International Journal of Engineering, Science and Mathematics
Vol. 6 Issue 8, December 2017 (Special Issue)
ISSN: 2320-0294 Impact Factor: 6.765
Journal Homepage: http://www.ijesm.co.in, Email: ijesmj@gmail.com Double-Blind
Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A

EMBEDDED BASED EFFICIENT RAILWAY TRACK SECURITY SYSTEM USING ZIGBEE TECHNOLOGY AND GPS

N.SWAMY*
B.SIVA PRASAD**

Abstract

The main problem is about railway track crack detection at the earliest to avoid accidents. Therefore it is essential that such problems must be communicated immediately to the concerned authorities by using GSM technology for appropriate action.

This project uses a microcontroller family. The primary objective of this paper is to detect the crack in the railway track and alert the nearby station through effective and highly reliable communication mode. To demonstrate this paper, two rails forming the part of the track are made using a pair of wire which is wired with a detachable jumper in between each wire/track. Removing the detachable jumper creates a fault in the respective track; otherwise it is generally shorted by the jumper wire to simulate healthy track condition.

Removing the jumpers result in driving transistors delivering a different logic to the controller. The program thereafter takes over to send an SMS through GSM modem interfaced through MAX232 level shifter IC to the microcontroller. An LCD is also interfaced with the MC to display the status of GSM and track condition. Thus the proposed model is designed to recognize the cracks in the railway tracks and provides instant information to the concerned railway authorities.

Keywords:

Railway track monitoring, robot section,Zigbeemodule,gate control,sensormodules, GSM,GPS ,RS232 Interface

Author correspondence:

N.Swamy,
PG student , Department of ECE, BITS, Visakhapatnam, A.P$_1$
B.Siva Prasad

Associate Professor, Department of ECE, BITS, Visakhapatnam, A.P2

1. INTRODUCTION

The Indian Railway has the world's fourth largest railway network in the world, next to the United states, Russia and China[3].The railway traverse the length and breadth of the country and carry over 20 million passengers

* Doctorate Program, Linguistics Program Studies, Udayana University Denpasar, Bali-Indonesia (9 pt)
** STIMIK STIKOM-Bali, Renon, Depasar, Bali-Indonesia

and 2 million tons of freight daily. It is one of the world's largest commercial or utility employers, with more than 1.6 million employees. Unfortunately there have been many accidents involved in the railways due to cracks. 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 current irregular and manual track line monitoring that is being carried out. Owing to the crucial repercussions of this problem, this paper presents an implementation of efficient and cost effective solutions that are suitable for large scale application.

In existing system, the same concept is used using LED and LDR sensor assembly. The main drawback of the system is that LED and LDR needs to be exactly aligned opposite to each other to detect the crack, also the environment needs to be controlled to detect the true values from LDR. For this reason we have used ultrasonic and IR obstacles sensor, also our proposed system which includes automatic gate control using PIC microcontroller.

2. REVIEW

Recently research and development of rail track inspection have received a great deal of attention to save passengers life. There are some methods based on inspection technology are as follow:

One such method is using Ultrasonic sensor for detecting the biggest obstacles such as rock and trees on the railway track, another method is to detect some cracks or deformation on the railroad track by using Infrared sensor. We proposed the inspection robot which has two sensors which detects the cracks and obstacles on the railroad track and then the intimation is directly send through the train driver using the GSM technology or automatically it will stop the train without driver control. Then our proposed system setup also has the automatic railway gate control using microcontrollers which will automatically controls the gate while the train crossing at gate. These three setup which prevents many accidents in the railway department.

The finding of cracks in railway tracks takes time consumption due to physical inspection. It shrinks the correctness too. This method of design is having limited intelligence and time consuming. TRAIN Accidents are commonly occurs in a country. They are mainly due to bad condition of tracks and absence of monitoring in level crossings Tracks are prone to cracks or expansion of metal plates. It is impossible to identify the obstacles from the train and on identification it is difficult to stop the train suddenly Then the automatic gate control system presents separately. But we have proposed that gate control system with this automated visual inspection robot.

