International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 01 | Jan -2017 www.irjet.net p-ISSN: 2395-0072

REVIEW ON RAILWAY TRACK CRACK DETECTION USING IR TRANSMITTER AND RECEIVER

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Abstract – *The IR transmitter and receiver total station for railway track geometry surveying system. Railway Crack Inspection is dedicated as a measure of railway safety. The defect information can be wirelessly transferred to railway safety management centre using a GSM module and it includes defect level and location information which is acquired by embedded GPS receiver. In terms of the reliability and safety parameters, Indian railway has not yet reached the international standards. The main problem about railway analysis detection of cracks in the structure. This work proposes a cost effective solution to the problem of railway track crack detection utilizing IR transmitter and receiver which tracks 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 a heavy loss of life and property has train derailment can be avoided and chance of loss of human life and economy can be minimized.*

Key Words: IR transmitter and receiver, Crack detection, GPS, GSM, PIC Microcontroller and LCD

1. INTRODUCTION

Transport has throughout history been a spur to expansion as better transport leads to more trade. 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 sustain ability and safety a major issue. In India, we 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. Today, India possesses the fourth largest railway network in the world. However, in terms of the reliability and safety parameters, we 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. In the past, this problem has lead 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. The new method which utilizes simple components inclusive of a GPS module, GSM Modem, IR Transmitter and Receiver based crack detector assembly is very useful in railway crack detection. proposed a system that utilises LED-LDR configuration for railway crack detection. RRCDS utilises simple components inclusive of a GPS module, GSM Modem and LED-LDR based crack detector assembly.

The pro- posed broken rail detection system automatically detects the faulty rail track without any human intervention techniques. The advantages include less cost, low power consumption and less analysis time. By this proposed system the exact location of the faulty rail track can easily be located which will mended immediately so that man lives can be saved. Processes the image signal collected, judges out the crack signal, and displays the curve through the LCD, and gives off the alarm. The system essential modules such as, the CCD timing generator, A/D converter timing generator, address generator, RAM memory all are realized on CPLD. It adopts the improved classical algorithm and morphology algorithm to perform noise elimination, the edge detection, the image segmentation and the edge linking to the railway surface crack image, which obtains the good detection result.

The whole system is fixed on the vehicle-hold system, travelling along the railway, then conveniently examines the crack position, thus may promptly carry through track maintenance, avoiding the accident. Moreover, the system can connect with the PC, transforming the sampling data to PC to further analysis. In another method K. Vijayakumar et.al [5] has investigated crack detection using microwave sensors. It describes how a Microwave horn antenna can be used to detect the cracks in a rail track. Based on the simulation results obtained from the High Frequency Simulation Structure (HFSS), it has been shown that the design of the Microwave sensor has the potential for detecting defects in the rail surface including minor cracks as well as more serious as well as. In another method Richard J. Greene et.al [6] have presented a new crack detection

method, for rail which utilizes the change in infrared emission of the rail surface during the passage of a train wheel. Initial data from this infrared method are presented, from studies of both a laboratory-based three-point bend specimen and a short section of rail. The results of these two studies confirm the ability of the proposed method to locate and quantify Surface-connected notches and cracks. Richard J. Greene et.al [6] developed an improved version of infrared-based method for surface crack quantification at conventional train speeds which delivers crack detection capability over the full depth of the rail section, with a crack resolution capability comparable to competing detection techniques.

Experimental results are presented for a laboratory three-point bend notched specimen, the geometry of which is representative of surface-connected cracks with lengths below 2 mm in sections of rail. Two analyses are considered a simulated trackside system, where the observation point is fixed and the repeated loading event experienced by a section of rail during the passage of multi-carriage rolling stock is considered; and a simulated train-based system, where the observation point moves along the rail and the loading event produced by the passage of a single train wheel is considered. Data from the track side simulation system clearly identifies the precise location and severity of an artificially introduced notch on the upper surface of the specimen. Initial data the train-based simulation system identifies the notch location precisely, but is unable to quantify the magnitude of the flaw using the current processing method. The paper then describes modifications to the testing and data processing methods required to improve the performance of both system. After going through all these papers, we came to a conclusion to do a project which would provide better safety standards in a cost effective way for railway crack detection. The method utilises IR transmitter and receiver for the purpose and have many advantages compared to the traditional technique.

2. LITERATURE SURVEY

A. RAILWAY TRACK

Track-caused derailments are often caused by wide gauge. Proper gauge, the distance between rails, is 56.5 inches (four feet, eight-and-a-half inches) on standard gauge track. As tracks wear from train traffic, the rails can develop a wear pattern that is somewhat uneven. Uneven wear in the tracks can result in periodic oscillations in the truck, called 'truck hunting.' Truck hunting can be a contributing cause of derailments. A rail breaks cleanly, it is relatively easy to detect. A track occupancy light will light up in the signal tower indicating that a track circuit has been interrupted. If there is no train in the section, the signaller must investigate. One possible reason is a clean rail break. For detecting the rail break this way, one has to use signal bonds that are welded or pin brazed on the head of the rail. If one uses signal bonds that are on the web of the rail, one will have a continued track circuit. If a rail is merely cracked or has an internal fissure, the track circuit will not detect it, because a partially-broken rail will continue to conduct electricity. Partial breaks are particularly dangerous because they create the worst kind of weak point in the rail. The rail may then easily break under load--while a train is passing over it at the point of prior fissure.

B. DIFFERENT METHOD OF CRACK DETECTION

A. CRACK DETECTION USING ULTRASONIC AND PIR SENSOR

In this detection of 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 two track and also PIR sensor are used to detect human being pursuing in the track. If any crack are occurred in the track means longitude and latitude of the place are messaged to the nearest station and ultrasonic sensor are measure the distance between the two track if any small variance means they detect and message to the nearest station using GPS and GSM modem. When PIR 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.

