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Research Paper

DESIGN OF SMART TRAIN WITH FIRE DETECTION AND NOTIFICATION SYSTEM

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In this paper, a remedy to reduce the death loss occurring due to fire accidents in trains is presented. Fire ona running train is more catastrophic than on a stationary one, since fanning by winds helps spread the fire to othercoaches. when these accidents are occurring in remote areas or during night times the loss or damage being caused is athigher rates. The damage is heavier due to improper reach of service at right time due to improper communication. Thistime delay is causing heavier damage. Thus, eliminating the time between when an accident occurs and when firstresponders are dispatched to the scene decreases the damage. This projects help in notifying the passengersandemergency services. The project consists of a microcontroller which is interfaced with the GPS module, GSM modemand fire sensors. Once the sensors attached in the compartments of train senses the smoke detection, it assumes a fireaccident. The controller assumes it as an emergency and starts the buzzer, LCD display and GSM modem in the enginesending the latitude and longitude information to the specified mobile number and emergency services, by fetching theinformation from the GPS.

Keywords: Fire sensors, GSM, GPS, Buzzer

INTRODUCTION

Security in travel is primary concern for everyone. Now a days fire accident are most often occurring in trains. Whenthese accidents are occurring 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 right time due to improper communication. This time delayis causing heavier damage. Thus, eliminating the time between when an accident occurs and when first respondersaredispatched to the scene decreases the damage. One approach to eliminate the delay is by identifying the fire accidentand notifying the concerned authorities, loco pilot and passenger with in no time. Passengers will be notified by ringing the buzzer and loco pilot will be notified showing the message in the LCD display fitted in the engine along with alarm.

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EXISTING SYSTEM

In existing system the controls are mostly electronical and also hardwired. It is contolled manually and also the components cannot withstand temperature . It needs manual operation which increases the risk to human lives and introduces a time delay. Due to such delay the fire will spread to other coaches and increases damages to both lives and properties.

PROPOSED SYSTEM

Hence to avoid such losses an new system has been proposed . In this system if fire occurs in any particular coach ,initialy a warning message will be sent to the control section which enables the controller or driver to slow down the train. Also an submarine motor is being enabled at the same time which sprinkles the water inside the coach. In advance, to prevent the fire from spreading to other coaches an new method is implemented.Here once the fire has been detected , that particular coach will get demagnetized and got separated from other coaches automatically.

SYSTEM ARCHITECTURE

Once there is a fire accident, immediately the fire sensor will immediately sense the change in temperature and thus the micro controller is supplied with power supply. When there is no fire accident the ZigBee fire sensors placed in the compartments will send no signal so the micro controller will not work. Thus, once the fire is detected, the ZigBee fire sensors placed in compartments sends a signal and the GPS, GSM, Buzzer, LCD modem which are kept ON all thetime will respond. The GPS modem will be continuously tracking and after the identification of fire the longitude and latitude values of that

Figure 1: Block Diagram of RF Transmitter

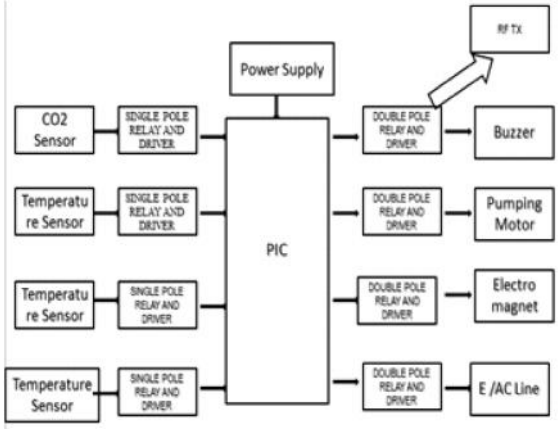
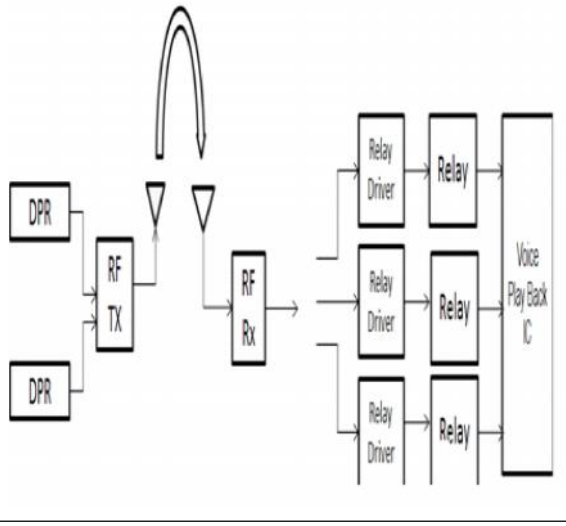


