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RAILWAY TRACK DEFORMATION AND IDENTIFICATION

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ABSTRACT

The Indian railways are the largest rail passenger transport in today's world and it is the back bone of the country transport infrastructure. Almost nearly 24 million passengers use the railway system on a daily basis. Railway authorities had made an analysis of the recent accidents and customer complaints to provide a safe and secured system which can be widely used throughout the railway connecting system. India possesses fourth largest network in the world exceeded only by those of the United States, Russia and China .One of the most widely used and comfortable nodes of transportation system is train, but occasionally, accidents are occur due to collision as well as other reason. It is very difficult to stop such collisions because of speed of moving trains, which is needs a lead distance to stop. Collisions are happened due to human errors n and/or faulty equipment's. The main problem about a railway analysis is detection of cracks in the structure. If these deficiencies are not controlled at early stages they might lead to a number of derailments resulting in a heavy loss of life and property. This project proposes a cost effective solution to the problem of railway track crack detection utilizing Zigbee control assembly which tracks the exact location of track damage which then mended immediately so that many lives will be saved.

Keywords- *Track damage detection sensor, ARM Controller, Detection, GSM, GPS.*

I.   INTRODUCTION

Now a days due to natural disaster like floods, earth quake, cyclone, etc. there are many accidents are occurring in Railways due to cracks in the rails. System have some limitations and delay in delivering the signals, if the bridges or track got damaged, the information goes to railway authority people takes prolonged time and there by notifying and informing to the corresponding trains takes more time. So to avoid delays, our proposed system will immediately notifies and informs the current train comes on the track through wireless medium. Project discusses the technical and design aspects in detail and also provides the proposed multi sensor railway track geometry surveying system

II.   HISTORY

Automatic Broken Track Detection Using
LED-LDR Assembly

In India rail transport occupies a prominent position in providing the necessary transport infrastructure to sustain needs of a rapidly growing economy. Today, India possesses the fourth largest railway network in the world. However, in terms of the reliability and safety parameters, we have not yet reached truly global standards. The main problem about a railway analysis is detection of cracks in the structure. If these deficiencies are not controlled at early stages they might lead to a number of derailments resulting in a heavy loss of life and property. This paper proposes a cost effective solution to the problem of railway track crack detection utilizing LED-LDR assembly which tracks the exact location of faulty track which then mended immediately so that many lives will be saved.

III.   SPECIFICATION OF THE PROJECT

A) Input power requirement: -   230 V, 50 Hz
B) DC power supply: -   + 5 V, + 3.3 V

C) LCD display: - 16*2 characters, 5*7 matrix.

D) Controller: - LPC2138

E) Memory: -   1. 32 kB to 512 kB of on-chip flash memory.
                         2. 8 kB to 40 kB of on-chip static RAM
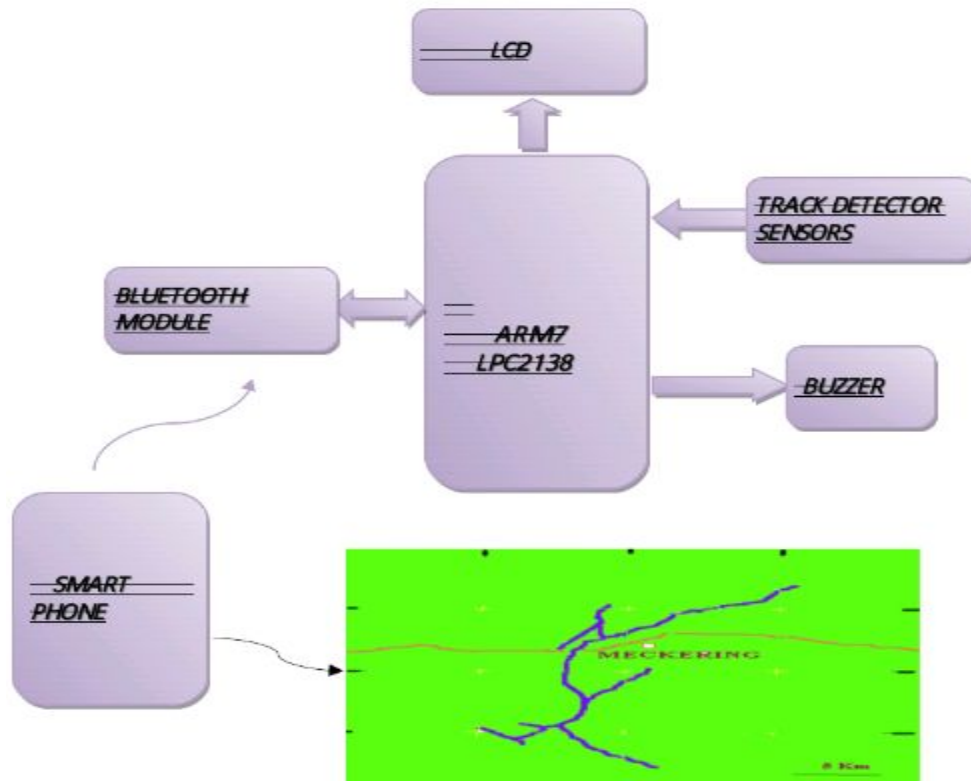F) Domain:- Embedded System

