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Automatic Detection System for Railway Track

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Abstract: ***The Indian Railways (IR) is one of 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 robotic 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 and ecosystem. Millions of people travel by railways on a daily basis. Travelling through railways is very common in all the countries because it save your time as compare to other transport vehicle 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. This can make a very harmful impact on the society. Due to which the people will not travel through the train because they will not feel safe to travel through train. Railway accidents causes the loss of human life. Which is the most disastrous and an irreversible
loss. Along with this loss there is also loss of rail infrastructure. It can make the GDP of countries low which play a role of high impact on the countries. So to overcome this problem i.e.is quite vital to ensure that cracks in railway track and obstacles present in the front of the train are detected during monitoring, so that the rail accidents can be avoided. In this paper we are presenting an implementing of robotic vehicle that is suitable for railway application. If any obstacles, crack on track detected by ultrasonic sensor. The GPS find the location of the damage place in track. So we can avoid rail accidents by using latest Communication technologies. 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. RF Module used to transmit and receive signals from one section to another. The System sets an example on how to use a wireless network efficiently for Railway track crack detection. Instead of manual method of crack detection a more advanced accelerometer sensor are compatible technology can be used. The primary objective of this project is to detect the crack in the railway track and alert the nearby station through efficient and highly reliable communication mode.

II. LITERATURE SURVEY

In the survey we have found that there are various train accidents causes due to present of crack on railway track, present of obstacles in the front of trail which increases the range from Human Failure to Equipment Failure to Sabotage etc. As in Codiv-19 situation we have seen in many news Channel showing that death rate increases by train due to present of human in the front of train. So to avoid such kind of accident we are making a robotic vehicle to identify the thing present in the railway track. 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 2020 there has been an increase in railway accidents mainly due to using the technology which is not updated if we use the technology which use in know a day so we can avoid the accident.

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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 railway track are inspected. 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 and obstacle.

III. 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.*

IV. PROPOSED SYSTEM METHODOLOG

The system is design to save a human life and the ecosystem of the countries. If we use this system to find the crack and obstacle present on the railway track it save the time and manual work. It is less complex and easier to use. If automatically identify the location of the damage place which will help to save the life.
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.
The proposed crack detector robot is a microcontroller based low price intelligent device. The cracks in the railway track can be sensed by using ultrasonic sound wave. This sensor is connected to Arduino Mega which is the central control unit of this project. DC geared motor is used to move the wheels on the track. A motor driver circuit that passes commands to the dc gear motor and two wheels run the robot. The chassis of this prototype robot made with the acrylic material.
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.

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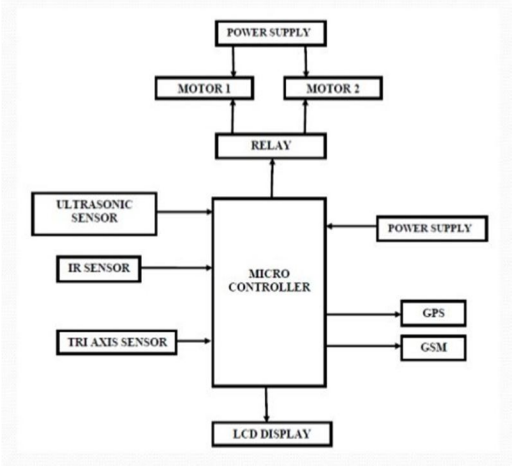

Fig.1.Block diagram of the robot

A. Global Positioning System

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.

C. Motor and driver circuit

DC geared motor is used to run the robot which is system. An optical encoder is included with Arduino Mega to measure the RPM so that the authority can know the exact location of the robot and there is a command given in Arduino Mega to skip the regular frame gap of the railway track which is default feature created its implementation period. A motor driver circuit is made to run the motor by using motor driver IC L293D. It basically works on the concept of H-bridge.

D. Arduino Mega

After getting the signal from the ultrasonic sensor is fed into the Arduino Mega. A GPS, GSM modem, and an LCD display are connected with Arduino also and they will help to find the location.

E. LCD display

A 16 x2 display shows real-time crack status after getting a signal from Arduino Mega.

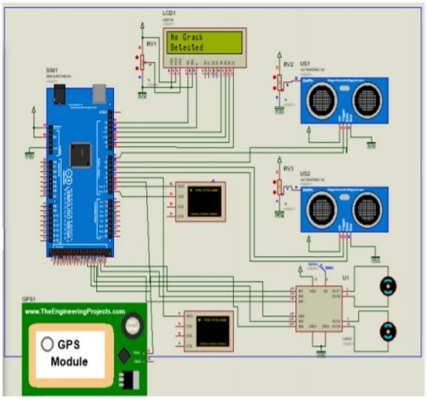

Fig.2. Circuit diagram of the system.

