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The Neoteric Solution for Addressing the fire Accidents and Train Collisions

J.Harinarayanan, D.Arulselvam, S.Ramesh Prabhu

Abstract: ***Railways are one of the most commonly used modes of transport by a wide range of the population. Safety is an important factor in any transport system. Regular changes are being made to ensure safe and efficient travel of passengers. Yet, there are more problems need to be considered because of the high usage of railways. Fire accidents in rails are one of the major problems which threaten passenger's safety. To address these issues we propose a system in which the rail compartments are coupled electromagnetically whereas in the existing system the rail compartments are coupled mechanically. The foremost thing aim of the proposed system is to save the people life and the public assets. In this system, if a fire is sensed in a compartment, it will be isolated from other compartments by de-energizing the electromagnets in the coupling to prevent the spreading of fire. Then the location of the affected compartment is sent to the nearby railway station for rescue work. This system also aids in some emergency cases. Whenever a train is stopped in need of some external help, the location of the train is sent to the nearby railway station to address the emergency within seconds.***

Keywords—Electromagnet, Temperature sensor, Zigbee module, Relay circuit, IoT.

I. INTRODUCTION

Most of the people prefer railways as it is cheaper and also comfortable. It is necessary to ensure a safe journey of traveling passengers. Fire accidents in trains are one of the serious threats to human lives. Presently, the rail compartments are coupled mechanically with either screw coupling or center buffer coupling by the concerned officials. With this system, the compartments cannot be separated automatically in case of fire or any kind of emergency. This may lead to severe damage to passengers and also to the train.

In trains, fire accidents can be due to so many reasons such as short circuits in electrical wires, human error, and unwanted banned activities like carrying flammable items, etc.

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* Correspondence Author
J.Harinarayanan*, Department of Electrical and Electronics Engineering, Sri Sairam Engineering College, Chennai, Tamilnadu, India.
(Email : er.harinarayanan@gmail.com)
D.Arulselvam, Department of Electrical and Electronics Engineering, Sri Sairam Engineering College, Chennai, Tamilnadu, India.
(Email : arulselvam.eee@sairam.edu.in)
S.Ramesh Prabhu, Department of Electrical and Instrumentation, Kamaraj College of Engineering, Vellakulam , Virudhunagar, Tamil Nadu., India.
(Email: ramesprabu@gmail.com)

The radiofrequency communication-based system implemented to check the collision between the trains [1] but till now, there are only precautionary measures to avoid overall protection of the trains are implemented. It is very important to have a system for continuous monitoring of rail bogies for fire and also a system capable of decoupling the rail compartments whenever needed. Currently, in Indian railways, the technique used to avoid the collision is the Anti-collision device system [2]. To accomplish all this, we have proposed a system capable of the above requirements. In the proposed system, the rail bogies are coupled electromagnetically using electromagnets instead of conventional mechanical coupling. This system aids in disengaging rail bogies whenever needed. In this system, the rail compartments are continuously monitored for fire using a sensor network. Once the abnormality is detected, the information is sent to the driver and the rail compartments are decoupled isolating the affected compartment. The location of the affected compartment in sent to the nearest control station through IoT for further action to be taken.

Train accidents also take place due to other reasons such as delay in information transfer to the control station in emergency cases. Even the Firozabad rail disaster in 1995 took place due to this reason. Now, there are no modern methods for data transfer in trains. In this system, we have added a method for this which enables instant message transfer containing the location of the train through IoT informing the nearby control station for help and for proper signaling.

II. HARDWARE COMPONENTS

1. Electromagnet
2. Arduino mega 2560
3. Gas Sensor(MQ-2)
4. Temperature Sensor(LM35)
5. Zigbee
6. IoT

III. DESCRIPTION

A. Electromagnet:

An electromagnet is one of the types of magnet in which it produces a magnetic field around it when the electric current flows towards it. The magnetic field is produced whenever the current flows through the coil and the magnetic field vanishes when the flow of current through it is turned off. Usually, it consists of a wire wound into a coil which is made up of ferromagnetic or ferromagnetic material.

A current through the wire forms a magnetic field that is concentrated in the hole at the centre of the coil. The preference of this type of magnet over varied magnet sorts is that the magnetic field will be quickly altered by governing the value of electric current passes to the winding. In this system, the electromagnet plays a vital role to avoid the collision between the compartments. All the compartments of the trains are coupled with each other with the help of the electromagnets and the current flow to the electromagnet is continuously monitored by the controller based on the signal obtained from the various sensors.

