Detection of Crack in Railway Track by Crack Detection System

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Abstract: Now a-days Transportation is very important for passenger as well as for goods from one place to another. Economic level depends on capacity and the level of transport. This paper presents an implementation of an efficient and cost effective solution for railway application. In this paper it consists of GSM module, GPS module and Ultra sonic sensor. In this paper motor driver is used to control the motor. The GPS and GSM module help us to send crack detection to nearest railway station. Now-a-days we use high cost LVDT having less accuracy to measure the crack. But also we use less ultrasonic sensor for above process. The importance of this paper is that, it is applicable in the detection during both day and night.

Index Terms - **GPS Module, GSM Module, Ultrasonic Sensor, Aurdino-mega, MINI ARM 7KIT, L298 Motor Driver.**

I. INTRODUCTION

In recently developments in railway systems, high-speed trains are being extensively used and rail-transportation is being increased. Reasons for this increase are high speed, economical, cost effectiveness, environment friendly, safety and modern characteristics of railway system. In railway tracks, anytime the tracks are damaged due to weather conditions, floods, earthquake, cyclones etc. The existing track surveying systems have some limitations. It takes more time and it is less accurate. In this paper by placing the robot in each stations and checking at uneven intervals will help to reduce train accidents. In proposed system consists of ultrasonic sensor which finds the cracks on the tracks. This section mainly consists of GPS module which is used to find the exact position of the cracks and GSM modules for transmitting the information to railway authority. It also consist two motors which is controlled by the motor driver L298. We used Arduino a vast majority of the work is done in the field of crack detection uses the infrared sensing technique. It was initially thought to be the best solution to the problem of crack detection. They introduce surveying systems in this project is operational on both ballast and slab tracks. This System can be operated in tunnels without any interruption. This is a very cheap, simple scheme with sufficient ruggedness suitable to the Indian scenario to track geometry survey by using sensor, which proves to be cost effective as compared to the existing methods.

II. PREVIOUS WORK

1] Akhil N, The author has presented an efficient and cost effective solution suitable for railway application. This paper consists of GPS module, GSM module, an Ultrasonic sensor, a microcontroller LPC2148 and motor driver L293D. This system is applicable in detection during both day and night. The proposed system immediately notices cracks in tracks and inform the railway authority and hence reduce railway accidents. It concludes that this system is more accurate and can be operated in tunnels without any interruption. In future, more sensors can be adopted for faster work. CCTV system with IP based camera for monitoring can be used.

2] Er. Nisthul G, The author has suggested that have a project for addressing an issue of crack detection on railway track by developing a automatic detection system using Infrared (IR) crack sensing module and a communication module based on GSM technology. It concludes that it will help in preventing train accidents to a large extent. With the help of crack detection is possible even in places like deep coal mines, mountain region and dense thick forest regions. In future, solar panel can also be used for conservation of power.

3] M. Kalaimathi, In this paper they are working on Innovative Railway Track Surveying with Sensors and Controlled by Wireless Communication system, in which they used MEMS,GPS,GSM,ARM7TDMI-S microcontroller, RF transmitter, LCD Display ,LVDT. The system is design in this paper is cheap in cost and used in both ballast and slab tracks, and because of LVDT sensor it is very accurate and take less time to inform to station and railway which on that track and also it operate in tunnel without interruption.

4] M. Benisha, This paper is base on Crack Detection & Fire Safety Monitoring System for Railway Inspection. In this paper, the robotic module is place in the train and ZigBee Network is in it which is used to inform the train. Ultra sonic sensors are used to monitor the track status & detect the exact location of crack on track. MEMs sensor is used to detect the obstacle on track and also Fire alarm are used alert the passenger, driver, and fire service station.LCD help to display crack position to the train operator. It concludes that the system is beneficial because it detect the crack without human intervention. This system has some advantages like less cost, low power consumption, less analysis time.

5] Mr. Prashanth Addagatla, In this paper, the proposed system automatically detects cracks on railway track without any human intervention. This paper has given the use of microcontroller LPC2148, LED & LDR, GSM & GPRS, DC motor. In this method cracks can be detected by using IR transmitter and receiver. Advantages of this system are less cost, less analysis time and low power consumption. Hence it concludes that this system is not suitable for small crack detection.

