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Review On Railway Track Crack Detection

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ABSTRACT

In India, railway transportation service is the cheap and the majority convenient mode of passenger transport and also for long-distance and suburban traffic. The main cause of the accidents happened in railways are railway track crossing and unrevealed crack in railway tracks. Therefore, there is a need to have new technology which will be robust, efficient, and stable for both crack detection in railway track as well as to object detection. This project discusses a Railway track crack detection using sensors and is a dynamic approach that combines the use of a GPS tracking system to send alert messages and the geographical coordinate of location. Arduino Microcontrollers used to control and coordinate the activities of this device.

The Indian Railways consists one of the largest railway networks in the whole world, crises-crossing over 1, 15,000 km in distance, all over India. However, with regard to reliability, dependability, and passenger safety of Indian Railways is not up to the global standards. Among other factors, the cracks are developed on the railway tracks due to absence of the inefficient timely detection Our work involves a project that aims of designing a railway crack detection system (RCDS) using an Ultrasonic Sensor, The GSM (Global System for Mobile Communications), GPS (Global Positioning System) and Arduino based module whose implementation is an efficient method of detecting the cracks which are present in the tracks and thus avoiding derailment of the trains.

In this project, we are using an ultrasonic sensor which is used to find the crack in the railway track And also capable of alerting the authorities in the form of SMS messages along with location by using GPS and GSM modules

INTRODUCTION

In India railways transportation service is the cheap and the majority convenient mode of passenger transport and also for long distance and suburban traffic. The main cause of the accidents happened in railways are railway track crossing and unrevealed crack in railway tracks. Therefore, there is a need to have new technology which will be robust, efficient and stable for both crack detection in railway track as well as object detection. This project discusses a Railway track crack detection using sensors and is a dynamic approach which combines the use of GPS tracking system to send alert messages and the geographical coordinate of location. Arduino Microcontrollers used to control and coordinate the activities of this device.

Railway is one of the most significant transportation modes of our country but it is a matter of great sorrow that, railway tracks of our country are very prone. Thats why, a vast number of accidents are occurred every year due to this primitive type of railway tracks and as the consequences of those accidents we lose huge number of lives every year.

These types of incidents motivate us to think over the above mentioned issue and take necessary steps to protect those lives. Through our proposed system, we need to establish more modern and secure railway system. Besides this, there is no such type of technology or system in our country which can stop the collision between two trains coming from the opposite direction of each other on the same track. We actually think over this matter and motivated to do so. Moreover natural disaster can throw any object on the rail track which cannot be removed very quickly in the remote area. We thought if our system can detect those object or barrier and inform to the control room then they can take necessary steps 3 to avoid accident. Figure1 depicts the crack on track. The Rail transport is growing at a rapid pace in India. It is one of the major mode of transport but still our facilities are not that accurate, safer as compared to international standards. A survey on the internet states that about 60% of all the railway accidents is due to derailments, recent measurements shows that about 90% are due to cracks on the rails. Hence, it is not safer for Human Life. This needs to be at the utmost attention. These goes unnoticed and the properly maintenance of tracks is not done.

In country like India, where majority of people depend on railways for transportation, if a crack in railway track is not detected during the early stages they may lead to derailment causing heavy loss to human life and property. In this paper a crack detection system is proposed which detects the crack without human intervention and sends the location of fault to the authorized personnel using GSM. Crack detection by this method can be done during both day and night time and exact location of fault can be obtained

In the current rail system, it is more necessary to have safety elements in order to avoid accidents. One of the important causes that can provoke serious accidents is the existence of obstacles on the tracks either fixed or mobile and the cracks that are happened to the track. This project deals with one of the efficient methods to avoid train collision and obstacles detection and crack detection. This project aims for the detection of cracks in railway tracks, distance between the tracks and the presence of humans on railway tracks. The design of system consist a Global Position System (GPS) module, Global System for Mobile (GSM) modem, In proposed system, the ultra-sonic sensor sensors are used for detect the crack in the rail track. If any cracks or obstacles are detected on the railway tracks or if any change in the

distance between the two tracks, the longitude and latitude of the track location is messaged to the nearest railway station using GPS and GSM modems. The proposed system is compared with the traditional measuring systems, where it stands as an efficient and cost effective system for railway applications.