3. MATERIALS AND SOFTWARE

This paper proposes a cost effective solution to the problem of railway track crack detection utilizing Zigbee communication and PIC control, track damage detection robot, GPS, GSM assembly which tracks the exact location of track damage which then mended immediately so that many lives will be saved. The sensor network is a wireless network formed by a group of sensors deployed in same region, which can be used to measure the air density, temperature , acceleration, etc. sensor scan transmit signal via radio motion. Meanwhile sensor share now minor and economy, they can be organized on a big scale.

In this paper, we have used three control sections, which are robot, train and control section. Each track will be monitored by one IR obstacle sensor Ultrasonic sensor, Whenever there is a crack on the track, the IR obstacle sensor senses the crack and activates GPS. The location Latitude and Longitude coordinates of the crack is sent to the pre-defined number with the help of SIM inserted into GMS module. Once the crack has been successfully identified and message is sent, the vehicle moves further on the model path till next crack is detected.

KEIL Software

Keil compiler is software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Keil compiler also supports C language code.

3.1 BLOCK DIAGRAM :

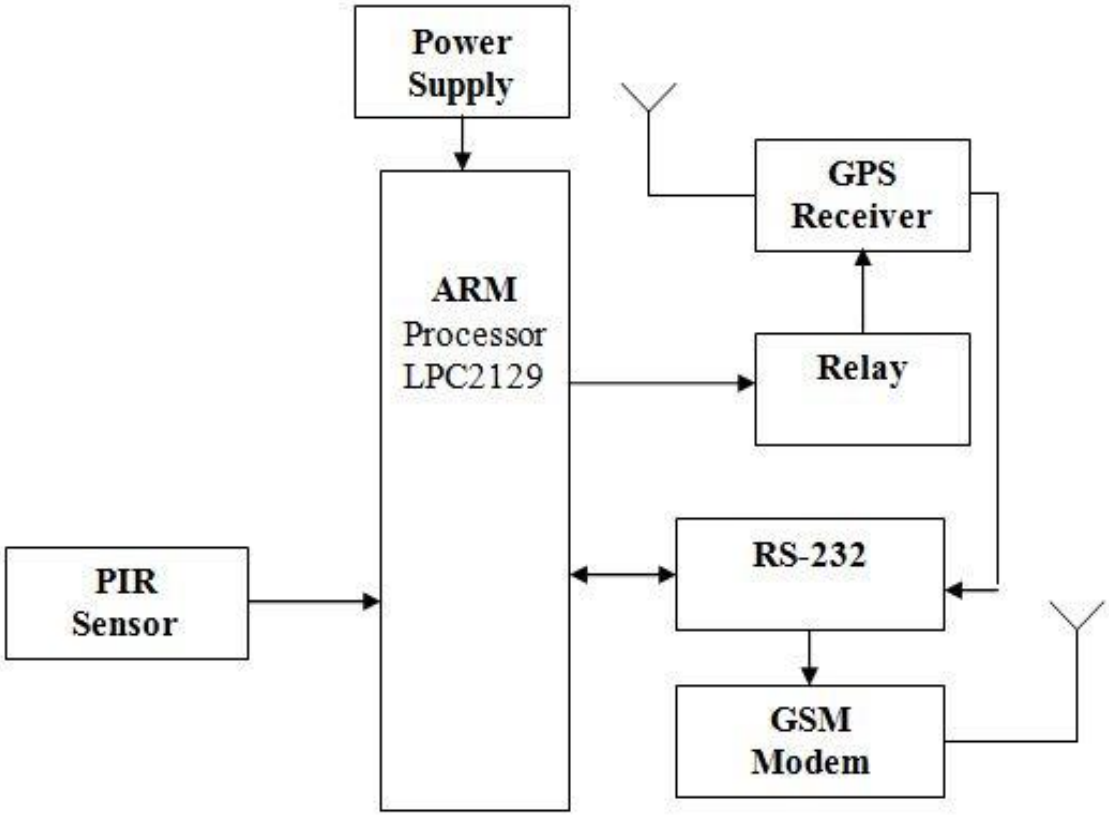

Fig :block diagram of trained monitoring section

The following flowchart.shows that the gate section of our proposed system. In gate control unit which consists of Microcontroller unit which automatically controls the gate signals which depends on the predefined program. The gate section also concludes driver unit and alert unit which alerts while train crossing the gate.

