Railway Track Fault Detection System

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Abstract— Today, India has possesses the fourth largest railway network in the world. In India, most of the commercial transport is transfer by the railway network from one place to another network and therefore, any problems occur in the same has the capacity to create major damage to the economy. However, in terms of the reliability and safety parameters, we have not provided protection to the traction system. The main problem occurs in the railway track is detection of cracks in the structure. If these deficiencies are not managing or protect at early stages they might lead to a number of derailments resulting in a heavy loss of life and railway property. This project proposes a cost effective solution to the problem of crack detection of rail track utilizing IR sensors which detect the exact location of faulty tracks which then system operated immediately so that many lives will be saved and avoid the railway accident This project is implementation of with LPC2148 microcontroller using GSM module and GPS receiver. Here IR sensors are used to found the crack in the track, whenever crack is detected GPS receiver receives the location information. This information of the crack detecting is send to the railway authority by using GSM system.

Key words: Arm 7 (LPC 2148), GSM, GPS, LCD Display, Mems Sensor, IR Sensor

I. INTRODUCTION

Depending on the fast developments in railway systems, high-speed trains are used, and rail transportation is increased day by day. Today's most of the people uses railway for transportation, it is essential for transferring the goods and passengers from one place to another place. And also the railway system are provide facility such as high speed, with economical, environment friendly, safety, and better characteristics of railway systems. These characteristics can be performed by time to time maintenance and control measurements. But depending on different factors, deformations and derailment may occur on the superstructure of railways. These derailments and other problems of railway system like, improper maintenance and the currently irregular and manual track line monitoring mistake from workers lead to cause mishap.[2]Such deformation and derailment are determining on time and taking precautions is very important for the safety of railway systems. Therefore effective solution system is design on this problem is introduced in this project. For providing protection to the railway accident because of cracks occur in the rail road, we design a detection system of cracks in the track based on IR sensor which is operated with GSM & GPS technology. It is used to determine the exact location of railway deformations and send message to the controlling station and signal system of railway will be stop automatically. This system also used in another application where cracking problem is occurs. [3] The accuracy of this system is high therefore no any problem are occurs in the detection of crack. Due to simple concept is design in this system, the installing this system on actual work is easy due to the simple design system.

II. LITERATURE REVIEW

Based on the continuous research pursued more than a decade in area of analyzing and monitoring the unbalancing, misalignments and moreover derailments of railway tracks would be a burning issue in a country like India which has one of the largest railway track networks around the globe.

Depending on different factors, deformations and derailment may occur on the superstructure of railways. These derailments and other problems of railway system like, improper maintenance and the currently irregular and manual track line monitoring mistake from workers lead to cause mishap.; More importantly the take out message we could able to find by doing literature survey on various aspects on the result of previous researchers which would be enlightening our problem statement as well.

Mao et al, [10] recognized uneven shine and clamor, the substantial rail surface deformities, as indicated by the qualities of overwhelming rail surface imperfections, in light of the numerical morphology of multi-scale and double structure components. Contrasted and the customary edge identification administrators, the outcomes demonstrate that their technique possesses solid hostile to commotion execution, can identify the little deformity edge precisely under clamor.

Faghih-Roohi et al, [11] proposed a profound convolutional neural system answer for the investigation of picture information for the location of rail surface deformities. They looked at the consequences of various system structures described by various sizes and actuation capacities. Raghupathy et al, [12] in their work have designed a system based on ultrasonic waves which would prevent the train accidents due to derailment of tracks, unmanned railway crossing and head on collision.

