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Railway track crack detection based on GSM technique

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Abstract - *Transport is a key necessity for specialization that allows production and consumption of products to occur at different locations. Transport has throughout history been a spur to expansion as better transport leads to more trade. In India, to find 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. 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. In the past, 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 in the past, yet there have been no cheap automated solutions available for testing purposes. Hence, owing to the crucial repercussions of this problem, they have worked on implementing an efficient and cost effective solution suitable for large scale application*.

Key Words: (Transport, Efficient, Derailment, GSM module, Automated)

1. INTRODUCTION

India has one of the world's largest railway networks, manual Inspection and detecting a crack on these railways tracks is very tedious process and consumes lot of time and human resource. The proposed system gives really cheap method for railway track crack detection using op amp and Microcontroller. The Indian railway network today has a track length of 113,617 kilometers (70,598 mi).over a route of 63,974 kilometers (39,752 mi) and 7,083 stations. It is the fourth largest railway network in the world. Indian rail network is still on the growth trajectory trying to fuel the economic needs of our nation. Though rail transport in India growing at a rapid pace, the associated safety infrastructure facilities have not kept up with the aforementioned proliferation.

Our facilities are inadequate compared to the international standards and as a result, there have been frequent derailments that have resulted in severe loss of valuable human lives and property as well. On further analysis of the factors that cause these rail accidents, recent statistics reveal that approximately 60% of all the rail accidents have derailments as their cause, of which about 90% are due to cracks on the rails either due to natural causes (like excessive expansion due to heat) or due to antisocial elements. Hence these cracks in railway lines have been a perennial problem which has to be addressed with utmost attention due to the frequency of rail usage in India.

These cracks and other problems with the rails generally go unnoticed due to improper maintenance and the currently irregular and manual track line monitoring that is being carried out. The high frequency of trains and the unreliability of manual labor have put forth a need for an automated system to monitor the presence of crack on the railway lines. Owing to the crucial repercussions of this problem, this report 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 idea also helpful for another application where cracking problem are take place. The sensitivity of this system is high hence therefore no any problem are comes in detection of crack. Due to simple idea are implement in this system the installation are quite easy. GSM standards define a radio communications system that works properly only if each component part operates within precise limits. Essentially, mobiles and base stations must transmit enough power with sufficient fidelity to maintain a call of acceptable quality, without transmitting excessive power into the frequency channels and time slots allocated to others. Similarly, receivers must have adequate sensitivity and selectivity to acquire and demodulate a low level signal. This document provides an overview of the key measurements required for testing GSM transceivers. It also discusses GSM mobile performance derivation

2. DIFFERENT METHODS

2.1: Eddy Current Detection

It is used to detect discontinuities and defects in conductive materials. Using this technique, two different types of artificial defects in a railhead were evaluated in order to analyze the relationship between different types of defects and eddy current signals, and to obtain data on the size of the rail surface defects and crack location.

Two eddy current sensor probes were used. One was for detecting the signal from a rail. It was positioned on a tested sample and scanned along the rail length. Another was for reference. It was positioned in air far from a sample. The controller supplied an excitation current to a series connection of two excitation coils and amplified a signal from the detection coils. The width of the rail head was 65 mm; thus, the detection coil in the sensor probe could not effectively evaluate the entire plane of the rail top. Therefore, the position of the sensor probe was varied in five different positions along the width.

2.2: IR Transmitter and Receiver

In this method the crack is detected by using the IR transmitter and receiver assembly. It includes a robot which will move on the tracks to detect cracks.

The principle involved in this crack detection is that light reaching the IR receiver is proportional to the intensity of crack i.e. when maximum light transmitted by transmitter reaches the receiver the crack intensity is more. The IR transmitter will be attached to one side of the rails and the IR receiver to the opposite side. During normal operation, when there are no cracks, the light from transmitter does not fall on the receiver and hence the set value is low. When the light from transmitter falls on the receiver, the value gets increased and the amount by which it is incremented will be proportional to the intensity of the incident light. As a consequence, when light from the transmitter deviates from its path due to the presence of a crack or a break, a sudden increase in the value can be observed.