6] B. Siva Rama Krishna: The paper proposes design of robust railway crack detection scheme (RRCDS). It consists of IR sensor, Bluetooth and Arduino. The manual inspection of railway track took more time and human fatigue. The proposed system introduces Bluetooth based technology to prevent the train accident. The author has implemented the IR sensor based railway crack detection system using Bluetooth technology and IP based camera for monitoring the visual video capture from the track. The proposed broken rail detection system automatically detects the faulty railway track without any human interference.

7] N. Karthick, The Author has presented a system suitable for railway transportation to identify the crack in railway track and to prevent the accident. They have used Magnetic particle inspection (MPI), Non destructive testing (NDT), Ultraviolet (UV), Anti collision device (ACD).In this system, sensors are placed in train engine so that when crack is detected on the track, train starts to slow and stop at respective point automatically and exact place of the crack is given to control room. Secondly, the next cause of accident is prevented from two trains opposite in same track by using same sensors fitted in the engine if the sensor senses same signal from opposite train then it automatically applies brake and stop train at certain distance. It concludes that, both face to face collision and crack on track are detected 4-5km before by the continuous monitoring of ultrasonic metal detecting sensor. System can be used in village areas by which man power is reduced and time is saved.

8] Prof. P. Navraja, This paper consists of GPS Module, GSM modem, IR sensor, PIR sensor for application of communication purpose, crack detection and finding of human being present in the railway track. The GPS module and GSM modem help us to find and sending railway geometric parameter of crack detection to the nearest railway station. For measurement of track distance Ultrasonic sensor with high accuracy and less cost is used. System is applicable for both day and night time detection purpose. It concludes that it does not give false output and crack can be detected without error.

9] Reenu George, The author suggest existing system has been modified by using smart phone which helps in detecting the exact location of the fault. This system consists of IR transmitter and receiver, crack detection, GPS, GSM, PIC microcontroller. The method utilizes IR transmitter and receiver for the detection purpose and have many advantages compared to the traditional technique. The advantage includes less cost, low power consumption and less analysis time. The method can be implemented in large scale in the long run to facilitate better safety standards and provide effective infrastructure for achieving better results in the future.

10] Aliza Rza Rizvi, In this research paper, a computer vision based method is presented. A system has been suggested which can periodically take images of the railway tracks and compared with the existing database of non-faulty track images on a continuous basis. If a fault arises in the track section, the system will automatically detect the fault and necessary actions can be taken, to avoid miss happening. This system includes railway track, cracks, manual inspection, Image processing, computer vision. The method replaces manual inspection by automatic inspection. Thus efficiency is ensured.

11] Mohit Dodval, The author has presented the paper to inspect the railway track by using real time photo image processing through wireless module. The methods were designed for various software setups, specifically MATLAB and C[++] using the Intel open CV library. To find the fault in railway track several techniques are used vibration sensor ultrasonic sensor detection of track using infrared.

12] Kunduru Umamaheswari, In this paper author considering the major problem that lead to railway accident. Which include obstacles entry on the track and crack on the track. To overcome this author have proposed a testing train which uses ultrasonic sensor with range of 100 Cms and delay 30 cm and according to distance between the obstacle slow down speed of vehicle and finally stop. The paper uses Aurdino micro-controller, light emitting diode (LED), Liquid crystal display (LCD), Global system for mobile (GSM), Global positioning System (GPS). In this paper, authors have proposed a proto type of testing for detecting obstacle and crack. The aurdino used for this system is Atmega 328 with flash memory and SPRM for storing data for future purposed. It concludes that the prototype of testing vehicle can efficiently detect crack and obstacle on railway track.

13] Rakesh V. Pise, The work proposes a cost effective solution to the problem of railway track crack detection utilizing IR transmitter and receiver which track the location of faulty track which then mended immediately so that many lives will be saved. If these deficiencies are not controlled at early stages they might lead to a number of derailments resulting in heavy loss of life and property has train derailment can be avoided and chance of loss of human life and economy can be minimize.

14] Parag Nikhar, This paper proposes a cost effective solution to the problem of crack detection of rail track utilizing IR sensors. In this paper is implementation of LPC2148 microcontroller along with GSM module and GPS receiver. Whenever the crack is detected a buzzer will be activated to alert the surroundings and message will be automatically sent to the controlling station of railway authority. It consists of Transport, Efficient, Detection, Derailment, GSM, and Liquid Crystal Display (LCD) , GPS. It concludes that the GSM based crack detection system automatically detects the faulty rail track without any human interface. The main advantages of this system are less cost, low power consumption, on time data operation and minimum analysis time. The simple idea can be implemented in large scale in order to have long run to facilitate better safety and provide effective testing infrastructure for achieving better results in the future.