Figure 2: Block Diagram of RF Reciever



location are stored in memory of the micro controller and the contents are moved to SBUF register of microcontroller and then to the GSM through the transmitter pin. The GSM modem will then send messages to the numbers specified about the accident specifying the latitude and longitude values. At the same time, the buzzer will be ON immediately after the micro controller is supplied with power supply. And also it is displayed in the LCD placed in the engine for loco pilot

HARDWARE DESCRIPTION

PIC16F877A

PIC- Peripheral Interface Controller. It is an 8 bit microcontroller and it is a 40 pin IC. It is a bit addressable microcontroller i.e.., each bit can be controlled separately It is a fully RISC (Reduced instruction Set Computing), the instructions will be executed only by a particular hardware. Six modules- ADC, timer, RS232, CCP, SPI. PIC is families of Harvard architecture microcontroller. There are three memory units present in PIC. They are RAM, ROM and data EEPROM. PIC IC having three packages and five ports such as PORT A, PORT B, PORT C, PORT D and PORT E. PIC is a family of modified Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Peripheral Interface Controller" now it is "PIC" only.[4] PICs are popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

GAS SENSOR

Having 6 terminals

4 terminals -fetch signals

2 terminals –produce heat

Working voltage:5v

Relay

Two types:

Single pole relay-12v

Double pole relay -24v

Three terminals:

common

Normally opened

Normally closed

Single Pole

The single pole relay is used to operate a single load at a time.

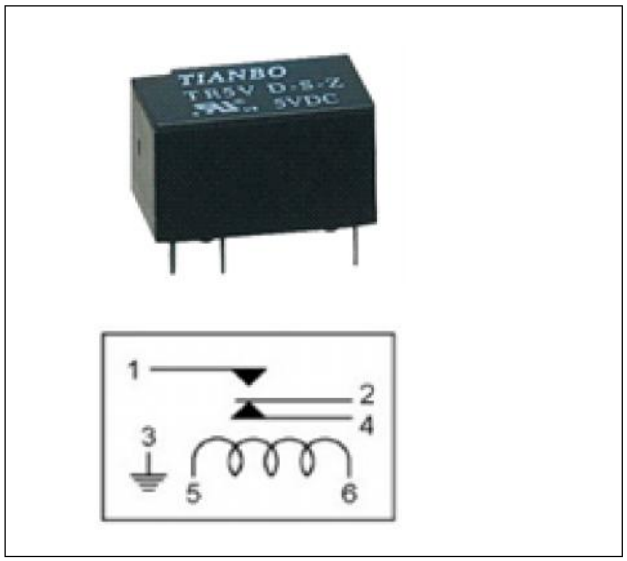
It has 3 contacts, such as

NO

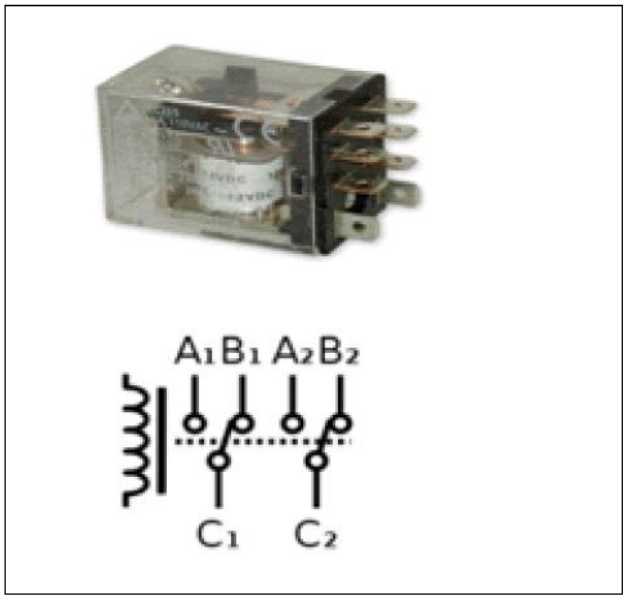
NC and

COMMON

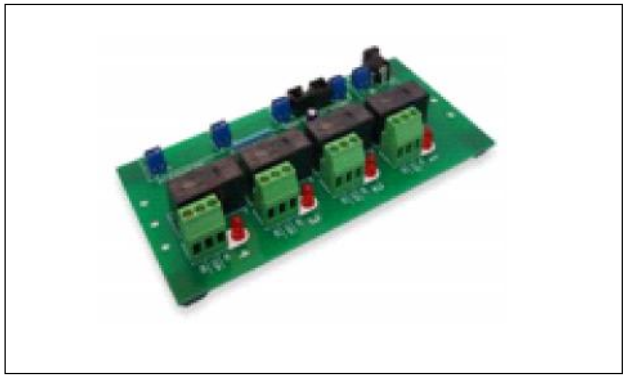
It is used for driving a single load.



