Efficient Real Time Railway Track Monitoring With Wireless Sensor Network

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ABSTRACT*:* The main objective of this project is to provide the multi sensor railway track geometry surveying system. Railway crack status is monitored by the sensor and transfer through wireless modules. For easy surveying of the railway track and if the crack is detected is transferred with less delay time the information can be send to the respected authority. The real time monitoring of the railway track avoids the accident and derailing of the train.

**KEYWORDS**: surveying, wireless, crack, railway track

I. INTRODUCTION

Transport is very important to carry the passengers and goods from one place to another. The better transport leads to more trade. Economic level is mainly depends on increasing the capacity and level of transport. This paper presents an implementation of an efficient and cost effective solution suitable for railway application. In India this process of checking the crack in railway track is still manually happening. This manual process will have many disadvantages. Railway department will provide well trained worker for this detection process, but sometimes worker cannot detect the missing crack because of his carelessness and many issues will be created.

In this project we can be used for monitoring the railway infrastructure such as bridges, rail tracks, track beds along with continuous monitoring. We use wireless technology and monitoring provides continuous and near real-time data acquisition and autonomous data acquisition, increased frequency of monitoring compared with manual inspection. We use sensors to cooperatively monitor infrastructure, structures, and machinery. Each sensor node generally has a radio transceiver, a small microcontroller, and an energy source. Accelerometer, temperature and continuity sensor ,etc. are used in a WSN node. It collects the data and sends to base station. They provide continuous real-time data capture and send to base station and analysis to identify faults.

II. BLOCK DIAGRAM
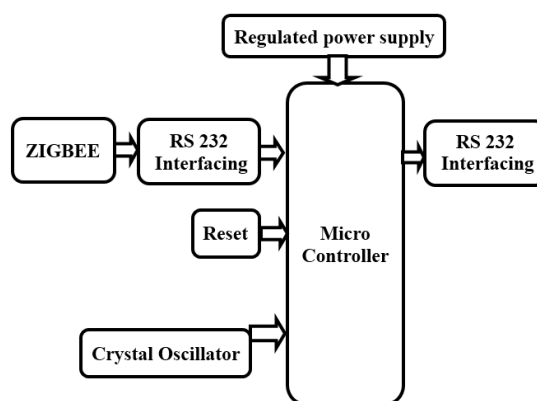
Train with Transmitter
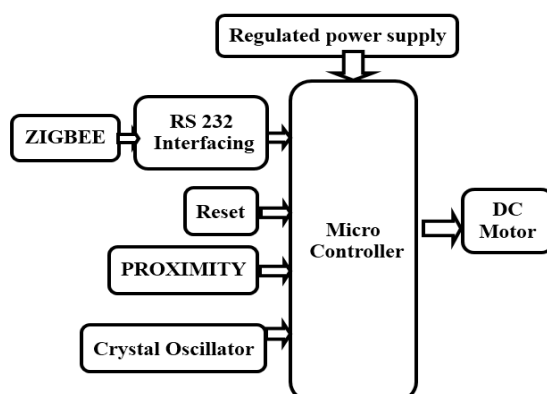
Control station with Receiver

III. BUILDING BLOCKS OF THE SYSTEM

a) PROXIMITY SENSOR

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors. For example, a capacitive or photoelectric sensor might be suitable for a plastic target; an inductive proximity sensor always requires a metal target.

b) ARM PROCESSOR(MAX 232)

The MAX232 is an integrated circuit that converts signals from a TIA-232 (RS-232) serial port to signals suitable for use in TTL-compatible digital logic circuits. The MAX232 is a dual transmitter / dual receiver that typically is used to convert the RX, TX, CTS, RTS signals. The drivers provide TIA-232 voltage level outputs (about ±7.5 volts) from a single 5-volt supply by on-chip charge pumps and external capacitors. This makes it useful for implementing TIA-232 in devices that otherwise do not need any other voltages. The receivers reduce TIA-232 inputs, which may be as high as ±25 volts, to standard 5 volt TTL levels. These receivers have a typical threshold of 1.3 volts and a typical hysteresis of 0.5 volts.

