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Research Paper

AUTOMATIC RAILWAY TRACK FAULT IDENTIFIER

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In India rail transport occupies a prominent position in providing the 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 mainproblem 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 using sensor and send a message to the control station using GSM Technology GPS finds the exact location of faulty track and gives a signal to GSM which then mended immediately so that many lives will be saved.Our project also has an advantage of In the current system we don't get the exact location of the faulty track. We only receive latitudes and longitudes of the location .In the proposed system we are using GPS module so that we can get the exact location of the broken rail track by using track scanning surveillance robot.

Keywords: Railway track, Crack detection, GSM, GPS, IR Sensor

INTRODUCTION

Transport is a key necessity for specialization that allowsproduction and consumption of products to occur atdifferent locations. Transport has throughout history been aspur to expansion as better transport leads to more tradeEconomic prosperity has always been dependent onincreasing the capacity and rationality of transport. Butthe infrastructure and operation of transport has a Greatimpact on the land and is the largest drainer of energy, making transport sustainability and safety a major issue. In India, we find that rail transport occupies a prominent position in providing the necessary transport infrastructureto sustain and quench the ever-burgeoning needs of rapidly growing economy [4]. The Indian railway networktoday has a track length of 115,000 kilometers(71,457,687mi).over a route of 65,436kilometers' (40,660 mi) and7,172 stations. It is the fourth largest railway networking the world exceeded only by those of the United States, Russia and China. The rail network

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traverses every length and breadth of India and is known carry over 30 million passengers and 2.8 million tons of freight daily. Despite boasting of such impressive statistics, the Indian rail network is still on the growth trajectory trying to fuel the economic needs of our nation. In terms of the reliability and safety parameters, we have not yet reached truly globalstandards.Though rail transport in India growing at a rapid pace, the associated safety infrastructure facilities have not kept up with the aforementioned proliferation. Our facilities are inadequate compared to the international standards and as a result, there have been frequent derailments that have resulted in severe loss of valuable human lives and property as well. 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 which jeopardize the security of operation of rail transport[4]

RELATED WORK

In general, there exist three main categories of techniques currently used for damage identification and condition monitoring of Railway tracks. These include:

- Visual inspection
- Non-destructive testing (NDT) technologies such as acoustic emissions or ultrasonic methods, magnetic field methods, radiography ,eddy current techniques, thermal field methods, dye penetrant, fiber optic sensors of various kinds
- Vibrationbased global methods. Visual inspection is the primary technique used for defect identification in tracks, and is effectively used in specialized disciplines. The successful implementation of this method generally requires the regions of the suspected damage to be known as a first step, and be readily accessible for physical inspection. As a result, this method can be costly, time consuming and ineffective for large and complex structural systems such as the rail track [3]. NDT techniques have resulted in a number of tools for us to choose from. Among the inspection methods used to ensure rail integrity, the common ones are ultrasonic inspection and eddy current inspection. Ultrasonic Inspections are common place in the rail industry in many foreign countries. It is a relatively well understood technique and was thought to be the best solution to crack detection The Ultrasonic Broken Rail Detector system isthe first and only alternative broken rail detection systemdeveloped, produced and implemented on a large scale. Byusing ultrasonic Broken Rail Detector system railwayoperators will have the benefit of monitoring railscontinuously for broken rails without human intervention. This will contribute to ensure that the people does not suffer

Figure 1: Ultrasonic Broken Rail

losses as a result of train derailments. Ultrasonic can only inspect the core of materials; that is, the method Cannot check for surface and near-surface cracking where many of the faults are located.

Another method for detection of cracks on tracks is by using wireless sensor networks. In this method thedetection of Cracks can be identified using IR rays with the IR transmitter & receiver. IR receiver is connected to the Signal Lamp or Electrified lamp with the IR sensor. CAN controller is connected to the main node and it send the information via GSM and transmit the message to engine and to the nearest station. The detection of Cracks can be identified using IR rays and IR sensor.IR receiver is connected to the signal lamp and to the CAN controller. The Electrified lamp is nothing but it sides of the tracks the electric lamp which is current flowing for the engines transportation [2]. But this type of system doe.