G) Software: Keil4, Flash magic, Eagle (pcb design), Android Application(JAVA) Language used: Embedded c

I) Crystal:12mhz

J) Communication device: - Bluetooth

IV. DEVELOPMENT OF PROJECT
4.1 BLOCK DIAGRAMME

4.2 BLOCK DIAGRAM DESCRIPTION
In general rail transport in India growing at a rapid pace, the associated safety infrastructure facilities. Analysis of the factors that cause these rail accidents, recent statistics reveal that approximately 60% of all the rail accidents have derailments as their cause, of which about 90% is due to cracks on the rails either due to natural causes (like excessive expansion due to heat) or due to anti- social elements. These cracks and other problems with the rails generally go unnoticed due to improper maintenance and the currently irregular and manual track line monitoring that is being carried out in the current situation. The principal problem has been the lack of cheap and efficient technology to detect problems in the rail tracks and of course, the lack of proper maintenance of rails which have resulted in the formation of cracks in the rails and other similar problems caused by anti-social elements. 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 pressure, temperature, acceleration, etc. Sensors can transmit signals via radio signal. Since sensors are now small and cheap, they can be deployed on a larg scale. It becomes more and m more important for applications like security, traffic monitoring, agriculture, battlefield, etc. Most of those sensors are powered by batteries. This project proposes a cost effective solution to the problem of railway track crack detection utilizing Zigbee control assembly which tracks the exact location of track damage which then mended immediately so that many lives will be saved.

Fig1:-track detector

  Project consists of track detector sensor, LCD, controller, smart phone, Bluetooth modules. Controller is heart of the system. Track detector is continuously detecting the track. If any track is open then it will send the signal and co-ordinate of that place.GPS facility of phone is used to send the co-ordinate. Smart phone has web application designed. So that anyone can view data from anywhere. This makes system reliable

Global Positioning System (GPS)-
GPS (Global Positioning System) technology is used to find the location of any object or vehicle to monitor or a child continuously using satellite signals. Three satellite signals are necessary to locate the receiver in 3D space and fourth satellite is used for time accuracy. GPS will give the information of parameters like longitude, latitude and attitude. With the help of these parameters one can easily locate the position of any object. In this GPS technology, the communication takes place

IR Sensor-
Infrared (IR) technology addresses a broad variety of sensing and remote control. An IR Emitter is a light emitting diode (LED). Different types of IR LED's are specified based on their packaging and special features, such as output optical power, wavelength, and response time. An IR Receivers are also called sensors since they detect the wavelength and spectral radiation of the light from the IR emitter. IR receivers are specified by optic features, packaging, special circuitry such as an ambient light filter, wide viewing angle, and more. Wireless applications, especially in the areas of sensing and remote control.

