PIRUS AND GAS COLLATERAL SYSTEM IN TRAIN

Ms. U. Vanitha, (Ameetha Parvin, Lakshmi Menon, Shiney Immaculate)
Asst. professor, Department of Electronics and Communication Engineering, SVS college of engineering, Coimbatore
Department of Electronics and Communication Engineering, Coimbatore

ABSTRACT

Passenger safety is the key concern of the railway system, but it is an urgent issue that a dozen of people lose their lives every year in fire accidents. This paper proposes and implements a state of art GSM based train security system. In trains, untoward accidents occur frequently and there is a need to implement secure system. A wireless based security system involves the GSM and if any security related issue occurs, then a SMS can be sent to the intended recipients and automate any process regarding safety. This paper intends to identify fire and gas leakage and to inform the concerned persons automatically within a short span of time. The system immediately perceives the dangerous state of the travellers and informs it to the intended recipients. Also to deal with the accident immediately it is provided with an alarm message and a provision for auto pipelining. This paper introduces the system overview and detection process with experimental results. We expect the proposed system will play a key role for establishing highly intelligent monitoring system in railway

KeyWords

CCTV, GSM, GPS unit, microcontroller
1. INTRODUCTION

Railway is a convenient and efficient public transportation system. However, a great loss of lives has occurred due to carelessness about safety. Recently many such safety accidents have been reported, the most disastrous being the fire and gas leakage accidents.

One of the coaches of the Chennai-bound Tamil Nadu Express caught fire early on 30th July 2012 morning, near Nellore in Andhra Pradesh. 47 people died and 25 others were injured. The local district police believe that the fire was caused by a short circuit. Figure 1 shows the Nellore fire disaster.

Figure 1: Nellore fire disaster

Recently to prevent and monitor the safety in railway platforms CCTV is widely used. However safety measure towards prevention and control of fire and gas leakage accidents has not been implemented yet. In this paper we introduce an intelligent system that would identify any abnormal situations of fire and gas leakage and take immediate steps towards preventing and controlling related explosion and havoc.

Although every train has a fire extinguisher in each compartment the unawareness and neglectance of the people toward its use have led to several tragedies throughout the world. Therefore a new concept of fire and gas monitoring system that perceives automatically the dangerous factors of fire and gas leakage in train is needed.

The proposed system monitors almost the entire length of the train and determine any abnormal level of fire and gas leakage in the boggy using the temperature and gas sensors. The raised temperature is sensed and the abnormality is immediately send to the fire engine, engine driver and the ambulance along with the location information. In case of an explosion auto pipeline facilitates escaping a calamity. The system contains predominantly 3 modules: fire and gas detection module, message passing module and explosion control module.

2. SYSTEM OVERVIEW

The figure 2 shows the block diagram of the fire and gas detection system in train.

Figure 2: block diagram of proposed system

The proposed system can be divided into fire and gas detection module, message passing module and explosion control module.

The fire and gas detection module senses and perceives dangerous factor such as a short circuit in the monitoring area. The detection process is carried out using the temperature and gas sensor that detects any abnormal temperature and gas levels in the boggy. A threshold value is set using the microcontroller that is suitably programmed. The sample output for detection of abnormal temperature is shown in figure 3.

The message passing module makes use of GSM to send the abnormality information to the intended recipients along with the geographical information of the train in case of an explosion.
The intended recipients include the fire engine, engine driver and the ambulance. The location information regarding the train is obtained using the GPS. Moreover, the alarm starts ringing when an abnormality is detected, which is a source of preventing further havoc.

Figure 3: sample output for detection of abnormal temperature

The explosion control module is intended to reduce the chaos due to the explosion. The relay drive unit is used to automatically open the engine door to facilitate the passengers to escape from the disaster. Auto pipelining is also provided to prevent the fire from spreading to the nearby bogies and to the surrounding.

Thus, this paper completely aims at reducing the probability of explosion in a railway system that could cause a havoc and risk millions of life, thus safeguarding the railway security.

