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Detecting Cracks and Obstacles in Railway Tracks

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ABSTRACT: In the fast developing country, people are facing many accidents; it would be undesirable for any nation to losing their life for unwanted cause. Railways are one of the important transports in India. There is a need for manual checking to detect the crack on railway track and always railway personnel takes care of this issue, even though the inspection is made regularly. Sometimes the crack may unnotice. Because of this the train accident or derailment may occur. In order to avoid this situation and automate the railway crack detection has been proposed. Here ultrasonic sensor is used to detect the crack in the railway track by measuring distance from track to sensor, if the distance is greater than the assigned value the microcontroller identifies there is a crack and IR sensor is used to detect the obstacle presence in the track, Here we are Using Arduino microcontroller. After crack detection or object detection the testing robotic vehicle stops and the longitudinal and latitudinal positions are sent via SMS to GSM and GPS and also send the information to nearby trains through RF Communication, Here RF Transmitter is placed on Robotic Section and RF Receiver is placed on Train section.

KEYWORDS: GPS Module; GSM Module; Derailments; IR Sensor; Ultrasonic Sensor, RF Module.

I. INTRODUCTION

Transport is a key necessity for specialization that allows production and consumption of products to occur at different locations. Economic prosperity has always been dependent on increasing the capacity and rationality of transport. But the infrastructure and operation of transport has a great impact on the land and is the largest drainer of energy, making transport sustainability and safety a major issue. In India, it is found that rail transport occupies a prominent position in providing the necessary transport infrastructure to sustain and quench the ever-burgeoning needs of a rapidly growing economy. Today, India possesses the fourth largest railway network in the world. However, in terms of the reliability and safety parameters, they have not yet reached truly global standards.

The principal problem has been the lack of cheap and efficient technology to detect problems in the rail tracks and of course , the lack of proper maintenance of rails which have resulted in the formation of cracks in the rails and other similar problems caused by anti-social elements which jeopardize the security of operation of rail transport.

This problem has led to a number of derailments resulting in a heavy loss of life and property. Cracks in rails have been identified to be the main cause of derailments, yet there have been no cheap automated solutions available for testing purposes. Hence, owing to the crucial repercussions of this problem, the proposed system is on implementing an efficient and cost effective solution suitable for large scale application. This idea can be implemented in the long run to facilitate better safety standards and provide effective testing infrastructure for achieving better results in the future. Statistics to justify the problem: The Indian Railways today has 114,617 kilometres (70,598 mi).of total track over a route of 64,974 kilometres (49,752 mi) and 7,084 stations.

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II. LITERATURE SURVEY

The existing conventional signalling system depends on the oral communication through telephonic and telegraphic conversations as input for the decision making in track allocation for trains. There is large scope for miscommunication of the information or communication gap due to the higher human interference in the system. This miscommunication may lead to wrong allocation of the track for trains, which ultimately leads to the train derailments. The statistics in the developing countries showing that 80% of worst collisions occurred so far is due to either human error or incorrect decision making through miscommunication in signalling and its implementation. The Anti -collision device system also is found to be ineffective as it is not considering any active inputs from existing Railway signalling system, and also lacks two ways communication capability between the trains and the control centres or stations.

Another approach uses the concept of LDR (Light Dependent Resistor) to detect the cracks. The LED is mounted on one side of the rails and the LDR to the opposite side. During normal operation, the light of LED does not fall on LDR, hence LDR resistance is high. When LED light falls on the LDR, LDR resistance is reduced and the reduction of the amount of light intensity will be nearly proportional. As a consequence, when light from the LED deviates from its path due to the presence of a crack or a break, a sudden decrease in the resistance value of the LDR ensues. This change in resistance indicates the presence of a crack or some other similar structural defect in the rails. In order to detect the Existing location of the device in case of detection of a crack, a GPS receiver whose function is to receive the existing latitude and longitude data is used. To communicate the received information, a GSM modem has been utilized. The function of the GSM module being used is to send the existing latitude and longitude data to the relevant authority as an SMS .The robot is driven by four DC motors. With this existing system only latitudes and longitudes of the broken track will be received so that the exact location cannot be known.