ARM 7 (LPC2138)-
The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers. The LPC2138 micro-controllers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine micro-controller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2138 are ideal for applications where miniaturization is a key requirement, such as access control and point of sal

V. IMPLEMENTATION OF PROJECT
5.1 HARDWARE DISCRIPTION
Following hardware's are used
•   Track deformation sensor
•   LCD
•   ARM7
•   Bluetooth module
•   DC motor

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1. **ARM7 (LPC2138)-** The LPC2138 microcontrollers are based on a 32 bit ARM7TDMI-S™ CPU with real-time emulation and embedded trace support, that combines the microcontroller with 512 kB of embedded high speed Flash memory. Due to their tiny size and low power consumption, these microcontrollers are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale.
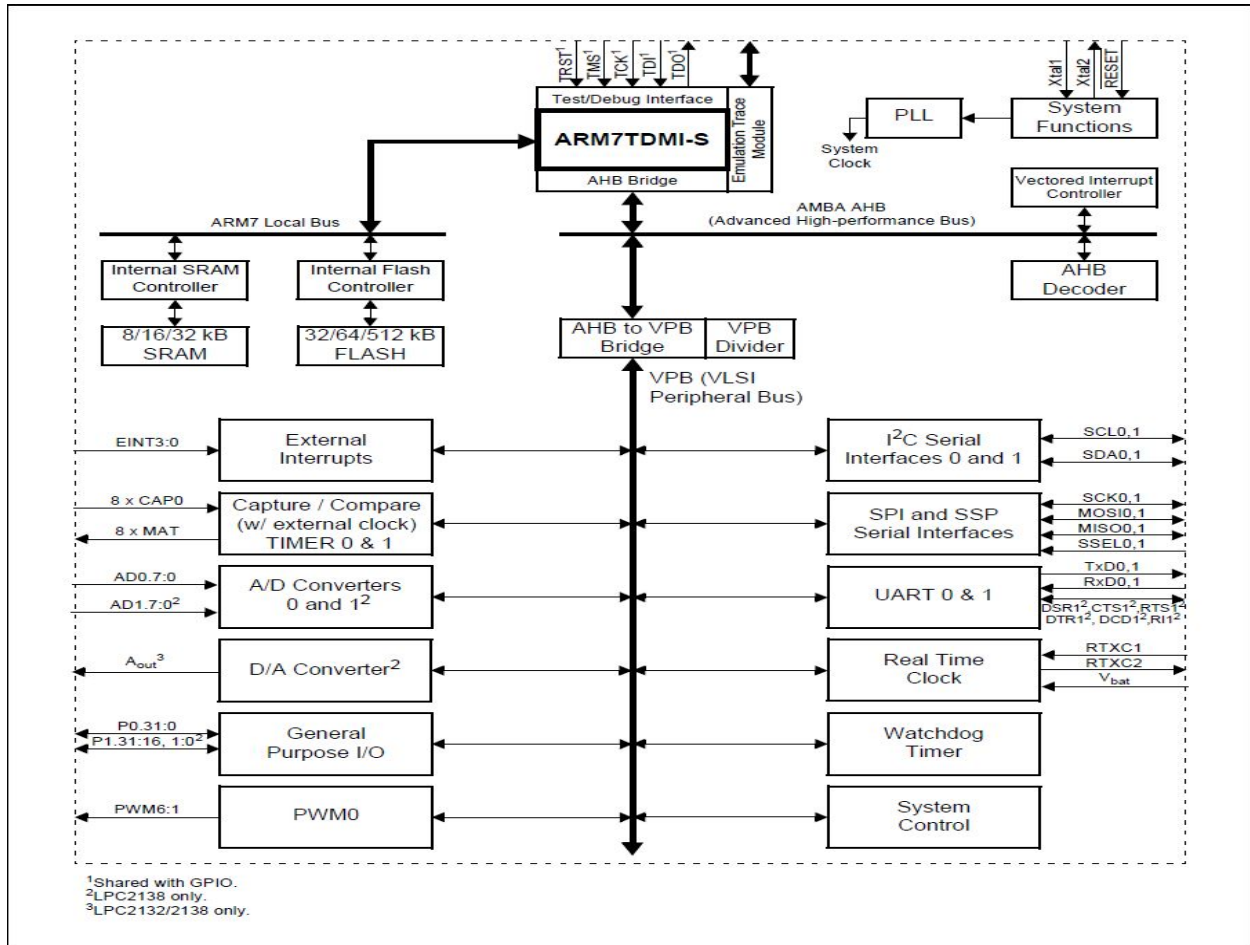
2. **Functional Diagram:**