III. SYSTEM DESCRIPTION

A. *Working Diagram*

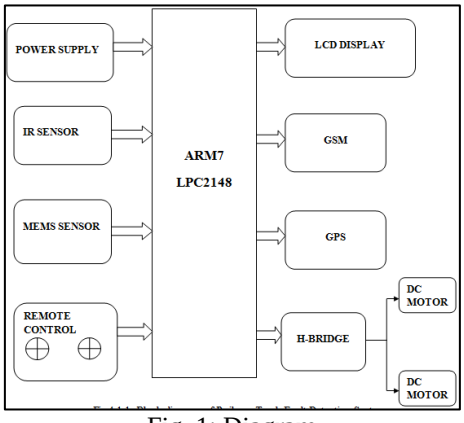


Fig. 1: Diagram

1) Working of Project

According to the diagram and Circuit diagram as shown higher than. It uses LPC 2148 microcontroller. It's a low power, high speed technology. LPC 2148 is a low value and simple to program microcontroller. It's the wide used IC from ARM-7 family. Before the beginning of the rail- approach line scan the robot has been programmed to self-calibrate the IR Transmitter and Receiver.[2] when measurement, the automaton takes time for a planned amount so the on board GPS module starts detecting the correct geographic location. The principle involved during this crack detection is that light-weight reaching the IR receiver is proportional to the intensity of crack i.e. once maximum light-weight transmitted by transmitter reaches the receiver the crack intensity is a lot of. The IR transmitter are attached on one rails track and therefore the IR receiver mounted on opposite rails track. Throughout traditional operation, once there are not any cracks, the light from transmitter doesn't fall on the receiver and therefore the set price is low. Once the light from transmitter falls on the receiver, the value gets exaggerated and therefore the amount by that it's incremented are proportional to the intensity of the incident light. As a consequence, once light from the transmitter deviates from its path thanks to the presence of a crack or a chance, an increment within the value is discovered. [6]

This change in value indicates the presence of a crack or another similar structural defect within the rails. So as to find out current location of crack in rail track, here we tend to use of a GPS receiver whose perform is to receive the present data kind faulty location. To communicate the received info, we tend to make a use of GSM modem The GSM module is being used to send info as associate SMS. The system working is achieved by interfacing the GSM and GPS modules with the LPC2148 microcontroller. The robot having four wheels that area unit drive by using 2 motor and this powered by 2 12V batteries. So the time taken for police investigation the crack within the track is a smaller amount and operates simply. [2]

B. ARM 7

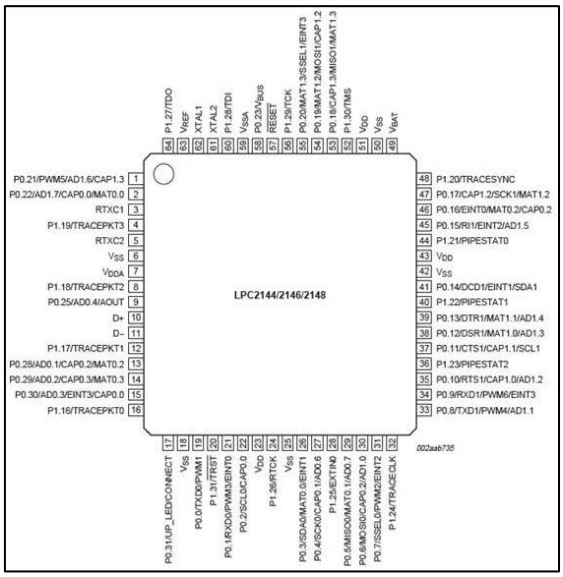


Fig. 2: Arm 7 Board

C. Problem Statement

The Transportation of train continually depends on railway tracks (rails) only. If there's a crack in these rails, it creates a significant problem. Most of the accidents within the train are caused a major cracks within the railway tracks, that can't be simply known. A major it takes longer to rectify this downside. So as to avoid this downside, we have a tendency to be using the crack detector golem that detects the crack within the rails and offers an alarm.

D. Objectives

In this project we come up with the idea of Railway track crack fault detection system using IR sensor based on GSM & GPS technology. The crack can be detected easily & it does not give the false output. GSM base crack detection system automatically detects the faulty rail track without any human interface. Also in track, any shake/tilt in parallel bridge position sensed by MEMS sensor. This method having many advantages on traditional detection techniques. The main advantages of this system like 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.