PROPOSED SYSTEM

A prototype is developed for the crack detection of railway track. In this project, a prototype vehicle is built which is designed to move in between the railway tracks. The prototype vehicle uses Arduino micro-controller and the driver circuit (L293D) and GSM module are interfaced with the Arduino microcontroller. Here, we have used GPS device for the movement of the vehicle. While moving in between the track as a crack is detected in either side of the railway track a message is sent to the authorized person with the information of location

OBJECTIVE

- Advanced project
- SMS Alert
- GSM and GPS based project
- Rail track crack detection

LITERATURE SURVEY

Indian Railway has developed a vandal-proof warning system for unmanned level crossings which is working satisfactorily for the last three months on Coimbatore Mettupalayam section [1]. In Indian railways, there are a total of 28,607 level crossings across the country of which 19,267 are manned and 9340 are unmanned. According to the action plan, the railways is focusing on eliminating almost all the unmanned level crossing in the next 3-4 years .

With this focus it is desirable to study various techniques to control the operation of gates at level crossings. Many journal papers are available which proposes automated railway gate system [3-7]. These papers discuss different options such as automatically controlled railway gate at the level crossing, railway track switching mechanism and the movement of the train using sensors, micro controllers for reduction of railway accidents and controller for stepper motor which operates the opening and closing of railway gates at the railway crossings.

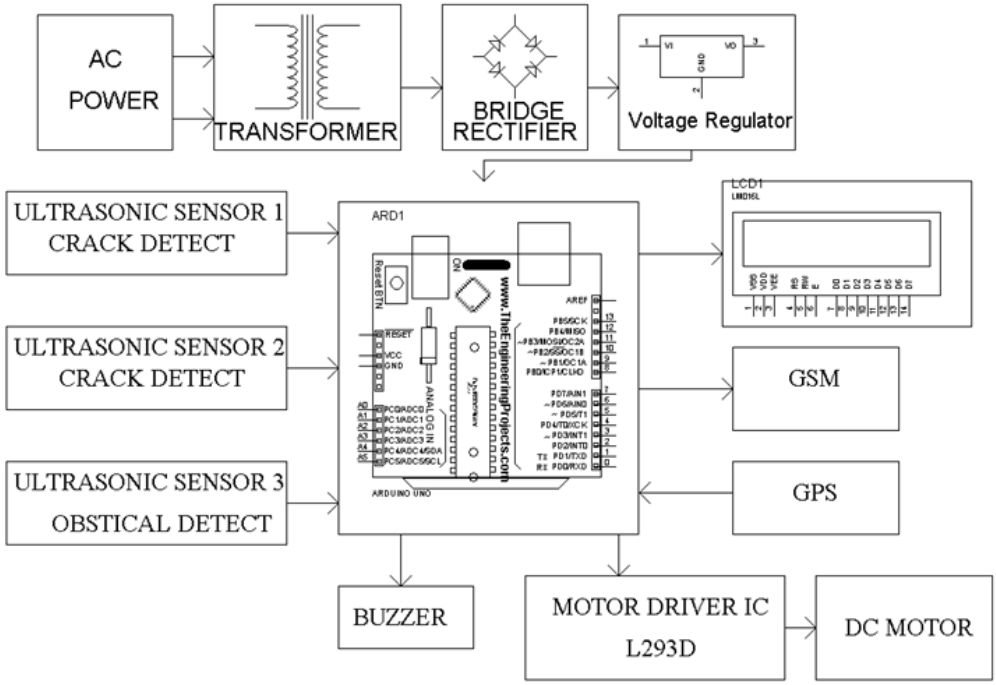
K Vidyasagar et al designed a system which uses ultrasonic sensors to identify objects on the track and accordingly control signal is generated and transferred to the control room via communication protocol to control the movement of train in railway track. Pwint et al [9] describes the automatic railway gate control system using PIC microcontroller for saving precious human lives and preventing major disasters in railway track. An Arduino based control system for the opening and closing of railway gates with IR sensors for detection of train is proposed by **Krishnamurthi et al** .

A detailed introduction about the technology adopted in railways is described with the disadvantages of manually operated railway warning systems at level crossings by Dewangan et al . Mahmud et al discuss the design and implementation of an automated railway gate control system which detects the train by analyzing the reflected waves, produces alarm, controls light signal and gate

METHODOLOGY

Ultrasonic sensor is used to detect the crack in the rail track with measuring the distance from track to sensor. Ultrasonic technique is the most effective method which detects cracks on a railway track. An android application will be developed to intimate about the rail cracks . GPS module when the crack is detected, relevant geographical location coordinates will sent to the nearest station. This recording and sending of coordinates are done by GPS module. GPS network used by cell phones provides a low cost, long range wireless communication channel for applications that require connectivity rather than higher data rates. GSM is use for the send in sms from the fault the railway track crack detection

BLOCK DAIGRAM



WORKING

The project block diagram which contains following process

1. Initially the tracks are being continuously monitored with the help of sensor, which is used to detect the crack in the track.

