

# Application of Sensors in Railway Tracks for Safety

Karthikamani R, Sathish Kumar.R, Divya.N

**Abstract:** Safety is important in context to any physical mobility. The journey in train has now become more dangerous because of some natural and man-made phenomenon such as floods, earthquakes, cracks in railway tracks, climatic changes etc. To get rid of such dangerous situation sensors are used for safe journey. Many techniques such as crack detection using vibration sensor, obstacle detection using IR sensor, crack and obstacle detection using laser, image processing etc have been used. But the proposed system came out with a brilliant idea of using PIR sensor and electrochemical fatigue sensor for obstacle and crack detection. The system also uses GSM based message alerting so that engine driver can stop the train according to the message received.

**Keyword:** Safety, Cracks, Obstacles, PIR Sensor, Electrochemical Fatigue Sensor, GSM.

## I. INTRODUCTION

The Indian Railways is among the world's biggest rail systems. The Indian Railways course length arrange is spread more than 115,550 km, with 12,617 passenger trains and 7,421 goods prepares every day from 7,439 stations handling 26 million travelers and 3.5 million tons (MT) of cargo day by day. India's railroad organize is perceived as one of the biggest railroad frameworks on the planet under single administration. The rail road arranges is likewise perfect for long travel and development of mass products, aside from being a vitality effective and financial method of movement and transport. Indian Railways was the favored transporter of autos in the nation with stacking from vehicles movement growing 16 for every penny in 2017-18. Safety has been one of the greatest worries in the Indian Railways framework. While the quantity of mischance's has gone down finished the most recent couple of years, the number still stays more than 100 mishaps per year.

Steps have been taken to lessen the mishaps in railroads. The proposed framework turned out with a successful thought of utilizing sensors for railroad wellbeing, which is a financially savvy technique. Here the sensors like PIR sensor is utilized for obstruction discovery and Electromagnetic weakness sensor is utilized for split location in railroad track and detecting those data through GSM [1]

## II. LITERATURE REVIEW

Mrs. V.Mahalakshmi, Dr.K.O.Joseph has proposed a railroad track study framework utilizing at89c51, biaxial inclinometer,

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GNSS receiver.at89c51 is a 8-bit microcomputer with 4kb of glimmer goes about as a focal part of this following framework due to its high adaptability and cost adequacy.

The rise point and the track co-ordinates are measured by the biaxial inclinometer and GNSS beneficiary separately. The fundamental favorable position of the framework is that it can overview the track even in tunnels with no interferences where GNSS bombs now and again [1]. Mehaboob. Mujawar, Sangam. Borkar turned out with the new thought of giving remote security to the Indian railroads. They have utilized IR sensor and ultrasonic sensor to recognize the obstructions on the railroad tracks. IR sensor is utilized to track the broken track where ultra sonic sensors are utilized to decide the correct area of the track. All these procedure are done with the control of Pic microcontroller [2].

Siegfried Miickel, Frank Scherer, Peter F. Schuster built up a framework with sensors for railroad security. The framework comprise of three sensors LIDAR dynamic optical sensor which is two dimensionally filtering sensor in view of the season of flight rule. They have a capacity to check long separations with high accuracy. The inactive sensor (camera) is utilized to catch the long scope of the railroad track. The speed of the prepare and its situation on the track are distinguished by the virtual sensor [3].

## III. PROPOSED SYSTEM

The proposed system is provided with three module sensor module, processing module and the transmission module. Sensor module is provided with two sensors PIR sensor and the electromagnetic fatigue sensor. And the next module processing module is provided with microcontroller for processing the data from the sensor and the final module is the transmission module. Here the data is sent to the train engineer using GSM.

### A. Sensor Module

The sensor module is attached with two sensor PIR sensor and the electromagnetic fatigue sensor. These sensors are used to the sense the obstacles and cracks in the railway track when the train is moving.

#### a. PIR Sensor:

The term PIR is an acronym of the passive infra red. The expression "passive" shows that the sensor does not effectively partake all the while, which implies, it doesn't emanate the alluded IR signals itself, rather latently identifies the infrared radiations originating from the human body in the encompassing territory [4]. it can adequately work up to the scope of 10 meters.

PIR sensor can screen the adjustments in warm produced by each protest when it finds any adjustments in the emanation of the objects.

