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Railway track crack detection system using arduino

Akshata Yadav, Sayali Yadav, Utkarsha Mane, Rohit Mane

Peth, Electrical,NMCOE, Peth, India

Abstract: In India, rail is one of the most frequently used means of transport, the fourth largest railway congregation in the world. Although the Indian railways are undergoing an exceptional boom, some of the main problems, such as the problem at the gate crossing, the fire disasters and the problem on the road that remains unattended and causes derailment, remain afflicted. Due to changes in the season the slopes contract and extend. Because of that, cracks on the track can develop. This proposed system detects the cracks and obstacles on the track via sensors and uses a GSM and GPS module to alert the control room via an SMS.

Keywords: Arduino, Ultrasonic sensor, IR sensor, GSM module, GPS module, DC motor, L293D motor drive

I. INTRODUCTION

The main objective is to locate the gaps in the railroad tracks and to determine if there are any hazards in the tracks to avoid and dissuade accidents. This type of model provides a cost-effective solution to the railroad crack detection problem by using a ultrasonic sensor and a IR sensor joint that responds to the exact situation of the faulty track, as well as forwarding the information to the control room via SMS, so that any incidents can be gridlocked.

II. EXISTING SYSTEM

In the existing system, techniques such as visual inspection, video transmission, and Magnetic field methods can identify the cracks on the railway tracks. Physical checking is one of the earliest method in which all the necessary components will be scanned manually. This process is commonly used in India, despite generating the worst outcome. A camera is used for continuous monitoring of the track while streaming content. In this procedure small cracks and a high-cost system cannot be seen. The current passes through the railway track for detection of flaws in the eddy current method and the results produced are not accurate. Many of these techniques require a lot of processing power and an extremely long period of time, making the robot's speed slow and therefore uncomfortable.

III. PROPOSED SYSTEM

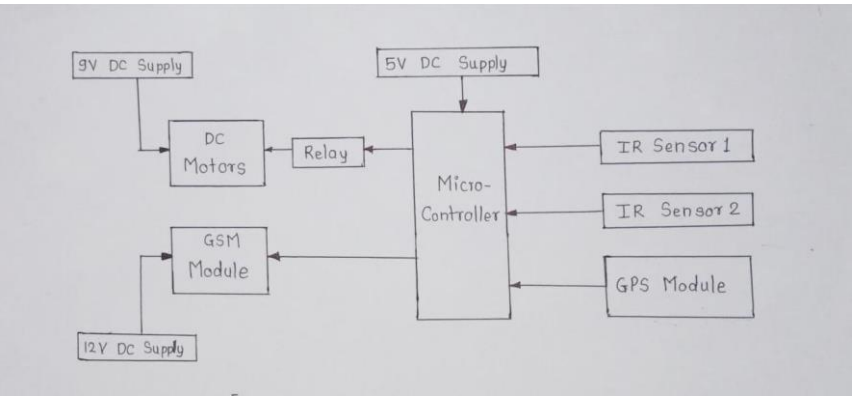

Fig.1.Block Diagram Of System

The proposed system surpassed the existing system limitations used to identify defective railroad tracks. We use Arduino UNO board in this proposed system. Arduino is an integrated open source development environment, which simplifies coding considerably. The system proposed is consisting of an ultrasonic sensor designed to detect cracks and IR sensors

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used to detect obstacles. The motor controller L293D helps to power the DC motors. The Arduino controller is primarily used for controlling the sensor outputs and is used for the transmission of information through GSM module, the purpose of which is to send the signal to the base station whenever a crack or obstacle is detected via an SMS. Using the GPS module, the exact latitude and longitudinal direction of the faulty track is obtained. In this device subtle cracks that are not visible to the naked eye can also be observed. The proposed system is therefore productive and minable.

IV. PROBLEM STATEMENT

A broken train speaks about one of the world's major causes of more expensive and dangerous rail accidents. Taking into account incidents in general, all considered in us alone, for every three days there is more than one major demolition, consistently over 10 years. Accessible interventions when the broken track clashes in different countries are disrupted do not sufficiently help to understand the political, social and ecological effects. In the current framework, when the track is open, the framework is forced to hurry up and out along the track at irregular intervals. Often, it will send an exception flag to the technician using a remote module just in case something stands out divided on the line. Divisions are detected by IR sensors and the error flag is conveyed.

