International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Articles available online http://www.ijoer.in

Vol.3., Issue.6., 2015
(Nov.-Dec.,)

RESEARCH ARTICLE

ISSN: 2321-7758

RAILWAY TRACK FAULT DETECTION SECURITY SYSTEM BASED ON ZIGBEE COMMUNICATION

RAHUL DHOD

Academic & Consultancy Division, Centre for Development of Advanced Computing (C-DAC), A Scientific society of the Ministry of Communication & Information Technology, Government of India, Mohali.

RAHUL DHOD

ABSTRACT

The main aim of this paper is to develop an embedded system to identifying rail track fault sending message to near station using ZIGBEE TECHNOLOGY. Railway tracks are important part of train, if there is any damage in railway track then it creates a major problem for train and passengers. Breaking of railway track is major problem today, which cannot be easily identified and only manual way is discovered to find out crack in train. In order to reduce this problem, we developed a railway track, crack detection system which detects the crack in track and alert by buzzer alarm. Zigbee module is used to transmit the distance and location of crack in track to nearest maintenance department of railway.

Keywords: Railway track, crack detection**,** Zigbee, GPS.

I. INTRODUCTION

Existing methods include the naïve manual detection by the human eye. This is not very efficient as on the outside, the human eye may be fooled, and a simple crack in the railway track may go unnoticed. This simple overlook may be the cause of catastrophic railway accidents. Rail inspection cars were specifically built for this purpose and had to traverse along the complete length of the track for inspection. Magnetic induction was the method used on the first rail inspection cars. This was done by passing large amounts of magnetic field through the rail and detecting flux leakage with search coils. Since then, many other inspection cars have traversed the rails in search of flaws. All these methods are fairly accurate, but cumbersome and expensive. The proposed paper aims to achieve the same goal by being a stationary process, cost effective and very accurate, without hindering normal railway operation and with provision of a warning mechanism.

II. RELATED WORK

In general, there exist three main categories of techniques currently used for damage identification and condition monitoring of Railway tracks. These include:

- **Visual inspections**
- **Non-destructive testing**
- **Vibration-based global methods**

Another method for detection of cracks on tracks is by using wireless sensor networks. In this method the detection of Cracks can be identified using IR rays with the IR transmitter & receiver.IR receiver is connected to the Signal Lamp or Electrified lamp with the IR sensor. CAN controller is connected to the main node and it send the information via GSM

and transmit the message to engine and to the nearest station. The detection of Cracks can be identified using IR rays and IR sensor.IR receiver is connected to the signal lamp and to the CAN controller. The electrified lamp is nothing but it sides of the tracks the electric lamp which is current flowing for the engines transportation [2], but this type of system doesn't locate small cracks and the system is also costly.

Figure 1.1: Model Figure to Fix the IR Sensor on the Wheel

III. DEVICE ARCHITECTURE

The principle involved in crack detection is the concept of LDR (*Light dependent Resistor*). Basic concept behind this project is the LED and LDR, both are used as crack detection sensor , LED will be placed on one side of rails and LDR on the other side , as we all know that , LDR is light dependent resister which changes resistance when light fall on it. When there is no crack on track and led light does not fall on LDR and hence LDR resistance is high. In case of crack track when the light fall on LDR its resistance changes. This change in resistance indicates the presence of a crack or some other similar structural defect in the rails. Now, the problem is to find out the location of crack area. Here is solution, we are using GPS module which track the coordinates of crack track area and send coordinates to the nearest railway maintenance department through zigbee communication. The sensors are placed on an automobile robot which uses the same path which is used by rails. With this current system only latitudes and longitudes of the broken track will only be received so that the exact location cannot be known.

***Hardware tools*:**

- Microcontroller 89s52
- Crack detection circuit
- Interfacing unite
- Robot Mechanism
- Communication System

