DETECTION OF FIRE ACCIDENTS USING GSM & GPS TECHNOLOGIES

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Abstract— The trains are the vehicles used for transportation. Most of the trains we have are induction trains there is a chance of fire mishaps. Fire on a running train is more catastrophic than on a stationary one, since fanning by winds helps spread the fire to other coaches. These fire accidents are causing serious threat to lives of people. There are no sophisticated protection parameters in existing system protecting people's lives from the fire accidents, have become a serious concern now. For avoiding fire accident in prior we can use the automatic fire detecting system which measures the current and load constantly and alarms the passenger, driver and guard the train if there is abnormal increase in it, so that the driver and guard can halt the train. The block diagram consists of a GSM & GPS modems, Arduino, a LCD display, sensors buzzers and power supply. A GSM modem is used to get the messages from the mobile as well as reading the message also. In this system mainly we have microcontroller, power supply, LCD, GSM. The total controlling action will be done through this Arduino. When the current or load increases, or when heat was detected by sensor then it automatically sends a message to the driver and guard indicating to halt the train immediately and the location of the train to the nearby control station to take further action, with the help of Arduino, GSM and GPS modems..

Index Terms— Arduino Microcontroller,Buzzers, GSM modem,GPS module, a LCD display, sensors, and power supply.

1 INTRODUCTION

Most of the trains we have are induction trains there is chance of fire mishaps. The fire incidences in trains are among the most serious disasters to human lives and the property of Indian Railways. Thus the prevention of train fire has become a serious concern for Railways. Moreover, passengers sometimes jump out of a running train on fire resulting in increased casualties. These fire accidents are causing serious threat to lives of people. Fire especially in uncontrolled state is a source of very rapid destruction and this gets compounded when loss of human life is involved. Hence all possible steps to prevent a fire from breaking out in coaches, and if it breaks out, to prevent it from spreading and causing further damage are of paramount importance. For avoiding the fire accident in prior we can use an automatic fire accident avoiding system which measures the current and load constantly and alarms the passenger, driver and guard of the train if there is an abnormal increase in it, so that the driver and guard can halt the train. The system can detect fire in two aspects:

- Short circuit
- Temperature increase (Heat)

The exact location of the train is sent to nearest control station by using GPS modem to take further action. For sending the message to relevant controlling authority GSM technology can be used.

2. CRITERIA OF CHOOSING ATmega238PMICROCONTROLLER

The Atmel 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory i[th] read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer / counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2 wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP-Thin Quad Flat Pack and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5volts.The device achieves throughputs approaching 1M IPS per MHz.

3. PIN DIAGRAM

FIG.3.1.PIN DIAGRAM OF MICRO CONTROLLER

3.1Description of pin diagram

Micro Controller	ATmega328P
Operating Voltage	5V
Input Voltage (Recommended)	7-12V
Input Voltage (Limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current Per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32KB (ATmega328P) Of which 0.5KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 Mhz
Length	68.6 mm
Width	53.4 mm
Weight	23 Gms

4. EXPLANATION OF BLOCK DIAGRAM

The Block diagram consists of a GSM & GPS modems, an Arduino Microcontroller, a LCD display, sensors, buzzers and power supply.

A GSM modem is used to get the messages from the mobile as well as reading the message also. In this system mainly we have microcontroller, power supply, LCD, GSM. Arduino Microcontroller is a heart of this project. The total controlling action will be done through this Auduino microcontroller. Here we have taken train as an example and established a complete control system in the train bogies. When the current or load increases, or when heat was detected by the sensor then it automatically sends a message to the driver and guard indicating to halt the train immediately and the location of the train to the nearby control station to take further action, with the help of Arduino microcontroller, GSM and GPS modems. Once the signal is send by the GSM modem to the loco pilot, the loco pilot applies break. Automatic alarm system which alerts all the passengers at sleep during the night. When the temperature senses it triggers the alarm in the coaches to make the people alert and wakeup who are sleeping and also it provides external and internal alarms, together with automatic operation of the train braking system by loco pilot. The thermocouple temperature sensor-(thermistor) is to monitor for fire conditions within rail coach. The maximum power supply required to operate the circuit is +5V DC voltage. A LCD display is used at the output section to display the message and location of loco.GPS Modem is used to track the location of the train. The message send by GSM consists of latitude & longitude and in which boogie the fire accident is occurred.