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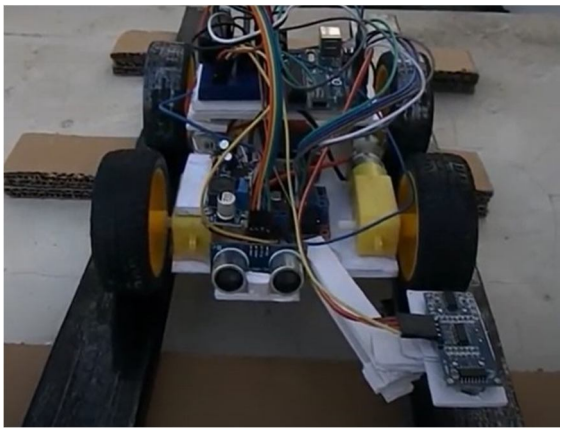

Fig.3.Dummy railway track System.

V. 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.

D. Most important thing is to that this system save a lot of time.

VI. CONCLUSION

This System propose is a robotic vehicle for the purpose of identifying the crack and obstacle present on and front of the railway track 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 robotic system 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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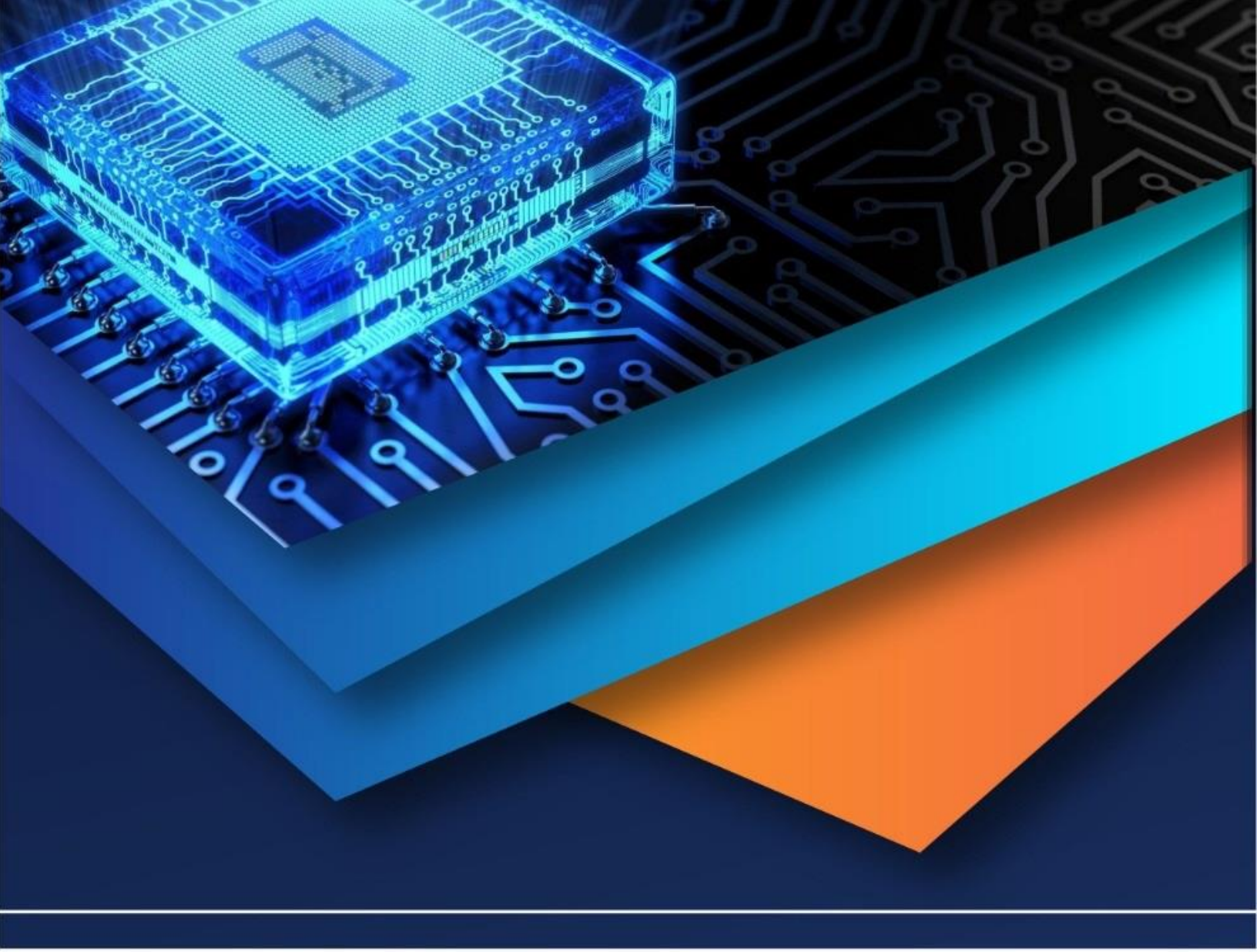

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