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## Early Detection of Obstacles in the Railway Track and Crack Identification System

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**ABSTRACT:** When go through the daily newspapers come across many accidents in railroad railings. The train accidents cause severe damage to life and property. Therefore more efforts are necessary for improving safety. However, in the case of railway, distant obstacles must be detected since the braking distance of a train is very long. This project deals with one of the efficient method to detect obstacles in railway track and crack on the track. Wireless sensor network can be used for monitoring the railway infrastructure. A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices that use sensors to monitor physical or environmental conditions. Ultrasonic sensors are used for detection of the obstacles in tracks. MEM sensor is used for detect the cracks and breakage of tracks. The information will be transmitted to the current train which comes on the track. The sensors sense the crack and send the information to the microcontroller, where it responds give the command to the particular component. Thus, this device would help to reduce the train collisions. To communicate the received information, make use of a GSM modem. The GSM module is used to send the current latitude and longitude data to the relevant authority as an SMS. The system can be operated at tunnels also, without interrupts.

**KEYWORDS:** Ultrasonic sensor, Wireless sensor network, Obstacles, Crack, GSM module.

### I. INTRODUCTION

In India railway network is the main source of transportation and therefore as any problem occurred during transportation the major damage is getting occurred to the economy-non withstanding a social life. Faults on rails are a reason for railway accidents. At present railways are using manual methods of crack detection through human inspectors. Taking all this to account it will be necessary to develop a automatic obstacle detection system which is also used to find the detection of breakage in the railway track. Economically railway network is comfortable from poor people to rich people even though it would help to growing economy rapidly.

The Indian railway (IR) network today has a track length of 1, 15,000 kilometres over a route of 65,000 kilometres and 7,500stations. According to a possible embodiment, the railway carriage carrying the control equipments is provided with sensor orientated to detect the crack and fire sensor used to detect the fire. Ultrasonic sensor is used to detect the crack as well as distance. This project pertains to a process for monitoring the condition of rail on train tracks and more specifically has the object of the identification of defects detected by monitoring equipment on the tracks to be checked to allow maintenance crews to subsequently find these defects. When we give the supply to the device, the DC motor gets start through relay driver circuit. Two IR sensors are fixed in front of the train is used to find out the crack on the rail. Each sensor will produce the signal related position with the rail. If the track is normal on its position both the sensor gives the constant sensed output. If anyone misses their output condition to fail then there is defect on



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that side. It will inform this by giving alarm and also fire sensor are used to detect the fire. If the fire is detected automatically spread the water over a fire detected Surface. Ultrasonic sensor is also used to measure the distance of crack between the tracks.

There are different types of cracks identified in the railway tracks. These effects include bending and shear stresses, wheel/rail contact stresses, thermal stresses, residual stresses and dynamic effects. Which has to be dealt with importance and kindness, as the occurrence of procedure of Indian railways is great. This difficult of cracks which is in main quantity, contributes for main train coincidences will drive ignored. Because of Indiscretion in physical track line monitoring and it's maintenance. So, to avoid this drastic condition of Indian railway networks from stopping down still more, an automated system which does not rely upon the manual labor is fetched into bright.

## II. RELATED WORK

V. Muralidharan et al., [1], in their work introduced the integration of railway track surveying system. In the proposed system it is used to detect the railway crack. This system consists of IR sensor and fire sensor. The IR sensor can be used to detect the crack and distances, fire sensors can be used to detect the fire accidents. GSM modem is used to receive information from the system.

Ramavath Swetha. Pet et al., [2], discussed about world's largest railway networks, manual Inspection and detecting a crack on these railways tracks is very tedious process and consumes lot of time and human resource. The work pointing to the designing railway track crack detection autonomous vehicle using Microcontroller, IR obstacle Sensors assembly system, which detects the cracks in the path; the vehicle is also capable of monitoring the location of the crack by using the GPS module and alerts through SMS messages using GSM module.

E. Sakthi Abiramiet al., [3], found the use of microcontrollers nowadays in modern times embedded in machineries such as automobiles for computers. In this particular paper Ethernet with ARM is used to control speed of the motor with making use IP address defined which is present in the embedded web server.

