AUTOMATIC RAILWAY TRACK CRACK DETECTION SYSTEM USING GSM AND GPS

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ABSTRACT
India has one of the largest rail systems in the world, spanning a total of 1,15,000 kilometers. Unfortunately, Indian railroads fall short of international norms in terms of dependability and passenger safety. Among other things, the development of rail cracks due to delayed discovery raises major concerns about the security of rail transit operations. According to a recent study, over 25% of the track length has to be replaced because it has developed cracks. Because manual track detection takes a lot of time and requires expert personnel, it is laborious and ineffective.
The goal of this paper is to solve the problem by creating a system that automatically detects railroad track cracks. This article introduces a paper that intends to design a reliable train accident prevention system that uses an ultrasonic sensor assembly system to detect fractures on railway rails. Further capable of notifying the authorities via SMS messages using GSM modules. As a result of automation, human effort is reduced. At this time, instead of employing the more expensive LVDT, which has lower precision for measuring track distance, use the less expensive ultrasonic sensor, which has higher accuracy. This paper's significance is suitable for both daytime and nighttime detection purposes. Less expensive, low-power, and quick analysis are some of the benefits. This system's precise position on the problematic rail track may be quickly determined and repaired, perhaps saving a great number of lives.

Keywords: Railway,Crackdetection and SMS.

INTRODUCTION
High-speed trains are used for speedy transportation, and rail transit is growing daily because of the rapid growth of railway infrastructure. The majority of people use the railway for transportation since it is necessary for quickly and cheaply moving both passengers and commodities from one location to another. Also, the railway system offers amenities like fast speed, economic efficiency, environmental friendliness, safety, and better quality than other railway systems. These might be done by periodically taking measurements for maintenance and control. However, due to poor maintenance and the currently sporadic and manual track line monitoring errors from personnel, deformations and derailments may occur on the superstructure of railways, depending on many conditions. The safety of railway systems depends heavily on the early detection of such deformation and the implementation of preventative measures. As a result, this paper introduces a solution to the issue. For the purpose of protecting against train accidents caused by track cracks. Using IR sensors, which broadcast sine waves for an ideal track, this method is employed between two stations to find track breaks. This sensor will alert the Arduino Uno board, which will turn on the GPS receiver, if a crack is found. The primary authorities will get a message with the precise

location sent by the GPS receiver. The controller will turn on the webcam after receiving a signal from the sensor[1-7]. The webcam will show real-time footage of the track. In the wireless camera's intended application, both the live video and the GPS data will be updated. The brave new digital world, which will be able to stop the loss of priceless lives and property, will use this clever technology [8-9].

LITERATURE SURVEY

Although it has been determined that rail cracks were the primary cause of derailments in the past, there are currently no accessible, low-cost automated alternatives for testing. In the beginning, LVDT was used instead of ultrasonic, but LVDT was expensive and temperature-sensitive. Afterwards, IR was used to implement it due to the drawbacks of LVDT. The performance of an IR sensor decreases with increasing distance since it is sensitive to sunlight and can only support a short range. For crack identification in our paper, used a very effective ultrasonic sensor [9].

PROPOSED SYSTEM

To locate fractures in railways, the train is approaching tails and designing a crack-finding robot. For connecting the robotic vehicle and crack-detecting sensor, this system needs a controller. The sensing device receives the signal from the microcontroller, which detects voltage fluctuations from the crack sensor. The microprocessor monitors the differences between the measured value and the threshold value and regulates the robot accordingly. The motor drive circuit is used to interface the robotic model with the microcontroller robot, which will detect any rocks on the rail. Will be stopped, and then an SMS will be sent.

COMPONENTS AND DESCRIPTION

The following are the primary elements of the automatic railway track crack detectionsystem[10-12:

ArduinoUNO: Arduino is an open-source electronics platform with straightforward hardware and software. An Arduino board can be used to take inputs such as light on a sensor, a user hitting a button, or a tweet and then turn on a motor, an LED, or publish something online.

