



## Automatic Detection of Crack in Railway Track

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**Abstract**—The Indian Railways (IR) is the world's largest railway system. IR carried approx. 23 million passengers daily (total 8.439 billion) in 2018-19 out of which 45 % was non-suburban passenger traffic. IR's vast rail network (third largest in the world) encompassed 68 442 route kilometers of which 63 491 kms was broad gauge (Mar 2018). During the recent times in Indian railways, frequent number of accidents have taken place due to fault like presence of cracks on rail tracks or due to break in a railway track. This is making railways a dangerous option for travelling and transportation. The monitoring system used at present in Indian railways is proving to be inappropriate and not update. To overcome this problem we making a rail monitoring system for detection of cracks an efficient monitoring system has been proposed and explained in this paper. we are using GPS module to find the crack location, infrared sensor are use to find the position of crack and GSM send the message to the drive of train.

**Keywords**— Rail tracks, crack detection, infrared sensor, ultrasonic sensor, microcontroller, Global Positioning System (GPS), Global System for Mobile Communications (GSM), PIR (passive infrared sensor).

## I. INTRODUCTION

Railways are an important part of human lives. Millions of people travel by railways on a daily basis. Travelling through railways is very economical in India but every year Indian railways encounters many rail accidents. A huge number of trains derail every year due to presence of faults in rail tracks. Faults such as misplaced bolts of fishplate or occurrence of cracks in rail tracks, object in front if train are causes of derailment of trains They have a very harmful impact on the society. Railway accidents many times cost the loss of human lives, which is the most disastrous and an irreversible loss. Along with this, loss of rail infrastructure is also caused. It is quite vital to ensure that cracks are detected during monitoring, so that the rail accidents can be avoided. In this paper we presents an implementation of robotic vehicle that is suitable for railway application. In this paper we going to

use IR sensor which help to find the crack present on the railway track. when the crack is detected its position or latitude and longitude values are send as a message to nearby station by using GPS or to the train driver by SMS. Then Ultrasonic sensor is used for the surveying process. Then other important component is PIR sensor it is used to detect the presence of object in track.

## II. LITERATURE SURVEY

In the survey we have found that there are various train accidents causes due to which increases the range from Human Failure to Equipment Failure to Sabotage etc. As in Covid-19 situation we have seen in many new Channel showing the death of labors due to train accident. In the year between 2009-10 and 2014-15, human failure has caused more than 86% of the total accidents. Out of this, 41% accidents were caused due to the failure of railway staff because of many difficulty face by the railway staff to keep the update information about the track over all the country it is not the easy work for manually and the rest due to the failure of others. Equipment failure caused only 2.2% of the accidents. The Indian Railway Safety Act, which came into effect in January 1989, it was made to improve human safety through rail by managing rail safety regulatory frame work, together with streamlined regulation development and process, and providing railway companies with greater freedom. In the year of 2002 there has been an increase in railway accidents mainly due to train derailments. The present system may not have latest technology due to which sometime the staff of the railway check the crack present on the rail manually.so the time and work of the staff is also increases. In the currently crack detection system use the LED, long range ultrasonic techniques along with radiography technique are the methods used for crack detection. and south pole pairs on the axles. The crack detection system also has provision for monitoring the crack present in the railway track for locating the position where the crack pattern is detected as open. The defect can be related to absent of bolts or loosening in build the a bolts at the

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railway track are inspected.

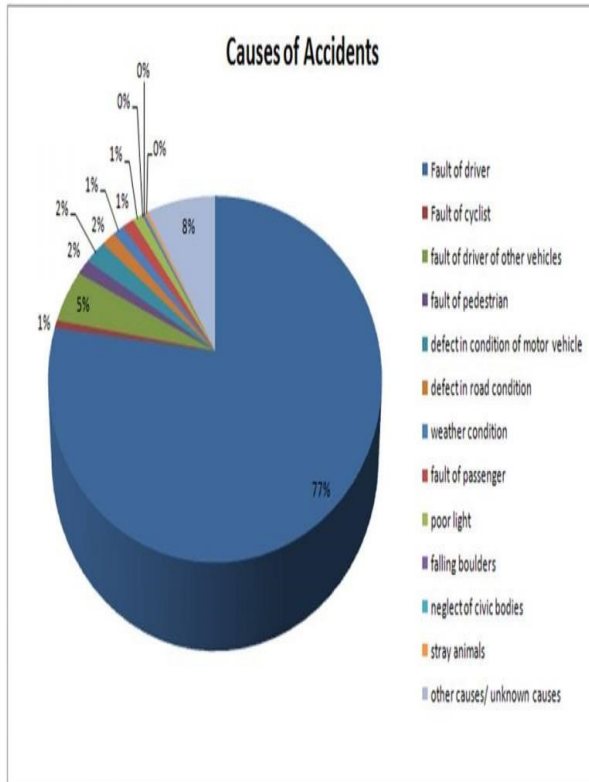


Fig. 1.

The existing systems are more complicated and time consuming. Therefore, in this paper we purposed a more latest technology and less time-consuming mode of crack detection in the railway tracks. This is a help has to save many time to find the crack.