B. Arduino mega 2560:

The Arduino boards are the recently used source for reading the inputs from the various sensors and transmitting the output signal to control the major system. To control the overall system the Arduino mega2560, a type of microcontroller, based on its performance ATmega2560 microcontroller is used. The Arduino board is equiped with sets of 54 digital input/output (I/O) pins, 16 analog pins, 4 UARTs, a 16MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. The Mega 2560 board is able to shield with most designed compare to other boards. The power consumption and cost of the system can be reduced by lessening the hardware component. The board holds two voltage regulators i.e. 5V and 3.3V that maintains a constant power supply to regulate the voltage as per the requirements. USB cable or an external 9-volt battery is used to power the board, though it accepts voltages between 7 and 20 volts.

C. Gas Sensor:(MQ-2)

MQ2 gas sensor is a type of sensor which is used for detecting flammable gases such as propane, LPG, , hydrogen, CH4, carbon monoxide and smoke concentrations from the air. Other types of gas sensors are also available for various kinds of detection like alcohol vapor, Coal Gas, LPG, Natural Gas, Town Gas, Carbon Monoxide, and Liquefied Gas. Aluminum oxide-based ceramics are used for making the sensing element. It also has a coating of tin dioxide which is of low conductivity when the air is clean. The smoke formed due to the fire is sensed, and then the sensor gives an analog resistive output based on the concentration of smoke. Tin dioxide is heated in the air at a high temperature then the donor electrons of tin dioxide are attracted to oxygen molecule which is absorbed by the sensing material. This blocks the flow of electric current reducing the gases and the surface density of absorbed oxygen drops as it interacts and undergoes a chemical change with the reduced gases. Electrons are then allowed to move into the tin dioxide allowing the current to flow freely through the sensing element then it is carried to the microcontroller.

D. Temperature Sensor:(LM-35)

A temperature sensor is a sensor that gives either the analog output signal or digital output signal based on the type of sensor used for sensing the heat energy or even frigidness. LM35 is the most accurate temperature sensor whose output is directly corresponds to the temperature in Celsius. Compared to the thermistor the LM35 can measure the temperature more precisely. It possesses a low self-heating as well as does not cause the temperature to rise more than 0.1 °C in still air. It has three terminals which is used to sense the working ambience temperature that range from -55 Celsius to 155 Celsius. LM35 has a linear output with low output impedance. It has a accurate inherent calibration interfaced to in/out or control circuitry easily. It has also found its applications on various bailiwick such as power supplies, battery management, appliances, etc..,

E. Zigbee:

Zigbee is one of the wireless technology which uses low power radio signal for transmitting the signal.

It is based on the specification considered as the best way for the high level communication system.

it is used for two-way communication between sensors and controller system.

Zigbee technology supports the data/signal coming from the sensor at the rate of about 250kbps. It operated at various frequency ranges such as 868MHz, 902-968MHz, and 2.4GHz. Since it requires low power for its working, the battery life is significantly improved, it is also one of the cheapest wireless technology used for transferring the signals. With Zigbee being the most suitable communication method for IoT devices, it has found its application in many automated systems such as Industrial Automation, Home Automation, Grid Monitoring, and Smart Metering.

F. IoT:

Internet of Things is one of the latest technology which is used to interconnect the controlling system and the physical objects through the space called the internet. IoT is developed due to the development of convergence of various technologies like machine learning, sensing, and embedded system. In this proposed system, the ESP8266 Wi-Fi Module is used as the IoT for transmitting the signal from the train to the main controller, which is a self-contained SOC integrated with a TCP/IP protocol stack which will provide any microcontroller access to the Wi-Fi network.

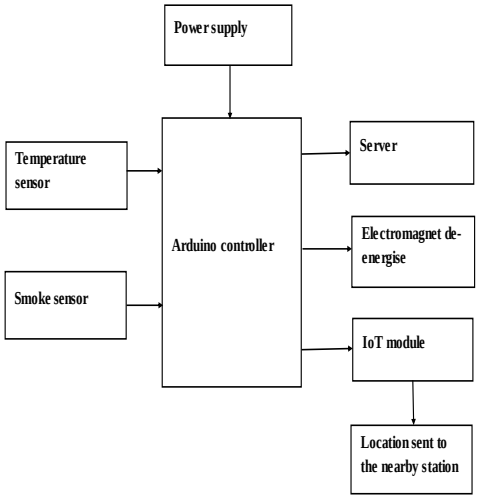
It has 1 MiB of built-in-flash that allows a single-chip device capable of connecting to Wi-Fi and the system. It also has the capacity of either hosting a system or offloading all Wi-Fi networking functions from the other application processor. ESP8266 is the most economical Wi-Fi module provided by AT commands firmware which allows to work like Arduino Wi-Fi shield; however, different firmware can be embedded to make use of the module's memory and processor.