IRSensor: An optoelectronic component with radiation sensitivity and spectral sensitivity in the infrared wavelength range of 780 nm to 50 m is known as an infrared sensor (also known as an IR sensor). IR sensors are increasingly being used in motion detectors, which are used in building services to turn on lights or in alarm systems to identify unauthorized visits.

Twochannel Relay: Relays are electrically powered switches. The device consists of a set of operational contact terminals and a set of input terminals for one or more control signals. Additionally, the gadget consists of one or more control signals. When more than one circuit needs to be controlled by a single signal or when a separate, low-power signal is required, relays are used.

ServoMotor: A servo motor is a specific type of motor with a control circuit that provides feedback on the motor shaft's current position. The servomotors can rotate quite precisely according to this feedback. An object can be rotated at precise angles or distances using a servo motor.

GPS: To locate objects on Earth, a system of satellites and receiving devices known as the global positioning system (GPS) is employed. Some GPS receivers can pinpoint their location (0.4 inches) with a precision of one centimeter. GPS receivers offer location information in the form of latitude, longitude, and altitude. In the modern era, GPS is widely utilized and included in smartphones.

GSM: The Global System for Mobile Communication (GSM) module was developed for short message service (SMS)-based wireless radiation monitoring. After receiving serial data from radiation monitoring equipment like survey meters or area monitors, this module may send SMS

data to a host server.