Fig.2 Functional diagram of ARM

RS-232 Standard:-To allow compatibility among data communication equipment made by various manufacturers an interfacing standards called RS232 was set by the Electronics Industries Association (EIA) in 1960. RS232 is the most widely used serial input output interfacing standard. This standard is used in PCs and numerous types of equipments. However since the standard was set long before the advent of the TTL logic family, its input and output are not TTL compatible. In RS232, a '1' is represented by -3 to -25 V while '0' bit is +3 to +25 V, making -3 to +3 undefined. For this reason, to connect any RS232 to a microcontroller system we must use voltage converter such as MAX232 to convert the TTL logic level to RS 232 voltage level and vice-versa. MAX232 IC chips are commonly referred to as line drivers.
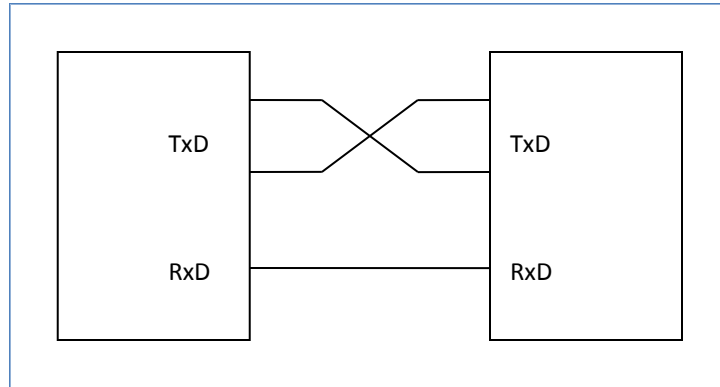
Fig 3: Null Modem Connection

The features of the RS232 are as given below:

Single ended mode of operation.
1 Transmitter, 1 Receiver.
50 Ft cable length.
Data rate 20 KBPS.
Driver range: - +/- 3V to +/- 25 V.
Load impedance 3 to 7 K.

MAX- 232:- Since the RS232 is not compatible with today's microprocessors and microcontrollers we need a line drive (voltage converter) to convert the RS 232 signal to TTL voltage level that will be accepted by 89C55 transmitter and receiver pin. The MAX232 converts from RS232 voltage level to TTL voltage levels and vice-versa. One advantage of the MAX232 chip is that it uses a +5V power source which is the same as the source voltage of 89C55. In other words with a single +5V power supply we can power both the 89C55 and MAX232 with no need for dual power supplies that are common in older systems. MAX232 requires four capacitor between 1uF to 22uF. The most widely used value for this capacitor is 22uF. The voltage levels of RS 232 are not suitable for microcontroller and hence the buffer IC is used which is MAX 232. The voltage levels of MAX 232 are 0 to +5 volts. The MAX 232 is TTL to CMOS converter and also CMOS to TTL converter and thus making the system compatible with PC. Serial waveforms are shown in fig. 4.5 on the single conductor to transmit a byte (0x41) serially. The upper wave is the TTL level waveform seen at the transmit pin of 8051. The lower waveform shows the same waveform converted to MAX 232 levels. The voltage level of MAX 232 is used to assure error free transmission over greater distances than would be possible with TTL levels.
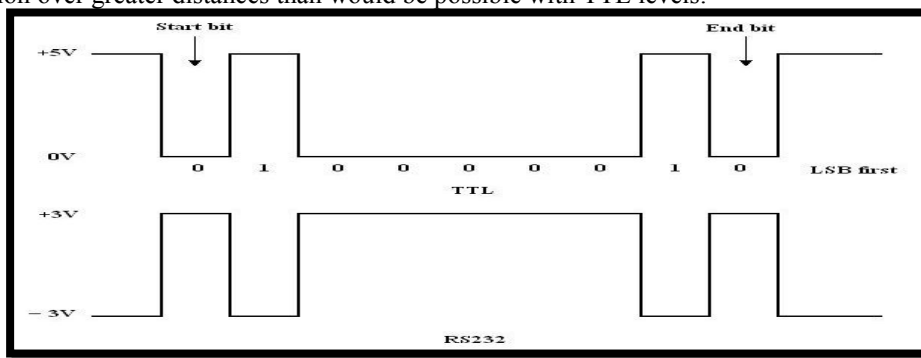