Thus, it has great development potential and a

promising market application in the field of industrial control. By applying a wireless sensor based GSM technology for train fire monitoring system, information can be easily collected and analyzed at any time. In addition the system can be extended significantly, the cost of equipment maintenance could be reduced and the whole system could be optimized.

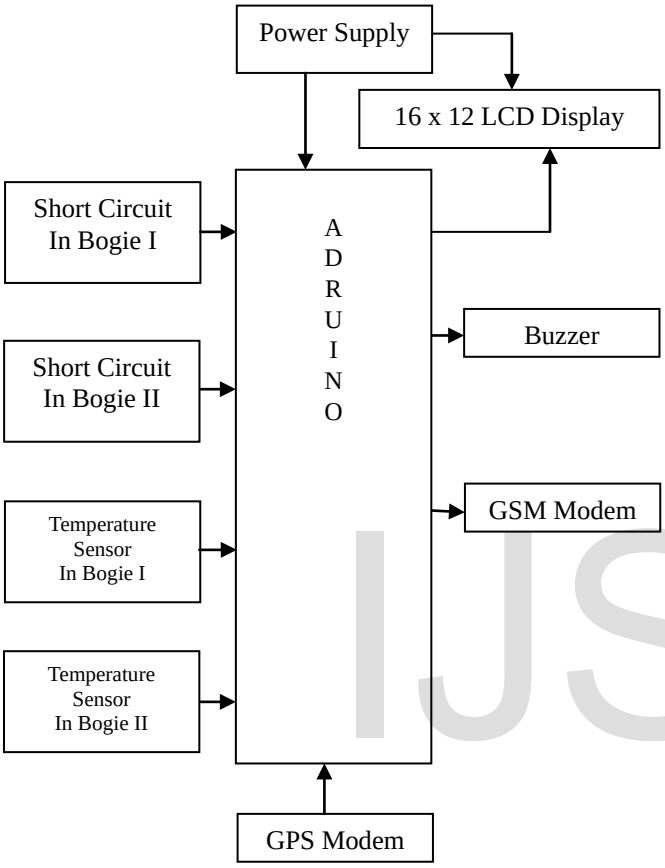


FIG.4.1.BLOCK DIAGRAM OF RAILWAY BRIDGE AMAGE AND TRACK FAULT DETECTION

5. CIRCUIT DIAGRAM

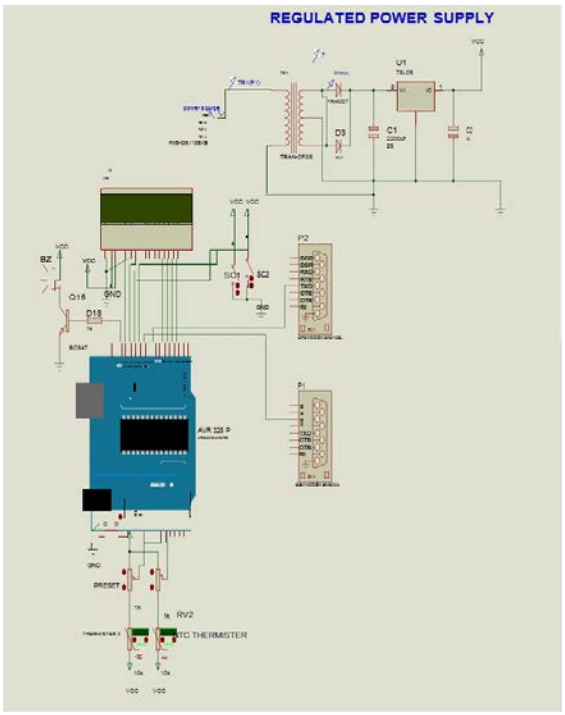


FIG .5.1.CIRCUIT DIAGRAM OF FIRE DETECTION

5.2. Description of circuit diagram

5.2.1Short Circuit

A common type of short circuit occurs when the positive and negative terminals of a battery are connected with a low-resistance conductor, like a wire. With low resistance in the connection, a high current exists, causing the cell to deliver a large amount of energy in a short time

In electrical devices, unintentional short circuits are usually caused when wire's insulation breaks down, or when another conducting material is introduced, allowing charge to flow along a different path than the one intended.

In mains circuits, short circuits may occur between two phases, between a phase and neutral or between a phase and earth (ground). Such short circuits are likely to result in a very high current and therefore quickly trigger an over current protection device

However, it is possible for short circuits to arise between neutral and earth conductors, and between two conductors of the same phase. Such short circuits can be dangerous, particularly as they may not immediately result in a large current and are therefore less likely to be detected. Possible effects include unexpected energisation of a circuit presumed to be isolated. To help reduce the negative effects of short circuits, power distribution transformers are deliberately designed to have a certain amount of leakage reactance. The leakage reactance (usually about 5 to 10% of the full load impedance) helps limit both the magnitude and rate of rise of the fault current.

