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# Real Time Implementation of Train Accident Prevention System Using Embedded Sensor Networks

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### Abstract

Now a day we know that train collision may occur due to many reasons. This system is aimed to avoid the train collision by giving an alert system to the driver and providing information to the station. The modern technology uses this system to detect the fire accidents, train collisions and also to inform the respective authorities with minimum delay. Two types of sensors fire sensor and Ultrasonic Sensor are use to detect the accidents. The signal from these sensors will activate the microcontroller which in-turn activates the message transfer system, alarm system, water sprinkler system and the motor to automatically open the emergency door of the bogie in which the accident took place.

Key Words: Microcontroller, GSM, Sensors.

## I. Introduction

One of the most widely used and comfortable nodes of transportation system is train, but occasionally, accidents are occur due to collision as well as other reason. It is very difficult to stop such collisions because of speed of moving trains, which is needs a lead distance to stop.

The Indian Railways has the world's fourth largest railway network in the world, after that of the United States, Russia and China. The railways traverse the length and breadth of the country and carry over 20 million passengers and 2 million tons of freight daily. It is one of the world's largest commercial or utility employers, with more than 1.6 million employees. About 15000 trains work every day. Unfortunately there have been many accidents involved in the railways.

The Railways has the most intricate and involved interdependencies. Safety on the Railways is the end product of the cohesive fusion of its myriad parts. A single flaw in the 64,600 route kms of track that criss-cross the country, a defect in over 9,500 locos, 55,000 coaches and 2.39 lakhs wagons that haul about 23 million passengers and nearly 2.7 million tons of freight every day, an incorrect indication on one of the thousands of signals that dot the rail landscape, a mistake or an act of negligence by one of its staff directly associated with train running, even a rash act by one of the millions of road users who daily negotiate around odd level crossing gates spread across the system, an irresponsible act of carrying inflammable goods – any one of these multiple possibilities has the potential to cause a major tragedy. Added to these are the acts of sabotage by misguided elements spanning the whole country, Thus utmost vigil is safety in operations and also security of the travel.

#### II. Block Diagram of the System

In these systems Microcontroller and the sensors are the main elements. Along with these there are a motor, a buzzer, an LCD display, water sprinklers and a GSM Modem. The two Sensors are placed in appropriate places to detect the fire and object. They are connected to the microcontroller. The block diagram of the system is shown in figure 1. Fire accident if any occurs in the train will result in fire and then high degree of heat. So whenever a fire accident occurs in train's sensor will be activated and will give the signal to the microcontroller.

Object is present in the railway track means the ultrasonic sensor fin out the object and give the information to the controller. The ultrasonic sensor consists of two parts there are Tx-er and Rx-er.

Tx-er part continuously sending an ultra sound wave if any object is placed in track means the wave should be reflected and then the Rx-er receive a reflected wave. Immediately the controller will activate buzzer system to alert the passenger.

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Figure 1: Block diagram of the system

The fire will be occurring in the compartment means the water sprinklers will turn ON to extinguish the fire, motor to open the emergency door. The GSM system is also activated and sends an emergency message to the mobile numbers of the officials which are already store in the memory. An LCD display is also provided in the bogies to display the alert message and the condition of the GSM system.

#### **III.Microcontroller**

Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer. A microcontroller combines on to the same microchip: 1.The CPU core, 2.Memory (both ROM and RAM), 3.Some parallel digital I/O. Microcontrollers will combine other devices such as: 1. A timer module to allow the microcontroller to perform tasks for certain time periods. 2. A serial I/O port to allow data to flow between the controller and other devices such as a PIC or another microcontroller, 3. An ADC to allow the microcontroller to accept analogue input data for processing. Microcontrollers are smaller in size, Consumes less power and Inexpensive Micro controller is a stand alone unit, which can perform functions on its own without any requirement for additional hardware like I/O ports and external memory.