E. Components Description

1) Dc Motor

a) Specification

- 100RPM 12V DC motors with Gearbox
- 6mm shaft diameter with internal hole
- 125gm weight
- Stall Torque = 1.5kgcm torque
- No-load current = 60 mA(Max), Load current = 300 mA(Max)

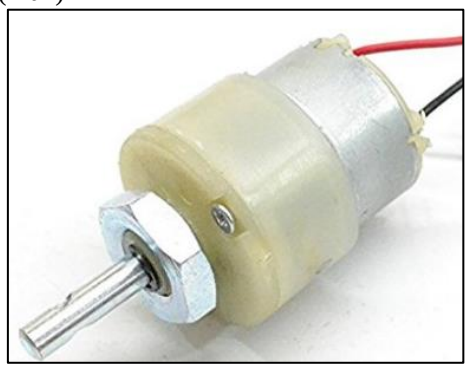


Fig. 3: DC Motor

2) LCD Display

- 4-bit data interface for compatibility with ARM boards
- LCD_E, LCD_RS, LCD_RW
- 2 line x 16 character Display
- Each character location consist of 5 dot x 8 bit display

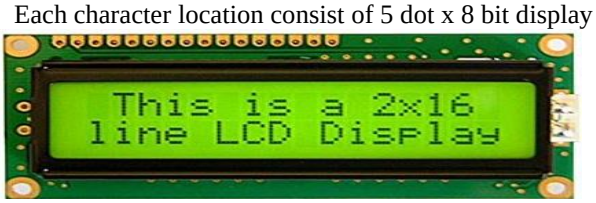


Fig. 4: LCD Display

3) GSM Module

GSM/GPRS-compatible Quad-band cell phone, which works on a frequency of 850/900/1800/1900MHz and which can be used not only to access the Internet, but also for oral communication (provided that it is connected to a microphone and a small loud speaker) and for SMSs. Externally, it looks like a big package (0.94 inches x 0.94 inches x 0.12 inches) with L-shaped contacts on four sides so that they can be soldered both on the side and at the bottom. Internally, the module is managed by an AMR926EJ-S processor, which controls phone communication, data communication (through an integrated TCP/IP stack), and (through an UART and a TTL serial interface) the communication with the circuit interfaced with the cell phone itself.

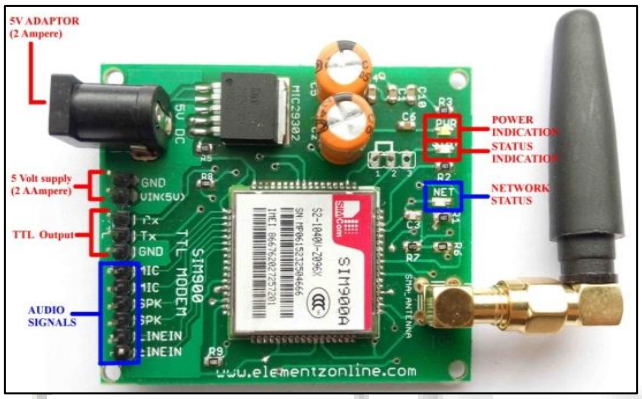
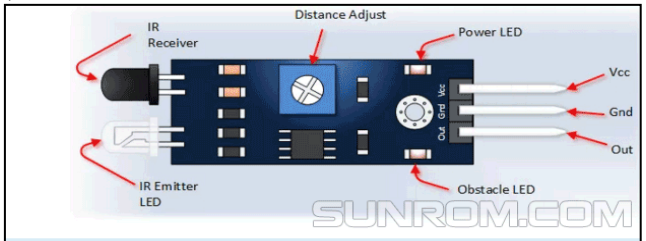


Fig. 5: GSM Module

SIM900 GSM Module – This means the module supports communication in 900MHz band. We are from India and most of the mobile network providers in this country operate in the 900Mhz band. If you are from another country, you have to check the mobile network band in your area. A majority of United States mobile networks operate in 850Mhz band (the band is either 850Mhz or 1900Mhz). Canada operates primarily on 1900 Mhz band.

4) IR Sensor



Pin, Control Indicator	Description
Vcc	3.3 to 5 Vdc Supply Input
Gnd	Ground Input
Out	Output that goes low when obstacle is in range
Power LED	Illuminates when power is applied
Obstacle LED	Illuminates when obstacle is detected
Distance Adjust	Adjust detection distance. CCW decreases distance. CW increases distance.
IR Emitter	Infrared emitter LED
IR Receiver	Infrared receiver that receives signal transmitted by Infrared emitter.

