

## Hybrid Integrated Intelligent Train System

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The main aim of the project is to identify the cracks in railway track. In order to find the cracks in railway track they have chosen a technique using ZigBee communication to transmit the signal. When the crack is detected it applies auto braking mechanism. When the fire detection is done, it is indicated using sensors and automatically the bogie which is on fire is detached from rest of the bogies. For passengers traveling to unknown destinations railway info system is also provided, for the problem related with baggage theft an app is installed in the user phone which will indicate the baggage theft.

**Keywords:** Crack Detection, Fire Detection, Station Info, Ambulance Info, Baggage Theft

**1. INTRODUCTION**

Today's most of the people uses railway for transportation, it is essential for transferring the goods and passengers from one place to another place. And also the railway system are provide facility such as high speed, with economical, environment friendly, safety, and better characteristics of railway systems. Depending on the fast developments in railway systems, high-speed trains are used, and rail transportation is increased day by day. These characteristics can be performed by time to time maintenance and control measurements. But depending on different factors, deformations and derailment may occur on the superstructure of railways. These derailments and other problems of railway system like, improper maintenance and the currently irregular and manual track line monitoring mistake from workers. Such deformation and derailment are determining on time and taking precautions is very important for the safety of railway systems.

Travelling is an integral part of life. Train travelling is the one of most prominent, efficient, cost effective and simple means of transport. Railways are facing increasing needs in term of safety, survives to passengers and operational efficiency. In spite of all the technical advancements in railways, which are eminent inside the trains and in the management systems, accidents claiming humongous amounts of life and property are still a common place .

The system, which is proposed, reduces the work of the driver and automates most of the processes in a train by which major accidents can be controlled. Addressing the Requirements & Service Needs of the Railway Sector, It provides a consistent, timely and cost effective services & solutions which makes the Train Travelling and journey more enjoyable and trust the System completely.

Railways are facing increasing needs in term of safety of passengers and operational efficiency. Addressing the Requirements & Service Needs of the Railway Sector, This paper provides a consistent, timely and cost effective services & solutions which makes the Train Travelling and journey more enjoyable and trust the System completely flexible in practical applications.

**2. RELATED WORK**

The Indian railway network today has a track length of 121,407 kilometres (75,439 mi).over a route of 67,368 kilometres (41,861 mi) and 7,083 stations. It is the fourth largest railway network in the world exceeded only by those of the United States, Russia and China. The rail network traverses every length and breadth of India and is known carry over 30 million passengers and 2.8 million tons of freight daily. Despite boasting of such impressive statistics, the Indian rail network is still on the growth trajectory trying to fuel the economic needs of our nation. Though rail transport in India growing at a rapid pace, the associated safety infrastructure facilities have not kept up with the aforementioned proliferation. Our facilities are inadequate compared to the international standards and as a result, there have been frequent derailments that have resulted in severe loss of valuable human lives and property as well.

With the advent of powerful digital signal processors, Image Processing techniques [1] have been explored to formulate solutions to the problem of railway crack detection. Though it provides good accuracy, this method uses techniques like image segmentation, morphology and edge detection all of which take a lot of processing power and an extreme amount of time rendering the robot slow and thereby unsuitable. Recent research has investigated the use of microwave horn antennas for crack detection [2]. This technique was found to produce very accurate results in lab based testing. But, unfortunately it requires spectrum analysers which are both costly and also can't be placed

on-board a moving robot because of their delicacy. Eddy current based methods ([3], [4] and [5]) are used to tide over limitations associated with ultrasonic and microwave techniques. However they have the problem of very slow Overall speed which reduces the usability of the same. A vast majority of the work done in the field of crack detection uses the infrared sensing technique ([6], [7] and [8]). It is a well understood technique so much so that it was initially thought to be the best solution to the problem of crack detection, but later it was found to be prone to external disturbances and hence came to be considered inaccurate. Techniques that employ ultrasonic ([9], [10] and [11]) tide over some of the problems mentioned earlier, but they can only inspect the core of the track; that is, it cannot check for surface and near surface cracking where most faults are usually located. Several other miscellaneous techniques like observation and analysis of wave propagation via model impacts and piezo actuation [12] have also been developed. The problem inherent in all these techniques is that the cost incurred is high.

