



Railway Track Crack Detection and Alert System Using GSM& GPS

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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, GSM module, GPS module, DC motor, motor driver, IR sensor.

1. INTRODUCTION

Transport is very important to carry the passengers and goods from one place to another. The better transport leads to more trade. Economic level is mainly depends on increasing the capacity and level of transport. This paper presents an implementation of an efficient and cost-effective solution suitable for railway application. The project relates to the detection of cracks in the railway tracks using IR sensor. According to a possible embodiment, the railway carriage carrying the control equipments is provided with sensor orientated to detect the crack. This project pertains to a process for monitoring the condition of rail on train tracks and more specifically has the object of the identification of defects detected by monitoring equipment on the tracks to be checked to allow maintenance crews to subsequently find

these defects. Two IR sensors are fixed near the wheels of the train is used to find out the crack on the rail. Each sensor will produce the signal related position with the rail. If the track is said to be normal on its position when both the sensor gives the constant sensed output. If anyone misses their output condition to fail then there is defect on that side. It will inform this by giving alarm. Where sensors and alarm should be connected to the microcontroller I/O lines and microcontroller is programmed to our needs.

The 60% of accidents in railways are due to track problems which lead to derailment. This project presents the system for automatic crack detection in railway tracks.

India has one of the world's largest railway networks, manual inspection and detecting a crack on these

railways tracks is very tedious process and consumes lot of time and human resource. The project aims in designing railway track crack detection autonomous vehicle using Microcontroller, IR obstacle Sensors assembly system, which detects the cracks along its path and send sends the alert information to both Station Manager of opposite side Railway Station.

Train accident statistics

TABLE-1:shows statistics of the number of injuries caused due to train accidents.

Table-I: statistics of the number of injuries caused due to train accidents

Year	Number of train accidents	Number of deaths/injuries	Number of deaths due to rail crack
2013-14	20	275	156
2014-15	15	196	124
2016-17	17	249	150
2017-18	29	37	38
2018-19	39	37	108

Figure 2 depicts the number of deaths due to rail accidents. As it can be observed from Figure 2, the number of deaths is increasing year to year. Hence there is a great need for technical solution to the problem of rail cracks.

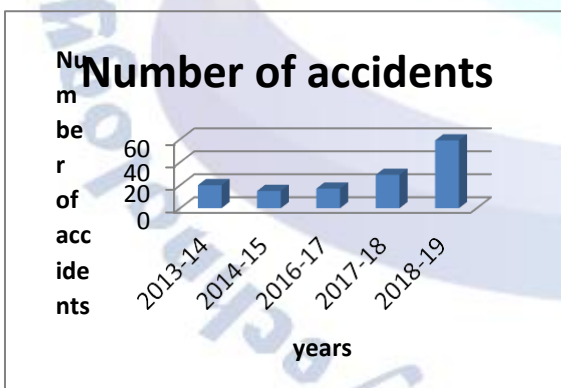


Figure. 2. Number of deaths year wise

2. REALATED WORK

Henrique Oliveira Member,et al [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.

Lad, P., &Pawar et al [2], this system consists of GPS module, GSM modem and IR sensor and PIRsensor. 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.

Rijoy Paul, Nima Varghese, Unni Menon, ShyamKrishna, et al [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 IRSensor 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 lot of time and human resource.

Rizvi Aliza raza, Khan Pervez Rauf, Ahmad shafeeq, et al [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.

Mr. Anand S. Muley, Mr. Siddhant B. Patil2, Prof. A.H.Shelar, et al [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.

3. METHODOLOGY

Figure3 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.

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.

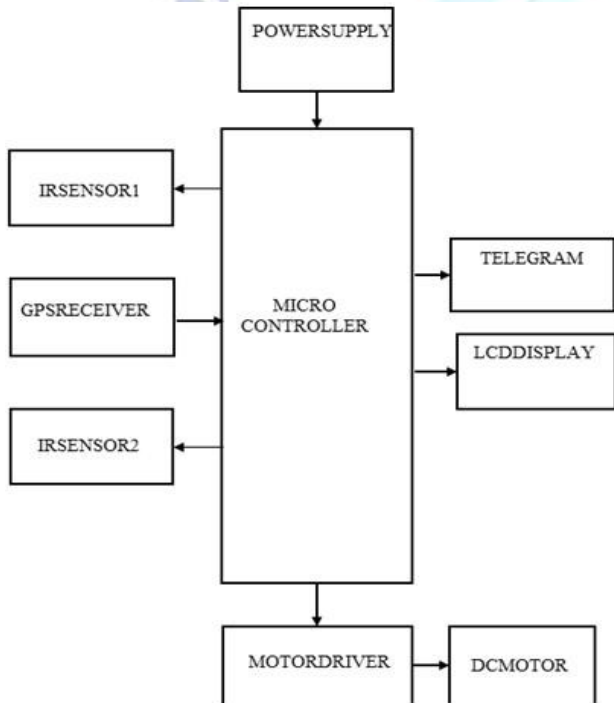


Figure 3: BLOCK DIAGRAM

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.