BLOCK DIAGRAM

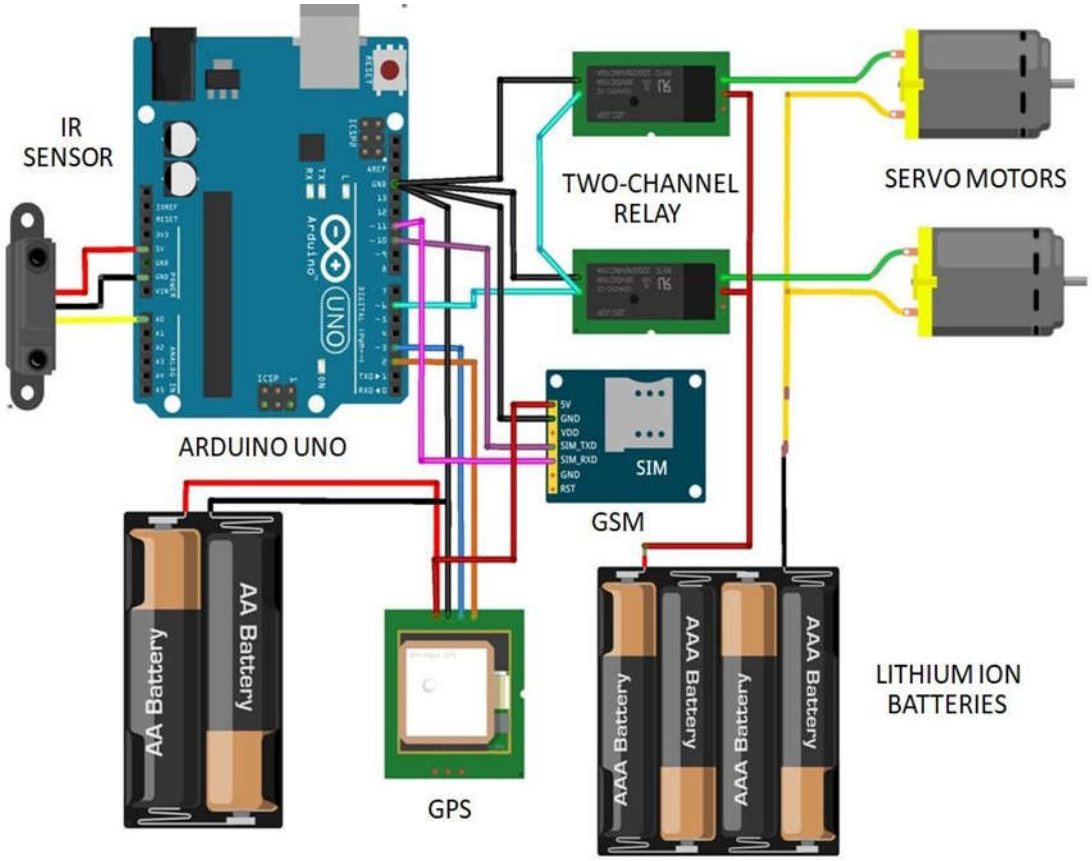

Fig1: Block Diagram of Automatic Railway track crack detection system by using GSM and GPS

HARDWARE PROTOTYPE MODEL

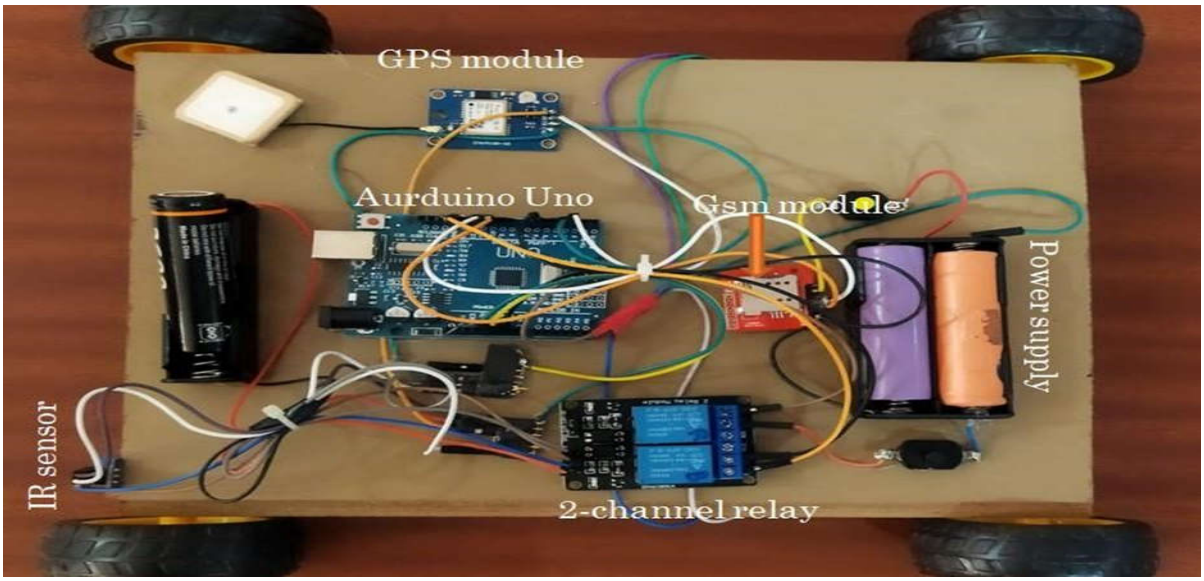

Fig2: Hardware of automatic railway track crack detection system by using GSM and GPS

HARDWARE RESULTS AND DISCUSSIONS

In order to check for cracks or other problems, the system comprises sensors put on the train track. Using GSM, GPS, and IR sensors, the autonomous railway track crack detection system offers a seamless and effective method of identifying and fixing track defects. In addition to improving train and passenger safety, it also speeds up and lowers the cost of maintenance. A GSM modem serves to send the data gathered by the IR sensor to a central server. The microcontroller analyses and processes the data to look for any kinks or imperfections in the path of the train. The system's GPS unit aids in tracking the position and motion of the train or locomotive. This aids in pinpointing the precise position of the flaw or break in the track, allowing the maintenance personnel to address the problem right away. When a crack or other problem is discovered, the system uses the GPS module to locate the location of the railway track and notifies the GSM module to alert the necessary authorities. When a defect or crack is found in the track, the server analyses the data and notifies the railway authorities. The proper authorities fixed the railroad after being informed.