A short circuit may lead to formation of an electric arc. The arc, a channel of hot ionized plasma, is highly conductive and can persist even after significant amount of original material of the conductors was evaporated. Surface erosion is a typical sign of electric arc damage. Even short arcs can remove significant amount of materials from the electrodes. The temperature of the resulting electrical arc is very high (tens of tho usands of degrees Fahrenheit), causing the metal on the contact surfaces to melt, pool an d migrate with the current, as well as to escape into the air as fine particulate matter.

The short circuit diagram is shown in Fig. 5.2

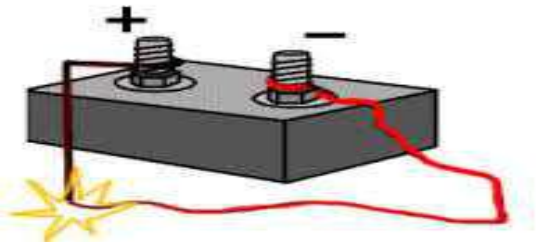


Fig 5.2 Short Circuit

6. HARDWARE COMPONENTS

6.1. Power supply: The supply given is the +5V D.C. The incoming power is 230V A.C., there is a need to convert it into +5V D.C. The input A.C. supply is stepped down from 230V to 9-0-9V. The rectifier consists of diodes D1 and D2 makes the supply D.C. The output of ordinary power supply is fed to the voltage regulator which produces the final output.

6.2. ***Voltage Regulator:***The LM 78XX series of the three terminal regulations is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation. The voltages available allow these regulators to be used in logic systems, instrumentation and other solid state electronic equipment. The LM 78XX series is available in aluminum to 3 packages which will allow over 1.5A load current if adequate heat sinking is provided. Current limiting is included to limit the peak output current to a safe value. The LM 78XX is available in the metal 3 leads to 5 and the plastic to 92. For this type, with adequate heat sinking, the regulator can deliver 100mA output current. The advantage of this type of regulator is, it is easy to use and minimize the number of external components.

6.3. Liquid crystal display: To understand the operation of an LCD, it is easiest to trace the path of a light ray from the backlight to the user. The light source is usually located directly behind the LCD, and can use either LED or conventional fluorescent technology. From this source, the light ray will pass through a light polarizer to uniformly polarize the light so it can be acted upon by the liquid crystal (LC) matrix. The light beam will then pass through the LC matrix, which will determine whether this pixel should be "on" or "off". If the pixel is "on", the liquid crystal cell is electrically activated, and the molecules in the liquid will align in a single direction. This will allow the light to pass through unchanged. If the pixel is "off", the electric field is removed from the liquid, and the molecules with in scatter. This dramatically reduces the light that will pass through the display at that pixel.

6.4.Global System for Mobile Communications: GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM differs from first generation wireless systems in that it uses digital technology and time division multiple access transmission methods. GSM is a circuit-switched system that divides each 200 kHz channel into eight 25 kHz time-slots. GSM operates in the 900 MHz and 1.8 GHz bands in Europe and the 1.9 GHz and 850 MHz bands in the US. The 850 MHz band is also used for GSM and 3GSM in Australia, Canada and many South American countries. GSM supports data transfer speeds 9.6 kb/s, allowing the transmission of basic data services such as SMS (Short Message Service). GSM satellite roaming has also extended service access to areas where terrestrial coverage is not available.

6.5.Global Positioning System (GPS):A GPS receiver calculates its position by precisely timing the signals sent by GPS satellites high above the Earth. Each satellite continually transmits messages that include

- The time the message was transmitted
- Satellite position at time of message transmission

The receiver uses the messages it receives to determine the transit time of each message and computes the distance to each satellite. These distances along with the satellites locations are used with the possible aid of trilateration, to compute the position of the receiver. This position is then displayed, with a moving map display or latitude and longitude. Many GPS units show derived information such as direction and speed, calculated from position changes.

