

Monitoring System for Defects in Rail Track

K. Gayathiri¹, R.Gomathi^{1,2}

¹(Department of Electronics and communication engineering, IFET College of Engineering, Villupuram)

^{1,2}(Department of Electronics and communication engineering, IFET College of Engineering, Villupuram)

Abstract:

The railways became the prime suggests that of transportation because of their capability, speed and responsible. Even a small improvement in this sector will aid the overall development of a nation. Due to the gigantic size, it's a tedious task to monitor and maintain the rails in a timely manner. The poor maintenance of the railway tracks will result in accidents. Occurrence of cracks in tracks became a serious concern for the railway. The rail cracks should be identified and corrected as early as possible as it poses a serious threat to the safe operation of the carriages. This proposal aims at elimination of the long prevailing issues in this sector. This effective methodology of continuous observation and assessment of rail tracks might facilitate to stop accidents. This methodology endlessly monitors the rail stress, evaluate the results and provide the rail break alerts such as potential buckling conditions, bending of rails and wheel impact load detection to the concerned authorities.

Keywords — **Seismic sensor, Triaxial MEMS sensor**

I.INTRODUCTION:

Wireless sensor networks (WSNs), it is widely applied to a various areas. In recent years, there have been an increasing interest in emerging sensing technologies for a railway infrastructure monitoring. The wireless communication of a railway is processed through sensor devices in poor environments such as high speed and much vibration, there may be a problem when the IEEE 802.15.4 and ZigBee would be applied in railway network. Therefore, it is necessary to reduce the transmission delay and power consumption in railway WSNs. To solve this problem, the relay scheme over the MAC sub-layer is introduced in this paper. In this paper, the relay scheme can be reduce the data transmission delay and power consumption.

The purpose of our project is to prevent the train accidents. Here we are

using Seismic vibration sensor, Triaxial mems sensor ,Zigbee, LCD,UART. Most properly accident may occur due train moving in same track and cracks in track. To reduce such an accident, we using 1X5 keypad to designate the track by train and share this information among trains as well as nearby signal station and administrator office via MAC. Then vibration sensor effectively sense the cracks in track and send information through MAC. At last ultrasonic sensor used to detect the distance of track then PIR is to monitor the persons. Next part of project is gate section, its an automatic gate controlling system. Suppose unfortunately persons may enter into a gate immediately existing gate will be open and entry gate will closed then giving intimation to train by signal via signal to train.

II. CONVENTIONAL SYSTEM:

In this conventional system system it describes an approach for characterizing the dynamic behavior of the vehicle/track interaction at railway crossings. In the approach, we integrate in situ axle box acceleration (ABA) measurements with roving-accelerometer hammer tests to evaluate the influence of train speed, train moving direction (facing and trailing directions), sensor position (leading and rear wheels of a bogie), and the natural response of track structure on ABA signals. The analysis of data from multiple sensors contributes to the following findings: the major frequency bands of the vertical ABA are related to the natural frequencies of the crossing; thus, these ABA frequency bands are not greatly affected by variations in train speed, moving direction, and sensor position. The vibration energy concentrated at the major ABA frequency bands increases at higher train speeds, along the facing moving direction and from the leading wheel. The crossing rails vibrate as a combination of bending and torsion rather than solely bending at the major ABA frequency bands, since the vibrations of the wing rails are not synchronized. These results help enhance our understanding of the vehicle/track interaction at crossings and can be used to improve the dynamic response-based system for monitoring the condition of crossings.

A. DRAWBACK OF CONVENTIONAL SYSTEM:

- They define problem in interaction of wheel crossing point only
- Less in pure bending

