



Monitoring in Railway Track Crack and Obstacles Using Smart Sensors

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Abstract: We propose a method that uses wireless sensors to identify cracks and obstacles in tracks with exact location of fault. It requires less time and provides accurate result. GPS module and GSM used to track the location and Ultrasonic sensor detects the obstacles on the track in which is controlled by a microcontroller. MEMS sensor mounted on the vehicle front end will inspect the track along the path.

Key words: MEMS, Ultrasonic sensor, GPS module, GSM module, Microcontrollers.

1. INTRODUCTION

India has one of the world's largest railway networks in which Railway network carried out most of the commercial transport in India. The train transportation increased due to high speed, economical, environment friendly, safety and modern characteristics of railway systems.

Major problem with this transportation is that the weather conditions like floods, cyclones, earthquakes, etc will influences damage to the railways. In our existing method, have some limitations over surveying track. It acquires more time and human interventions. Lack of proper maintenance also causes crack on railway tracks[3].

Level crossings have when human railway employee waving red flag or shining light then manually close the gate. Still the railways were concerned with preventing the accidents from level crossing and train collision. By providing electric boom gates to block the road traffic and equipped with vibration-based method for detecting the defects. Accidents in railways owed to 60% wrecks and 90% level crossing gates.

We propose a method with MEMS and Ultrasonic sensors used to detect the defects and cracks where as automatic gate provides gate control without human interventions[10]. GPS gives exact location of the crack and that information transferred as radio signals by using RF transmitter to the authorized person. This method also used to inspect the railways in tunnel. It is simple and accurate method compared to existing methods..

2. RELATED WORKS

There exists some works for detecting cracks in railways. Many systems based on the field of IR sensors.

Reenu George[1] proposes a cost effective solutions to detect the cracks in railways with the help of IR transmitter and receiver, which provides the faulty location. It requires less processing time but the reading may changed due to external disturbances. High



intensity of light causes interference problem. It is only suitable for short scale applications.

Saurabh maheshwari, Neeti Jain describes all kinds of rail defects inspection and

S. Buggy *et al* defines Optical fiber sensors deployed at the network side to provide therefore allow for better supervision and maintenance. It has multi signal propagation within on cable. But manufacturing of optical fibre is more complex and need expensive materials[5].

P. Kolakowski establishes Structural Health Monitoring system committed to railway transportation. It has two subsystems one is weigh in motion (WIM) and the other is actual SHM. Piezoelectric sensors collect damage by using strain gauges or optical fibers. These sensors are not sufficient to analysis cracks in bridges[6][7].

High Speed Railway gives convenience to people lives using wireless communication. One part of HSR is signaling system that is also called the “operation control system”, where wireless communication play an important role in the transmission of train control[11].

This paper proposes a wireless sensors such as MEMS acoustic emission sensor which is used in steel bridges[8].

3. PROBLEM STATEMENT:

Main problem in railway network is Collisions. This is the most dreadful accident. Collisions are occurred due to bad condition of tracks and fail to monitor in level crossings. Tracks are cracks horizontally or expanded metal plate. It is very difficult to bring to the end because the speed of the moving train requires some distance to stop. Lack of maintenance and human errors will lead to these collisions. There are two types of collisions **1. Front-On** **2. Rear-End-Collisions**

fault detections were described using wireless sensors for crack detection and breakages in the railway track[2]. It has less processing time. This method includes IR , LED–LDR assemble and fiber optic sensors.

feedback from the system that will give real time health and usage monitoring and will

First one is a direct accident where forward facing two trains or any other vehicles strike each other in opposite direction, occurs on a single line railway. Whereas forward facing train collide with the rear of another train.

4. PROPOSED SYSTEM:

Here proposes a crack tracking method using ultrasonic sensors and MEMS. Ultrasonic sensor used to detect the obstacles in track. In addition to that, also detect the uneven track during inspection. MEMS sensor used to detect cracks in the railway track[8]. When any break or bend detected on the track vehicle stops and the location of crack is recognized. . With GPS find the location of defects and send that information to RF module. The location Latitude and Longitude coordinates are procured using GPS/GSM module is used to send these Location coordinates in the form of Short Message Service (SMS) to the authorized person using Predefined mobile number[10].