2.3: Ultrasonic Method

The composite detection system consists of a laser source, whose beam is collimated by a suited optic lens into a light plane, two 512X512 –pixel CCD cameras for complete optimum observation of the track, a digital processing system per camera, and a supervision system.

In each column of the image localizing the position of the track profile means to find the position of the maximum laser reflection intensity. In the ideal case the intensity distribution along the column is Gaussian. Localizing the maximum implies therefore detecting the position of the expected Gaussian profile with the maximum likelihood.

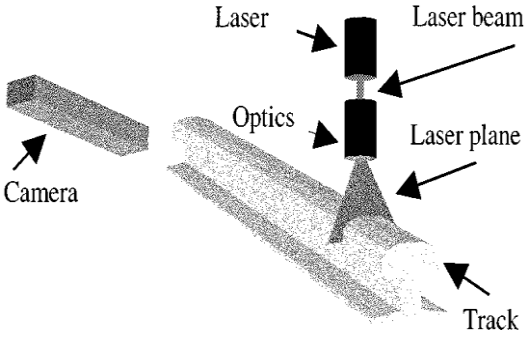
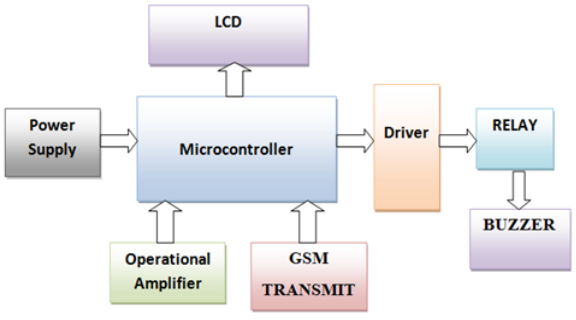


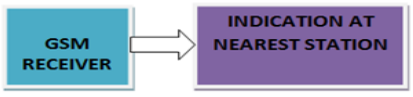
Fig -1: Ultrasonic Method

3. PROPOSED SYSTEM

In this model op-amp play a vital role that helps to identify the cracks in railway line. Here we use LM358 op-amp that is connected to resistive network and in another terminal, we apply reference voltage. Suppose there is no crack in the main line then it gives us a predefine voltage, but due to crack in the line voltage changes. Output of op-amp is applied to microcontroller. Using GSM modem we can find out whole information of the track whether the track has gap, if there is gap then it will show on software that is designed in vb6.0. At software end, we can find out location where crack is. If there is any crack then on LCD there is pole message display. There is LED indication if there is crack then green LED turn RED. In these manners we can find out the crack. In this project we have used AT89S52 microcontroller. It has 8 kb of flash memory and it is easily available in the market. As shown in the circuit diagram we



(a) Transmitter section



(b) Receiver section

Fig -2: Block Diagram

have connected 10 k 9 pin SIP resistor in the port line of microcontroller. 10 k ohm resistor and 2.2 uF capacitor form the reset circuit for microcontroller. 11.0592 MHz crystal in connected in 18 and 19 pin of microcontroller with 33 pf capacitor. Here we are using four LM358 that is connected to port 2.4- port2.7 and port 3.4-port 3.7. We are showing 8 track hence we used 4 op-amp. Each op-amp gives two outputs. Two relay are used which is connected through ULN2803, connected to port P1.

16X2 LCD display is connected with port 0 of microcontroller. We can display track status on LCD and show pole no. of track which was cracked. GSM modem is connected to P3.0 and P3.1. Transmitter modem is connected through Microcontroller and receiver side is connected to PC end. If any crack is detected we can receive it through modem and status observe in software. Power Supply is made-up of simple bridge diode filter and regulator ic. All the ics are work on 5 volts so we have employed 5 volt regulator here and 12 volt supply for the relay driver circuitry.

4. CONCLUSION

This system makes an attempt in providing a viable solution in making the railway tracks crack free with GSM based railway detection scheme. By using the op-amp the cost of this system is totally reduces as compare to another system which is already invented for track security purpose. The main idea of the system can be implemented on a large scale in order to have safe track with sound infrastructural facilities for better results in future.

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