***Software tools*:**

- Keil Compiler
- Proteus

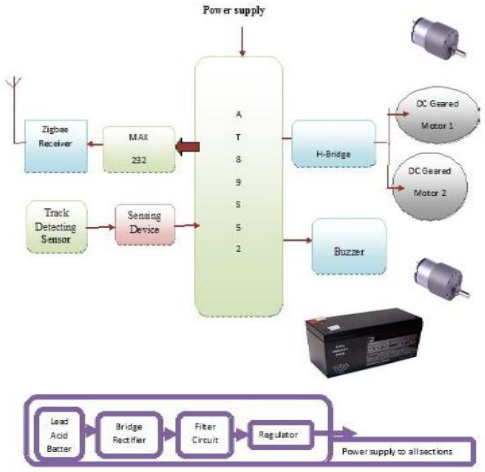


Figure 1.2: Block diagram of transmitting unit

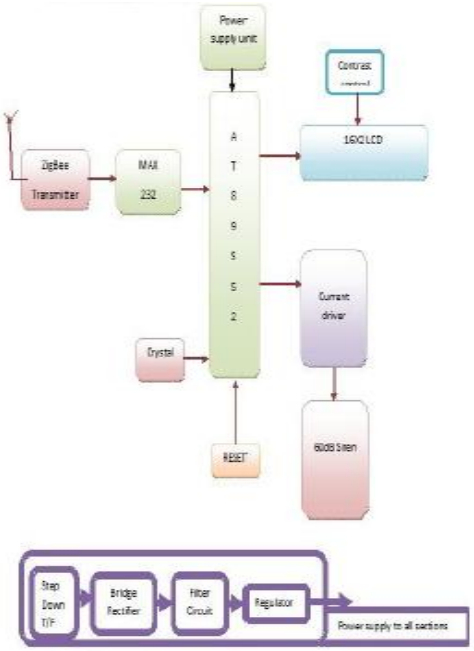


Figure 1.3: Block diagram of receiving unit

IV. HARDWARE DESCRIPTION

ATMEL (AT89S52): The AT89S52 belongs to the 8051 family of microcontrollers which have low power idle and power down mode, and are high performance computing devices. It works at crystal frequency ranging from 0Hz to 33MHz and executes most of complex instructions in a single clock cycle. It has 8KB of ISP flash memory, 256 bytes RAM, 32 I/O programmable lines, full duplex UART serial channel, a watchdog timer, power off flag and two 16 bit timer/counters. It is used to interface various sensors and modules like GPS, GSM and IR sensors.

GPS Technology: The Global Positioning System is a satellite based navigation system that can be used to track longitude and latitude. It utilizes a constellation of 24/32 active satellites orbiting the earth that transmit an accurate microwave signal. A GPS receiver requires at least three or four satellites to calculate the distance and direction as shown in Figure 2. It can calculate two dimensions, that is latitude and longitude or three dimensions that is latitude, longitude, and altitude positions.

DC MOTOR: DC motor is used for movement and locomotion purpose of the rover. It has high revolution per minute and low torque. In general robotics requires low revolution per minute and high torque. Hence gearbox is used to achieve this configuration, which reduces the rpm and increases the torque. The operation is based on the principle of electromagnetism which states the magnetic field is generated by a current carrying conductor and when it is placed in an external field, it experiences a force proportional to the current in the conductor. The speed of the motor can be controlled by changing the voltage applied to the armature or by changing the field current.

LIGHT DEPENDENT RESISTOR (LDR): Light dependent resistor is very useful especially in light/ dark sensor circuit as shown in figure 3. Normally the resistance of an LDR is very high (1000000 ohms) but when they are under light its resistance drops significantly. We are using 10 X LDR sensors in this project. It principle behind its working is, when it's dark, the LDR has very high resistance. Due to high resistance the voltage across the base of the transistor is not sufficient enough to turn on the transistor so current path from collector to emitter is blocked. When LDR is illuminated, the transistor is turned on allowing the current path from collector to emitter.

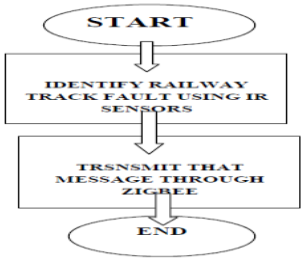
V. SOFTWARE DESCRIPTION

µVISION FOR AT89S52: Kiel software is used for the software implementation of the developed system. With help of it, we can generate embedded applications for the multitude of 8051 and 251 derivatives**. µvision4** Integrated Development Environment is an IDE that make facility, editor and powerful debugger. It is used for compile the programs [6]. In this project, coding is written for all modules, sensors, switching unit which are interfaced with AT89s52 microcontroller. As per the embedded in the controller, the interfaced modules and sensors generate appropriate output at the receiving terminal.

PROTEUS 7.0 FOR CIRCUIT SIMULATION: Proteus 7.0 is a virtual system modelling that combines circuit simulation, animation components and microcontroller model to co-simulate the complete microcontroller based designs. In this project, virtual simulation circuit is designed with help of proteus for testing.

