

# Railway Track Crack Detection Using GPS and GSM

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**Abstract:- The Indian Railways has one of the largest railway networks in the world and it provides the most important mode of public transport in India which is most commonly used and cost-effective long-distance transport system of the country. The main problem about a railway analysis is detection of cracks on track. If these damages are not controlled at early stages, they might lead to a number of derailments resulting in a heavy loss of life and property.**

**In this work we are introducing a project that aims in designing robust railway crack detection scheme (RRCDS) using IR Sensor. This avoids the train accidents by detecting the cracks on railway tracks. The Robotic model is designed with a camera which sends pictures and live videos. And also capable of alerting the authorities in the form of SMS messages along with location by using GPS and GSM modules. The system also includes distance measuring sensor which displays the track deviation distance between the two tracks. This will save several trains in India from unwanted damages from the rail track.**

**Keywords:- Arduino Uno (At mega 328p) GPS, GSM, IR Sensor.**

## I. INTRODUCTION

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

Therefore, solution for this problem is introducing in this project. To provide the protection to the railway accident because of cracks occurs in the railway track. This system is used in-between two stations which will detect the cracks present on the track using IR sensors which transmit sine waves for an ideal track. If a crack is detected then this sensor will send a signal to the Arduino Uno board which will activate the GPS receiver. The GPS receiver will send the exact location which will then be messaged to the main authorities. Once the sensor sends a signal to the controller, the controller will activate the webcam. The webcam will provide the live video of the track. The live video and the data from the GPS will be updated in the designed application of the wireless camera. Using this smart technology will be a part of the brave new digitalized world which will be able to prevent the loss of precious life and property.

## II. RELATED WORK

In this paper, “Henrique Oliveira Member, IEEE, and Paulo Lobato Correia, Senior Member, IEEE “Automatic Road Crack Detection and Characterization”, IEEE TRANSACTION ON INTELLIGENT TRANSPORTATION SYSTEM, VOL.14, NO. 1, MARCH 2013” [1], the 2-D feature space used for detecting the crack. The crack is detected by capturing the images, based on the images calculated the length and width of the crack and also it will check whether the track is over lapping or non overlapping. The crack detection is considered a one of the procedure for the collection of data about the condition of the pavement surface.

In this paper, “Lad, P., & Pawar, M.(2016) “ Evolution of Railway track crack Detection system” 2016 2<sup>nd</sup> IEEE International Symposium on Robotics and Manufacturing Automation (ROMA). doi:10.1109/roma.2016.7847816 [2]”, this system consists of GPS module, GSM modem and IR sensor and PIR sensor. To check the crack detection, communication and identification of the railway track. The GPS module and GSM modem used to identification and transmission of railway geometric parameter of crack detection to the nearby railway station. The PIR sensor is used to finding of living beings across the tracks. This can operate during the night time and daytime.

In this paper, “Rijoy Paul, Nima Varghese, Unni Menon, Shyam Krishna, “Railway Track Crack Detection Rijoy”, International Journal of Advanced Research and Development, Volume3, Issue3(2018), [3]”, this method is used to check railway track crack detection using Raspberry Pi 3, Image Processing and ultrasonic sensors. When the crack or deformation is detected using IR Sensor on the track the location of the crack is identified and the location latitude and longitude coordinates are procured. The GPS module and the WIFI module are used to send this location in the form of Short Message Service (SMS) to the pre-defied number or railway authority. The manual Inspection and detecting a crack on these railways tracks is very difficult and it takes 1ot of time and human resource.

In this paper, “Rizvi Aliza raza, Khan Pervez Rauf, Ahmad shafeeq, “Crack Detection Railway Track Using Image Processing”, International Journal of Advanced Research, Ideas and Innovations in Technology, volume3, Issue4 (2017)” [4], this method is used detect cracks on railway tracks has been presented using image processing techniques. The method replaces manual inspection of the track section, by automatic inspection. A video camera can be installed in separate sections of the track to take images of the track section and to detect any cracks in the track section. This will help to detect cracks immediately and

reduce the possibilities of accidents. Since the system would be automatic and will require less manual resource.