3.2. ZigBee technology:

ZigBee is a low-cost, low-power, wireless mesh network standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications. Low power-usage allows longer life with smaller batteries. Mesh networking provides high reliability and more extensive range. ZigBee chip vendors typically sell integrated radios and microcontrollers with between 60 KB and 256 KB flash memory.

ZigBee operates in the industrial, scientific and medical (ISM) radio bands; 868 MHz in Europe, 915 MHz in the USA and Australia, and 2.4 GHz in most jurisdictions worldwide. Data transmission rates vary from 20 to 900 kilobits/second.

The ZigBee network layer natively supports both star and tree typical networks, and generic mesh networks. Every network must have one coordinator device, tasked with its creation, the control of its parameters and basic maintenance. Within star networks, the coordinator must be the central node. Both trees and meshes allows the use of ZigBee routers to extend communication at the network level.

Fig zigbee module

SENSORS

IR Obstacle sensor:

This sensor is a short range obstacle detector with no dead zone. It has a reasonably narrow detection area which can be increased using the dual version. Range can also be increased by increasing the power to the IR LEDs or adding more IR LEDs. The photo below shows my test setup with some IR LED's (dark blue) as a light source and two phototransistors in parallel for the receiver. You could use one of each but I wanted to spread them out to cover a wider area.

This sensor mainly used to detect cracks or deformation on rail road track. It has a range of about 10-15cm (4-6 inches) with my hand as the object being detected.

Ultrasonic sensor:

The ultrasonic ranging module HC-SR04 provides 2cm-400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The frequency range for ultrasonic sensor is 40 to 250 MHZ. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

1. Using IO trigger for at least 10us high level signal.
2.The Module automatically sends eight 40kHz and detect whether there is a pulse signal back, the ultrasonic sensor can be used to sense the biggest obstacles on the railroad track, which is fitted in the inspection robot.

PHOTO DIODE:

The amount of current passed through the photodiode is directly proportional to amount Photodiode is alight sensitive semiconductor diode which converts the light energy into voltage or current based on the mode of operation. In general Photodiodes are operated in reverse bias condition. The clear Photodiode can detect visible and IR rays to limit the Photodiode to detect only IR rays a black cutting is applied to the glass of the Photodiode. The photodiode allows the current to pass through it if the photodiode is exposed to IR rays and it doesn't allow current to pass through it if no IR rays falls on of IR rays falls on it.

GPS: Global Positioning System tracking is a method of working out exactly where something is. A GPS tracking system, for example, may be placed in a robot, on a cell phone, or on special GPS devices, which can either be a fixed or portable unit. GPS works by providing information on exact location. It can also track the movement of a vehicle or person. So, for example, a GPS tracking system can be used by a company to monitor the route and progress of a delivery truck, and by parents to check on the location of their child, or even to monitor high-valued assets in transit.

GSM: An embedded system is a special-purpose system in which the computer is completely encapsulated by or dedicated to the device or system it Controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few pre-defined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Global System for Mobile Communication (GSM) is a set of ETSI standards specifying the infrastructure for a digital cellular service.

3.3 ANALYSIS AND DISCUSSION

The design is expected to be robust and cost effective and will also function efficiently. It can travel about 11km on battery. This method will be helpful in regular track checking as it is more convenient than the handheld checking system. Also, chances of error are less as Global Positioning Satellites are used to determine the exact location of the crack.