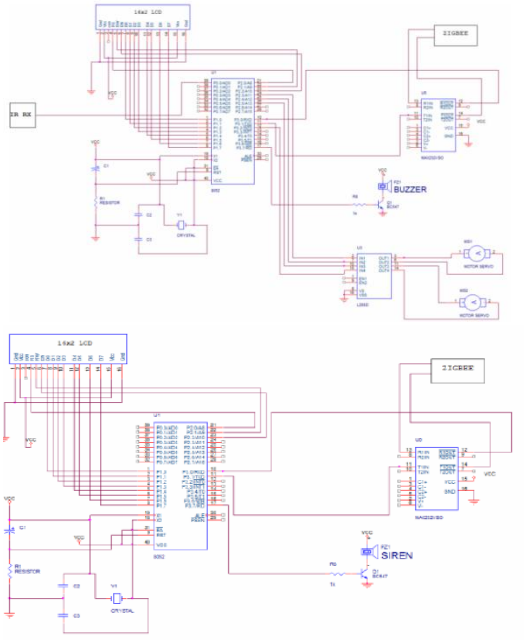
VI. RESULTS

i. Flowchart of transmitting section:

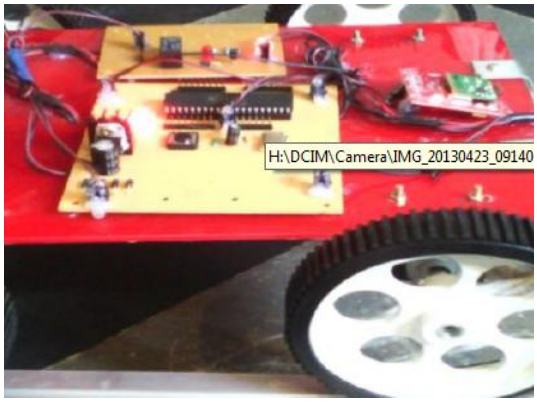


ii. Flowchart of receiving section:

VII. PINNING INFORMATION OF TRANSMITTER & RECEIVER



iii. Design View:



VIII. CONCLUSION

This work proposed the design of a fault detection device called "railway track fault detection security system based on zigbee communication" for assisting avoidance accident in rail transportation. The system is much cheaper compared to other such devices available in the market. It is a real time system which detects the position of fault and direction, monitors the coordinates of their location there are many advantages with the proposed system when compared with the traditional detection techniques. The total cost of this prototype development is under $ 60. So, this device can be easily afforded by affected people in developing countries. Another aspect of the project was to develop an electromechanical design of the system. The structural design of the device ties to optimize the signal-structure interaction aimed towards effective's message signal transfer and minimal power consumption by system.

REFERENCES

[1]. V.Reddy, "*Deployment of an integrated model for assessment of operational risk in railway track*", Master Thesis, Queensland University of Technology School of Engineering Systems, 2007.

[2]. C. Esveld, "*Modern railway Track*". Second Edition, MRT Productions. 2001 .

[3]. D.Hesse "*Rail inspection using ultrasonic surface waves*" Thesis ,Imperial College of London,2007.

[4]. C. Campos-Castellanos, Y.Gharaibeh, P. Mudge *, V. Kappatos, "*The application of long range ultrasonic testing (LRUT) For examination of hard to access areas on railway tracks*". IEEE Railway Condition Monitoring and Non- Destructive Testing (RCM 2011) Nov 2011.

[5]. M. Singh, S.Singh1,J.Jaiswal, J. Hempshall "*Autonomus rail track inspection using vision based system*" .IEEE International Conference on Computational Intelligence for Homeland Security and Personal Safety . pp 56- 59, October 2006.

[6]. S.Zheng, X.An, X.Chai, L. Li "*Railway track gauge inspection method based on computer vision*" IEEE International

Conference on Mechatronics and Automation, 2012. pp 1292-1296.

[7]. W. Al-Nuaimy , A. Eriksen and J. Gasgoyne " *Train-mounted gpr for high-speed rail trackbed inspection*" Tenth International Conference on Ground Penetrating Radal; 21 -24 June, 2004 .

[8]. A.Vanimiredd, D.A.Kumari "*Automatic broken track detection using LED-LDR assembly*" International Journal of Engineering Trends and Technology (IJETT) - Volume4 Issue7- July 2013.

[9]. http://www.seeedstudio.com/depot/images/product/sr-92.pdf.

[10]. [http://www.wvshare.com/datasheet_html / LPC2148-PDF.html