5. DESIGN IMPLEMENTATION:

There are three sections to monitor the railway track.

5.1 Vehicle segment:

In vehicle section, consists of ultrasonic sensor and MEMS. E ultrasonic sensors consistently monitors the depth of the crack. Both information are transferred to the microcontroller and latitude and longitude of the current place will be get from GPS module. Immediately it sends signals to GSM module and RF module where the electronic signals

converted to radio signals. Radio signals

transferred through RF transmitter.

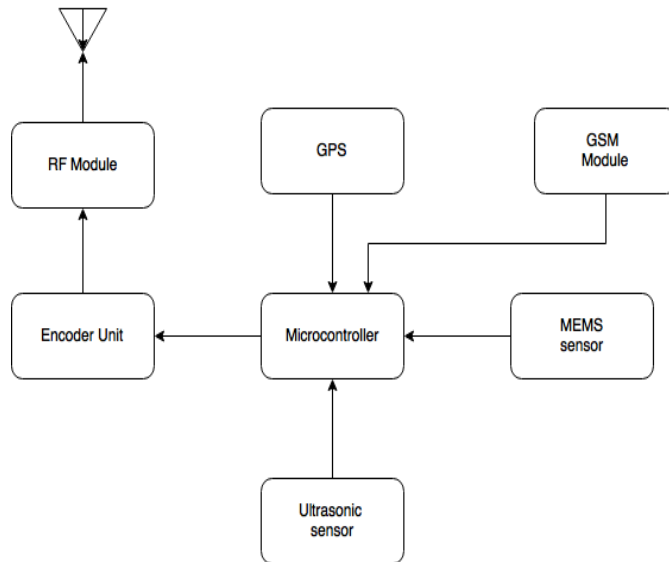


Figure 1.vehicle segment with wireless sensors.

5.2 Monitoring Segment:

Transmitted RF signals are received by RF receiver. It will be send to microcontroller where the information is given to display unit. This display shows the defects to the controller. Alarm will be enabled with driver

circuit.

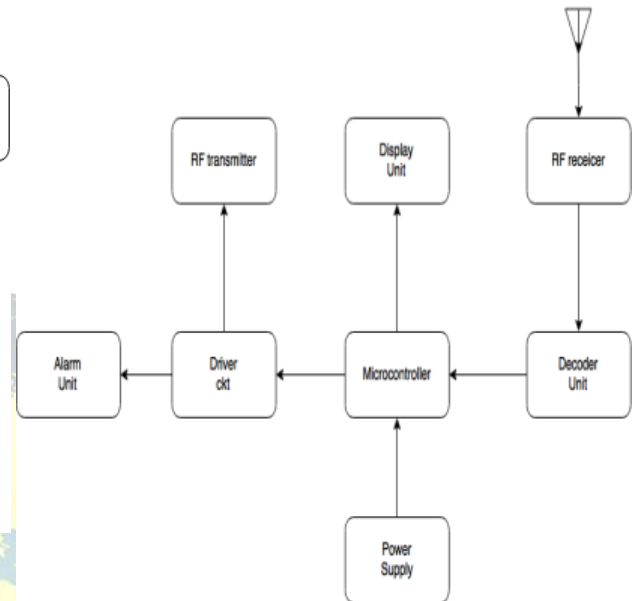


Figure 2. Monitoring with LCD display to the train.

5.3 Gate Segment:

Finally these signals send to the gate control to control the gate automatically.

6. HARDWARE NECESSITIES:

Microcontroller: This is the main section to control whole project. It consists of a Microcontroller with related circuitry like capacitors, resistors, reset and so on. Microcontroller interfaced with another devices according to the program being written.

Liquid Crystal Display(LCD): It does not emit light directly. The words, digits and images can be displayed by using LCD display. The same basic technology ,except the images are made up of large number of small pixels, while other displays have larger elements.