2. This monitoring is done with the help of ultrasonic sensor in order to sense the minor changes also which can be quite difficult with other sensors.

3. Whenever the crack gets detected with the help of ultrasonic sensor it passes the alert of crack found to the Arduino controller.

4. The Arduino controller will perform the process assigned to it accordingly.

5. The process mainly includes positioning, sending and alerting through the help of GPS module.

6. As the message gets delivered to the Railway Authority, the alert is to be taken into account and important measures must be taken by them in order to avoid future incidents and miss happenings which can lead to loss of human life and also to major injuries.

HARDWARE REQUIREMENTS

- Transformer
- Rectifier
- Regulator
- Arduino id
- LCD Display
- Dc motor
- Buzzer
- Ultra Sonic sensor
- GSM
- GPS
- Relay
- Regesister
- Capacitor
- Diode

- LED

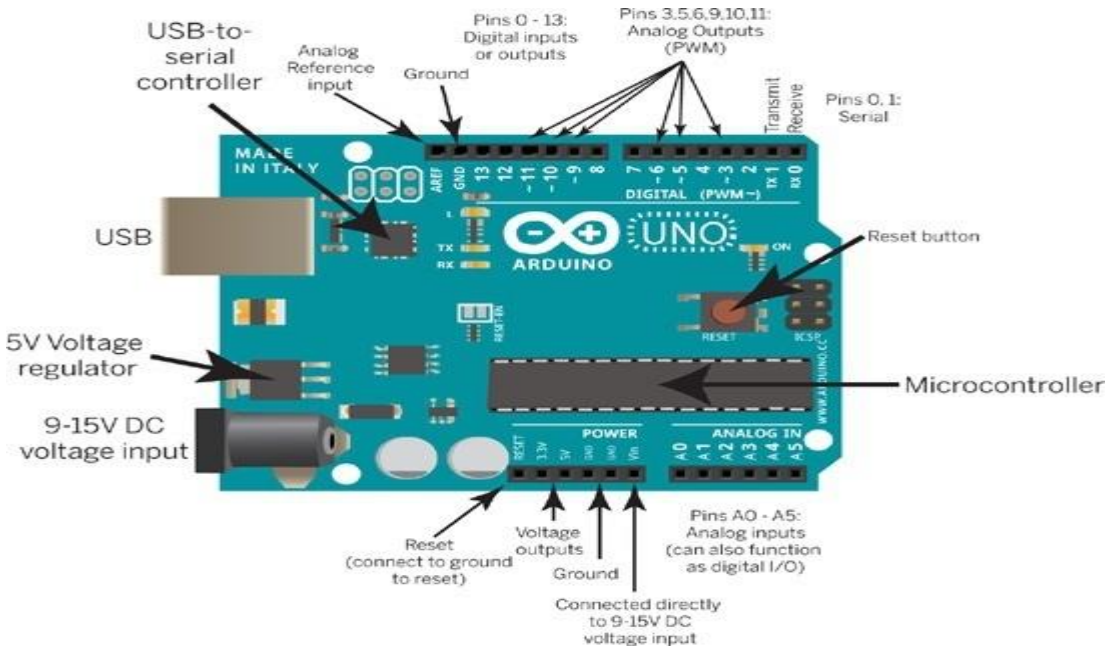
SOFTWARE REQUIREMENTS

- Eagle
- Arduino id

ARDUINO

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible pack The Uno is one of the more popular boards in the Arduino family and a great choice for beginners. We'll talk about what's on it and what it can do later in the tutorial.



Why Arduino?

Thanks to its simple and accessible user experience, Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone - children, hobbyists, artists, programmers - can start tinkering just following the step by step instructions of a kit, or sharing ideas online with other members of the Arduino community.

