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ULTRASONIC FLAW DETECTOR ON A RAILWAY TRACK BY USING IOT

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ABSTRACT:

Railway transportation needs regular inspections and rapid maintenance to ensure public safety. Traditional manual inspections are time-consuming and expensive. Though the defect can also be identified by humans it is time-consuming based robotic systems could be placed on railway tracks to detect the cracks which are controlled from the control rooms. In this paper, an ultrasonic flaw detector is used for detection. When detected, the automated system provides image processing, which could be stored in cloud storage, consisting of images of detected railway tracks. Such locations are then marked, and more careful inspection can be performed by a dedicated operator with very few locations to inspect. This paper proposes the design of crack finding robot on railway tracks. At present India possess the fourth largest position in the world in terms of the network. It is the lifeline of about 25 million people using it daily. This paper uses a powerful monitoring system to address the defects of the existing railway surveillance system to detect cracks in railway tracks. To design IOT enabled robot that informs the railway controller about damaged tracks when detected by the robot and sends the information through wireless communication-based devices.

KEYWORDS:

CRACK IDENTIFICATION, ARDUINO BOARD, ULTRASONIC SENSOR, GPS MODULE, GSM MODULE, MOTOR, BATTERY.

INTRODUCTION

Railways are our country's most significant mode of transportation, but it is very sad to know that our railway tracks are very susceptible. That's why a large number of accidents happen every year due to this primitive type of railway track, and as a consequence of those accidents, we lose a huge number of lives every year. These types of incidents insist on us thinking over the above-mentioned issues and taking steps to protect those lives. Rail transport is fast growing in India. It is the major mode of transport, but still, our facilities are not accurate as compared to international standards. The major problem here is due to cracks in the rails. so, it is not safe for human life. This needs the utmost attention. These go unnoticed, and the proper maintenance of tracks is not properly done.

The work is done manually in the already existing system, but the proposed system has a robot that will run automatically on the tracks. This system has LED and LDR sensor assembly, but the only disadvantage is that the LED and LDR must place opposite each other, and the environment needs to be perfect to detect the track. To overcome this disadvantage, sensors are used which detect the crack accurately. This system GSM and GPS module which gives the real-time location in the form of SMS (Short Message System) to the nearest railway station.

FIGURE A) CRACK ON THE TRACK

FIGURE B) EFFECT DUE TO NATURAL CALAMITIES ON THE TRACK

OBJECTIVE:

Our main objective is to identify the cracks in the railway track and to find if there are any difficulties in the tracks to avoid accidents. This type of model provides a cost-effective solution because it needs minimum manpower. When a crack is detected by the crack-detection system the corresponding loco pilot will be intimated through a pop-up message. This pop-up notification service is implemented with the help of a GPS module by forwarding information to the control room through SMS to avoid any accidents.

EXISTING SYSTEM:

In the existing system, visual inspection, video transmission, and magnetic field methods are the techniques to detect the cracks in the railway track. Physical checking is the earliest method to scan all the necessary components manually. This method is commonly used in India, though it has the worst outcomes. A camera is used for monitoring the cracks in the tracks and it is not efficient to detect small cracks. current is passed through the railway track to detect the flaws in the eddy current method and the obtained results are not accurate. Many of these processes are not cost-efficient and it needs a lot of manpower.

FIGURE C) MANUAL INSPECTION

DRAWBACKS:

The current system has the following shortcomings:

- ❖ Inconvenient
- ❖ Time-consuming
- ❖ Labour-intensive
- ❖ Difficult to communicate

PROPOSED SYSTEM:

The proposed technique gets around the drawback of the current system in identifying broken railway tracks. in the suggested solution, an Arduino board is utilized. Based on the microchip ATmega328P microprocessor, the Arduino is an open-source microcontroller board. A variety of expansion boards and other circuits can be interfaced with the board s sets of digital and analog input/output pins. the project deals with the dynamic characteristics of a GPS tracking system, a GSM module to deliver alert messages, and the location's coordinates to detect the railway tracks using sensors. Control and coordination are performed using an Arduino microcontroller.

REQUIRED COMPONENTS

1) ARDUINO UNO

The following components are found in Arduino Uno:

- It is made comprised of an input voltage, a ground, and a 5v/3.3v power supply.
- It has fourteen pins.

A) MICROCONTROLLER

This is the main chip that serves as the brain of your Arduino board. They let you program your Arduino so that it can carry out instructions and make choices based on the code. Before loading a new program from the Arduino software, you must be aware of the microcontroller used on your board.

B) USB TO SERIAL CONVERTER FOR ARDUINO

It transforms a USB connection into a 5V serial TX and RX that may be connected directly to an Arduino Mini, Arduino Ethernet, or other Microcontroller to enable communication with a computer.

C) USB PORT

A board connected to an Arduino through computer software can be reset using the Arduino's USB connector. The Arduino board has three ports: B (Digital pins 8 to 13), C (analog inputs), and D (Digital pins 0 to 7).

