GSM based railway track crack detection using ultrasonic and infrared sensor

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Abstract: GSM based railway track crack detection using ultrasonic and infrared sensor. In this paper, we will discuss about the IoT Based System and its application in Indian Railways,as it is the problem of Indian railway system. Indain railways being one of the world's largest railway networkcomprising of 115,000 km(71,000 mi) of track length over a route of 67,312km (41,826 mi) this means that if the Indian railway tracks are laid out, they would circle the earth almost 1.5 times. The recent trend that is used by the Indian railway system is manual inspection which requires much manpower and time. Our project has its main application here. The vehicle would move on the railway tracks inspecting the track and find faults if any. Our main motive is to introduce such an automated vehicle and try and reduce the human efforts, save time and provide a much precise output. In our paper, railway track sensing is done using different sensor modules mounted on the moving train.

IndexTerms - **IoT,Railway Track, Track Sensing, Fault Detection,obstacles detection, GPS, GSM, Buzzer, Ardiuno, DC-Motor, Sensors, Modules.**

I. INTRODUCTION

In India, railway network is the cheapest form of network hence most of the commercial transport is carried out by railways , preffered over all other means of transport such as buses, flights, cruises etc. The Indian railways is the largest rail-passenger transport and now is the backbone of country's transport infrastructure. Indian railways is still growing trying to fuel the economic needs of our nation. Though the indian railways aregrowing with amassive speed, the associated safety infracstructure facilities have not kept up with the aforementioned proliferation.   Our facilities are inadequate compared to the international standards which has resulted in frequent derailments that is severe loss of valuable human lives and property as well. With some surveys and analysis about the factors causing rail accidents, statistics reveal that approximately 60% of all the railway accidents have problems of derailments of which 90% are due to cracks in the railway tracks. The causes are either natural which include exccesive expansion due to heat or due to antisocial elements. The cracks in the Indian railway systems is one of the biggest problem which needs to have the utmost attention due to the large frequency of people using Indian railways. The problems go unnoticed due to the improper maintanenceand the manual track monitoring that is being carried out. An automated systemwhich manages the presence of cracks of the railway systems is the need of the hour. Owing to the crucial repercussions of this problem, this paper presents an efficient and effective solution for large scale solution. In previously existing system, the same concept is used using LED and LDR sensor assembly. The main drawback of the system is that LED and LDR needs to be exactly aligned opposite to each other to detect the crack, also the environment needs to be controlled to detect the true values from LDR. For this reason, we have used IR Obstacle sensor, which has only one module that has both transmitter and receiver and alignment will not be an issue.

The main objective of the project is to identify any crack or deformation and obstacles on the railway track using this setup, which can be implemented in live by Railway authorities. The proposed setup would make the inspection and maintenance of railways tracks easier and help them to monitor efficiently by replacing the human inspection which is currently followed. The design of the vehicle and software related to it are very simple and can be easilyadopted by the present system.

II. PROPOSED SYSTEM

In proposed system our project are detect the rail road crack, measuring distance for two rail road and also measure the pursuing human in the railway track. when IR sensor are used for detect the crack in the track and ultrasound sensor measure the distance between the track and the obstacle sensors are used. If any crack is detected it is sensed by IR sensor and sent to nearest station. when obstacles sensor are detect the human being and animals on the railway track, if any one pursuing on the track means they stop the surveying work after crossing rail road they are detect the track.
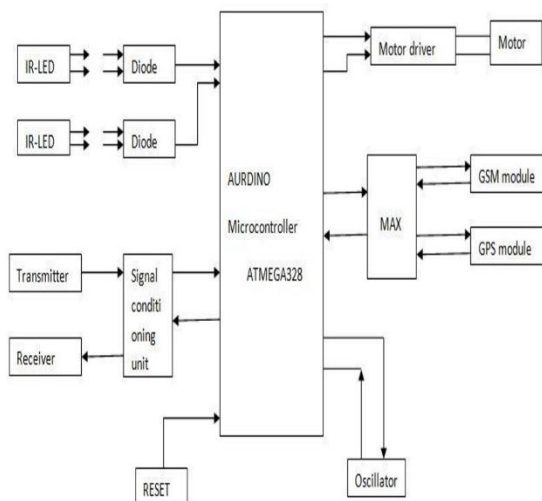
Fig. Block diagram of Railway Track Sensing