III. PROPOSED METHODOLOGY AND DISCUSSION

Proposed approach is useful for railway department to reduce the effort for taking care of track and also the railway crossing management. Basically it consists of modules which are respect to the crack detection, obstacle detection, and railway crossing management. ATMEGA328 micro-controller is the heart of the system which is based on the Arduino microcontroller architecture. It will interface with all other modules. Microcontroller receives the information from all the modules and processes the data for further uses. Whenever any problem occurs it will give the alerts to the railway department control station. LCD use is to display the robot status. At the same time it will alerts to the nearby trains by using RF Communication, here RF transmitter is placed on Robotic section and RF receiver is placed on Train section. Train section is placed on all trains for receiving track Status information through RF Communication.

The Main Objectives of our proposed system

A. Crack Detection

Ultrasonic sensor is used to detect the crack and send the information to the microcontroller. It analyses the input and makes robot to stop automatically providing 0 volts to DC motor. The "Railway crack detected" message is displayed on LCD display of robotic section. The position of robot is detected by GPS and information of latitude and longitude is sent to subscribe mobile station through GSM module.

B. 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" 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.

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C. Position Detection

When the robot section detect any crack or obstacle GPS module get activated, then it find 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.

D. Alerting Information about Track Status to Nearby trains

An alerting message is sent to the nearby trains through RF communication, here RF transmitter is sends 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.

Block Diagram:

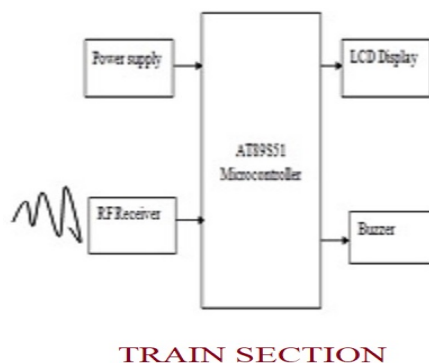
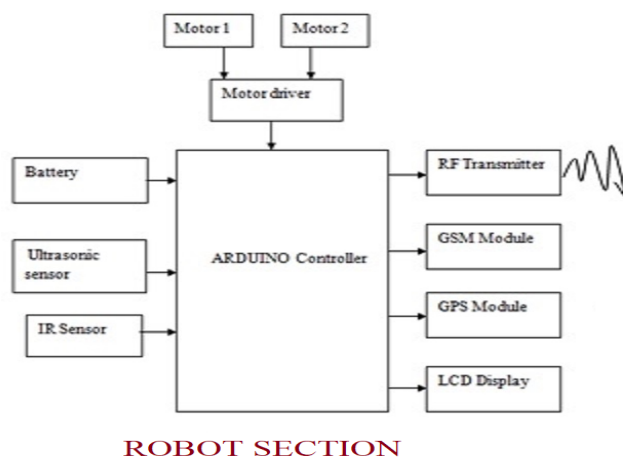


Fig. 2. Block diagram of the Proposed System

Block diagram of the proposed system as shown in fig. 1 contains two sections for track surveying. In Robot section consists of ATMEGA328 microcontroller, GSM, GPS, Ultrasonic Sensor, LCD display, Battery, RF Transmitter and Motor driver and 2 DC Motors, Here Ultrasonic sensor is used to detect the cracks on tracks and IR sensor is used to

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detect the obstacle over the track, GPS and GSM systems are used to locate the fault and send information to the concerned authorities .RF transmitter is sends track status.

In Train section consists of AT89S51328 microcontroller, LCD display, Battery, RF Transmitter, power supply and Buzzer. Here RF Receiver is used for receiving the track status information from RF Transmitter then buzzer will ring and also displayed the information in LCD Display then automatically alerts the driver and train will stops .In This way railway accidents may be Reduced in Some extent.