V.SYSTEM DESIGN

A. Arduino UNO

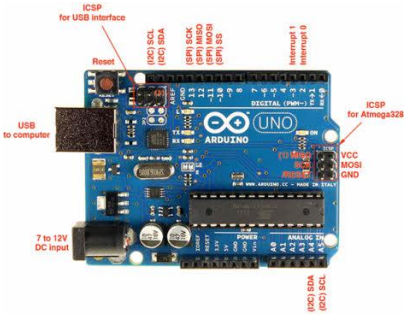

Fig.2.Arduino UNO

Arduino is an easier-to-use, programmable circuit with open source hardware and software. It is very strong in nature, and can effectively support devices. This concentrates on the ATmega328. It has 14 digital I / O connectors, 6 analog outputs, a USB interface, an ICSP connector, a power jack and a reset switch.
Attaching it to the laptop via an Usb connection or attaching an ACDC power source can able to provide the power that is needed to run the card.

B. IR Sensor

Fig.3.IR Sensor

The infrared obstacle sensor module is equipped with an integrated IR transmitter and IR receiver which sends IR energy and checks for reflected IR energy to identify any obstacles in front of the machine. Module The sensor has an integrated potentiometer that allows the user to change the range of detections. The sensor does have a very stable and secure response even under low light conditions.

C. GSM Module

The figure shown below is the module GSM SIM 900 (Global mobile communication system). A GSM module is a designated device with a serial link, USB, Bluetooth or a mobile phone which offers support for GSM modems. A GSM module allows programs like SMS to transmit and receive messages over the modem interface.

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Fig.4.GSM Module

The costs for receiving and sending this message is the same as the the directly incurred on a mobile phone. A GSM modem must be consistent with a "expanded set of AT instructions" for sending / receiving Text messages to do so.

D.GPS Module

Fig.5.GPS Module

The Global Positioning System is denoted as GPS, It is a satellite communication system used to identify a path of an object on the earth.

A GPS receiver measures its location precisely by transmitting 123234the signals sent by GPS satellites well above Earth. The position is then shown on a latitude and longitude view or map view.

E.DC MOTOR

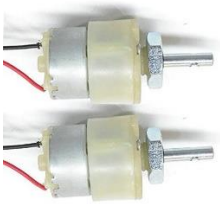

Fig.6.DC Motor

A DC motor is the device which is used to convert Electrical power to a mechanical power. The DC motor speed can be regulated by a dynamic supply voltage, or by adjusting the current strength in its field windings.

The stronger the voltage at the input, the greater the engine velocity. The concept proposed uses 2 direct current motors of 100 rpm.

F. 5V RELAY MODULE

Fig.7.Relay Module

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The following diagram shows its pinout diagram. It is known as a single channel because only one relay is used and it operates on 5V. Relay module consists of six pins such as normally open pin , normally closed, common , signal, Vcc and ground pins.

G. Wheel

Wheel selection is an important aspect, because the torque and speed of the motor may vary depending on the size of the wheel. The designated motor measurements are 68 mm in diameter, and 200 g in weight. The wheel base component is in alloy steel, and the outer part (handle) is in rubber. The outward use of rubber improves momentum with the guide.

V. METHODOLOGY

The mechanism shown here is the detection by sensors of a faulty rail track and the transmission of the report via an SMS to the nearest control tower if a faulty track is identified. We use two sources in this module, which is the IR-sensor and the ultrasonic sensor. The ultrasonic sensor induces ultrasonic waves of sound which reach the target and return. Should the object have a crack, the time forced to return the echoes signal can vary. Test range= (high-level time* sound velocity (340M / S)/2) by using a method. The IR sensor mainly works relied on luminance that falls on the sensor. Both devices are allocated set standards. When the check reaches the defined value, it stops and the faulty track's latitude and longitude location is collected using the GPS device, and sent via the GSM modulation to the base station. Ultrasonic rail check is usually limited to lower speeds of about 20-30 mph which reduces the ability to test several tracks consistently. Additionally, using the presently available evaluation equipment, many of the most significant deficiencies that may develop in the track head may be very harder to detect. One justification for using traditional NDT for slow inspection speeds is the need to combine the transducer and track using liquid or dry coupling components. Regardless of the length given to it the vehicle stops. For eg, if the duration is less than 15 and higher than 10, we set a 20-second interval and if the vehicle is less than 10 and higher than 5, then we have a set of around 100 seconds. If the length reaches 5 cm the vehicle completely stops. These three requirements will only be fulfilled when the item in stop mode is available in its path.