An Arduino board consists of an Atmel 8-bit microcontroller with complementary components to facilitate programming and incorporation into other circuits A lithium-ion battery or Li-ion battery (abbreviated as LIB) is a type of rechargeable battery in which lithium ions move from the negative electrode to the positive electrode during discharge and back when charging.   A simple electromagnetic relay consists of a coil of wire wrapped around a soft iron core, an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts. A brushed DC motor is an internally commutated electric motor designed to be run from a direct current power source.

III. METHODOLOGY

3.1 Hardware Requirments.

3.1.1   Arduino UNO R3
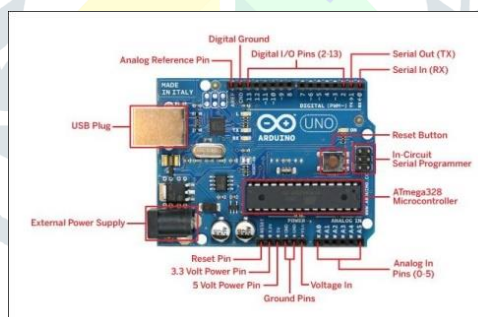
The arduino uno is a open source microcontroller board based on micro chip ATmega328P microcontroller & developed by arduino.cc.The board is equipped with set of digital and analog input output pins that may be interfaced to various expansion boards and other circuits.

3.1.2   GPS Module

A GPS navigation device, GPS receiver, or simply GPS is a device that is capable of receiving information from GPS satellites and then to calculate the robot's geographical position.

3.1.3 Infrared Sensor

IR Sensor module has great adaptive capability of the ambient light, having a pair of infrared transmitter and the receiver tube, the infrared emitting tube to emit a certain frequency, encounters an crack detection.

3.1.4 Ultrasonic Sensor

The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1" to 13 feet.

3.1.5 GSM and GPRS Module

A GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM or GPRSsystem.

3.1.6 Buzzer.

Buzzer. A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarmdevices, timers, and confirmation of user input such as a mouse click or keystroke.

3.1.7 DC Motor

20 RPM Side Shaft Gear DC Motor for Arduino. This is a Side Shaft DC metal gear motorhaving 20 RPM. It is most suitable for medium weight robot running on average voltage. Motor runs smoothly from 9V to 12V and gives wide range of RPM.

3.1.8 LED Bulb

Convenient for DIY, repair equipment and electrical appliances, including for Arduino projects

3.2 Software Requirment.

The Arduino integrated development environment is a cross-platform application that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. The Arduino IDE supports the languages C and C++ using special rules of code structuring. he source code for the IDE is released under the GNU General Public License, version 2.3 the Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.
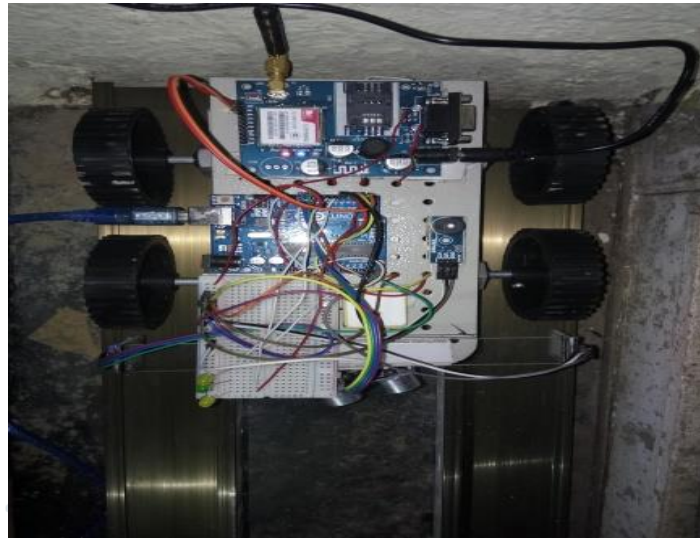
IV. IMPLIMENTATION AND RESULTS

