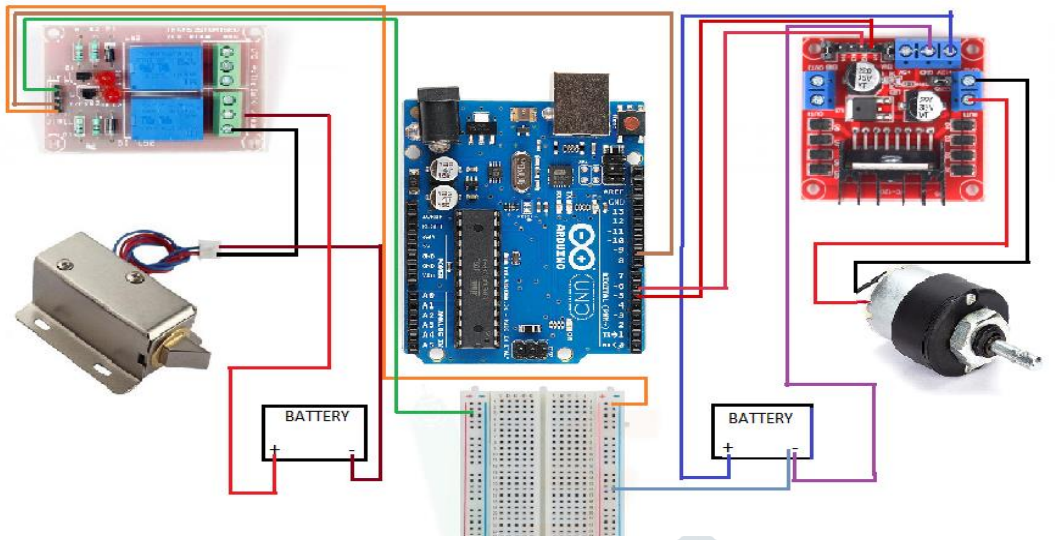
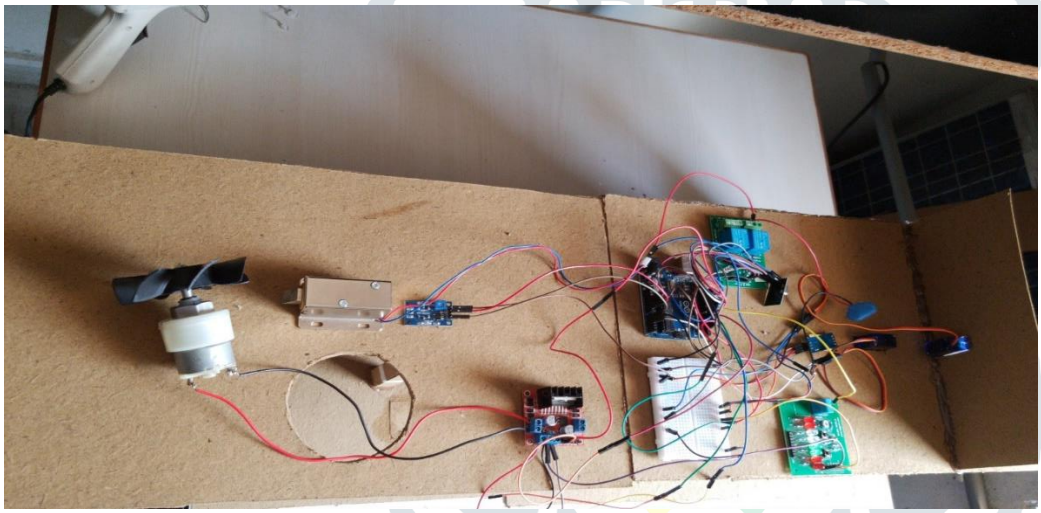


Figure 3.3.1

4. EXPLANATION:



When the temperature or the smoke in the compartment exceeds the threshold value that is set in microcontroller, the buzzer rings in the compartment and a red LED glows in the driver compartment indicating that there a fire accident has occurred in the compartments. As soon as a signal is given the driver tries to halt the train so that the fire does not spread any further. As this process is happening a signal is sent to the near by station using the NRF set and the extinguishers also come into action to supress the fire. Authors use an International Bussiness Machines (IBM) cloud to monitor the time to time temperature, humitdy and smoke level or content in the compartment.

Under normal operating conditions or when the temperature is under the threshold value, green LED glows in the driver compartment indicating there is no issue happening. When the reading crosses the threshold value red LED glows indicating that there is an accident occurred in the compartment.

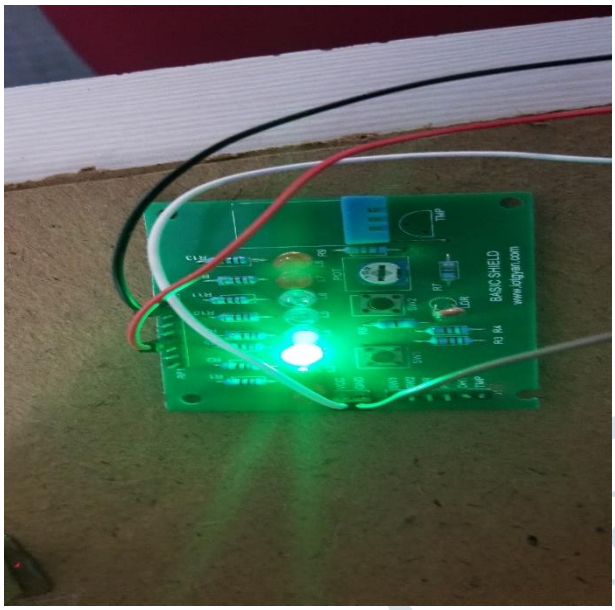


Figure 4.1

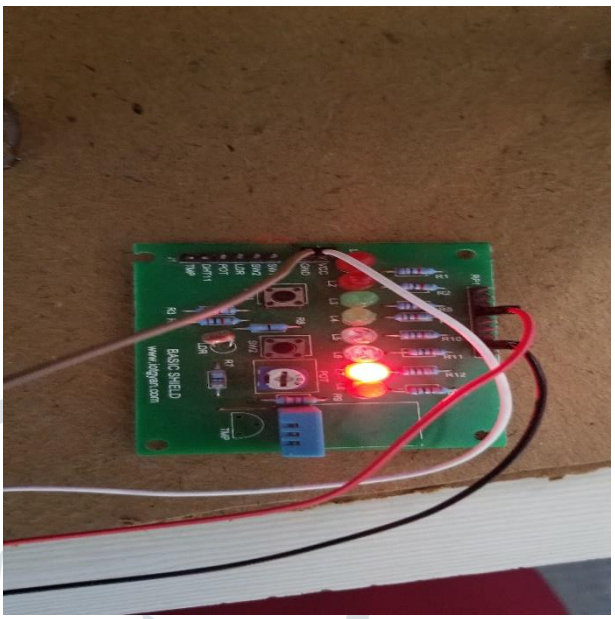


Figure. 4.2

5. CONCLUSION:

Here by the authors conclude that the project will help Railways in reducing the accidents by providing better safety mechanism. This model does not require frequent maintenance. The parameters can be monitored real time and their threshold values can be set or reset using computer.

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