3. HARDWARE DESCRIPTION

A. Microcontroller

The AT89C52 is best suited to implement the system because of its low-power, high-performance CMOS 8-bit microcomputer with 8Kbytes of Flash programmable and erasable read-only memory (PEROM). The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. We chose AT89C52 since it is highly-flexible and cost-effective solution to many embedded control applications. We interface it with temperature and gas sensor, buzzer, LCD display, GSM, GPS and relay drive unit to provide fire and gas safety in train.

Figure 4: block diagram of AT89C52

B. Serial Communication

The serial communication is used to send data from sender to receiver one bit at a time. Here we use RS232 serial communication cable to implement this. In the system introduced here, it is interfaced with AT89C52 microcontroller to transmit the risk conditions detected by the sensors to intended recipients through mobile phone connected to a GSM modem. The MAX232 is used to convert the signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits.

C. Temperature sensors

The LM35 precision centigrade sensor is used to detect when the temperature exceeds the threshold temperature. Since the normal room temperature lies around 25°C – 27°C, we have kept our threshold temperature as 40°C. The output voltage of the LM35 temperature sensor is linearly proportional to the Celsius (Centigrade) temperature. It is opted to implement this system because; the user is not required to subtract a large
constant voltage from its output to obtain convenient Centigrade scaling. The LM35 also does not require any external calibration or trimming to provide typical accuracies of \( \pm 1/4^\circ C \) at room temperature and \( \pm 3/4^\circ C \) over a full \(-55 \) to \(+150^\circ C\) temperature range. The LM35’s low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies.

**D.MQ-2 GAS SENSOR:**

It is suitable for detecting LPG, i-butane, propane, methane, alcohol, Hydrogen, smoke.

### STANDARD WORKING CONDITION

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter name</th>
<th>Technical Condition</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>VC</td>
<td>Circuit value</td>
<td>5V±0.1</td>
<td>AC OR DC</td>
</tr>
<tr>
<td>VH</td>
<td>Heating value</td>
<td>5V±0.1</td>
<td>AC OR DC</td>
</tr>
<tr>
<td>RL</td>
<td>Load resistance</td>
<td>Can adjust</td>
<td></td>
</tr>
<tr>
<td>RH</td>
<td>Heater resistance</td>
<td>33Ω±5%</td>
<td>Room temp</td>
</tr>
<tr>
<td>PH</td>
<td>Heating consumption</td>
<td>Less than 80mw</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: standard working condition

### ENVIRONMENT CONDITION

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter name</th>
<th>Technical Condition</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_{ao}</td>
<td>Using ten</td>
<td>-20C-50C</td>
<td></td>
</tr>
<tr>
<td>T_{as}</td>
<td>Storage ten</td>
<td>-20C-70C</td>
<td></td>
</tr>
<tr>
<td>R_H</td>
<td>Related humidity</td>
<td>Less than 95%Rh</td>
<td></td>
</tr>
<tr>
<td>O_2</td>
<td>Oxygen concentration</td>
<td>21% O_2</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: environment condition

### E. LCD Display

The LCD is connected to the AT89C52 to display the required information. There are basically two types of LCD displays namely, 16x2 and 20x2 displays. In the proposed system we have used the 16x2 LCD display. This means that 16 characters are displayed per line by 2 lines. The display consists of high contrast and large viewing angle. Each module contains a CMOS controller and all necessary drivers which have low power consumption. The controller is equipped with an internal character generator ROM and RAM. The 16x2 LCD display is programmed to display the welcome message when the temperature is normal (around 25°C – 27°C). If the temperature is above the threshold LCD will display as abnormal temperature. LCD will be placed in engine and in all compartments in the train.