GPS: GPS revenue Global Positioning System .It may placed in a vehicle, smart phones, any

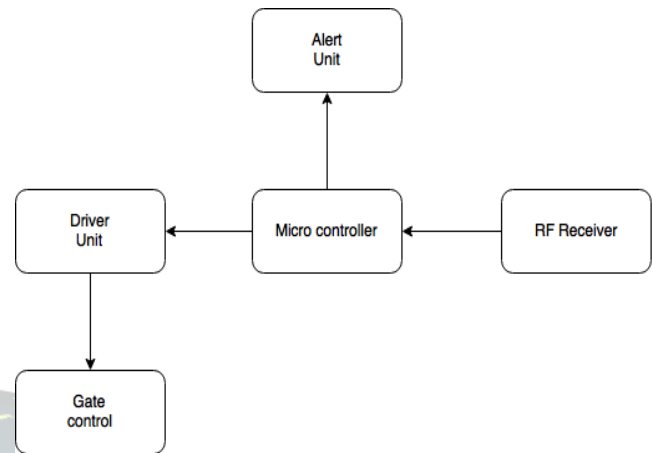
GPS devices or portable units. It can track every movement of user or vehicle and provide the location. It is used by many industries to monitor the route of delivery truck. GPS gives exact location information and works in 2 ways. Some systems will store the data within the GPS tracking itself and other send the information to centralized database via a modem.

GSM: GSM is a standard used to describe the protocols for 2G digital cellular networks used by mobile phones. Here we use SIM300 that establishes GSM/1800/1900 MHz for voice, SMS and data with low power consumption.

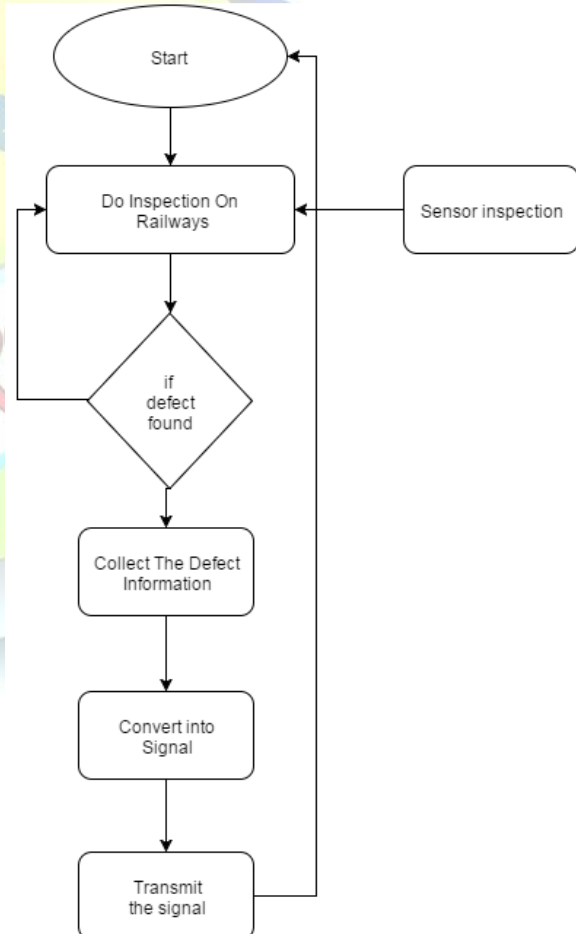
Motor: There are five motors are used. Motor can be used for gate control, which is operated both in clockwise and anticlockwise directions. When an enable input is high then the related motors get enabled and output became active. Similarly, for an enable input is low then the related motors gets disabled and output became off state. They take low current control signal and provide a higher current signal.

Ultrasonic sensor: Ultrasonic sensors use sound waves rather than light, making them ideal for stable detection of uneven surfaces, liquids, clear objects, and objects in dirty[16].

MEMS: Micro electromechanical system is the technology of very small devices. It can be defined as miniaturized mechanical and electromechanical elements.



7. FLOW DIAGRAM:





8. RESULT:

To test the accuracy of this system experiment has done on a surface having crack. By deploying the vehicle section having multiple sensors like MEMS and ultrasonic sensor sense the crack. It gives more accurate than the existing systems and GPS gives exact location of fault.

9. CONCLUSION:

This paper proposed a system to detect the cracks in railway tracks successfully. With the wireless sensors the cracks are easily identified and information passed to the monitoring section. It is monitored by authorized person when a error occurs a sound is produced and produced with location of the crack. The location is identified by using GPS module in the system. In this paper also proposed for both slabs and ballast tracks. Even also used in tunnel operations without any interruption. For future a camera will be quipped with vehicle section provides video capturing of the crack.

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