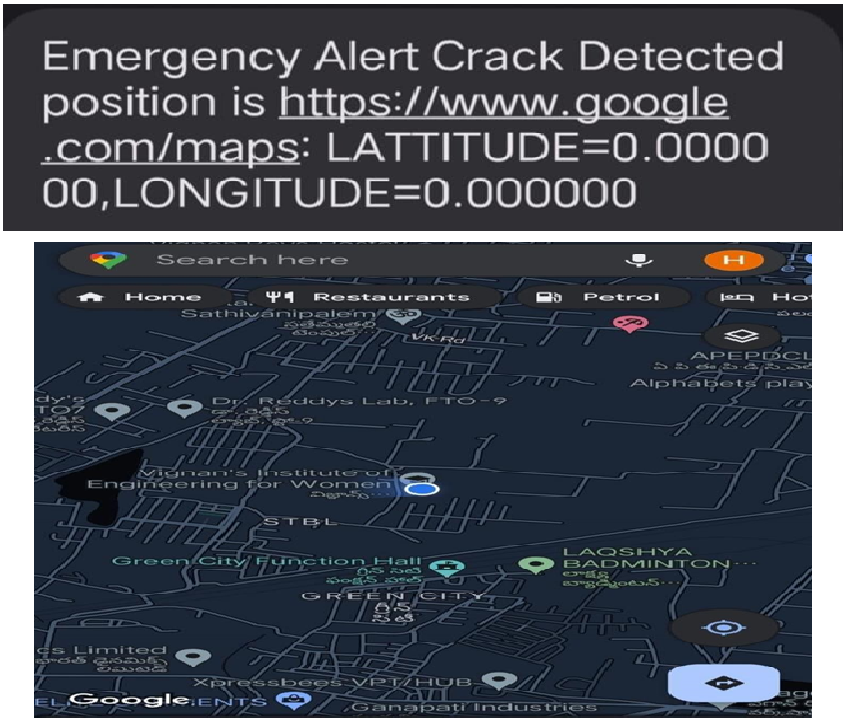

Fig3: Hardware result of automatic railway track crack detection system by using GSM and GPS(a) Message (b) Google Map

ADVANTAGES

Very user-friendly and effective design, Simple to utilize, Minimal electricity usage, to locate the crack with the aid of IR sensors and SMS tracking information sent via GSM, to prevent mishaps on single-track highways, Design that is efficient, Worked everywhere in the world (GSM availability).

CONCLUSION

The maintenance of the tracks will be greatly impacted by the use of this automatic vehicle for railway track inspection and crack identification, which will greatly aid in the prevention of train accidents. This vehicle can readily be used in areas where manual inspection is not feasible, such as deep coal mines, mountainous areas, and thick, dense forest regions. The automated SMS will be sent to a pre-defined phone number anytime the vehicle sensors detect any crack or deformation

when this vehicle is used for railway track inspection and crack detection.This helps in maintaining and monitoring the condition of railway tracks without any errors, thereby maintaining the tracks in good condition and preventing train accidents to a very large extent. A railway track crack detection autonomous vehicle is designed in such a way that it detects the cracks or defects on the track, which, when rectified in time, will reduce train accidents. People in remote areas can use it as a means of transportation. Applied to find track cracks in wireless software. Access and industrial control, A different remote-control device. Navigation systems.

FUTURE SCOPE

The automated vehicle robot can be given a faster speed, but more work needs to be done in this area. In addition, improvements can be made to provide a more precise location for the fault's origin. To increase the effectiveness of this system, the robot can also be made large enough that, using its weight, the track's stress and strain parameters can be evaluated. If you want to offer robust connectivity at a low input cost, you can also add a Zigbee module for a quick, short-distance inspection mechanism. A solar supply could be used to power it. Being environmentally friendly and generally accessible, solar energy.

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