IV. PROCESS OVERVIEW

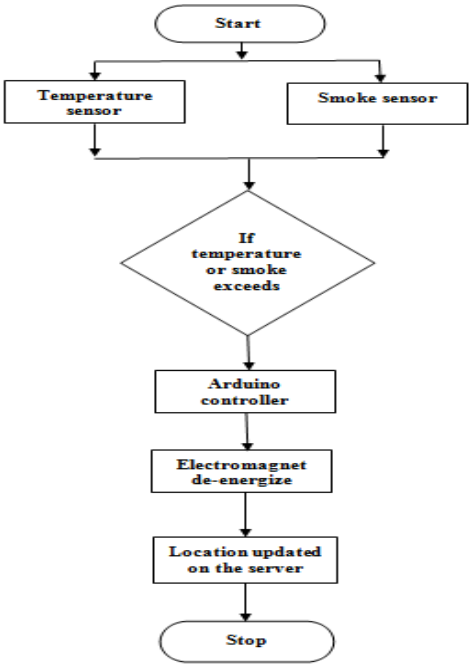
The rail compartments are continuously monitored for fire, smoke, and collision using sensors. Fire and smoke were detected by the sensors like temperature sensor LM35 and gas sensors MQ2.

The signal from the train is monitored and the values are continuously sent to the Arduino controller.

When the sensors' value exceeds the set value, the controller detects the fire and gives a signal to de-energize the electromagnet so that the affected compartment becomes isolated from the train to avoid the spreading of fire. Thus minimizing human loss and damage caused to the train. The passengers are alerted with an alarm signal and an alert signal is also sent to the controller present in the engine regarding fire breakout, through Zigbee wireless technology. Then the controller sends the location of the affected compartment to the nearby control station through IoT for assistance. In this proposed system, when the driver presses the alert switch, the precise location of the train is transmitted to the nearby control station to aid within a minute so as to avoid moratorium in message transfer at the time of emergency.



V. WORKFLOW & RESULTS



VI. FUTURE SCOPE

In the future, this system can be used to save rail compartments from the collision and fire accidents. It protects the train even before the fire starts to spread throughout the rail carriages.

In this proposed system, the data is sent to the control station earlier. Also, the disturbance to passengers is much reduced.

VII. CONCLUSION

The main objective of this system, to couple the rail compartments has been achieved. The proposed system gives an early detection and extinguishing of fire disasters so as to reduce the damages caused considerably. By using this system, the rescue activities are also done immediately. The necessary help is provided at the site quickly thus saving the human lives and properties.

REFERENCES

1. K.P Shantha Krishnan, Dr.M.Geetanjali, L.D. Shree Vishwa Shamanthan,"RF Train Collision Avoidance System " , IEEE India Conference, pp 978, 2013.
2. A.N.Kulkarni , Smita S.Bhavsar, "Trains Collision Avoidance System by using RFID and GSM Technology", International Journal of Innovative Research in Electrical, Electronics, Instrumentation and control engineer, vol.4, June2016.
3. R.Rothfeld, U.Floegel – Delor, T.Riedel, B.Goebel, " Recent up-scalling in HTS magnetic device technology," IEEE Transactions,App.SuperCond., Vol.21,pp1473-176, June 2011.
4. V.Siva Prasad, M.Nagamani,M.Suresh,G.Sumanth " Fire Accident Avoidance System in Trains Using GSM technology" Journal of Electronics and Communication Engineering, Vol.9, issue 4, pp 01-01, August 2014.
5. M.Praveen Kumar, R.Pitchai Ramasamy, S.Sarath Kumar and R.Raghu Raman, " Avoidance of Fire Accident on running train Using Zigbee Wireless Technology Sensfor network", International Journal of Information and computation technology , Vol.3, pp 583-592, 203.
6. K.Subbulakshmi, S.Philomina," Avoidance fire accidents by wireless sensor networks", International Journal of pure and applied Mathematics ,Vol.116,pp295-299,2017.
7. S.Abinaya, M.Surekha," Real Time System Based Coupling of a Train by Using Magnetic Method" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol.5,2016.
8. B.Ashok, G.Srikanth Reddy, "Trains Collision Avoidance System by using GSM Technology", International Journal of advanced technology and innovative research, Vol.8,pp 4005-4007, November 2017.