In this paper, “Mr. Anand S. Muley, Mr. Siddhant B. Patil2, Prof. A.H.Shelar, “Railway Track Crack Detection based on GSM Technique”, International research journal of engineering and technology(IRJET), Volume: 04 Issue:01/jan-2017 [5]”, the proposed system provides easy method for railway track crack detection using op amp and microcontroller. The GSM is also used to send the SMS to main branch. He also explained different method to identify the crack that present on the track.

**III. METHODOLOGY**

Fig 1 shows block diagram of “Railway track crack detection using IR sensor”, there are two set of IR sensor units fixed to the front side of the vehicle with the microcontroller to check the crack present in the track of the railway line. When the vehicle is switched on, it moves forward along the track. The IR sensors check the condition of the tracks. In normal condition the motor, LDR, Serial transmission is in initial stage. When the power supplies the microcontroller then it starting the motor in forward direction and sends the messages to the microcontroller using serial transmission.

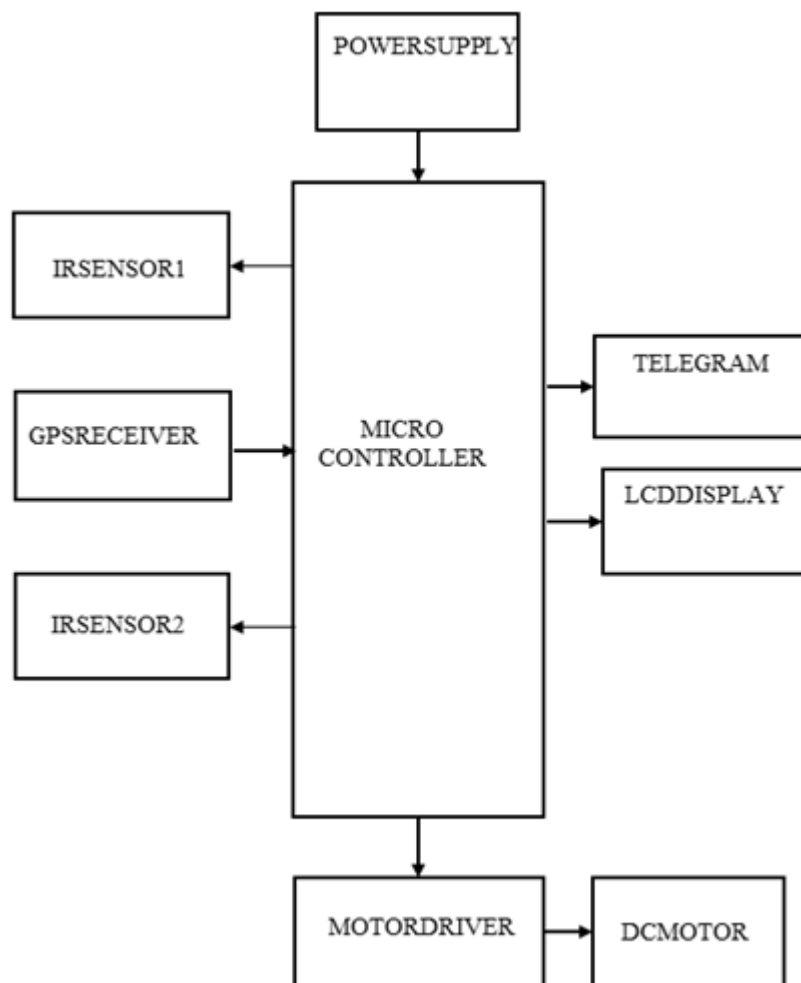


Fig 1:- BLOCK DIAGRAM

When the crack is detected by the IR sensor automatically vehicle stops, and the GPS receiver triangulates the position of the vehicle to receive the Latitude and Longitude coordinates of the vehicle position, from satellites and Latitude and Longitude coordinates received by GPS are converted into a text message which is done by microcontroller. The Wi-Fi Module sends the text message through IOT (Telegram APP).

➤ *At Normal Condition:*

The IR transmitter sensor is transmitting the infrared rays and received by the IR receiver. At normal condition Transistor is OFF condition, at the same time relay is also OFF, so that the vehicle moving forward continuously.

➤ *At Crack Condition:*

At crack detection conditions the IR transmitter transmit infrared rays and received by the IR receiver after hitting the object. If there is no crack present on the track then output of IR LED and Photodiode will be high.