APPLICATION OF ARDUINO

- Xoscillo, an open-source oscilloscope
- Arduinome, a MIDI controller device that mimics the Monome
- OBDuino, a trip computer that uses the on-board diagnostics interface found in most modern cars
- Ardupilot, drone software and hardware
- Gameduino, an Arduino shield to create retro 2D video games
- ArduinoPhone, a do-it-yourself cellphone
- Water quality testing platform
- Automatic titration system based on Arduino and stepper motor
- Low cost data glove for virtual reality applications
- Impedance sensor system to detect bovine milk adulteration
- Homemade CNC using Arduino and DC motors with close loop control by Homofaciens
- DC motor control using Arduino and H-Bridg

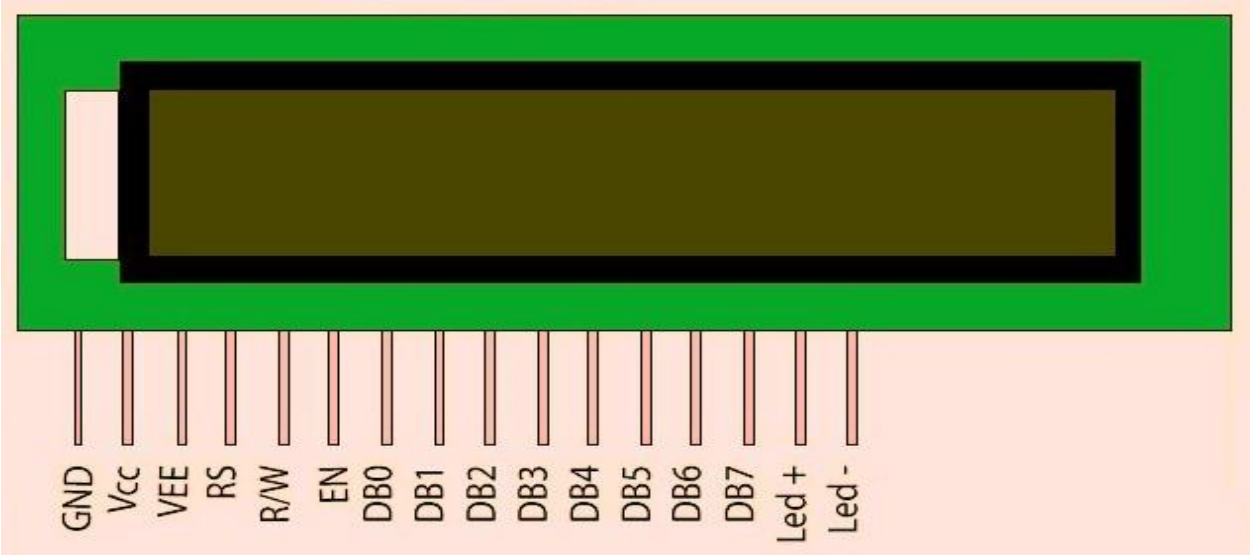
LCD DISPLAY

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.

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.

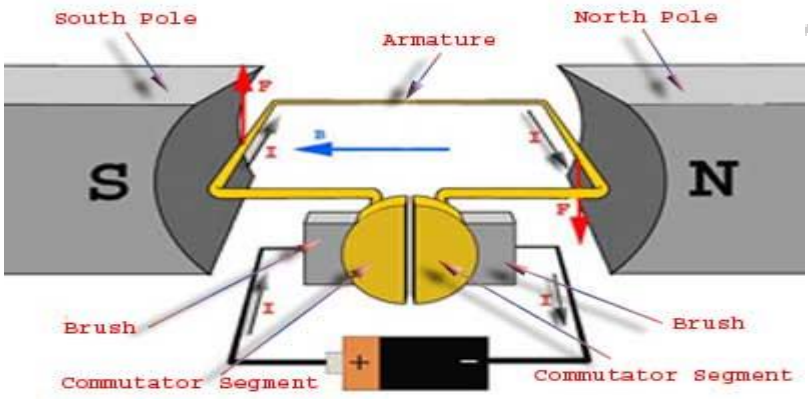
The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position,

controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD

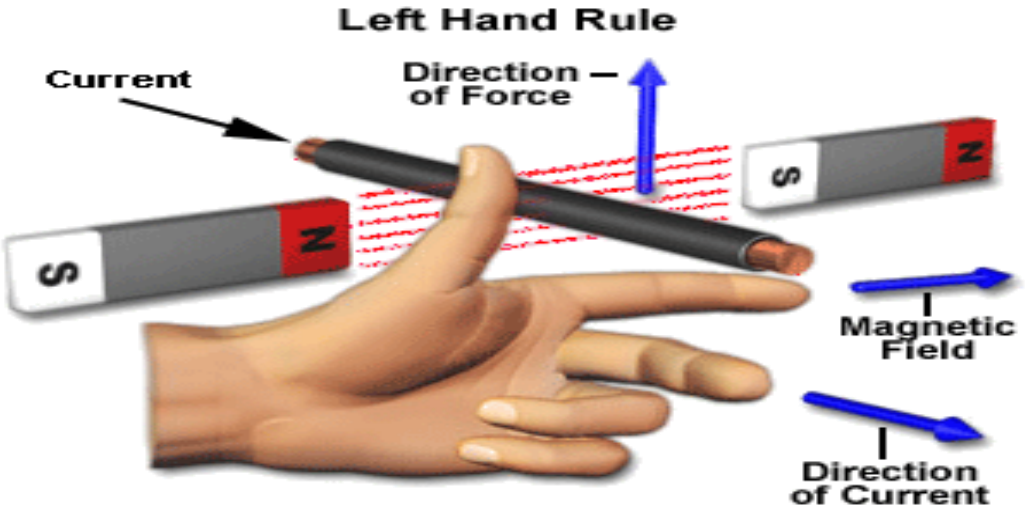


DC MOTOR

A DC motor in simple words is a device that converts direct current(electrical energy) into mechanical energy. It's of vital importance for the industry today, and is equally important for engineers to look into the **working principle of DC motor** in details that has been discussed in this article. In order to understand the **operating principle of dc motor** we need to first look into its constructional feature.



The very basic construction of a dc motor contains a current carrying armature which is connected to the supply end through commutator segments and brushes and placed within the north south poles of a permanent or an electro-magnet as shown in the diagram below. Now to go into the details of the **operating principle of DC motor**its important that we have a clear understanding of Fleming's left hand rule to determine the direction of force acting on the arm



Armature conductors of dc motor Fleming's left hand rule says that if we extend the index finger, middle finger and thumb of our left hand in such a way that the current carrying conductor is placed in a magnetic field (represented by the index finger) is perpendicular to the direction of current (represented by the middle finger), then the conductor experiences a force in the direction (represented by the thumb) mutually perpendicular to both the direction of field and the current in the conductor.

ULTRASONIC SENSOR

Ultrasonic sensors emit short, high frequency sound pulses at regular intervals. These propagate in the air at the velocity of sound. If they strike an object, then they are reflected back as echo signals to the sensor[5], which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo. If the signal from the ultrasonic sensor the motors will change the direction of the grass cutter. 5. Working: The design contains the micro controller, solar panel DC motors ,battery makes a robotic .The whole components are interfaced to micro controller. First the ultrasonic sensor will send the signal if the signal gets back then it sends the information to the micro controller and this will control the movement of the DC motors. If there is no object in front of the robotic vehicle both the motors will have movement and it is indicated to us using the led light[6]. Any object or human detected in front of it the direction changes to the right or left based on the direction the other

GSM

Allows you to create data connections on the GSM network through a standard USB interface.
The cellular modems, particularly USB-stick ones, are now at very affordable prices, however they're limited: they are explicitly designed for Internet connections, so you cannot use it as a normal modem and so implement, for example, a point to point data communications with them. The GSM modems that allow this are quite rare, and so we create and offer you one: it is a device for PC with an USB interface with "voice" functions: there is a jack for a speaker and one for microphone

The GSM module offers the advantages as below

- Ultra small size (22x22x3 mm), lightweight (3.2 g) and easy to integrate
- Low power consumption
- R&TTE type approval plus CE, GCF, FCC, PTCRB, IC
- Full RS232 on CMOS level with flow control (RX, TX, CTS, RTS, CTS, DTR, DSR, DCD, RI)
- Embedded TCP/IP Stack UDP/IP Stack , Embedded FTP and SMTP Client
- High performance on low price

ADVANTAGES

- Quick tracking of the cracks on the railway tracks and can rectify easily.
- Easy to automate unmanned level crosses.
- Can avoid accidents due to trains coming on the same tracks.
- Reduces chances of human error.
- Sefety and quality of services.

APPLICATION

- To automate unmanned level crosses.
- To track cracks on railway tracks.
- Its cost very low compared to exiting system
- Very accurate detection
- Accidents reduced

FUTURE SCOPE:

This will help to detect cracks immediately and reduce the possibilities of any mishappening. Since the system would be automatic and will require less manual intervention, the utmost efficiency of the system can be ensured. However, this system finds difficulty in sensing an internal crack in the railway track. The idea can be implemented in large scale, in the long run, to facilitate better safety standards for rail tracks and provide effective testing infrastructure for achieving better results in the future.

CONCLUSION:

As per the study the existing systems are time consuming as well as uneconomical. The proposed system is not only overcome these problems but also improve accuracy and crack detection in rails. It is the most economical solution provided in order to achieve good results of railways of our country in order to minimize the stats of accidents caused. There by possible to save precious lives of passengers and loss of economy. It also saves the time and money for identification of crack.

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