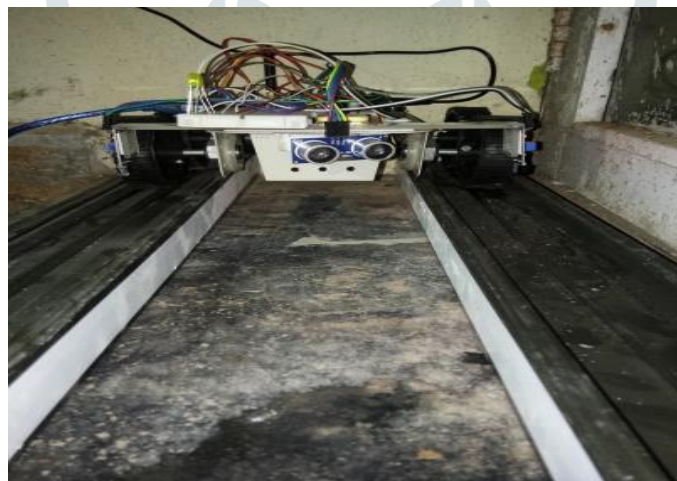**Fig 1**. Railway track crack detection module.

Fig 2. Railway track crack detection module start.
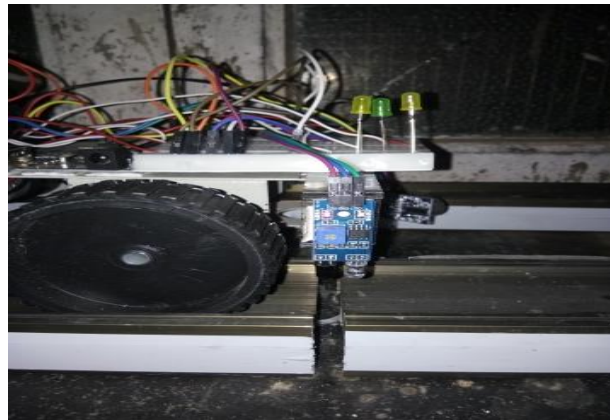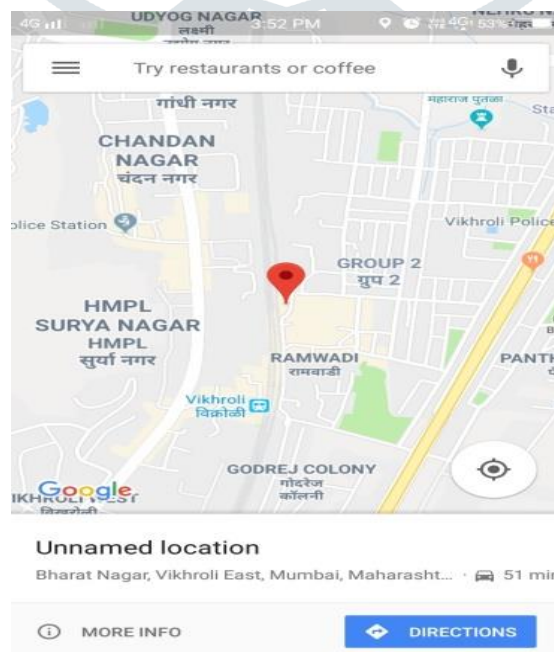
Fig 3. Crack on railway track.

Fig 4. Crack detected on railway track with the help of railway track crack detection module.

Fig 5. Message sent to control panel with location of crack.

Fig 6. Display location of crack with the help of google map.

