International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 05 | May-2016 www.irjet.net p-ISSN: 2395-0072

Robust Railway Track Crack Detection Scheme

Ajeya G R[1], Ashwini N[1],Kavitha S[1],Latha D C[1], ChaithraG[2]

[1]BE Scholar, ECE Department, Brindavan College, VTU university, Bangalore

[2]Assistant Professor, ECE Department,Brindavan College, VTU University, Bangalore

---

Abstract - *Most of the commercial transport is being carried out by the railway network and therefore, any problems in the same has the capacity to induce major damage to the economy-notwithstanding the societal impact of loss of life or limb. This paper is developed to overcome the problem of railway crack, the cracks is detected through LDR when the LED light falls on it through the crack, the current location is sent through GPS and to receive the information GSM is utilized, 4 wheel robot is used in the place of train, with the help of the DC motor.*

Key Words: *Railway track, crack detection, Renesas RL78, GSM, GPS, LED, LDR, 4 wheel robot.*

1.INTRODUCTION

In today's world, transport is a key necessity because in its absence it would be impossible for products to be consumed in areas which are not in the immediate vicinity of the production centers. Throughout history, transport has been a necessity for the expansion of trade. Once we look back into our history for the development of trade from the beginning till today transport is one of the main reason. Economic prosperity can be achieved by increasing the rationality and capacity of transport systems. The proper operation and maintenance of transport infrastructure has a great impact on the economy. Transport, being one of the biggest drainers of energy, its sustainability and safety are issues of paramount importance. 4.6million's of vehicles are introduced every year in India. Even though so many vehicles are introduced only 10% of houses India holds their own vehicle, rest of the people depend on the public transports for their transportation. In the world India is the country were public transport is highly used. People want to travel longer distances mainly depend on the either Railway's or Airway's. Since The railway transport occupies a prominent position in quenching the ever burgeoning needs of a rapidly growing economy. 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.

In the history of railways the first railway in India was "Peninsula railway" which travelled from Mumbai to Thane in the year 1853. Later in the mid of 19th century the railways was established in India. In the railway transportation among the world Indian railway networks is the fourth largest Railway's. There are 7112 railway stations and 68 railways zones in India. The total length of railway track is 1,15,000km. Compared to past 20-23years 15 times more people uses Railway's. Around 80 Million's of people travel in railways per day. Around 16,000 trains run on rails per day. Approximately 300 railway accidents takes place per annum, among with 15% of accidents are in India. 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. 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, they have been frequent derailments that have resulted in severe loss of valuable human life and property as well. 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 labour have put forth a need for an automated system to monitor the presence of crack on the railway lines. The principle problem as been the lack of cheap and efficient technology to detect problems in railway tracks.

To overcome the crack problem we propose a robust solution to the problem of railway crack detection using LED-LDR which is cost effective. In this paper is

implemented using simple components Microcontroller (renesas RL78), LED, LDR, GSM, GPS module, 4 wheel robot. The LED-LDR monitors the cracks in the rails, GPS detects current location, to receive information GSM is utilized, the robot is driven by dc motors on railway tracks.

Fig -1: Crack in the railway track

2.LITERATURE SURVEY

[1].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.

[2]. 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.

[3].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.

3.PROPOSED SYSTEM

The proposed crack detection scheme consists of a Light Emitting Diode (LED)-Light Dependent Resistor (LDR) assembly that functions as the rail crack detector. 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 function of the GSM module being used is to send the current latitude and longitude data to the relevant authority as an SMS. The functionality has been achieved by interfacing the GSM module, GPS module and LED-LDR arrangement with a microcontroller. The robot is driven by four DC motors. The LCD is utilized to demonstrate the working of the entire unit.