Fig. 6: IR Sensor

5) MEMS Sensor

ADXL345 from Analog Devices, is a triple-axis accelerometer with digital I2C and SPI interface. We added an on-board 3.3V regulator and logic-level shifting circuitry, making it a perfect choice for interfacing with any 3V or 5V microcontroller such astheArduino. The sensor has three axes of measurements, X Y Z, and pins that can be used either as I2C or SPI digital interfacing. You can set the sensitivity level to either +-2g, +-4g, +-8g or +-16g. The lower range gives more resolution for slow movements, the higher range is good for high speed tracking. The ADXL345 is the latest and greatest from Analog Devices, known for their exceptional quality MEMS devices. The VCC takes up to 5V in and regulates it to 3.3V with an output pin

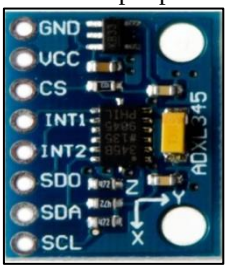


Fig. 7: Mems Sensor

IV. SCOPE OF PROJECT

By using Wireless sensor networks techniques we tend to conjointly develop more and additional reliable security systems applications, during which endlessly monitors the railway track through the sensors and observe any abnormality within the track. The sensor nodes are equipped with sensors that may sense the vibration within the railway track due a returning train. The geographical positioning sensors are placed on the trains. These sensors send the train's geographic location. the whole method is required to be real time in nature and will meet the deadlines.

V. ADVANTAGES & FUTURE SCOPE

A. Advantages

- The potential of human errors such as automated inspection and asset monitoring techniques, replacement of over-aged assets and up gradation of assets maintenance will emphasize.
- Finding the cracks in a railway track system depends upon automation therefore, it reduces the chances of human errors also reduces the man power as well.
- The System does monitoring the condition of rail tracks and if any defect detected by monitoring equipment it allow monitoring crews to subsequently find these defects hence, efficiency is high which lead to avoid accidents as well.
- As the system involves automation hence human interference is less as it increases accuracy level also it sends out the transmission signal immediately to the base station.
- As proposed system is less costly than existing system and in future it can be reduced in size as well.

VI. FUTURE SCOPE

In this project, we are using IR sensor and for detecting the cracks and obstacles & MEMS sensor for sensing any shake/tilt in parallel bridge position in rail track.

In future, we can detect cracks in railway tracks by 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 then it can be input to the suggested system to detect any cracks in the track section. This will help to detect cracks immediately and reduce the possibilities of any mishap. Since the system would be automatic and will require less manual intervention, the utmost efficiency of the system can be ensured.[1]

VII. RESULT & CONCLUSION

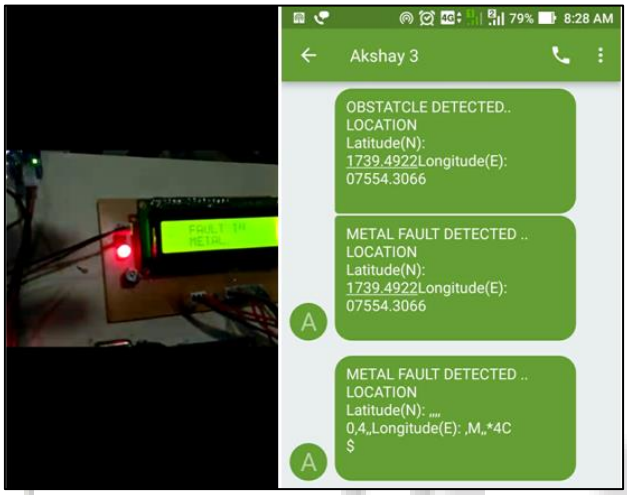


Fig. 8: Crack Detected with Longitude & Latitude Position

The Indian railways are the largest rail passenger transport in today's world and it is the back bone of the country transport infrastructure. The main problem about a railway analysis is detection of cracks in the structure. If these deficiencies are not controlled at early stages they might lead to a number of derailments resulting in a heavy loss of life and property. The proposed Railway track fault detection system automatically detects the faulty rail track without any human intervention.

In this project, we used to detect the fault in rail track automatically without any human intervention and used IR based rail inspection system with ARM 7 Microcontroller. The existing detection techniques are having many problems compared to the proposed system and the advantages are cost effective and less analysis time. By this proposed model find the exact fault location in rail track and which will takes the remedy action immediately so that time many people lives can be saved.

The method can be implemented in large scale in the long run to facilitate better safety standards for rail tracks and provide effective testing infrastructure for achieving better results in the future.

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