### 3. PROPOSED SYSTEM

In this proposed system we use SST89E516RC2 microcontroller. It is a low power, high speed technology. SST89E516RC2 is a low cost and easy to program microcontroller. It is the widely used IC from ARM-7 family. Before the start of the rail- way line scan the robot has been programmed to self-calibrate the IR Transmitter and Receiver. After measurement, the robot takes time for a Predetermined period so that the on board GPS module starts detecting the correct geographic location. The principle involved in this crack detection is that light reaching the IR receiver is proportional to the intensity of crack i.e. when maximum light transmitted by transmitter reaches the receiver the crack intensity is more. The IR transmitter will be attached on one rails track and the IR receiver mounted on opposite rails track. During normal operation, when there are no cracks, the light from transmitter does not fall on the receiver and hence the set value is low. When the light from transmitter falls on the receiver, the value gets increased and the amount by which it is incremented will be proportional to the intensity of the incident light. As a consequence, when light from the transmitter deviates from its path due to the presence of a crack or a break, a sudden increase in the value can be observed.

This change in value indicates the presence of a crack or some other similar structural defect in the rails. In order to find out current location of crack in rail track, here we use of a GPS receiver whose function is to receive the current data form faulty location. To communicate the received information, we make a use of GSM modem The GSM module is being used to send information as an SMS. The system working is achieved by interfacing the GSM and GPS modules with the LPC2148 microcontroller. The robot having four wheels which are drive by using two motor and this powered by two 12V batteries. This design is very simple and sensible therefore device easily works.

## 4. SYSTEM MODEL AND DESIGN GOALS

### 4.1 System Model

As illustrated in Fig. 1, the system model consist of different entities: the microcontroller, a group of sensor, relay, drivers, motors and ZigBee.

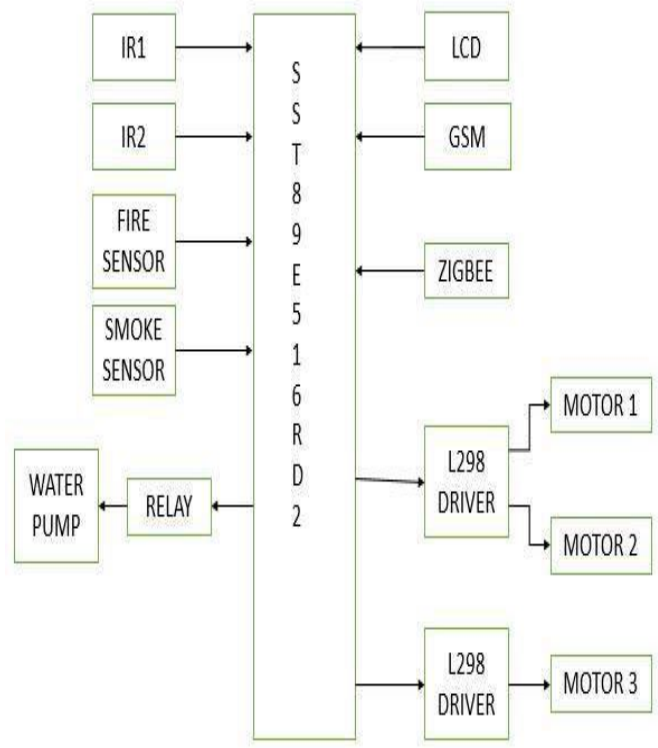


Fig. 1. System model

### 4.2 Component Description

#### SST89E516RD2 MICROCONTROLLER



It has a 5V operating voltage from 0 to 40 MHz. 64 kB of on-chip flash user code memory with ISP and IAP. SPI and enhanced UART. Four 8-bit I/O ports with three high-current port 1 pins. Three 16-bit timers/counters. Programmable watchdog timer. Eight interrupt sources with four priority levels. Second DPTR register Low EMI

mode (ALE inhibit) TTL- and CMOS-compatible logic levels.