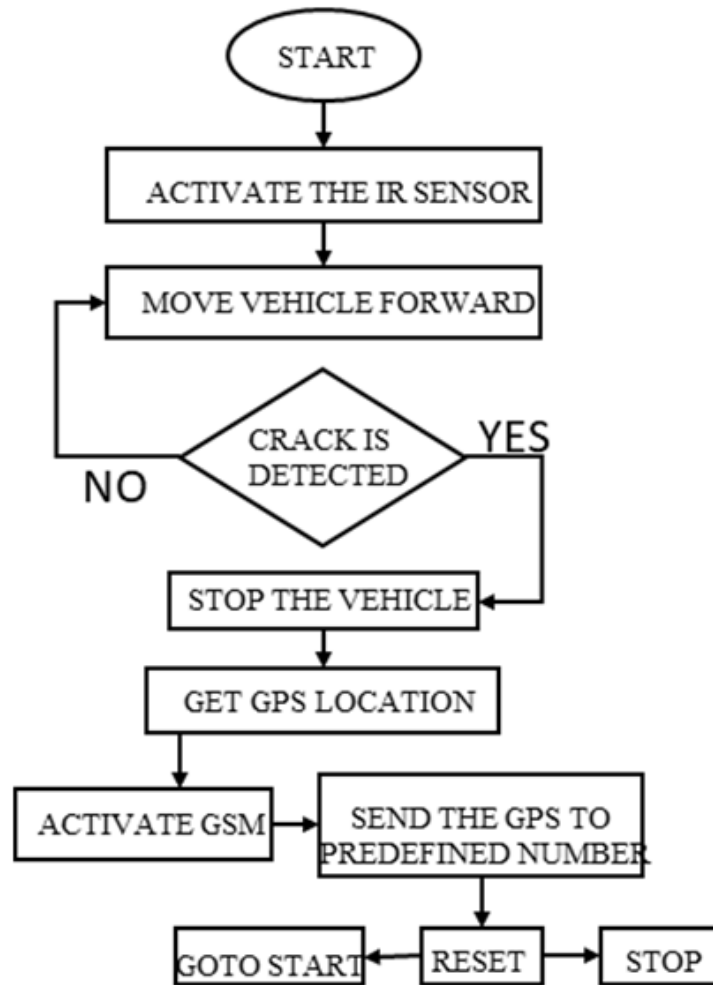


Fig 2:- FLOW CHART

If the crack is present on the track, is detected by the system, the sensor reflection will be equal to zero and the robot will be stopped automatically. Another TSOP sensor is used to monitor the crack on the way of the Railway track. When this output is high then it is considered that there is no crack on the track. But if any crack is detected by the sensor the output of the sensor given to the microcontroller will be zero and again the microcontroller will stop the robot. That means when a crack is detected by the IR sensor the vehicle stops at once, and the GPS receiver sends the position of the vehicle to receive the Latitude and Longitude coordinates of the vehicle position, from satellite as show in the Fig 2.

IV. WORKING

Fig 1.shows the block diagram of “**Railway track crack detection**”. The system consists of Arduino Uno, LCD Display, GPS, IR sensors, and DC Motor. The Arduino Uno microcontroller, which acts as a brain of the system. This microcontroller controls the circuit function. Various components are interfaced with this microcontroller. The hardware components used in this system requires regulated power supply for the operation. This power is provided by the rechargeable battery connected in the system. In this system we have interfaced two IR sensors with the microcontroller to check damage or crack present in the track of the railway line. A GPS receiver is also interfaced with the microcontroller to

determine the exact location of the crack on the railway track. The Telegram is used to send the message for railway station or main authority. Two DC motors are used to move the robot in forward direction. A wireless camera provides the live video to the device in which the application of that camera is installed. The architecture of the proposed system also consists of a 16x2 LCD display, interfaced with the microcontroller for the display purpose.

## V. CONCLUSION

The “Railway Track Crack Detection Using GPS & GSM” is a helping unit which identifies the crack that present on railway track using IR Sensor. Sensor will checks whether the crack is present or not and the message is displayed on LCD display. So, this proposed system reduces the railway accidents and saves the people life and also reduces the economical losses.

## REFERENCES

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