IV.RESULTS

Step 1: When all the components are activated, Robot runs continuously on the track until there is no crack on the railway track as shown in the fig. 2.

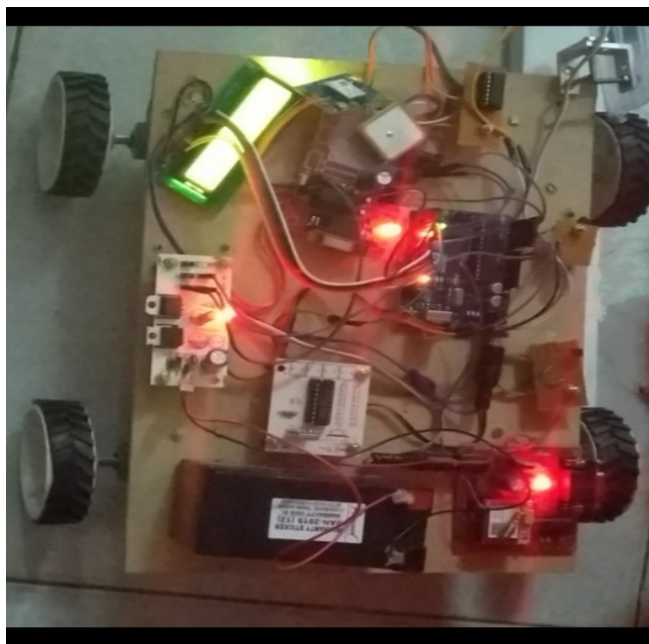


Fig. 2.Robotic section for Crack and Object detecting

Step 2: When crack is detected by the Ultrasonic sensor on the track then robot stops. GPS locates the crack and 'CRACK DETECTED' message is displayed and the same is sent to control station through GSM as shown in the fig.3.

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Fig. 3: LCD Displaying Crack Detected Message

Step 3: When any object is detected by IR sensor then the robot stops. GPS locates the Object and 'OBJECT DETECTED' message is displayed and the same is sent to control station through GSM.



Fig. 3: LCD Displaying Crack Detected Message

Step 4: An alerting message is sent to the concerned authority along with the latitude and longitude values of location where crack or obstacle has been detected as shown in fig. 5.

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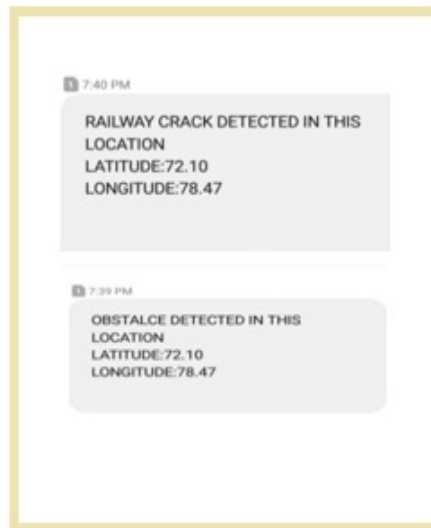


Fig. 5: Messages Received by the Concerned Person

Step 5: An alerting message is sent to the nearby trains through RF communication, here RF transmitter is sent the crack or object detected information and Buzzer will ring as shown in fig. 6.



Fig. 6: Messages Received by the Train section

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V. CONCLUSION

The cost of the proposed system is very less. It also checks surface and near surface of the cracking position. Transmitting signals are immediately transferred and accidents are reduced. It can work in any terrain 24*7 and detects cracks accurately. The project is developed and designed to improve rail track management and the main aim of project is to reduce man power. By using this project we can detect crack in railway track and obstacle on the track. In the proposed method Ultrasonic sensor is used to detect the crack and IR sensor is used to detect object on the track. The robotic section continuously checks the crack and obstacle. Location of crack and obstacle is detected by GPS and then send to authority by GSM and also sends the information from Robotic section to near train sections through RF Communication.

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