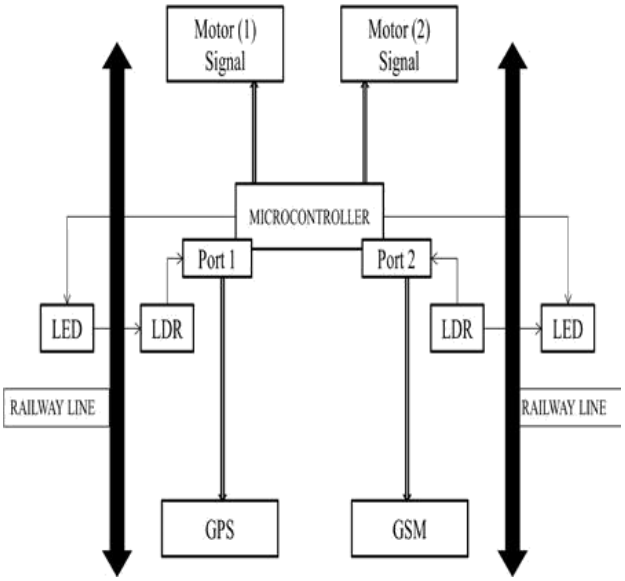

Fig:Technical design

4. RESULT AND DISCUSSION

In our proposed system all modules done successfully which shows clearly about what all are the modules involved and how they can be controlled with the help of microcontroller in embedded system technology. Thus the proposed system which implemented in real time in railway applications which prevents many accidents involved in railway maintenance and to save passengers life.

Thus the proposed system which implemented in real time in railway applications which prevents many Accidents of passengers' life.

The following figure. shows that train section in which the train was running normally, and when the problem is identified the intimation is comes from the robot then the train can be automatically stopped without driver control. Than the robot section can be controlled with the help of PIC microcontroller. The infrared and ultrasonic sensor is fitted on the front side of the robot which will detect cracks and obstacles I onthe rail track then the intimation is send through sms using GSM then the robot is stopped. In the gate control section, the gate can be automatically closed while train running on the gate and the gate can be closed after train crossing the gate. These all can be controlled in train section with help of a zigbee communication by using embedded system

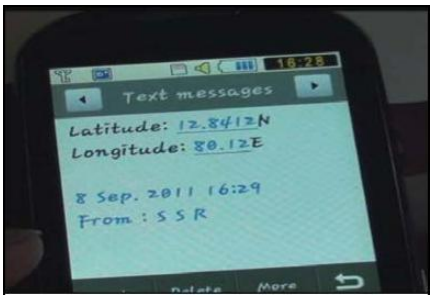

Fig., Detected crack received as text message

5. CONCLUSION

By using this automated visual using inspection robot for purpose of railway track inspection and crack detection, it will have a great impact in the maintenance of the tracks which will help in preventing train accidents to be a very large extent. The regions where manual inspection is not possible, like in deep coal mines, mountain regions and dense thick forest regions can be easily done using this robot. By using this robot

for the purpose of Railway track inspection and crack detection and automated SMS will be sent to pre-defined phone number whenever the vehicle sensors detected any crack, obstacles and deformation. This will help in maintenance and monitoring the condition of railway tracks without any errors and thereby maintaining the tracks in good condition, preventing train accidents to very large extent.

Railway track crack detection automated visual inspection robot is designed in such a way that it detects the cracks, obstacles on the track which when rectified in time will reduce train accidents. The addition of automatic gate control is an added advantage, which also helps and reducing the risk factor.

REFERENCES

.

1. Zhang Wen, Jiang Meng" Design of Vehicle positioning System Based on ARM",Business Management and Electronic Information (BMEI), International Conference 2011 IEEE.

2. Lu Xutao1, Cui DongSen2" Design of Transport Vehicles Remote Monitoring System", 2nd International Conference on Education Technology and Computer (ICETC). 2010

3. R . Want, "Enabling ubiquitous sensing with RFID," Computer , vol. 37, no. 4, pp. 84–86, Apr. 2004.

4. S. Garfinkel and B. Rosenberg , Eds., RFID : Applications, S ecurity, and Privacy . R eading, MA: Addison-Wesley , Jul. 2005.

5. S. Han, H. Lim, and J. Lee, "An efficient localization scheme f or a diff erential-driv ing m obile robot based o n R FID system," IEEE Trans. Ind. Electron., vol. 53, no. 5, pp. 3362–3369, Dec. 2007.

6. C lass 1 Generation 2 UHF Air interface Protocol Standard. [Online]. Available: http://www.epcglobalinc.org/standards/

7. www.ieee.org