## II. RELATED WORK

The earlier systems are not well efficient in monitoring the surface of track and near surface cracks precisely and it was inappropriate in tunnels and it was operated manually. And it also not known about the object present in front of train during running. So, by doing it manually required more time to detect the crack present on the railway track And the inform send to the authority to avoid any accidents it take more time as well as high cost and less accuracy. The proposed system can overcome these drawbacks. Our System can detect the crack on track the authority without any delay. And also find the object present of object in the front of train. The use of multiple sensors makes the proposed system highly accurate. And the cost is low when compared with the existing systems the authors have implemented a method that utilizes neural network (NN) classifier for detecting cracks present in the rail tracks. Among various wavelet bases, Gabor

functions provide the optimal resolution in both the time (spatial) and frequency domains, and the Gabor wavelet transform seems to be the optimal basis to extract local features for several reasons.

The technical motivation is that, the earlier systems used techniques like LED-LDR, infrared etc. for detecting the cracks, and all the above techniques are less accurate and are less efficient in detecting the cracks. Thus, by using multiple sensors will help for detecting the cracks effectively without any errors, and the GPS module will give the exact location of the crack to the authority. There is various algorithm present which we can use like *CTSM Algorithm*.

## III. PROPOSED SYSTEM METHODOLOG

Ultrasonic sensor is used to detect the crack present on the track and send the information to the microcontroller which is present on railway station. It analyses the input and makes robot to stop automatically providing 0 volts to DC motor. The Location of crack on the railway track is send in form of message and it is displayed on LCD display of robotic section. The location of robot is detected by GPS and information of latitude and longitude is sent to subscribe mobile station through GSM module.

Obstacle Detection IR sensor is used to detect the obstacle and sends the information to the microcontroller. It analyses the input, makes robot to stop automatically by providing 0 volt to DC motor. The “obstacle detected or crack” position displayed on LCD display of robot section. The position of robot is detected by GPS and information of latitude and longitude is sent to subscribe mobile station through GSM module. Position Detection When the robot section detects any crack or obstacle GPS module get activated, then it finds the latitude and longitude of the position where the crack or obstacle are found. Then through GSM module the location is sent to respected subscriber.

Alerting Information about Track Status to Nearby trains an alerting message is sent to the nearby trains through RF communication, here RF transmitter is sending the crack or object detected information to RF Receiver then the “Railway crack detected” or “Obstacle Detected” message is displayed on LCD display of Train section. Through mail or through notification.

### A. Global Positioning System

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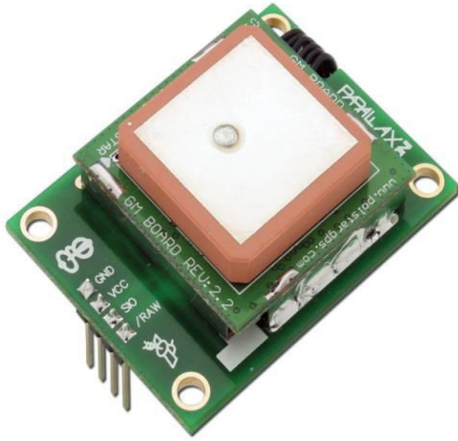


Fig. 2. GPS Module

A GPS module is a device that uses Global Positioning System to determine the location of a crack in railway track. GPS receivers are used to provide reliable navigation, positioning and timing services to the users at anytime and anywhere on the earth. Which is easy for the railway staff to keep the track of all rail without any problem. GPS provides continuous real-time, 3-dimensional positioning, navigation and timing worldwide.

## B.IR Receiver

This is an extremely undersized IR receiver stand on top of the TSOP1738 receiver. These recipients have all the sort and 38 kHz demodulation make into the component as publicized in figure 3.

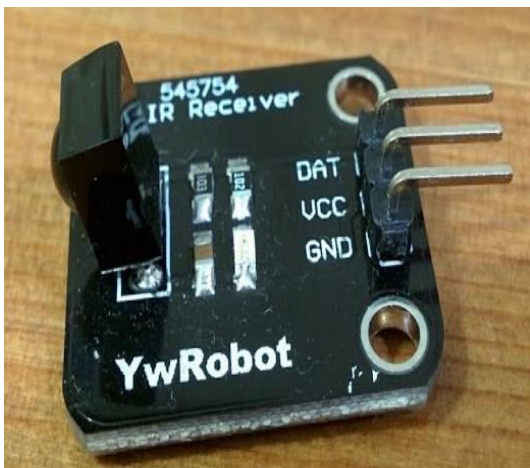


Fig. 3. IR Receiver

## IV.ADVANTAGES OF PROPOSED SYSTEM

- A) The manual work for inspection of the crack on the tracks is reduced.
- B) The proposed system helps in preventing accidents caused by the crack present in the rail track and present of object in front of train.
- C) Exact Position of the crack which is present on the track.

## V. CONCLUSION

This Autonomous is a robotic vehicle for purpose of railway track inspection and crack detection, it will have a great impact in the maintenance of the tracks which will help in preventing train accidents to a very large extent. The place where manual inspection is not possible, like in deep coal mines, mountain regions and dense thick forest regions can be easily done using this robot. By using this robot for the purpose of Railway track inspection and crack detection present on the track and automated the SMS will be sent to pre-defined phone number whenever the robot detect any crack or deformation. This system will help in maintenance and monitoring the condition of railway tracks without any errors and thereby maintaining the tracks in good condition, preventing train accidents to very large extent Railway crack detection is designed in such a way that it detects the cracks automatically which help the train to stop before the crack come.

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