



ISSN(Online): 2320-9801

ISSN (Print): 2320-9798

# International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: [www.ijircce.com](http://www.ijircce.com)

Vol. 5, Issue 4, April 2017

## Railway Track Fault Detecting Rover using GPS and ZigBee

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**ABSTRACT:** The Indian Railways has the world's fourth largest railway network in the world, after that of the United States, Russia and China.. It is one of the world's largest commercial or utility employers, with more than 1.6 million employees. About 15000 trains work every day. Unfortunately there have been many accidents involved in the railways. In the year between 2009-2015, there were a total of 803 accidents in Indian Railways killing 620 people and injuring 1855 people.47% of these accidents were due to derailment of trains according to research. The Transportation of train always depends on railway tracks (rails) only. If there is a crack in these rails, it creates a major problem. Also it takes more time to rectify this problem. In order to avoid this problem, we are using the crack detector robot, which detects the crack in the rails and gives an alarm .A robot is an apparently human automation, intelligent and obedient but impersonal machine. The project discusses the technical and design aspects in detail and also provides the proposed robust crack detection algorithm. The currently existing technical solutions in the detection of cracks in rails involve periodic maintenance coupled with occasional monitoring the inspection methods like are visual inspection, eddy current and laser methods.

**KEYWORDS:** ATMEGA328;ZigBee;GPS.

### I. 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.

In India, rail transport occupies a prominent position in quenching the ever-burgeoning needs of a rapidly growing economy. 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 labours have put forth a need for an automated system to monitor the presence of crack on the railway lines.

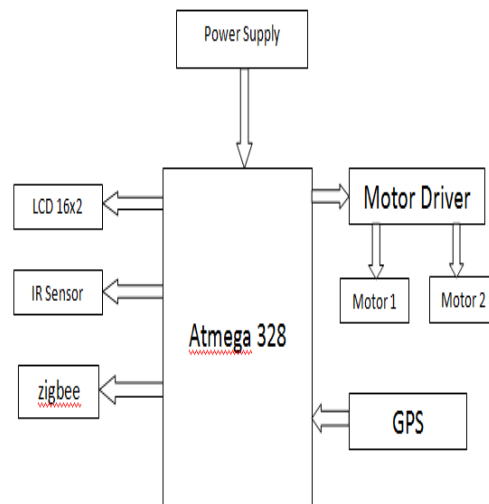
Owing to the crucial repercussions of this problem, this project presents an implementation of an efficient and cost effective solution suitable for large scale application. The main of this project is to develop and embedded system to identifying rail track fault sending message to near station using ZIGBEE technology.

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Basic block diagram

## II. RELATED WORK

Firstly we will be generating linear power supply which is required for the rover by designing the PCB and using the required components for the supply. Then by using Arduino as development board in which atmega238 as micro – controller. The programming is done with the help of ARDUINO UNO an open source IDE having ARDUINO 1.6.3 compiler. IR sensors to detect Cracks and the obstacles present in between the tracks to avoid accidents. IR sensor incorporates both a Transmitter and Receiver section on a single module which facilitates its position and crack detection will be done. The Rover which are designing is designed to be run on DC motors by using the motor driving IC which is L293d. Crack fault alert detected by the rover is then sent to the micro-controller by locating the position of crack by GPS module which supports serial communication. The required result on the track is send with the help of zigbee module. The required output is obtained on the PC by communicating with ZigBee module.

## III. PROPOSED ALGORITHM

### Design Considerations:

- **ATMEGA 328:** A microcontroller (sometimes abbreviated  $\mu\text{C}$ ,  $\text{uC}$  or  $\text{MCU}$ ) is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. High Performance, Low Power Atmel AVR 8-Bit Microcontroller Family. Programmable Serial USART, Master/Slave SPI Serial Interface, Byte-oriented 2-wire Serial Interface (Philips I2C compatible), Programmable Watchdog Timer with Separate On-chip Oscillator, On-chip Analog Comparator.
- **ARDUINO PROGRAMMING:** Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL) permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits.
- **ZigBee MODULE:** ZigBee is a low power spin off of WiFi. It is a specification for small, low power radios based on IEEE 802.15.4 – 2003 Wireless Personal Area Networks standard. Zigbee is built with emphasis on low data rate control system sensors featuring slower data of just 250 kbps.



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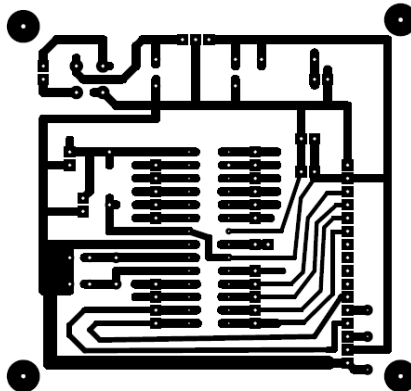
- **GPS MODULE:** A GPS device can retrieve from the GPS system location and time information in all weather conditions, anywhere on or near the Earth.
- **LCD 16X2:** LCD accepts two types of signals, one is data, and another is control. These signals are recognized by the LCD module from status of the RS pin. Now data can be read also from the LCD display, by pulling the R/W pin high. As soon as the E pin is pulsed, LCD display reads data at the falling edge of the pulse and executes it, same for the case of transmission.
- **L293D:** L293D is a dual [H-bridge](#) motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

## II. PSEUDO CODE

- Step 1: Start(transmitter section )
- Step 2: Identify railway track fault using IR sensor .
- Step 3: Transmit that message through ZigBee.
- Step 4: END
- Step 5: Start(Receiver section )
- Step 6: Receiver receive the message through ZigBee.
- Step 7: Display
- Step 8: End.

## III. SIMULATION RESULTS

Then by using Arduino as development board in which atmega 238 as micro –controller. As the simulation is done with the help of ARDUINO UNO compiler is an open source IDE. IR sensors will detect Cracks as the fault are mentioned in the programming . IR sensor incorporates both a Transmitter and Receiver section on a single module which facilitates its position and crack detection will be done . The Rover will be running on the track on DC motors by using the motor driving IC which is L293d. Crack fault alert detected by the rover is then sent to the micro-controller by locating the position of crack by GPS, and messaging via zigbee module.



PCB DESIGN



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## IV. CONCLUSION AND FUTURE WORK

The simulation results showed the improvement in railway transport by avoiding the accidents and the de-railments occurring. Its cost is very low compared to existing system, accurate system, checks surface and near surface of the cracking position, Accidents are reduced. In future we will also use the CCTV systems with IP based camera for monitoring the visual video captured from track.

## ACKNOWLEDGEMENT

We take this opportunity to express my true sense of gratitude towards our guide Prof. A.B.WANI who at every discrete step in the study of this topic, contributed with their valuable guidance and provided with perfect solution for ever problem that arose.

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