15] Ebi Benny, This paper, consists of an introduction to railway track inspection and its various applications. Sensor is used to detect the various cracks and object. In this project sensor used is optical sensor for detection of crack in the track. 89C25 control

unit is used to analyze the fault. The FM receiver unit is fixed at the nearest railway station and transmitted signal is received by receiver unit and gives information to the responsible authority. This paper also consists of Relay for Buzzer operation and different voltages 12V, 7Ah lead acid battery. The IR sensor is used to detect the crack in the track and send signal up to 9 Volt to the frequency modulator. It has an advantageous than problem to GSM communication.

16] Diksha Nagdevte, This paper introduces the detection of cracks in rail road's using ultrasonic and PIR sensor. This system mainly consists of PIR sensor, Ultrasonic transmitter and receiver, GPS module and GSM modem, IR sensor. There is several crack detection technique but this system is less costing and gives more accurate result. By using this system manual checking is avoided hence requires less power. This idea can be implemented in large scale for safety and helps in reduction of derailments.

17] Anand S. Muley, This paper presents an implementation of an efficient and cost effective solution suitable for large scale application by using the op-based crack detection in railway track using GSM system. This system is also helpful for another application where cracking problem take place. The sensitivity of this system is high hence no any problem comes in detection of crack. Due to simple idea, installation is quite easy. This document provides an overview of the key measurement required for testing GSM trans-receivers. By using the op-amp, cost of this system is reduces.