6.6. RS232 Cable:RS 232 is defined as the interface between data terminal equipment and data communication equipment using serial binary data exchange. RS-232 is the most known serial port used in transmitting the data in communication and interface. The three links provides "transmit", "receive" and common ground. The "transmit" and "re-

ceive" lines on this connecter send and receive data between the computers. The two pins are TXD & RXD. There are other lines on this port as RTS (Request To Send), CTS (Clear To Send), DSR (Data Set Ready), DTR (Data Terminal Ready), and RTR (Ready To Receive), RI (Ring Indicator). The "1" and "0" are the data which defines a voltage level of 3V to 25V and -3V to -25V respectively.

6.7. BUZZER:

Fig 6.7: Buzzer

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.

6.8 MAX232 IC:

The MAX-232 is an integrated circuit first created in 1987 by Maxim Integrated products that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX-232 is a dual driver/receiver and typically converts the Rx, Tx, CTS and RTS signals. The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range. The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTL levels. . When a MAX232 IC receives a TTL level to convert, it changes a TTL Logic 0 to between +3 and +15 V, and changes TTL Logic 1 to between -3 to -15 V, and vice versa for converting from RS-232 to TTL. This IC provides best noise rejection and very reliable against discharges and short circuits.

Fig 6.8 MAX232 IC

6.9 Sensors:A sensor is a device that detects and responds to some type of input from the physical environment. The specific input could be light, heat, motion, moisture, pressure, or any one of a great number of other environmental phenomena. The output is generally a signal that is converted to human-readable display at the sensor location or transmitted electronically over a network for reading or further processing.

A sensor's sensitivity indicates how much the sensor's output changes when the input w being measured changes.

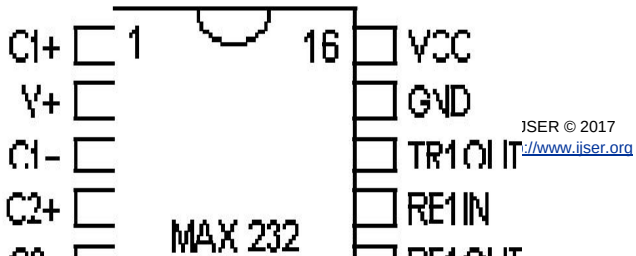
A good sensor obeys the following rules:

· It is sensitive to the measured property
· It is insensitive to any other property likely to be encountered in its application and
· It does not influence the measured property

The sensitivity is then defined as the ratio between the output signal and measured property. For example, if a sensor measures temperature and has a voltage output, the sensitivity is a constant with the unit [V/K]; this sensor is linear because the ratio is constant at all points of measurement.

7. RESULTS

When the current or load increases, or when heat was detected by the sensor then it automatically display the message on a LCD which is connected in the driver room and buzzer sounds which indicating loco to halt the train immediately. The detection of fire accidents kit is as shown in fig.8.1



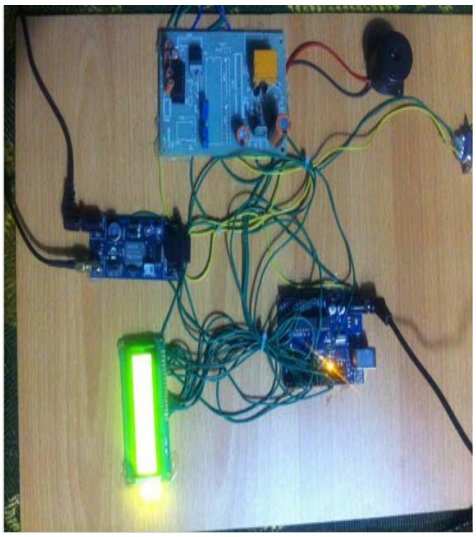


Fig.7.1. Detection of fire accidents kit

When the fire is detected the message is sent to the nearby control station to take further action. The output at the control room (mobile) is as shown in Fig8.2.This process is done by using GSM modems

Fig. 7.2. Output in Mobile phone when inputs are applied.

8. ADVANTAGES AND APPLICATIONS

8.1. *Advantages:*

- It reduces the time delay.
- Simple and easy to implement.

8.2. Applications:

- Can be used in Trains and other vehicles
- Used in Home automation system
- Used in industries

9. CONCLUSION

The project " DETECTION OF FIRE ACCIDENTS USING GSM & GPS TECHNOLOGY" has been successfully designed and tested. Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC's and with the help of growing technology the project has been successfully implemented.

10. FUTURE SCOPE

Wireless sensor network are increasingly applied in the field of fire safety and monitoring. In addition, wireless sensor technology has a broad application background in the field of real time forest fire monitoring.

11. REFERENCES

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12. AUTHORS BIBLOGRAPHY

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