BLOCK DIAGRAM

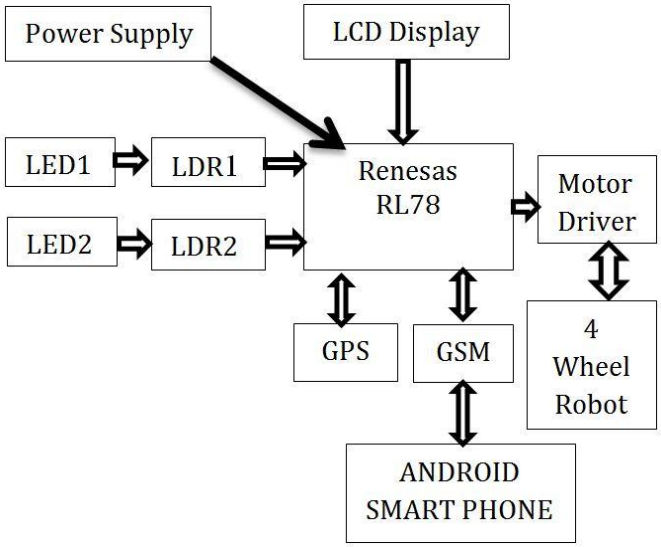

Fig -2: Robust Railway Track Crack Detection Scheme

4.PROPOSED SYSTEM DETAILED DESCRIPTION

4.1 Renesas Microcontroller RL78

Renesas RL78 microcontroller was developed and manufactured by RENESAS ELECTRONICS in 2011, it is a 16 bit CPU core architecture for embedded microcontrollers. The RL78which is supported with a range of hardware and software development tools

including the GNU compiler collection and IAR systems compiler with an integrated design environment called eclipse embedded studio or e2studio.the RL78 was the first microcontroller core to emerge from the new renesas electronics company from the merger of NEC electronics and renesas technology.

4.2 Light Emitting Diode(LED)

Alight emitting diode(LED)is a semiconductor light source. LEDs are used as indicator lamps in many devices and are increasingly used for general lighting. Appearing as practical electronic components in 1962,early LEDs emitted low-intensity red light, but modern versions are available across thevisible,ultraviolet, andinfraredwavelengths, with very high brightness.

4.3 Light Dependent Resistor(LDR)

Light dependent resistor alternatively called LDR, photo resistor, photo conductor or photocell, is a variable resistor value decreases with increasing incident light intensity. An LDR is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photos absorbed by the semiconductor give bond electrons enough energy to jump into the conductor band.

4.5 Liquid Crystal Display (LCD)

A liquidcrystal display (LCD) is a flat panel display, electronic visual display, based on a Liquid Crystal Technology. A liquid crystal display consists of an array of tiny segments (called pixels) that can be manipulated to present information. Liquid crystals do not emit light directly instead they use light modulating techniques. LCDs are used in a wide range of applications, including computer monitors, television, instrument panels, aircraft cockpit displays, signage, etc.

4.5 Global Position System

Global Positioning System was developed by the United States Department of Defense. It uses between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals. This enables GPS receivers to determine their current location, time and velocity. The GPS satellites are maintained by the United States Air Force. GPS is often used by civilians as a navigation system. On the ground, any GPS receiver contains a computer that "triangulates" its own position by getting bearings from at least three satellites. The result is provided in the form of a geographic position - longitude and latitude - to, for most receivers, within an accuracy of 10 to 100 meters. Software applications can then use those coordinates to provide driving or walking instructions.

4.6 Power Supply

An external power supply is used in order to provide the electrical energy for the dc motor to run. Since the power supplied to Microcontroller is only 5V and which is not sufficient for the DC motor to run it requires 12v, so an external power supply module is used.

4.7 L293D Motor Driver

The Device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays, solenoids, DC and Stepper motor) and switching power transistors.The L293D is assembled in a 16 lead plastic package which has 4 center pins connected together and used for heat sinking. Since L293D is an integrated circuit motor driver it can be used for simultaneous bidirectional control of two small motors. L293D is limited to 600mA.