Double Pole



CHANNEL RELAY BOARD



Input Logic -5v level Interfaced with Transistor 547 Single pole relay

RF MODULE

As the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).

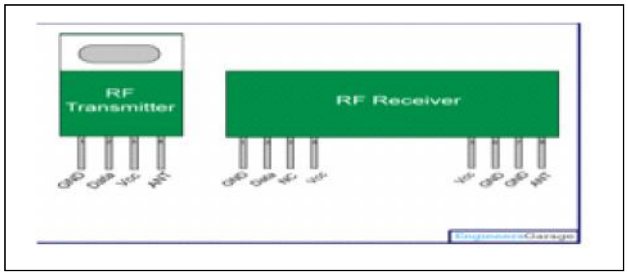
Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data input pin	Data
3	Supply voltage; 5V	Vcc
4	Antenna output pin	ANT

Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources.

This RF module comprises of an RF Transmitter and an RF Receiver**.** The transmitter/ receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the

transmitter. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.

Pin Diagram



RF Transmitter Module

Working voltage- 3-12 volt

Working current-10-15ma

Model - FS1000A

Range- 80m

RF RECEIVER MODULE

Working voltage- 5v

Working current- 0.5 to 0.8 mA

Model-PSR2

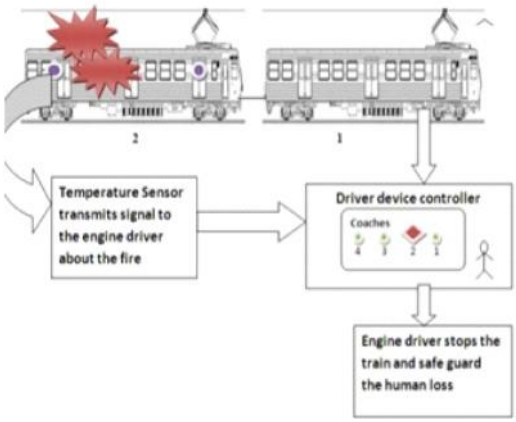
Voice Playback

It can store 8 data ,each data can store 60 seconds.It had non-volatile memory.Operating voltage 12v dc.

FIRE SENSOR

Fire accidents in trains are among the most serious disaster to human lives and to the property if government. Because the only precautionary warnings about the fire in each compartment are the notices showing “Do not Smoke”, “Do not carry inflammable material”. Flame detection is the technology for detecting flames, using a flame detector. Flame detectors are optical equipment for the detection of flame phenomena of a fire.

Figure 3: Control of Fire Accident



GPS Location Module

GPS location module GS-87 is the third generation of GPS receiver chip designed by the United States SiRF star IIIcompany, which consists of a radio frequency integrated circuit, a digital signal processing circuit and standardembedded GPS software composition

Message Transmission Module GSM

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication.GSM is the name of a standardization group established in 1982 to create a common European mobile telephonestandard that would formulate

specifications for a pan-European mobile cellular radio system operating at 900 MHzfrequency. Cellular is one of the fastest growingand most demanding telecommunications applications. GSM (GlobalSystem for Mobile communication) is a digital mobile telephony system that is widely used in Europe and other partsof the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the threedigital wireless telephony technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends itdown a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band.

The network is structured into a number of discrete sections:

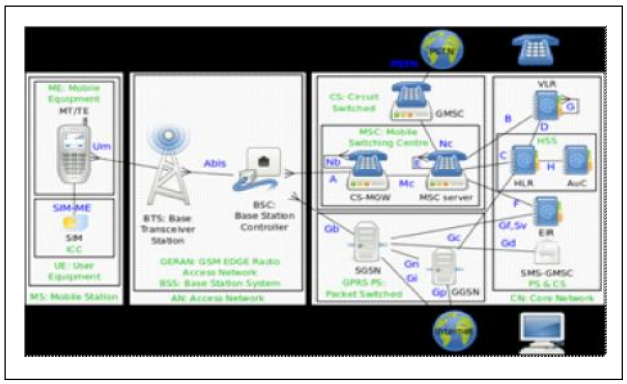
The *Base Station Subsystem* (the base stations and their controllers).

The *Network and Switching Subsystem* (the part of the network most similar to a fixed network). This is sometimes also justcalled the core network.

The *GPRS Core Network* (the optional part which allows packet based Internet connections).

The *Operations support system (OSS)* for maintenance of the network.

STRUCTURE OF GSM NETWORK



CONCLUSION

Here two technologies are used, at first ZigBee technology is used to sense or detect the fire and information istransferred to microcontroller in engine. Then GSM technology is used to transmit information about accident toconcerned railway authorities and emergency services like police ambulance etc

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