c) ZIGBEE

ZigBee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection.

d) RS-232 INTERFACE

In telecommunications, RS-232 is a standard for serial communication transmission of data. It formally defines the signals connecting between a DTE (data terminal equipment) such as a computer terminal, and a DCE (data circuit-terminating equipment or data communication equipment), such as a modem. The RS-232 standard is commonly used in computer serial ports. The standard defines the electrical characteristics and timing of signals, the meaning of signals, and the physical size and pinout of connectors.

e) CRYSTAL OSCILLATOR

An electronic circuit or electronic device that is used to generate periodically oscillating electronic signal is called as an electronic oscillator. The electronic signal produced by an oscillator is typically a sine wave or square wave. An electronic oscillator converts the direct current signal into an alternating current signal. The radio and television transmitters are broad casted using the signals generated by oscillators. The electronic beep sounds and video game sounds are generated by the oscillator signals. These oscillators generate signals using the principle of oscillation.

f) DC MOTOR

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

g) LCD DISPLAY

A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals. Liquid crystal display is very important device in embedded system. It offers high flexibility to user as he can display the required data on it. These are used in a wide range of applications, including computer monitors, television, instrument panels, aircraft, cockpit displays, signage, etc., Here, the LCD Display is used to show the Crack which is detected by the system to the user.

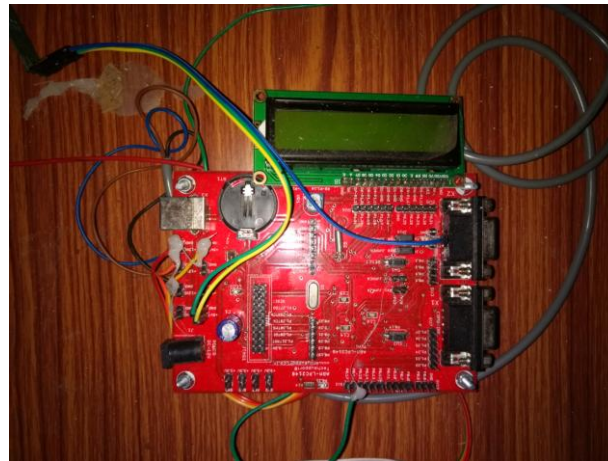## IV. WORKING OF THE CRACK DETECTION SYSTEM

The Proximity sensor used here is Inductive type Proximity sensor which detects metal. Railway track is made up of metal, if any crack exists in the track there is a void space i.e., there is no metal. So, the proximity sensor detects there is crack in the track. Dc motor is used to run the Rail on the track, when the crack is detected it automatically stops and give information to the control station via Zigbee wireless module. ZigBee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. The Arm processor (Max 232) is used for control the circuit which is programmed in Embedded C using Keil compiler. The system also has LCD display which is used to display the crack on the railway track. The crystal oscillator is used here to stop the Train when the crack is detected. The crack detected information is also to the control station via Zigbee trans receiver. The Zigbee wireless module is used to here to transfer information from the Railway track to the control station. This system alerts the Train on the Railway Track to avoid the derailing and accident.

V. CONCLUSION

This project is helpful in real time monitoring of Railway track using Zigbee wireless module. This reduces the cost of manual surveying using railway employees. This system detects the crack and inform it to the control station immediately which avoids derailing of the Train and accident, which saves the plenty of lives.

VI. FUTURE WORK

This type of Crack detection Vehicle in future used by the Railways will reduce the cost of manual surveying and also efficiently monitors the health of the Railway bed 24X7. This in turn reduces the human effort using wireless module. This type of vehicle is helpful to detect the crack in the Railway track before the derailing will happen.

ACKNOWLEDGMENT

We hereby Thank Mrs. V.P. Kavitha, Assistant Professor –II, Department of Electronics and Communication, Velammal Engineering College for encouraging us to do the project in terms of technical help and for making the project successful.

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International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 3, March 2017

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