VI. IMPLEMENTATION

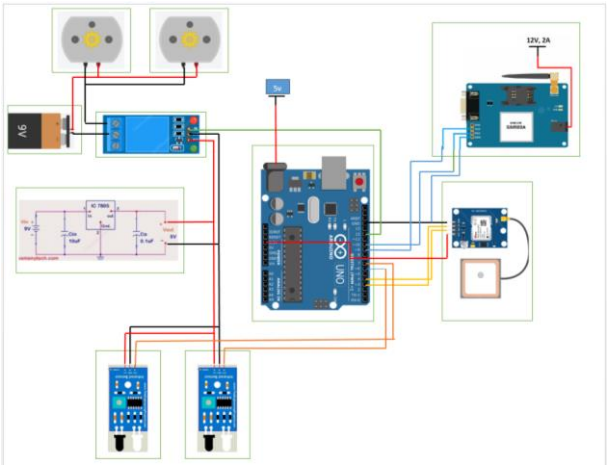

Fig.8.Circuit Diagram

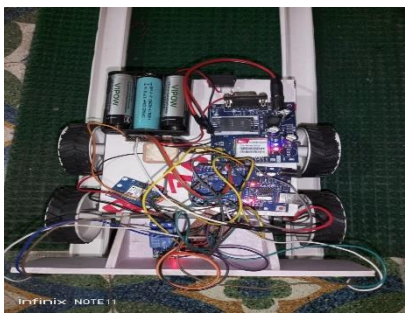

Fig.9 Hardware Module

Fig.9.a.Crack Detected

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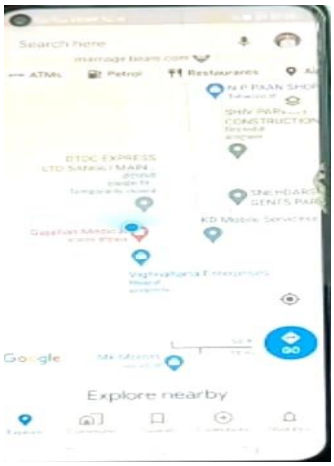

Fig.9.c. Location of the Instance

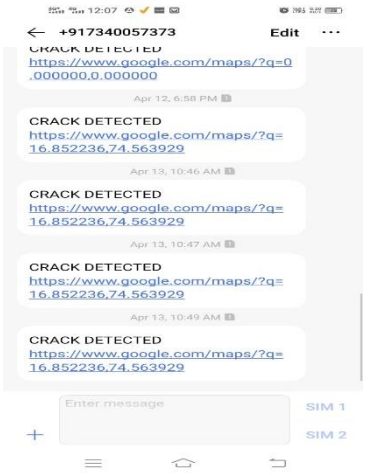

Fig.9.b.SMS Received in the Mobile Phone

Here the proposed module is made up of hardware which was previously explained in the description of the system design hardware which is shown in fig .9. The fig.9.a. shows the Crack Detected in the Display Screen of the Arduino. The fig.9.b. shows that the SMS obtained on the mobile phone with the latitudinal and longitudinal position at the point where a crack is detected and gives link of the location. The fig.9.c. shows that the location of the instance.

VII.CONCLUSION

The approach taken is capable, if there are any, of detecting flaws and obstacles on the surface. The method proposed has lots of advantages over conventional detection approaches that include minimal cost, reduced energy consumption, efficient detection system without human involvement and shorter analytical times. With this prototype, train collisions and derailments can be easily prevented to save many lives. It is also very beneficial for railroad operations testing units. And we can also notice the position failure and the system used in this, and also the location data is sent to the default mobile number. So that this enables us in rail line preservation and control as well. When we use the detector model for monitoring and we can claim that it is a fusion energy vehicle. The result shows that this exciting new technology will keep increasing the efficiency of the safety features for rail infrastructure. We can prevent accidents of up to 70% by enforcing these functionalities in the real-time implementation. Areas where manual testing is not feasible with this vehicle, such as in shallow coalmines, mountainous areas and thick and deep forests regions, can be easily carried out. When this vehicle is used for railway inspections and breakage detection, automatic SMS will be sent to a predetermined mobile number if cracks or abnormalities are identified by the device sensors. This will lead without errors to the management and control of the state of the railway tracks, and thus to the preservation of the tracks in good condition.

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