Fig 4. A TTL Serial Waveform converted into MAX 232 levels

The data byte is always transmitted LSB first. The bits are transmitted with specific time intervals determined by the baud rate of the serial signal. The baud rate is the reciprocal of the time to send 1 bit. Error free serial communication requires that the baud rate, number of data bits, number of stop bits and presence or absence of a parity bit be the same at the transmitter and at the receiver. A standard serial interfacing for mobile, MAX 232,

requires negative logic i.e. logic '1' is -3V to -25V and logic '0' is +3V to +25V. To convert TTL logic, say TxD and RxD pins of μC chips thus need a converter chip. A MAX 232 chip has long been using in many μC boards. It provides 2 channel 232C ports and requires 5 external 10μF capacitor

The features of IC MAX232 are as given below

- TTL to RS 232 Converter.
- VCC = 5V.
- Two sets of line drivers.
- Max 232 requires four external capacitors of value 22 uF.

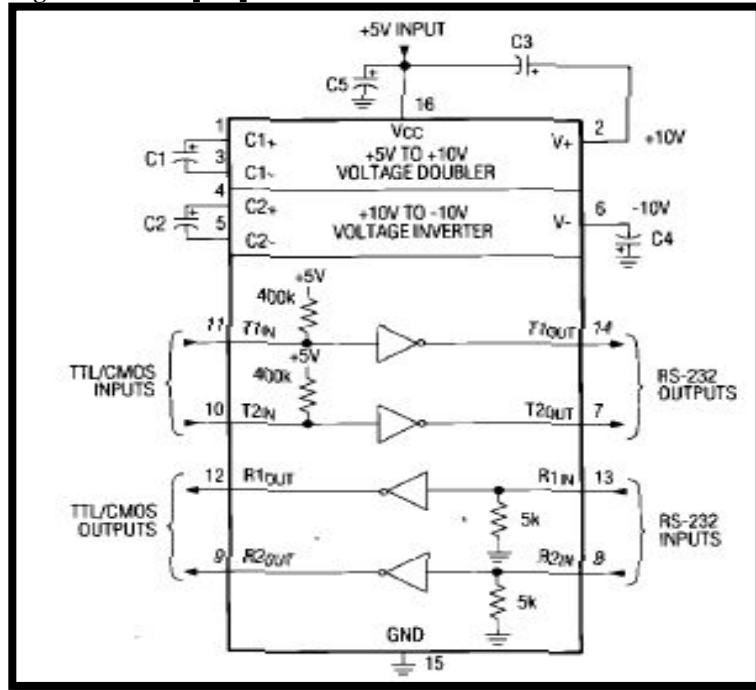**Pin out / Functional diagram of MAX 232**

Fig 5: Internal Circuitry of MAX 232 IC.

The MAX 232 has two sets of line drivers for transferring & receiving data
The line drivers used for TXD are called T1& T2 the line drivers for RXD are called R1&R2
T1&T2 Are used together for TXD & RXD of the microcontroller & 2nd set is left unused.HereT1IN is TTL side& is connected to TXD of microcontroller while T1 out is the ES232 side which is connected to the RXD pin of RS232 DB connecters, and R1 out is the TTL side which is connected to the RXD pin of the microcontroller. MAX232 requires four capacitors ranging from 1 to 22 micro-fared .These capacitors are connected to internal D.C. to D.C. converters. If we will use MAX 233 instead of Max 232 the external capacitors are not required. But cost of the MAX 2333 is 10 times greater than Max 232.The applied TTL voltage gets doubled across the C1 & C2 capacitor, thus giving a double output with positive polarity while across C4 we observe double voltage with negative polarity.
TRACK DETECTION SENSOR: It operates on variable resistance principle. As the movement of float of the sensor takes place its resistance varies accordingly. The change in resistance is in the range of 1 Ohm to 100 Ohms. By connecting resistor of 100 Ohms in series with this level sensor we can create voltage divider circuit.