**Infrared Sensor**



Infrared sensor is an electronic device, which emits and sense some aspects of surroundings. IR sensor also detects the motion and measure the heat of an object. In the infrared spectrum, all objects are radiate in the form of thermal radiations. These kind of radiations are invisible to our eyes, which is detected by an infrared sensor. The emitter is same as that of an IR LED (Light Emitting Diode) and the detector is same as that of IR photodiode. When IR light falls on the photodiode, output voltage and resistance change in the proportion to the magnitude of the IR light received.

**Fire Sensors**



The Fire sensor is used to detect fire flames. The module makes use of Fire sensor and comparator to detect fire up to a range of 1 meters. Allows your robot to detect flames from up to 1 M away. Calibration preset for range adjustment. Indicator LED with 3 pin easy interface connector. Input Voltage +5VDC

**LCD (Liquid Crystal Display)**



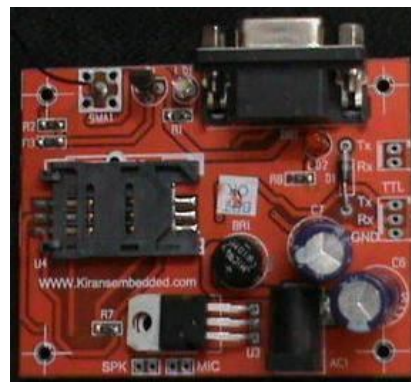
LCD screen is nothing but an electronic display module and it is used for various applications. A LCD display is a 16x2 basic module. Basically this is used in various devices. In Liquid Crystal Displays (LCDs) operating voltage is 4.7V-5.3V. It is an alphanumeric LCD display module can display alphabets and numbers. It consist of 2 rows and each row can print 16 characters. Each character is built by a 5 X 8 pixel box. It can work both on 4 bit and 8 bit mode

**Buzzer**

Piezoelectric buzzer is an electronic device which commonly used to produce sound. Low weight, simple construction and economical make it usable in various applications like car reversing indicator, computers, mobiles bells etc. Piezoelectric buzzer is works on the inverse principle of piezoelectricity which is discovered in 1880 by Jacques and Pierre Curie. It is a principle of generating electricity when mechanical pressure is applied to certain materials. This type of materials is known as piezoelectric materials. Here in this project buzzer is used to produce sound whenever robbery occurs.

**GSM (Global System for Mobile Communications)**

Global System for Mobile Communications system is the most popular standard for mobile telephony systems in the global. The GSM is one the wireless networks which has low power and low cost communication device. The GSM Association, its support industry trade organization of mobile phone carriers and manufacturers, estimates that 80% of the global mobile market uses the standard. GSM is used by over 1.5 billion people in world across more than 212 countries. A GSM modem is a specialized type of modem which is provided slot for SIM card, and it operate just like a mobile phone. When a GSM modem is connected to a microprocessor kit it allows the microprocessor communicate with mobile network for sending message to the programming set mobile number.



## Power Supply Circuit

The whole electronic system is depend on the power supply for providing the required power for their operational circuit. For the LCD, GSM, keyboard, +5V are required and for operating buzzer +12V is required. The power supply supplied the regulated output of +5V & non-regulated output of the +12V DC supply.