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 Figure4.

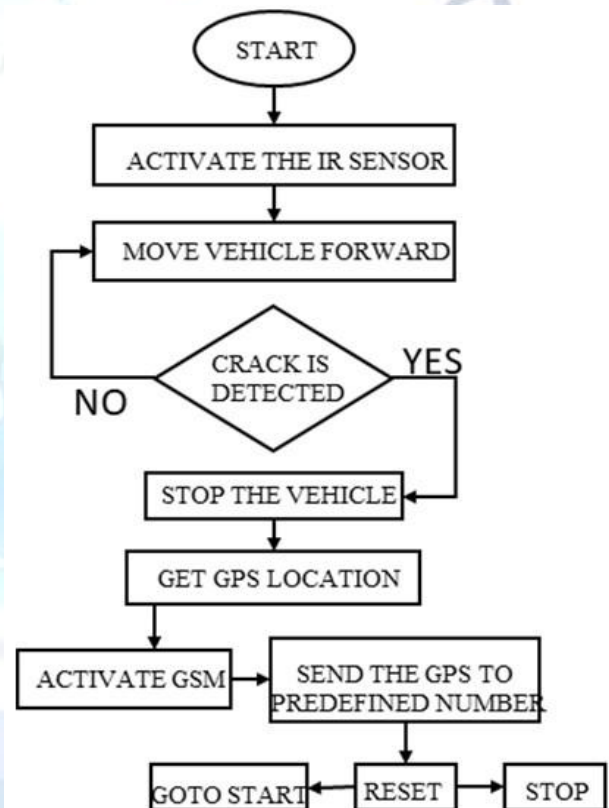


Figure4: FLOW CHART

4.WORKING

The central component of the whole system is a Arduino Development Board. The vehicle is powered using 12V Transformer Power supply along with Voltage Regulators and Filters Capacitors.Forward and Backward movement of vehicle is done using Bluetooth based Android Application and L293D Motor Drivers is used drive two Motors. The vehicle moves along the path of railway track and IR sensors mounted on the vehicle front end will inspect the track along the path. When any

crack or deformation is detected on the track the vehicle stops, Retrieves GPS Location and Send Alert SMS to Predefined Numbers and High Frequency Alert Sound is also Produced. LCD 2x16 is used to display the Alert information to the Train Driver.

This System is also equipped with Ultrasonic Sensor to sense if there is any Other Train coming from opposite direction on same track. If any Train is detected, then Vehicle Stop, Retrieve GPS Location and send SMS to Predefined Numbers. GSM Module 800L is used to Send SMS.

This system thus can be used in many domestic applications and in industrial setups. The power supply setup of the system contains a step down transformer of 230/12V, used to step down the voltage to 12VAC. To convert it to DC, a bridge rectifier is used. Capacitive filter is used which makes use of 7805 voltage regulator to regulate it to +5V that will be needed for microcontroller and other components operation, in order to remove ripple.

4.RESULT

Here the proposed module comprises of equipment that was clarified above in framework plan equipment depiction.

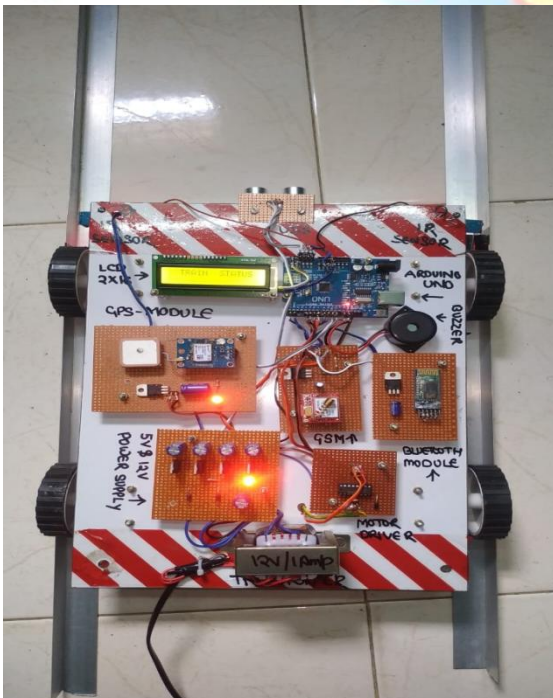


Figure 5:Hardware module

The below figure shows the SMS got on the cell phone alongside the latitudinal and longitudinal situation in the spot a crack or obstacle is detected.



Figure 6:SMS with location

5.CONCLUSION

As per the study the existing systems are time consuming as well as uneconomical. The proposed system is not only overcome these problems but also improve accuracy and crack detection in rails. It is the most economical solution provided in order to achieve good results of railways of our country in order to minimize the stats of accidents caused. There by possible to save precious lives of passengers and loss of economy. It also saves the time and money for identification of crack. Anti-collision technique helps train to collide in head-on direction. This technique is also now applying in commercial 4 wheeler vehicles.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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