HC-06 BLUETOOTH MODULE: Bluetooth takes small-area networking to the next level by removing the need for user intervention and keeping transmission power extremely low to save battery power. Picture this: You're on your Bluetooth-enabledcell phone, standing outside the door to your house. You tell the person on the other end of the line to call you back in five minutes so you can get in the house and put your stuff away. As soon as you walk in the house, the map you received on your cell phone from your car's Bluetooth-enabled GPS system is automatically

sent to your Bluetooth-enabled computer, because your cell phone picked up a Bluetooth signal from your PC and automatically sent the data you designated for transfer. Five minutes later, when your friend calls you back, your Bluetooth-enabled home phone rings instead of your cell phone. The person called the same number, but your home phone picked up the Bluetooth signal from your cell phone and automatically re-routed the call because it realized you were home. And each transmission signal to and from your cell phone consumes just 1 milliwatt of power, so your cell phone charge is virtually unaffected by all of this activity.

Hc05:-This module enables you to wireless transmit & receive serial data. It is a drop in replacement for wired serial connections allowing transparent two way data communication. You can simply use it for serial port replacement to establish connection between MCU or embedded project and PC for data transfer.

DC motor

An Electric Motor is a machine which converts electrical energy into mechanical energy.
We have used two DC motors 1) To drive conveyor belt(12v, 30rpm) 2) To rotate robotic arm (12v, 10rpm)
LCD(16x2): LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.
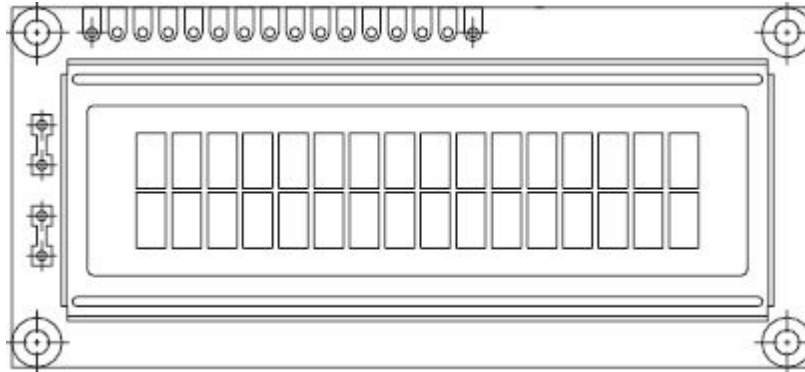

Fig.6 LCD Display

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

Buzzer: The **piezo buzzer** produces sound based on reverse of the piezoelectric effect. The generation of pressure variation or strain by the application of electric potential across a piezoelectric material is the underlying principle. These buzzers can be used alert a user of an event corresponding to a switching action, counter signal or sensor input. They are also used in alarm circuits. The buzzer produces a same noisy sound irrespective of the voltage variation applied to it. It consists of piezo crystals between two conductors. When a potential is applied across these crystals, they push on one conductor and pull on the other. This, push and pull action, results in a sound wave. Most buzzers produce sound in the range of 2 to 4 kHz. The Red lead is connected to the Input and the Black lead is connected to Ground.

VI. FUTURE SCOPE

1)   We can use solar energy instead of battery so that our system covers long distance.
2)   We can send direct information to the on going railway and control room to decrease   the time.
3)   Ethernet module can be interfaced with micro-controller which sends data over web. Instead of Bluetooth, we
       can interface WI-FI module to the micro-controller to operate the devices.

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