4.8 DC Motor

A DC motor in simple words is a device that converts direct current into mechanical energy, it's of vital importance for the industry today, and is equally important for engineers to look into the working principle of dc motor.

5.MERITS, ISSUES AND APPLICATIONS

5.1 Merits

- It avoids railway accident, reduces the damage and loss of life.
- Manual operation has been reduced to major extent.
- Very accurate detection.

5.2 Issues

- Designing of robot is difficult
- A part from crack in railway track it will not detect more cause for rail accident
  Ex. Train derailment, improper maintenance of tracks, collision with vehicles/animals etc

5.3 Applicatons

- Used in metro trains
- Used in normal railways
- Used in gaming systems

Ex. Roller coaster, wonder splash etc..

6.CONCLUSION

In this paper, we have presented the rationale, design of our robust LED-LDR based railway crack detection scheme. This 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. It proposes a cost effective yet robust solution to the problem of railway crack detection utilizing a method that is unique in the sense that while it is simple, the idea is completely novel untested.

REFERENCES

[1]. QiaoJian-hua; Li Lin-sheng; Zhang Jing-gang; "Design of Rail Surface Crack detecting System Based on Linear CCD Sensor", IEEE Int. Conf. on Networking, Sensing and Control, 2008 .

[2]. K. Vijayakumar, S.R. Wylie, J. D. Cullen, C.C. Wright, A.I. AIShamma'a, "Non invasive rail track detection system using Microwave sensor", Journal of App. Phy., 2009.

[3]. Tranverse crack detection in rail head using low frequency eddy currents, Patent US6768298, www.google.com/patents/US6768298.

[4] M. Cacciola, G. Megali, D. Pellicanμo, S. Calcagno, M. Versaci, and F. C. Morabito, "Rotating Electromagnetic Field for Crack Detection in Railway Tracks", PIERS ONLINE, Vol. 6, NO. 3, 2010.

[5]. Wojnarowski, Robert John Welles, II, Kenneth BrakeleyKornrumpf, William Paul, "Electromagnetic system for railroad track crack detection and traction enhancement", Patent US6262573, www.patentstorm.us/patents/6262573/description.html

[6]. Stuart B Palmer, Steve Dixon, Rachel S Edwards and XiaomingJian, "Transverse and longitudinal crack detection in the head of rail tracks using Rayleigh wave-like wideband guided ultrasonic wave", Centre for Materials Science and Engineering The University of Edinburgh, www.cmse.ed.ac.uk/AdvMat45 / Rail- crack - detection.pdf

[7]. Lanza di Scalea, F., Rizzo, P., Coccia, S., Bartoli, I., Fateh, M., Viola, E. and Pascale, G., "Non-contact ultrasonic inspection of rails.

[8]. A. L. Polivka and W. L. Matheson, "Automatic train control system and method", U.S. Patent No. 5828979, (**2014**) October 27.

[9]. A. L. A. T. D. Ambegoda, W. T. S. D. Silva, K. T. Hemachandra, T. N. Samarasinghe and A. T. L. K. Samarasinghe, "Centralized traffic controlling system for SriLanka railways", 4th International Conference on Information and Automation for Sustainability (ICIAFS08), Sri lanka, (**2013**) December 12-14.

[10]. "Automatic railway track switching system"International Journal of Advanced Technology, vol. 54, (**2014**).

[11]. F. R. L. Boylestad and L. Nashelsky, "railway crack detection using GPA technology", 9th edition, Prentice Hall, USA, (**2012**), pp. 196-199.

[12]. GopichandKatragadda, San Antonio, TX (US); Douglas Earnest, San Antonio, TX (US); Gregory Anthony Garcia, Pueblo, CO (US); Richard Paul Rei?', Pueblo, CO (US)

[13]. Garcia and Reiff, TTCI, Technology Digest, Rail—Defect test Facility: A Tool of Evaluating Defect—Detection Technologies, Jan. 1999, 4 pages.