The heart of the microcontroller is the CPU core. In this system taking an AT164P microcontroller where AT indicates Atmel company. The device is manufactured using Atmel's high density nonvolatile memory technology. The On chip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional nonvolatile memory programmer, or by an On-chip Boot program running on the AVR core. The boot program can use any interface to download the application program in the Application Flash memory.

Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega16 is a powerful microcontroller that provides a highlyflexible and cost-effective solution to many embedded control applications.

The ATmega16 AVR is supported with a full suite of program and system development tools including the following features: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits are mainly used in ATmega 164P.

Features of AT164P Microcontroller:

- 1. High-performance, Low-power Atmel AVR 8-bit Microcontroller
- 2. Up to 16 MIPS Throughput at 16 MHz
- 3. On-chip 2-cycle Multiplier
- 4. 16 Kbytes of In-System Selfprogrammable Flash program memory
- 5. Power-on Reset and Programmable Brown-out Detection
- 6. Internal Calibrated RC Oscillator
- 7. External and Internal Interrupt Sources
- 8. Programmable Serial USART
- 9. Master/Slave SPI Serial Interface
- 10. Programmable Watchdog Timer with Separate On-chip Oscillator

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## Figure 2: Pin Diagram of AT164P

The AT164P is designed with static logic for operation down to zero frequency and supports two software selectable power saving mode. The Idle mode stops the CPU while allowing the RAM, timer/ Counter, serial port, and interrupt system to continue functioning. The power down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next hardware reset.

#### IV. Sensors

#### ULTRASONIC SENSOR:

Ultrasonic sensors (also known as transceivers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring the wind speed and direction (anemometer), fullness of a tank and speed through air or water.

An ultrasonic sensor transmits ultrasonic waves from its sensor head and again receives the ultrasonic waves reflected from an object. By measuring the length of time from the transmission to reception of the sonic wave, it detects the position of the object.



**Figure 3**: Ultrasonic Sensor Operation Sound Velocity in the Atmosphere:

The sound velocity in the atmosphere reaches 331.45 m/s when the temperature is 0°C. The sound velocity at different temperatures can be calculated with the following formula.

C = 331.45 m/s + 0.607 m/s x

Where.

C: Sound velocity T: Current temperature

FIRE SENSOR:

LDR can be used as fire sensor. The light sensitive part of the LDR is a way track of cadmium sulfide. Light energy triggers the release of extra charge carries in this material, so that its resistance falls as the level of illumination increases.



Figure 4: LDR as Fire Sensor

#### V. GSM Technology, Buzzer and Water Sprinklers

GSM (Global System for Mobile communication) 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 TDMA transmission methods.

GSM is a circuit switched system that divides each 200 kHz channel into eight 25 kHz time slots. It operates in the 900 MHZ an 1.8GHZ bands in Europe an the 1.9 GHZ an 850 MHZ bands in the US.GSM supports data transfer

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speeds 9.6 kbit/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. The transmission power in the handset is limited to a maximum of 2 watts in GSM850/900 and 1 watt in GSM1800/1900.

GSM has used a variety of voice codec's to squeeze 3.1 kHz audio into between 5.6 and 13 Kbit/s. Originally, two codes named after the types of data channel they were allocated, were used, called Half Rate (5.6 Kbit/s) and Full Rate (13 Kbit/s). These used a system based upon linear predictive coding (LPC). In addition to being efficient with bitrates, these codes also made it easier to identify more important parts of the audio, allowing the air interface layer to prioritize and better protect these parts of the signal.

#### 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.

#### WATER SPRINKLERS:

The main function of the water sprinkler is for sprinkling is for sprinkling the water, in these system when the sensors get activated it produces power to the motor, water is released through the water sprinklers.

## **VI.** Conclusion

The system introduced a low cost, lowpower embedded system for railway accidents control system and we discuss the design of proposed safety system for railway, using AT mega Microcontroller as hardware platform, and combines with GSM as a communications platform of wireless area network, which can transmit, receive and display the train information. The result shows that this new innovative technology will increase the reliability of safety systems in railway transport. References

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