B. CRACK DETECTION USING LED-LDR

The principle involved in crack detection is the concept of LDR. In the proposed design, the LED will be attached to one side of the rails and the LDR to the opposite side. During normal operation, when there are no cracks, the LED light does not fall on the LDR and hence the LDR resistance is high. Subsequently, when the LED light falls on the LDR, the resistance of the LDR gets reduced and the amount of reduction will be approximately proportional to the intensity of the incident light. 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 current location of the device in case of detection of a crack, a GPS receiver whose function is to receive the current latitude and longitude data is used. To communicate the received information, a GSM modem has been utilized. The GSM modem transfers the received Information to the GPRS which then shows the exact location of the faulty rail track in the mobile. The proposed rail track detection system architecture consists of ARM7 controller, GPS, GSM, LED-LDR Assembly, and GPRS, DC Motor

C. INTELLIGENT RAILWAY CRACK DEFECT INSPECTION

The proposed system consists of mainly three components that are Micro-controller, IR module and Zigbee module. IR sensor is used to detect the crack in railway track. Infrared (IR) transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. The transmitted light rays are received by IR receiver on adjacent side. IR transmitter and receiver should be kept parallel and adjacent to each other so that transmitted light can fall on receiver straight. Then the LCD display is used to view the result.

4. PROPOSED SYSTEM

In this proposed system we use PIC16F877A microcontroller. It is a low power, high speed CMOS FLASH/EEPROM technology. It is also a low cost easy to program microcontroller which have only 35 instruction set. Before the start of the rail- way line scan the robot has been programmed to self-calibrate the IR Transmitter and Receiver. After calibration, the robot waits for a predetermined period of time so that the onboard GPS module starts reading the correct geographic coordinate. 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.

This change in value indicates the presence of a crack or some other similar structural defect in the rails. In order to detect the current location of the device in case of detection of a crack, we make use of a GPS receiver whose function is to receive the current latitude and longitude data. To communicate the received information, we make use of a GSM modem.

The GSM module is being used to send the current latitude and longitude data to the relevant authority as an SMS. The aforementioned functionality has been achieved by interfacing the GSM and GPS modules with the PIC16F877A microcontroller. The robot has four wheels which are powered by two 12V batteries. The design is simple and sensible enabling the device to be easily portable.

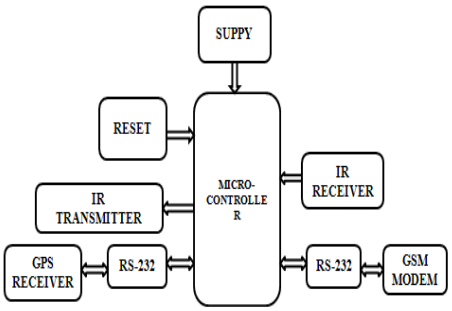

Fig -1: Functional Block Diagram

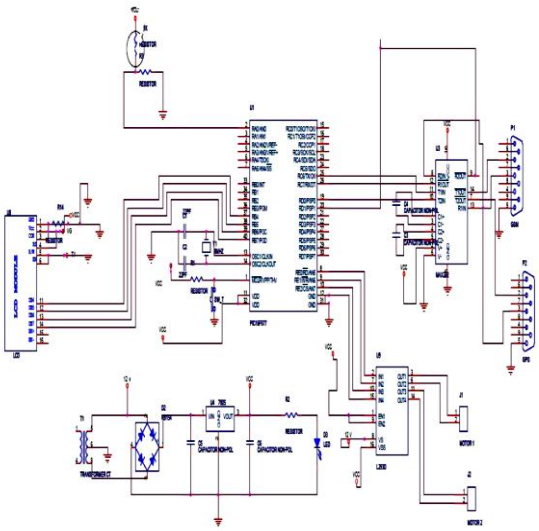

Fig. 2: Circuit Diagram

5. RESULT

The sensors sense the crack and send the information to the microcontroller, where it responds and gives the command to the particular component with predefined algorithm, the time parameters are crucial which can be easily changed and modified using microcontrollers. Thus, this device would help to reduce the train collisions. The arrangement utilized aluminium frame kept in the form of tracks and the model was made to traverse it. We included a break manually and found that the device successfully detected that user-created crack and the current latitude and longitude values were received by the GPS receiver, converted into a suitable text format and then finally transmitted to a mobile phone by means of the GSM module. However, as the rail tracks did not contain any cracks, we were not able to test the GSM and GPS modules on field. But the previously mentioned simulated trial validates the project. Thus, the field trials indicate a fairly good degree of accuracy and also the GSM and GPS modules worked properly by transmitting the current latitude and longitude data to a mobile phone on detecting our simulated crack.

6. CONCLUSIONS

Railway crack detection by using IR transmitter and receiver robot is an eminent way to detect the crack in the railway track. The defect information which includes GPS value is wirelessly transmitted to the railway safety management centre through GSM Module and the alert can be given to the next approaching train. The proposed scheme possesses many advantages such as fast monitoring and reporting system, low cost, low power consumption and less analysis time. Also the easy availability of the components make an ideal project for industrial use with very little initial investment. So the current location device on rail track can easily be measured from home station. By this proposed model many lives can be saved by avoiding accidents. The idea 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.

ACKNOWLEDGEMENT

I express my sense of gratitude and sincere regards to my guide Prof. A. H. Shelar for guiding me properly in my project work and for helping to solve the project work difficulties. I would also like to thanks all the staff members of Electrical (Electronics & Power) Department for supporting and guiding me in my project work whenever required.

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