V. LITERATURE REVIEW

We first organized a review of existing technologies of automatic visual inspection of railroad track and track components. This gave understanding with respect to which assignments were best suited to vision based assessment for which technology was not already under development. This review encompassed well-established inspection technologies and experimental technologies currently under development. In this section, we provide a brief review of the technologies currently in use or development that are of greatest relevance in the determination of the scope of our research. Safety in railways is one of the major issues for public transportation organization and a fast and efficient inspection system is vital to ensure the safety of railways. Authors had tried to provide effective solution on the problem. Previous, rail inspection methods include destructive techniques, such as coring, and non-destructive techniques, such as hammer sounding. But these methods just "cover limited space and have limited effectiveness in identifying the faults. Further non-destructive evaluation techniques for rail track inspection had developed. These technologies include visualinspection, ground penetrating radar (GPR), infrared, X-ray and laser light.

[1]Avinash.Vanimireddy1 ,D.Aruna Kumari et al said that the main problem about a railways is the crack detections which needs to stop at an early age, if not done so can cause a heavy loss or damage. Ramavath Swetha et al inferred the ideas in designing railway track crack detection autonomous vehicle using Microcontroller, IR obstacle Sensors assembly system, which detects the cracks along its path; the vehicle is also capable of monitoring the location of the crack by using the GPS module and alerts through 0

[2]V.Muralidharanet.al.,"AN ENHANCED CRACK DETECTION SYSTEM FOR RAILWAY TRACK".In this paper we introduced the integration of railway track surveying system. In our proposed system it is used to detect the railway track crack.

[3] Katragaddaet.al., "TRANSVERSE CRACK DETECTION IN RAIL HEAD USING LOW FREQUENCY EDDY CURRENTS".In this paper, A method and system for detecting transverse cracks beneath horizontal cracks in the rail Way track. As a transporter moves over rail, a saturation magnetic field is generated into and across the rail head using a toroidal-shaped DC saturation magnet located a predetermined distance above the rail head.

[4] K. Vijayakumaret.al.,"NON INVASIVE RAIL TRACK DETECTION SYSTEM USING MICROWAVE SENSOR".In this paper, As fuel costs continue to rise, efficient public transport, especially rail will play an increasingly important role in the UK and worldwide.

[5] M.Pradeep & K. Naganarasaiah Goud This paper represents" Damage Detection of Railway tracks by using sensors. Industrial establishments and particularly metrology areas are using ultrasonic distance measuring systems. Because of their high precision characteristics of different methods these sensors are used in engineering disciplines. GPS and receivers are widely used in this industry. In this paper we are introducing a new railway track geometry survey system, which is designed by ultrasonic sensor. To identify the location of damage detection of track gauge and track axis coordinates can be easily determined while making measurements be using the new system.

[6] K.Bhargavi 1, M.Janardhana RajuThis paper represents," Railway Track Crack Detection Using sensor Assembly" In India rail transport occupies a prominent position in providing the necessary transport infrastructure to sustain needs of a rapidly growing economy. Inspite of being the forth largest railway network in the world, we haven't achieved any global standards in terms of safety. The main problemof Indian railways is the crack detection. If these problems aren't controlled now they can be a major threat in the future causing life and property. This paper proposes a cost effective solution to these faulty tracks .

[7] Dr.Sri Rajitha & L.Chandra Shekar This paper represents, " An Embedded Based Railway Track fault Detection Using ARM7LPC2148" The Transportation of train always depends on railway tracks (rails) only. If there is a crack in these rails, it creates a major problem. The problem is mostly cracks in the railways which is not identified. Also it takes more time to solve the problem. In order to avoid this, we are using crack detector robot, which will detect the crack and give an alarm.

VI. CONCLUSION

In this paper, we have been implemented GSM based railway track crack detection using ultrasonic and infrared sensor.The problem faced by Indian Railway because of railway track crackingwill be solved by using this paper.By using Ultrasonic and Infrared sensors and modules based on IoT,this paper proposed and tested for railway track sensing

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