Figure 2: Model Figure to Fix the IR Sensor on the Wheel

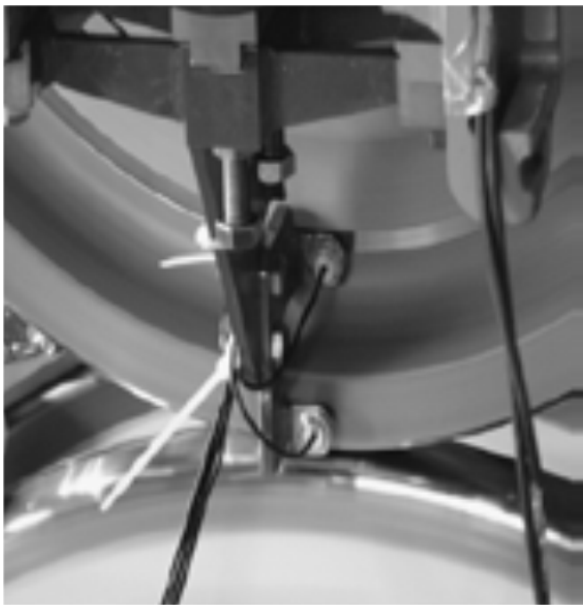
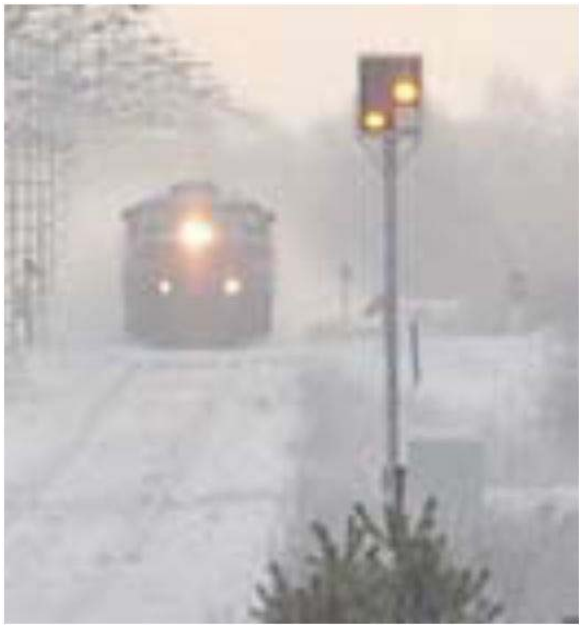


Figure 3: Signal Lamp Example



CURRENT SYSTEM

In the Current System the principle involved in crack detection is the concept of LDR (Light dependent Resistor).In the proposed design, the LED will be attached to one side of the rails and the LDR to the opposite side. During normal operation, when there are no cracks, the LED light does not fall on the LDR and hence the LDR resistance is high. Subsequently, when the LED light falls on the LDR, the resistance of the LDR gets reduced and the amount ofreduction will be approximately proportional to the intensity of the incident light. As a consequence, when light from the LED deviates from its path due to the presence of a crack or a break ,a sudden decrease in the resistance value of the LDR ensues. This change in resistance indicates the Presence of a crack or some other similar structural defecting the rails. In order to detect the current location of the Device in case of detection of a crack, a GPS receiver whose function is to receive the current latitude and

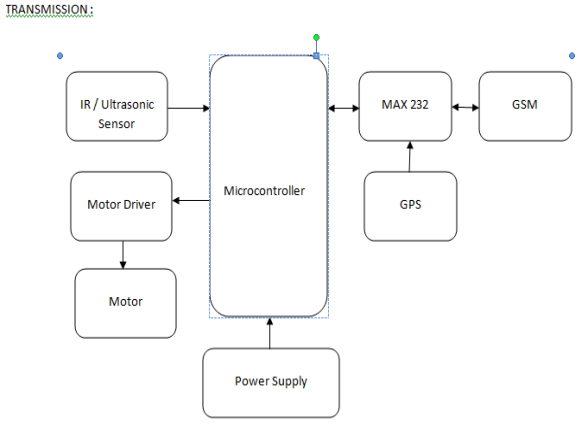
longitude data is used. To communicate the received Information, a GSM modem has been utilized. The function of the GSM module being used is to send the current Latitude and longitude data to the relevant authority as anSMS.The robot is driven by four DC motors. With this Current system only latitudes and longitudes of the broken track will only be received so that the exact location cannot be known.

PROPOSED SYSTEM

The proposed system will overcome the limitations of both the traditional and the current system that are using for detection of faulty tracks. In the current system we don't get the exact location of the faulty track .we only receive latitudes and longitudes of the location. In the proposed system we are using GPRS module so that we can get the exact location of the broken rail track .In this proposed system we are also using PIC16F877A controller which consumes low power and also less cost. By using the PIC16F877A controller the analysis time of the proposed will be reduced drastically. Before the start of the railway line scan the robot has been programmed to find the faulty track. After calibration, the robot waits for a predetermined period of time so that the onboard GPS module starts reading the correct geographic coordinate. This is necessary because any GPS module will take some time to synchronize with the satellites and it finds exact location of faulty track, after finds the location it gives the signal to main Station through GSM technology. Our project focuses on safe guarding the train collisions by detecting the faulty tracks. This project proposes a cost effective solution to the problem of railway track crack detection by utilizing CRACK SENSOR with GPS modules assembly which tracks the exact location of faulty track using track scanning surveillance robot. Which then mended immediately so that many lives will be saved.Our project also has an advantage of In the current system we don't get the exact location of the faulty track. We only receive latitudes and longitudes of the location. In the proposed system we are using GPS module so that we can get the exact location of the broken rail track by using track scanning surveillance robot.