D) ANALOGUE AND DIGITAL PINS

A microcontroller board based on the ATmega328P is called the Arduino Pro Mini. It contains 6 analog inputs, an onboard resonator, 14 digital input/output pins (of which 6 can be used as PWM outputs), an onboard reset button, and mounting holes for pin headers.

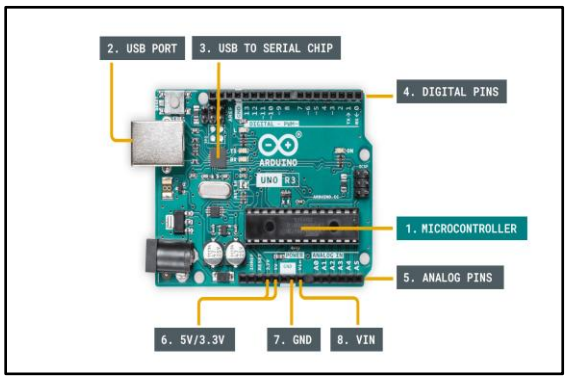


FIGURE D) ARDUINO BOARD

B) ULTRASONIC SENSOR

- An ultrasonic sensor is a device that uses ultrasonic sound waves to determine the distance between two objects. An ultrasonic sensor of the HC-SR04 type is employed for this.

- The HC-SR04 ultrasonic sensor uses SONAR to calculate an object's distance. It provides superb non-contact range detection from 2 cm to 400 cm or 1 to 13 feet in a user-friendly design with high accuracy and reliable results .

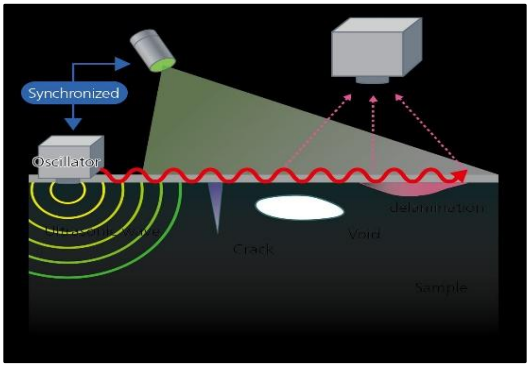


FIGURE E) WORKING OF ULTRASONIC SENSOR

FIGURE F) HC-SR04 ULTRASONIC SENSOR

C) GSM MODULE

GSM stands for **G**lobal **M**obile **C**ommunication **S**ystem. An object in charge of wireless communication with the GSM network is referred to as a GSM module. A GSM modem is a hardware component that modulates and demodulates wireless network signals to enable internet connectivity. Programs like SMS may send and receive messages over the modem internet thanks to a GSM module. GSM SIM 900 model is utilized here.

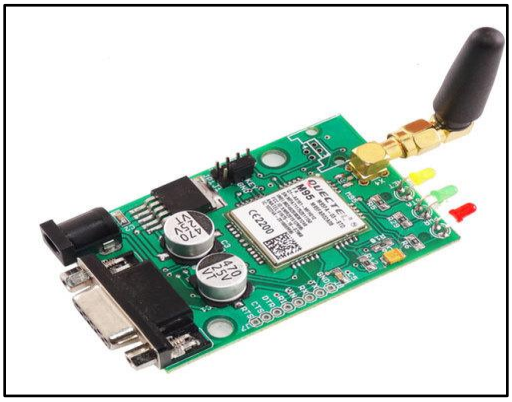


FIGURE G) GSM MODULE

D) GPS MODULE

GPS stands for **G**lobal **P**ositioning **S**ystem. Global. It uses signals from both terrestrial stations on Earth and satellites in orbit to pinpoint its location on the planet. The location is then displayed on a map or latitude and longitude view.

FIGURE H) GPS MODULE

E) DC MOTOR

DC motor is a device that is used to convert electrical power to mechanical power. Dc motor speed can be maintained by a dynamic supply voltage or by adjusting the current strength in the field winding of the dc motor. If the voltage at the input is higher then the engine's velocity also higher.

FIGURE I) DC MOTOR

F) MOTOR DRIVER

Motor drivers employ a modest voltage signal from a microcontroller or a control system to deliver a high amount of power to the motor. The motor driver will rotate the motor in one direction while keeping one pin high and one pin low if the CPU sends the motor drives a high input. Here, we employ l293D. It has a 16-pin IC and is a microcontroller. The bidirectional drive current is supplied by this microcontroller.