III. PROPOSED SYSTEM:

A. BLOCK DIAGRAM:

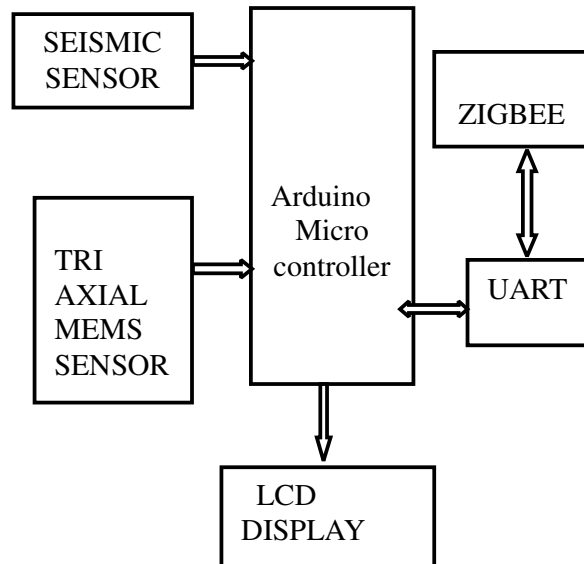


Fig 1. BLOCK DIAGRAM

Railways are one of the important transports in India. There is a need for manual checking to detect the crack on railway track and always railway personnel takes care of this issue, even though the inspection is made regularly. Sometimes the crack may unnotice. Because of this the train accident or derailment may occur. In order to avoid this situation and automate the railway crack detection has been proposed. Here seismic sensor is used to detect the crack in the railway track by measuring the internal vibration of the crack in the track, if the vibration is greater than the assigned value the microcontroller identifies there is a crack and the tri axial mems is used to accurate values and direction of the crack in the track. This information is passed to the control unit using zigbee.

B. ADVANTAGE OF PROPOSED SYSTEM:

- Cost effective
- Speed of transmission

- Crack identified in the track itself no need of additional requirements in train
- It monitor both normal track and cross track

IV.HARDWARE DESCRIPTION: COMPONENTS OF HARDWARE,

- MICRO CONTROLLER (ATMEGA328)
- LCD DISPLAY
- SEISMIC SENSOR
- TRI AXIAL MEMS SENSOR
- ZIGBEE
- PC

A. MICRO CONTROLLER

The ATmega328 is based upon the Arduino microcontroller and it has 14 digital I/O pins, which 6 can be used as PWM outputs) and another 6 Analog inputs. Its frequency range is 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller

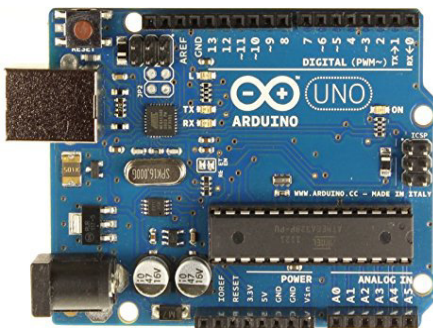


Fig 2. ARDUINO UNO

B. SEISMIC SENSOR

The seismic sensor is used to detect the crack in the railway track by measuring the internal vibration of

the crack in the track, if the vibration is greater than the threshold value then the microcontroller identifies there is a crack.



Fig 3. Seismic Sensor

C. TRIAXIAL MEMS SENSOR

Micro-electromechanical systems (MEMS) incorporate miniature electro-mechanical components with enhanced processing techniques and sensors originally developed in the semiconductor industry. Combining traditional and non-traditional silicon processing techniques, bonding technologies MEMS are being developed for different applications.

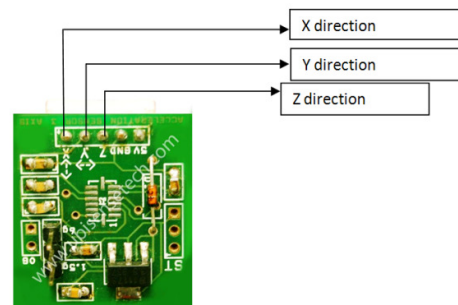


Fig 4. MemS sensor

D. LCD DISPLAY

A 16x2 LCD display is very basic module and is very commonly used to display the output character various devices and circuits. In this module, there are seven segments and multi-

segment for displaying the character.

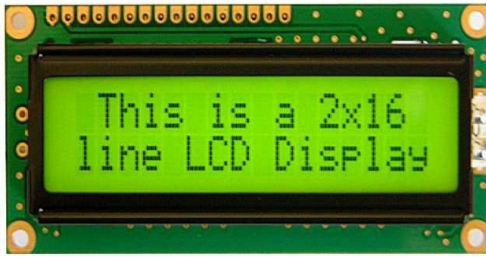


Fig 5. 2x16 LCD Display

E. ZIGBEE

ZigBee is introduced for a high level communication protocols. It consuming low-power digital radios and small in size. Its standard version is IEEE 802.15.4-2003 for wireless personal area networks (WPANs), such as wireless communication connecting with cell phones via short-range radio.