One of the most important aspects of the railroad operations is the safety, the research and the system development for the safety equipment have been conducted in a large area. In terms of the sensors, camera vision has been utilized in many applications as it is relatively ready to apply while being capable of providing large amount of information. Velastin et al., in order to monitor the passengers at the stations he applied camera image processing method [4]. Xue et al. used cameras for level crossing monitoring and obstacle detections [5]. Otherwise laser sensors have shown its applicability as a railroad safety monitoring mean. Deloof et al. mounted a laser radar sensor on a locomotive and used it for detecting upcoming train, measured its distance, and also evaluating its state of operation [6]. Peng et al. Also find lasers for the railroad line profile measuring purpose [7]. The primary importance of level crossing area has been recognized and related research has been carried out including Tey et al. where they conducted survey on conventional warning devices at the level crossings in relation to the driver behaviours [8]

## III. DESIGN

### A. Train Monitoring System

This section consists of different sensors like track fault sensor, obstacle sensor. it also consists of display devices communication devices like GPS, GSM modules. Main section every second monitor all sensors, if any sensor triggered then microcontroller sends message to mobile unit section.

### B. Mobile Section

In this section mobile unit receives message from main section and control commends sends to main section.

### C. Hardware Requirements

- ARM7 Micro Controller LPC2148

ARM is one of the used microcontroller available for embedded system developer. Over the last few years, the ARM architecture has become the most pervasive 32-bit architecture in the world, with wide range of ICs available

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from various IC manufacturers. In cell/mobilephones and automotive braking systems ARM is used. A worldwide community of ARM partners and third-party vendors has developed among semiconductor and product design companies, including hardware engineers, system designers, and software developers. ARM7 is one of the widely used micro-controller family in embedded system application.

- GSM Module

This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily. The modem can either be connected to PC serial port directly or to any microcontroller. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control.

- GPS

In all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites the GPS receives the all time information. On any telephonic or internet reception, the GPS system works independently though these technologies can enhance the usefulness of the GPS positioning information. The GPS system provides critical positioning availability to military, civil, and commercial users around the world.

- UltraSonic Sensor

Ultrasonic sensor have the same principle as radar or sonar by interpreting the echoes from radio or sound waves which evaluates the attributes of target. Using Ultrasonic sensors high frequency waves are generated and evaluate the echo which is received back by the sensor. Time interval between sending the signal and receiving the echo to determine the distance to an object will be calculated. Multiple detectors are used for measuring distance and calculates the speed from the relative distances to particulates in the air or water. The sensor measures the distance to the surface of the fluid for measuring tank or tunnel level. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms and non-destructive testing.

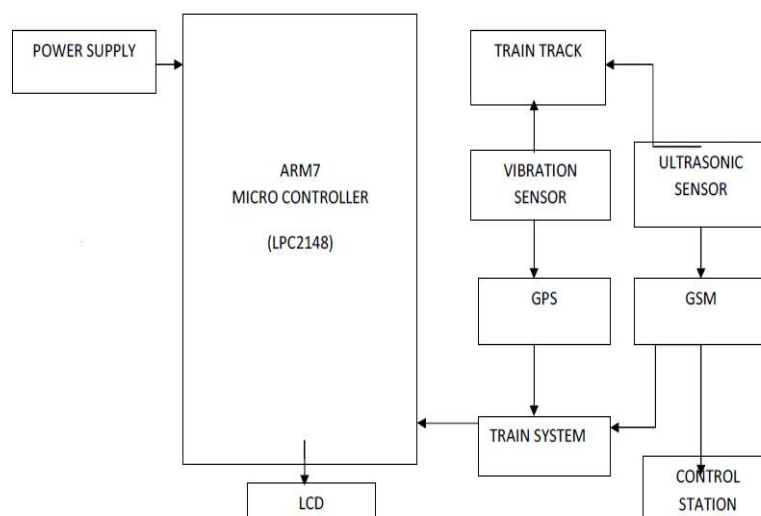


Fig. 1. Block Diagram

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In Figure 1, In track, any shake/tilt in parallel bridge position sensed by vibration sensor. If any obstacles, crack on the track detected by ultrasonic sensor. Operated in both slab and ballast. A GPS receiver calculates its position by timing the signals sent by GPS satellite. Transmits messages of latitude and longitude position. Satellite position at time of message transmission via GSM. The modem will respond with the message from sensors and GPS, indicating that the message to train station. ARM microcontroller is used. Display the message. A relay is an electrical switch that opens and closes under the control of another electrical circuit. Alarm unit ON, For alert the stations.