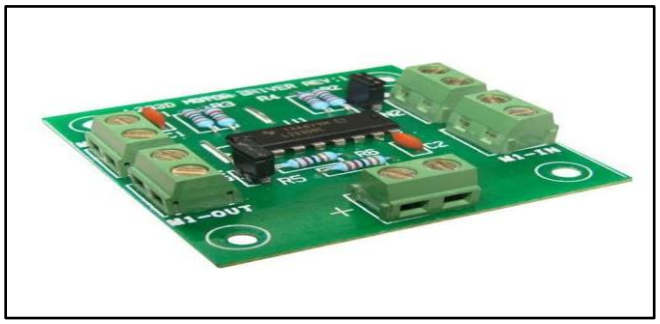


FIGURE J) MOTOR DRIVE

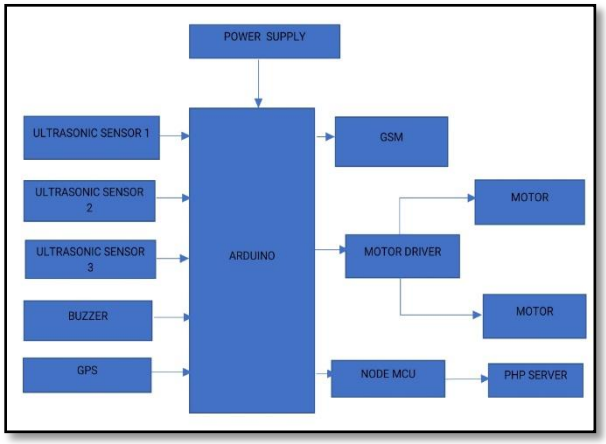
G) BATTERY

The rechargeable battery is an energy storage device that can be charged again after discharge by applying the DC to its terminals. It is a secondary type of electrical battery. It works best in applications with long run times and operates at a constant discharge. Rechargeable batteries allow for multiple usages from a cell reducing the waste.

FIGURE K) BATTERY

WORKING PRINCIPLE:

The defect defective system provides two ultrasonic sensor units which are equipped and opposite sides of the vehicles. This unit is used to initiate or deactivate the GSM transmission unit if there is a crack in the path.



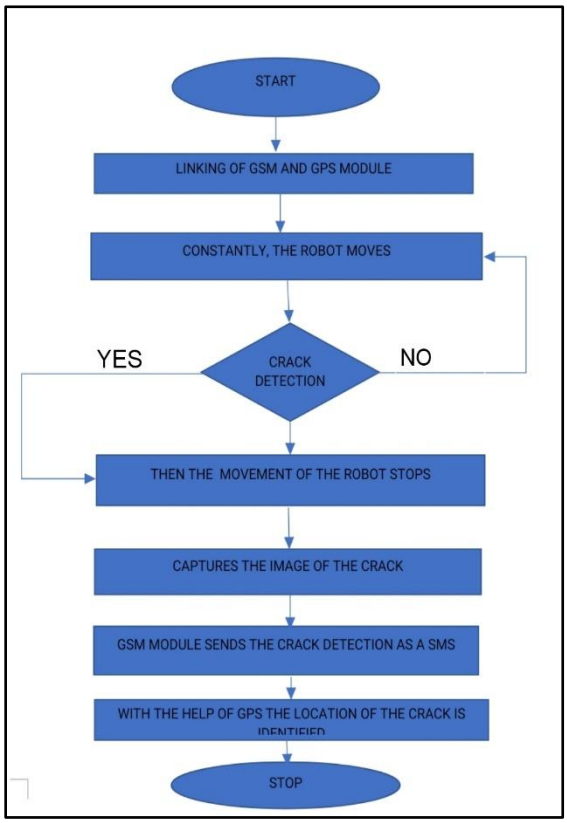
BLOCK DIAGRAM OF ULTRASONIC FLAW DETECTOR

PROCESS OF THE RAIL TRACK SYSTEM.

1) Initially the rail track is inspected by the sensor which is used to detect the crack in the track.
2) This is done with the help of ultrasonic sensors to sense the minor changes also which can be quite difficult with the other sensors.
3) If the crack is detected by the sensor then the information is passed to the controller with the help of an Arduino microcontroller.
4) Then the Arduino will perform the work assigned to it accordingly.
5) The process includes positioning, sending, and allowing with the help of a GPS module.
6) As the message gets delivered to the controller, the alert is to be taken into account and important measures must be taken by them to prevent future incidents.

FLOW CHART

The flowchart given below depicts the working process of the ultrasonic flaw detector on a railway track using IoT.



ADVANTAGES

- Cost efficient
- More efficient
- Maintenance is easier
- Quick response
- Easier to find the small crack
- More accurate

APPLICATION

Automatic detection of cracks on railway tracks.

RESULT

Thus, rail track crack is determined using an ultrasonic fault detector.

CONCLUSION

It will have a significant influence on to use of this automatic vehicle for railway track inspection and crack detection. Track upkeep, which will significantly reduce the likelihood of train accidents. the areas, such as deep coal mines, mountainous terrain, and thick, dense forests, where manual inspection is not feasible. Using this vehicle makes it simple. When using this vehicle for railway track inspection, crack detection, and Automated SMS will be sent whenever the vehicle sensors detect any fracture or deformation to a pre-defined phone number. This will assist in keeping track of and monitoring the status of

railway tracks without any mistakes, keeping them in good shape and preventing train accidents.

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