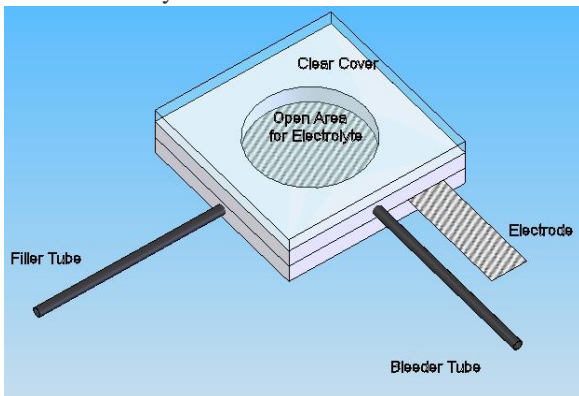


**Fig (1) Image of PIR sensor**

*b. Electrochemical Fatigue Sensor:*

Electrochemical weakness sensor is utilized to distinguish the breaks with the steel objects. They are given EFS sensor, EFS electrolyte, EFS potentiostat data link (PDL). EFS sensor is furnished with R sensor and CM sensor put close-by for consistent checking and the EFS electrolyte is water construct arrangement connected in light of the sensor .and EFS PDL is utilized for gathering information's and giving the procured results[5].

The EFS depends on electrochemical standard .The electric current delivered from synthetic concoctions in ECC underlies the essential response called as oxidation-lesening response or redox response. Event of such responses causes arrival of electrons from metals utilized. On the off chance that metal loses electron it gets oxidized and on the off chance that it picks up it is lessened. At whatever point such responses happen free vitality gets diminished and shows up as electrical vitality.



**Fig (2) Image of Electrochemical Fatigue Sensor**

**B. Processing Module:**

It is the second procedure in the proposed framework where the detected information is prepared utilizing the microcontroller .Here raspberry pi is utilized to process the information from the sensors [6]. Raspberry pi is a Mastercard measured PC with help of 40 GPIO pins, empowering it to test the sensor information at general interims. It has an on board processor ground-breaking enough to gather and process information all the while. The Raspberry Pi might be worked with any bland USB PC console and mouse it might likewise be utilized with USB stockpiling, USB to MIDI converters, and for all intents and purposes some other gadget/part with USB capacities. Different peripherals can be appended through the different pins and connectors on the surface of the Raspberry Pi.

**C. Transmission Module:**

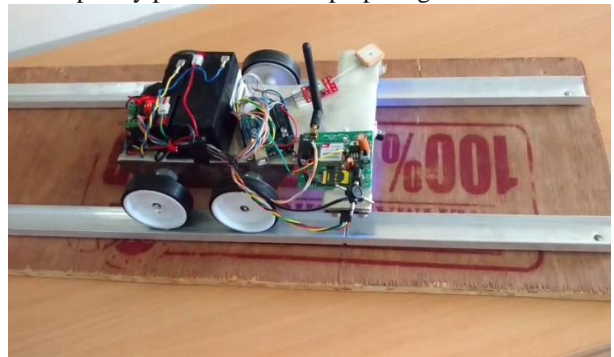
The last advance in the proposed framework is that transmitting the handled information to the mobile phone. The information is transmitted to the prepare designer's close to home cell phone through GSM [13]. GSM framework was produced as an advanced framework utilizing time division different access (TDMA) strategy for correspondence reason [7]. A GSM digitizes and decreases the information, at that point sends it down through a channel with two unique surges of customer information, each in its own specific schedule vacancy. The computerized framework has a capacity to convey 64 kbps to 120 mbps of information rates.gsm comprise of portable station, base station subsystem and system subsystem. The framework helps in suggesting the client that there is an issue in proceeding with the present work through alarms.



**Fig (3) GSM Transmitting the Information**

**D. Working and Results:**

The sensors, for example, PIR sensor and the electrochemical weakness sensor are connected to the surface of the trains [8]. This persistently screens the adjustment in warm created by the items before the prepare and voltage changes through electrolytic arrangement connected on the electrochemical exhaustion sensor. The gained information from the sensors are given to the microcontroller board for additionally preparing [9],[10]. Here raspberry pi is utilized for preparing the information.



**Fig(4) Images of Train with Sensors and GSM Module Detecting Crack and Obstacles**

Raspberry pi is given 40 GPIO pins. These pins are utilized to take the information from the sensors and process them. Handled information from the raspberry pi module sent to the mobile phone with the assistance of GSM [11].



GSM is an institutionalized convention for sending and accepting information by means of a 2.4GHz remote connection. It's a protected convention, and it is appropriate for negligible range, less power devouring, more affordable, remote transmissions between electronic gadgets [12]. The utilization of GSM innovation enables the framework to track prepare and gives the most a la mode data about the prepare track. This framework discovers its application continuously activity observation [14].

#### IV. CONCLUSION

The sensor based application model for railway track improves the safety of the travelers travelling in the train. Nowadays the accidents in train tracks are increasing due to the presence of an obstacle or due to the cracks in the train tracks. The minor cracks sometimes may not be visible which in turn may cause serious accidents. The proposed system is provided with Electromagnetic fatigue sensor which senses the crack on the track and sends the information through GSM module to the personal computer. The proposed framework is exceptionally anchored, financially savvy; less power expending framework in this manner it discovers its application in numerous railroads. The framework can be additionally reached out with the utilization of a few encryption methods to evade the getting away of data's.

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