BLOCK DIAGRAM

Figure 3: Transmitter Circuit



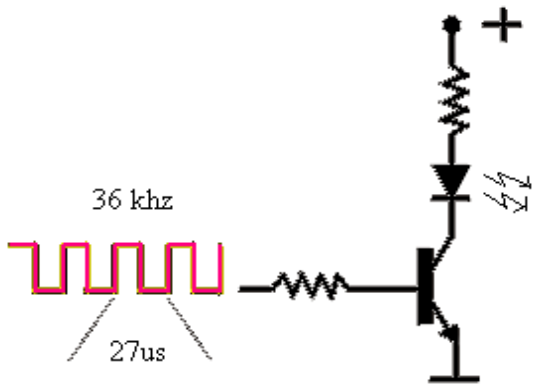
IR TRANSMITER AND RECIEVER

The job is between 30 and 60 kHz, the most used is around 36kHz.So, remote controls use the 36 kHz (or around) to transmit information. Infra-Red light emitted by IR Diodes is pulsated at 36 thousand times per second, when transmitting logic level "1" and silence for "0". To generate a 36 kHz pulsating infrared is quite easy, more difficult is to receive and identify this frequency. It has an output pin that goes high (+5V) when there is a pulsating 36kHz infrared in front of it, and zero volts when there is not this radiation. Infrared is an energy radiation with a frequency below our eyes sensitivity, so we cannot see it Even that

we cannot "see" sound frequencies, we know that it exist, we can listen them. Even that we cannot see or hear infrared, we can feel it at our skin temperature sensors. When you approach your hand to fire or warm element, you will "feel" the heat, but you can't see it. You can see the fire because it emits other types of radiation, visible to your eyes, but it also emits lots of infrared that you can only feel in your skin.

A **photodiode** is a type of photo detector capable of converting light into either current or voltage, depending upon the mode of operation. Many diodes designed for use specifically as a photodiode will also use a PIN junction rather than the typical PN junction. Most photodiodes is similar to a light emitting diode. They will have two leads, or wires, coming from the bottom. The shorter end of the two is the cathode, while the longer end is the anode. See below for a schematicdrawing of the anode and cathode side. Current will pass from the anode to the cathode, basically following the arrow.The best frequency for

Figure 4: Photodiode



IR SENSOR APPLICATION

The primary function is to recognize IR signals which are emitted from an IR transmitter. The transmitter is usually mounted on a shearer and the receivers in the shields. The latter are connected to the controller

PIC Microcontroller (PIC16F877A)

- High-performance RISC CPU
- Only 35 single word instructions
- All single cycle instructions except for program branches which are two cycle
- Operating speed: DC - 20 MHz clock input DC - 200 ns instruction cycle
- Up to 8K x 14 words of FLASH Program Memory, Up to 368 x 8 bytes of Data Memory (RAM) Up to 256 x 8 bytes of EEPROM data memory
- Interrupt capability (up to 14 sources)
- Eight level deep hardware stack

MAX232

Now that we have the 8 bit value in the 16F877A, we want to send that value to the PC. The 16F877A has a built in serial port that makes it very easy to communicate with the PC's serial port but the 16F877A outputs are 0 and 5 volts and we need +10 and -10 volts to meet the RS232 serial port standard. The easiest way to get these values is to use the MAX232. The MAX232 acts as a buffer driver for the processor. It accepts the standard digital logic values of 0 and 5 volts and converts them to the RS232 standard of +10 and -10 volts. It also helps protect the processor from possible damage from static that may come from people handling the serial port connectors. The MAX232 requires 5 external 1uF capacitors. These are used by the internal charge pump to create +10 volts and -10 volts. The MAX232 is an electronic circuit that converts signals from a

serial port to signals suitable for usage in e.g. microprocessor circuits.

GPS

The Global Positioning System (GPS) is a location system based on a constellation of about 24 satellites orbiting the earth at altitudes of approximately 11,000 miles. GPS was developed by the United States Department of Defense (DOD), for its tremendous application as a military locating utility. The DOD's investment in GPS is immense. GPS has proven to be a useful tool in non-military mapping applications as well. GPS satellites are orbited high enough to avoid the problems associated with land based systems, yet can provide accurate positioning 24 hours a day, anywhere in the world. Uncorrected positions determined from GPS satellite signals produce accuracies in the range of 50 to 100 meters. When using a technique called differential correction, users can get positions accurate to within 5 meters or less.