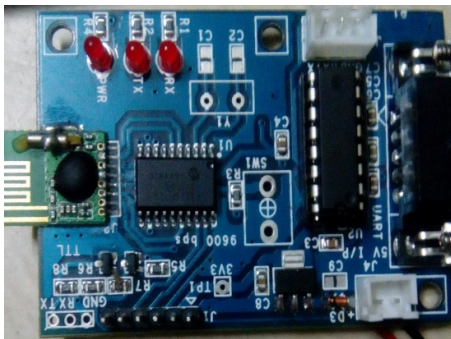


Fig 6. ZIGBEE

F. UART

A Universal Asynchronous Receiver/Transmitter is a type of computer hardware that translates information of process between parallel and serial forms through RS-232. At each end of link this translation of data sequentially.

V. WORKING:

This project is mainly reduce the train accidents by continuous monitoring of rail track. It's working is when the vibration is exceeds or decreased below than the fixed vibration level then it detect the crack

occurred in the track. It is detected through seismic sensor. And the values accurate by MEMS accelerometer. All functions are controlled through Arduino microcontroller. Then the output is display in Liquid Crystal Display(LCD). The information are send to concerned authorities through UART by zigbee protocol. It is a wireless transmitter and receiver,in which vibration waveform at X, Y and Z directions will display in the MEMSVIBBUILD software.

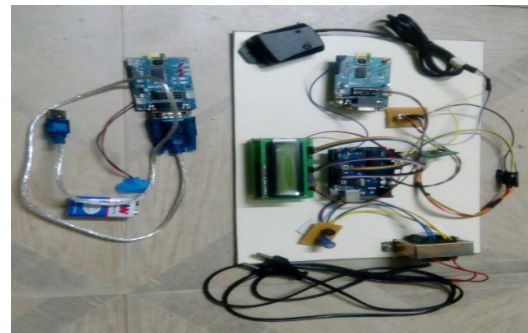


Fig 7. Hardware Setup



Fig 8. LCD Display

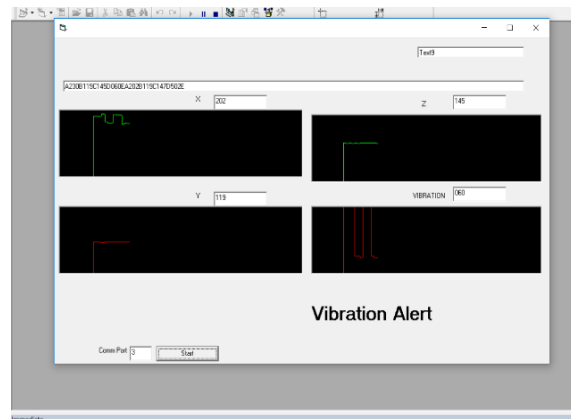


Fig 9. Waveform Of Vibration

VI. RESULT:

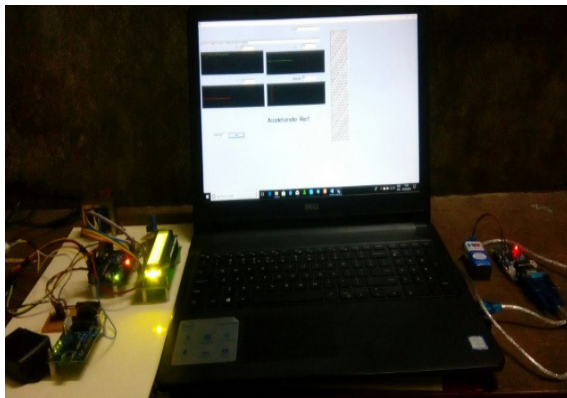


Fig10. Experimental Setup

The above figure shows the overall experimental setup to monitoring the rail track by measuring the vibration occur in the track. The detection is carried through seismic sensor and MEMS sensor. The vibration alert message is send to concerned authorities.

VII. CONCLUSION:

In this paper, seismic sensor is used to monitoring the rail track vibration. If the vibration level will be low or high is depending upon the direction of acceleration sensor. And the level of vibration which is not in normal value then it detect the defect in the rail track. The zigbee protocol is used for short distance communication by providing the alert message through microcontroller. It reduces the risk factor faced by the passengers. And also minimize the rate of train accidents which occurs by means of crack in the rail track.

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