III. PROPOSED CONTROL DESIGN
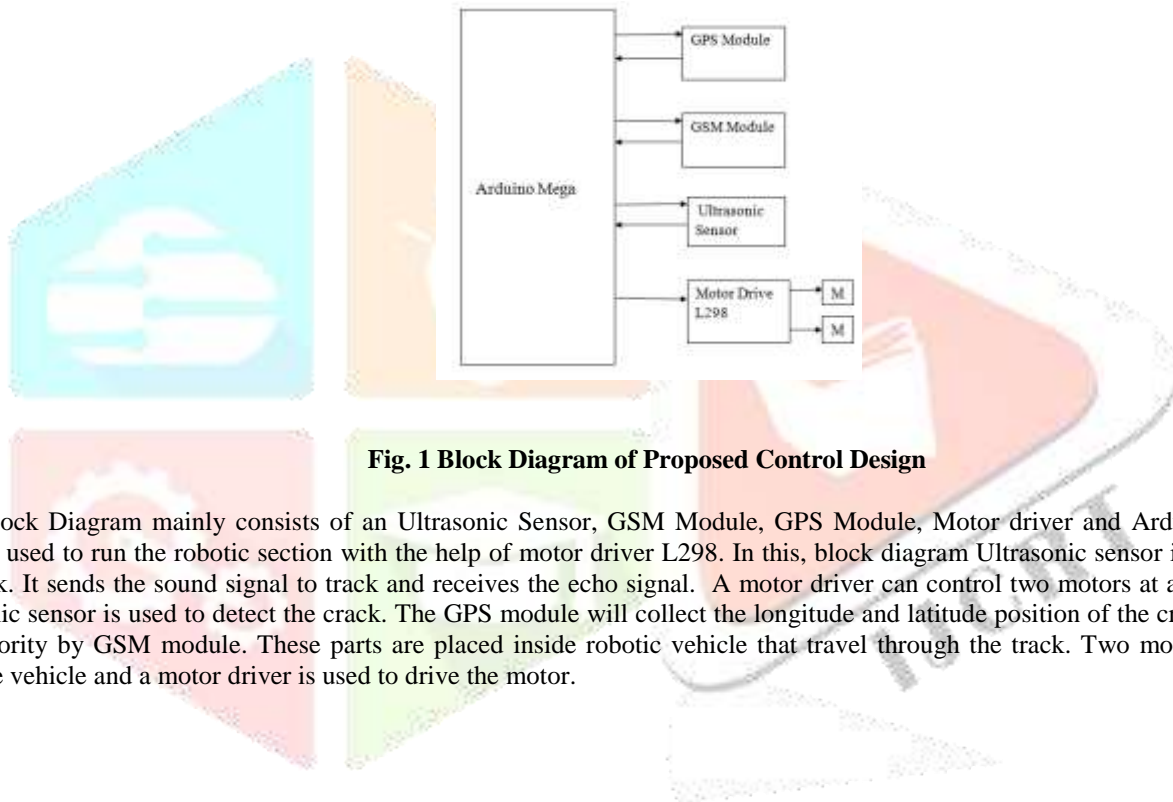
Fig. 1 Block Diagram of Proposed Control Design

Fig.1 Block Diagram mainly consists of an Ultrasonic Sensor, GSM Module, GPS Module, Motor driver and Arduino Mega. DC motor is used to run the robotic section with the help of motor driver L298. In this, block diagram Ultrasonic sensor is used to detect the crack. It sends the sound signal to track and receives the echo signal. A motor driver can control two motors at a time. And also Ultrasonic sensor is used to detect the crack. The GPS module will collect the longitude and latitude position of the crack and send to the authority by GSM module. These parts are placed inside robotic vehicle that travel through the track. Two motors are used to drive the vehicle and a motor driver is used to drive the motor.

IV. PROGRAM FLOW CHART

Fig. 2 Flow Chart

Fig. 2 shows the flow chart of implementation of Arduino to detect the fault. We have to initialize the GPS module, GSM module and input - output port of the Arduino. Then start the motor using motor driver L298. At that time the Arduino sends a trigger pulse continuously to the ultrasonic sensor and turn on the timer. And the transmitter of the ultrasonic sensor send sound signal to the track and Receiver of the ultrasonic sensor receives the echo signal. Then Arduino will turn on the timer. Due to this we get the time and velocity of the sound. Accordingly, we can calculate the distance between the sensors and track continuously and check it with reference value (7cm). If the distance is 7cm, then it will continuously track the distance. It is the continue process (checking distance). Otherwise (distance greater than 7 cm), motor will be stop. GPS module will collect the position of the crack and send to the authority by GSM module.

V. EXPERIMENTAL SETUP & RESULTS
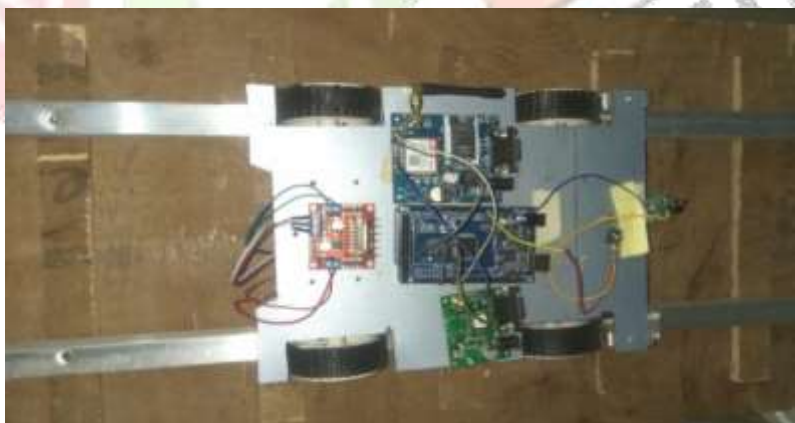
Fig. 3 Robotic Section

It Contains GPS module, GSM module, Motor Driver, 2 DC motors, LCD display, Vehicle Kit and an arm board.

When crack is found, the robotic section sends that location of the crack to the authority. Above given is the message received from the robotic section. The crack is founded at 20.878765N, 77.757671E position.

VI. CONCLUSION

The Railway crack detection system is introduce in this paper, for this surveying system experiment had done on a surface having crack by running our designed robot section having ultrasonic sensor to sense the crack. It is more accurate than the existing works more over the GPS module gives the exact position of the crack.

In this, the system is presented to detect the cracks in tracks effectively. With the ultrasonic sensor the cracks in the railway track is detected and by using wireless modules the information is passed to the authority. Continuously check the crack by robotic section. The location can be found out by using GPS module in the system. The introduced surveying system is operational on both ballast and slab tracks. These systems can be operated in tunnels without any kind of interruption. We use the cctv systems with IP based camera for monitoring the visuals videos captured from the track. Here DC supply is given to the system from ac supply through adaptors. A rechargeable battery can replace the adaptors and making the system much more user friendly.

VII. ACKNOWLEDGMENT

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