## V.FLOWCHART

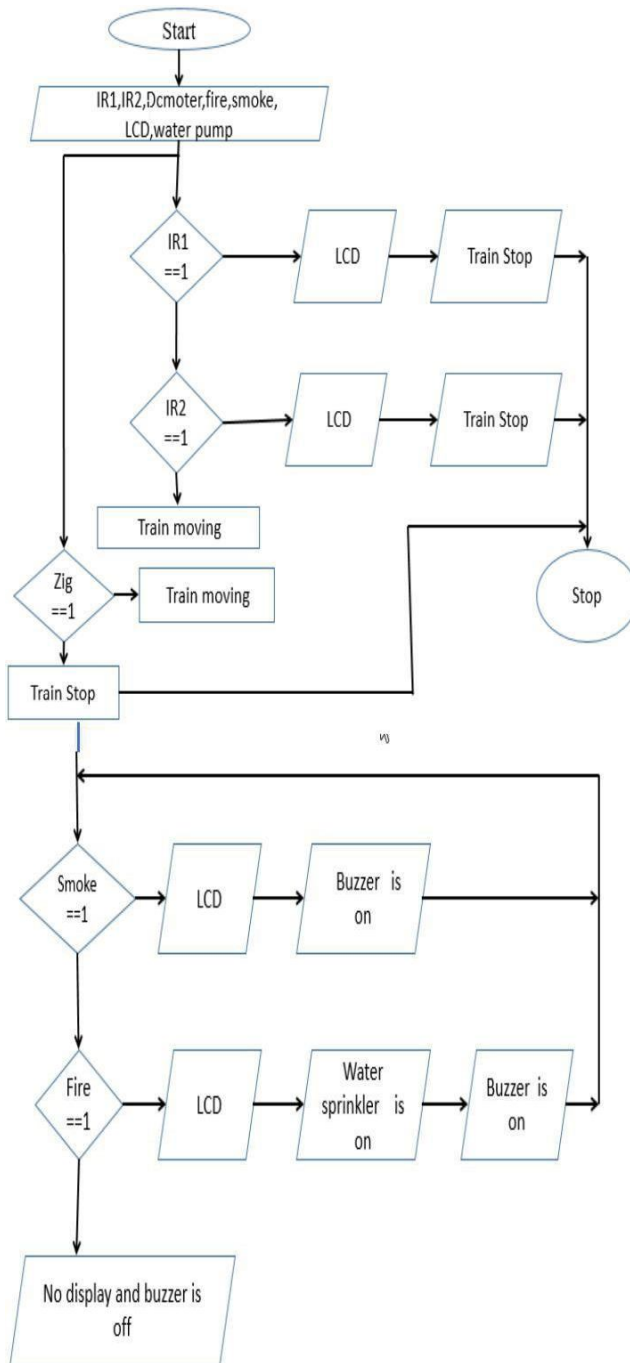


Fig 2. Proposed Flowchart

## 5. ALGORITHM

Step1: Start

Step2: Input IR1, IR2, fire, DC motor, Smoke, LCD

Step3: if IR1==1 or IR2==1 then

"Display Crack Detected" and goto Step6  
else

"Train is Moving"

end if

Step4: if Zig==1 then

goto step6

else

"Train is Moving"

end if

Step5: if Smoke==1 then

"Display Smoke Detected" and Turn on  
the Buzzer.

else if fire==1

"Display fire Detected" and Water sprinkler  
Is on

end if

end if

Step6: Stop

## 6. MODULE DESCRIPTION

### 6.1. Crack Detection :

The current state of the art in detecting immediate and long-term railway track problems involves both inspectors walking the track lines and train cars instrumented with accelerometers and ultrasonic sensors that are capable of detecting wear of the rail and breakages. Additionally, a widespread practice of sensing rail continuity by using the tracks to complete simple circuits is in place. In this paper, we propose a fundamentally different approach to improve the current practices in railway operations using wireless sensor network (WSN). The primary technical and scientific objectives of the system introduced in this paper are to generate innovative solutions for a number of the issues facing the railroad community through the development of a system based on WSN. The objectives from a railroad perspective include finding new approaches to reduce the occurrence rate of accidents and improving the efficiency of railroad maintenance activities

### 6.2. Fire Detection :

Fire / Flame Identification system is implemented in this project to identify the fire / flame in the Train and if any unwanted incident happens the Train will be stopped and the message will sent to the Main station and alarm will be given. The compartment which is on fire shall automatically be detached from the engine to

stop fire spreading to other compartments. And passengers can easily get out of the train once it is halted.

### 6.3. Smoke Indication :

Smoke detectors warn of fire when the gas level in the area reaches a certain level. Heat detectors do not notice smoke. A gas detector is a valuable additional protection in areas where heat detectors are not recommended. The gas of a particular area is monitored, indicated with different set points and the Data will be transmitted to MCU and alarm is raised.

## 7. RESULT & CONCLUSION

In this paper, we have presented the IR sensor based crack detection of railway system GSM & GPS technology. The crack can be detected easily & it does not give the false output. IR Sensor base crack detection system automatically detects the faulty rail track without any human interface. This method having many advantages on traditional detection techniques. The main advantages of this system like less cost, low power consumption, on time data operation and minimum analysis time. The simple idea can be implemented in large scale in order to have long run to facilitate better safety and provide effective testing infrastructure for achieving better results in the future.

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