## IV. PSEUDO CODE

- Step 1: Initialize GSM
- Step 2: Display current status of sensors.
- Step 3: If any sensor activated then go to step 5 else next step. The sensor nodes communicate with the base station using wireless transmission protocol; examples include Bluetooth and Wi-Fi.
- Step 4: All sensors monitoring go to step 2. The base station collates data and transmits it to the control center server possibly.
- Step 5: Any obstacles, detect using ultrasonic sensor and cracks are identified with vibration sensor.
- Step 6: End.

## V. RESULTS

The anticipated system of this project will overcome for breathing system in many traditions. This is implementing in real time in always for security purposes that only avoid trouble condition. For track blunder detection, impediment over crossing these all are assembled in a single real time progression. Vibration sensor is used for the track fault detection. This sensor is placed in the track using an automated machine and it runs through the railway track, when the train is come nearby sensor to sense the track. And give the information to coming train for stop process by GPS (Global Positioning System) to find the track location. Figure 2 represents the crack detected message send to the locomotive driver. Figure 3 represents the corresponding location of the detected obstacle. The next process in obstacle over passage computes by ultrasonic sensor. This had been sense the info among train and objects long reserve also. So, that is advantage of one in real time. The property will be saved by send the memo from GSM (Global system mobile) to the control station.

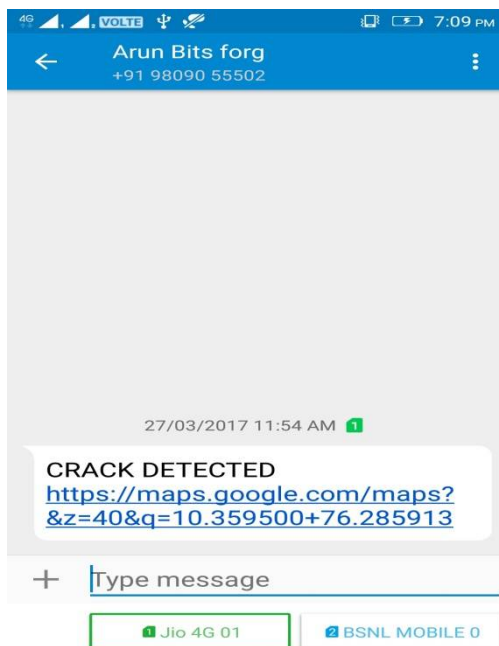


Fig. 2 Crack detected message

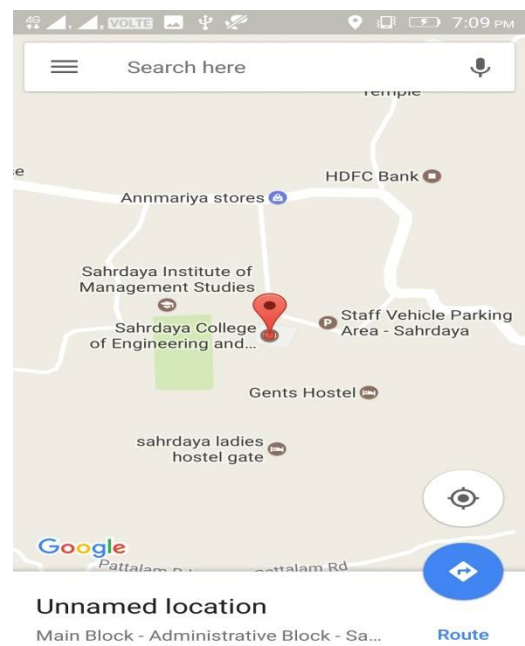


Fig 3. Location in the Map



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## VI. CONCLUSION AND FUTURE WORK

The embedded system and sensors are used to utilize the study to replace traditional flaw detection system. Obstacle detection and cracks identification Detecting crack and collision avoidance will be analyzed in the simulation platform using embedded system. Based on the automated machine (smart trolley model) all parameters are kept in action. The model which is carried out is working satisfactorily to my design extent. The detection of crack and obstacle avoidance are detected and fetch the exact location of crack and send it to the concerned authority to immediate action. For the future aspect the system can be shirked to the track itself for the flexibility.

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## BIOGRAPHY

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