Computing the Distance between Your Position and the GPS Satellites

GPS determines distance between a GPS satellite and a GPS receiver by measuring the amount of time it takes a radio signal (the GPS signal) to travel from the satellite to the receiver. Radio waves travel at the speed of light, which is about 186,000 miles per second. So, if the amount of time it takes for the signal to travel from the satellite to the receiver is known, the distance from the satellite to the receiver (distance = speed x time) can be determined. If the exact time when the signal was transmitted and the exact time when it was received are known, the signal's travel time can be determined.

In order to do this, the satellites and the receivers use very accurate clocks which are synchronized so that they generate the same code at exactly the same time. The code received from the satellite can be compared with the code generated by the receiver. By comparing the codes, the time difference between when the satellite generated the code and when the receiver generated the code can be determined. This interval is the travel time of the code. Multiplying this travel time, in seconds, by 186,000 miles per second gives the distance from the receiver position to the satellite in miles

GSM

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer.

Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.

GSM Modemcharacteristics:

- Triband GSM GPRS modem (EGSM 900/1800 / 1900 MHz)
- Designed for GPRS, data, fax, SMS and voice applications
- GPRS multi-slot class 10
- GPRS mobile station class B

- Designed for GPRS, data, fax, SMS and voice applications
- Fully compliant with GSM Phase 2/2+ specifications
- Built-in TCP/IP Protocol
- Built-in RTC in the module.
- AT Command based

Specifications For Data

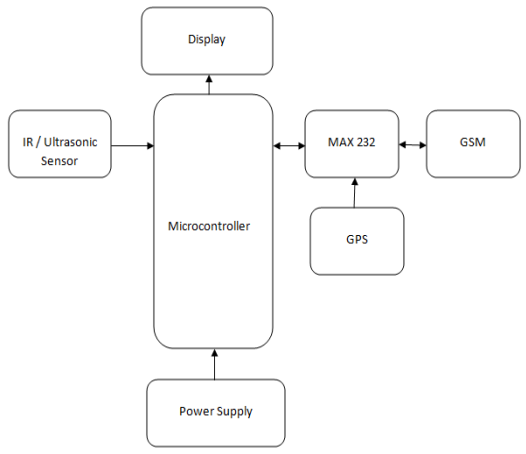
- GPRS class 10: max 85.6 kbps (downlink)
- PBCCH Support
- Coding schemes CS 1,2,3,4
- CDS up to 14.4 kbps
- USSD
- Non transparent mode
- PPP – stack

Specifications For SMS Via GSM & GPRS

- Point-to-point MO & MT
- SMS cell Broadcast
- Text & PDU mode

Receiver

Figure 5: Receiver Circuit



System Module

Figure 6: Side View of Project

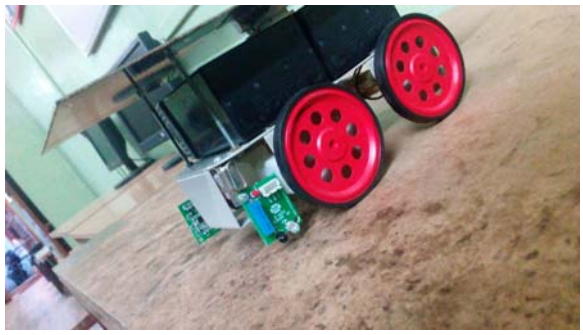
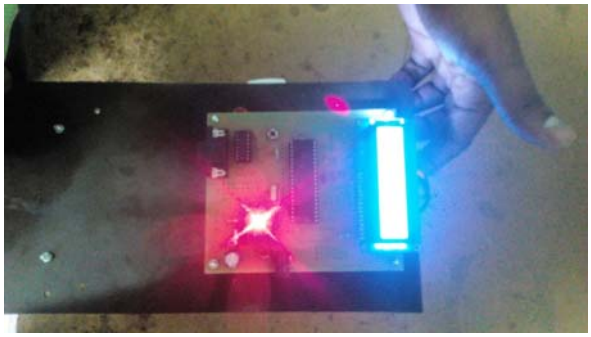


Figure 6: Top View of Project



CONCLUSION

The proposed broken rail detection system automatically detects the faulty rail track without any human intervention. There are many advantages with the proposed system when compared with the traditional detection techniques. The advantages include less cost, low power consumption and less analysis time .By this proposed system the exact

Location of the faulty rail track can easilybe located which will mended immediately so that many lives can be saved.

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