### F. GPS

The Global Positioning System (GPS) is a Global Navigation Satellite System (GNSS). It uses a constellation of between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals, which enable GPS receivers to determine their current location, the time, and their velocity. GPS is often used by civilians as a navigation system. A GPS receiver calculates its position by precisely timing the signals sent by GPS satellites high above the Earth. In our
proposed system each satellite continually transmits messages that include
1. The time the message was transmitted
2. Precise orbital information

And in case if fire explodes GPS unit is used to inform the intended recipients (fire station, engine driver and ambulance) and the information regarding the geographic location of the train at the time of accident is also sent. The position is displayed with a moving map display or latitude and longitude; elevation information may be included.

G. **GSM**

The GSM/GPRS Modem comes with a serial interface through which the modem can be controlled using AT command interface. The range of GSM is 22 miles. An antenna and a power adapter are provided. The basic segregation of working of the modem are Voice calls, GSM Data calls, GPRS, SMS.

In the proposed system we use the GSM modem to send the information regarding the unsafe conditions of the train to the intended recipients. SMS is an area where the modem can be used to provide features like:

- Pre-stored SMS transmission
- These SMS can be transmitted on certain trigger events in an automation system

![Figure 6: Interfacing of GSM with microcontroller.](image)

H. **RELAY DRIVE UNIT**

The hardware discription of the proposed system consist of a relay drive unit that is used to rescue the people in case of an emergency condition in the train. It is used in the explosion control unit. A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism, but other operating principles are also used. Relays is necessary to control a circuit by a low-power signal, or where several circuits must be controlled by one signal.

I. **INTERFACING UNIT**

An analog-to-digital converter is a device that converts the input continuous physical quantity to a digital number that represents the quantity's amplitude. In the proposed system we use 0808 ADC. The detected temperature and pressure is converted to a suitable form that can be used by the microcontroller using the ADC. The conversion involves quantization of the input, so it introduces a small amount of error.

J. **BUZZER**

Here we use a Piezo Buzzer to alert the passengers and engine driver in case of an emergency. The piezobuzzer mainly consists of a multi-vibrator circuit, piezoelectric buzzer films, and the resonance box, shell etc. Multivibrators consist of transistors or integrated circuits. When switched on, after (1.5 ~ 15V DC working voltage), multi-harmonic oscillator Start-up, output 1.5 ~ 2.5 kHz of audio signals, which results in audible sound. It is interfaced with the microcontroller. If a abnormal temperature and pressure is detected by the sensors such as in the case of a fire, the buzzer beeps to indicate the occurrence of a an unsafe condition.

K. **POWER SUPPLY UNIT**

Power supply block consists of following units: Step down transformer, Bridge rectifier circuit, Input filter, Voltage regulators, Output filter, Indicator unit. It provides the power required to drive the entire system. Power supply required for the system is 12v DC. By using step down transformer it converts 230v AC to 12v AC. Then it is converted to DC by using bridge rectifier.
3. CONCLUSION
In this paper, design and development of an automatic fire and gas detection system in train is described. The system contains several modules to detect, prevent and control disastrous fire and gas leakage in train. Auto pipeline facility is provide for control of havoc due to explosion without human intervention thus reducing the risk. It also provides the location information about the train in case of a fire accident. Thus it saves the risk of millions of life in case of a fire or gas leakage in train.

4. FUTURE WORK
The system can be made made multipurpose by integrating facilities to obtain local route maps inside the train. The fare collection can also be made automatic by using another mobile to which the passenger using the public transport are subscribed. Provisions to detect any obstructions in the path and methods to control complications due to derailing etc can also be incorporated into the same system with careful designing.

5. REFERENCE
1. GPS/GSM based train tracking system— utilizing mobile to support public transportation by Dileepa Jayakody, Mananu Gunawardana, Nipuna Wicrama Surendra, Dayan Gayasri Jayasekara, Chanaka Upendra, Supervisor, Rangana De Silva.
3. Fire extinguishers - How & When To Use Them.
4. Light operations briefing notes cabin operations - Managing In-Flight Fires
5. Gnss-based sensor fusion for safety-critical applications in rail traffic by S. Bedrich.