e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:02/February-2024 Impact Factor- 7.868 www.irjmets.com

RAILWAY TRACK CRACK AND DETECTION SYSTEM USING ARDUINO

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ABSTRACT

In India railway is one of the most common means of transport, which is the fourth largest railway community in the world. Even though Indian railways has an outstanding boom, it remains plagued because of some of the major issues like problem in gate crossing, fire accidents and problem in the track which remains unmonitored causing derailment.

The tracks contract and expand due to changes in season. Due to this cracks may develop on the track. This proposed system identifies the cracks and the obstacles on the track using sensors and inform the control room through an SMS using GSM and GPS module. In India railways transportation service is the cheapest and most convenient mode of passenger transport as well as for long distance and suburban traffic. Almost 80% of the transport in India is being carried out by railway network.

The main cause of the accidents happened in railways are railway track crossing and unidentified crack in rail tracks. About 60% accidents are happened at railway track crossing and due to crack in railway tracks resulting in loss of precious life of passengers and loss of economy. 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.

Keywords - GSM, GPS Module, Arduino Microcontroller, Ultrasonic sensor, IR sensor

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. In today's world, transport, being one of the biggest drainers of energy, its sustainability and safety are issues of paramount importance.

In India, rail transport occupies a prominent position in quenching the ever urge owing needs of a rapidly growing economy. However, if we consider the reliability and safety parameters, India has not reached the global standard yet. The major problem is that there is no efficient and cost effective technology to detect problems in the rail tracks and the lack of proper maintenance.

However the proper operation and maintenance of transport infrastructure has a large impact on the economy. This model says about a proposed proto type of testing train for detecting obstacles and cracks, which is similar to that of line following testing train. The proposed testing train is cost effective and analysis time is less .With this proposed system the exact location of the faulty rail track can be easily located.

II. LITERATURE SURVEY

This system is mainly concerned in identifying the cracks in railway tracks and helps to prevent the accidents without manual power. It's not only concentrated on finding damaged tracks but also helpful to find out the derailment and the exact place where it is.

In thistechnical solutions offered by many companies in the detection of cracks in rails involve periodic maintenance coupled with occasional monitoring usually once a month or in a similar time frame. But the roboticspossesses the inherent advantage of facilitating monitoring of rail tracks on a daily basis during nights, when the usual train traffic is suspended.

Further, that the simplicity of this idea and easy availability of the components make for implementationon a large scale with very little initial investment. The simplicity of this work ensures robustness of operation and also the design has been carefully modified to permit rugged operation.

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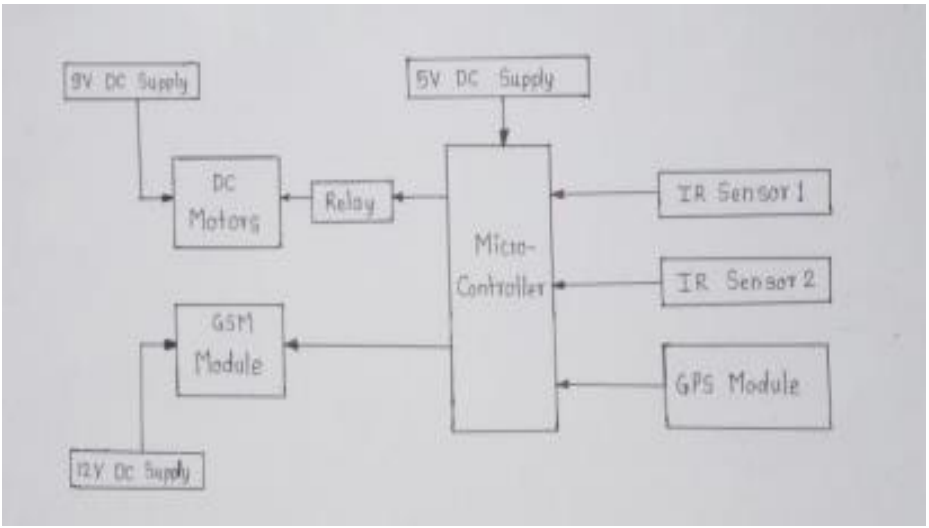
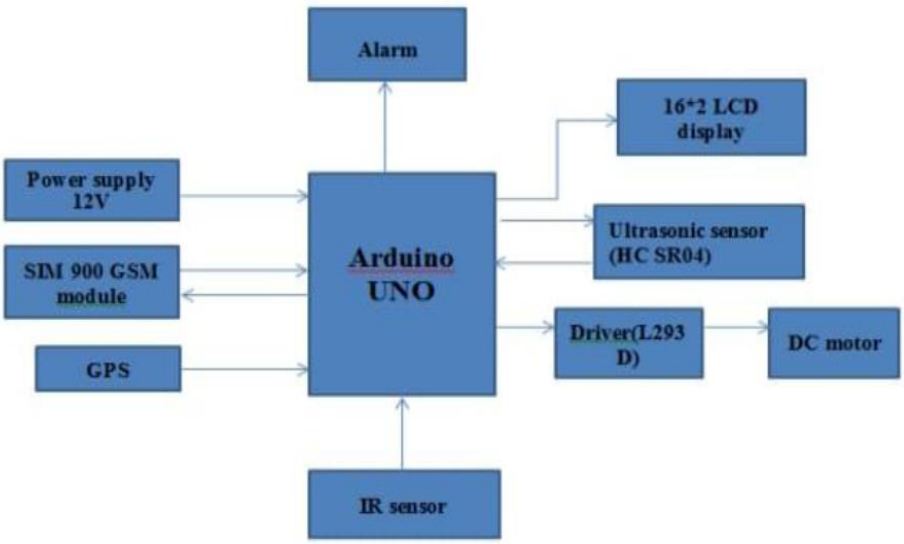
III. EXISTING SYSTEM

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.

IV. PROPOSED 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. 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.



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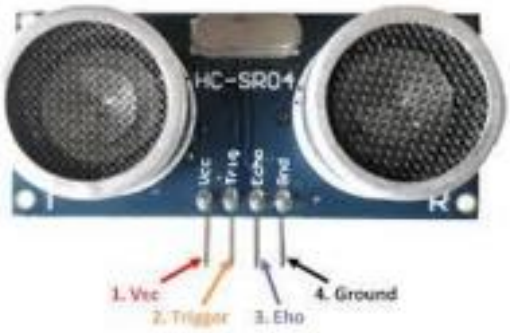
V. SYSTEM DESIGN

1. Arduino UNO

Arduino is an open source programmable circuit board based on easy to use hardware and software. It is very robust in nature and can support the peripherals efficiently. It is centred on ATmega328. It has 14 digital I/O pins 6 analog inputs, a USB connection, a power jack, an ICSP header, and a reset button. The power required to run the board can be supplied through connecting it to the laptop using a USB cable or plugging an ACDC power supply.

2. Ultrasonic Sensor



Ultrasonic sensor HC SR04 is a 4 pin module whose pin names are Vcc, trigger, echo and ground. It assess target by deciphering the reflected signals. The sensor produces sound waves at the ultrasonic range, by converting the electrical energy into sound then upon receiving the echo signal converts the sound waves into electrical energy by which the distance can be measured and displayed.

3. IR Sensor

Infrared Obstacle Sensor Module shown in the above figure has built-in IR transmitter and IR receiver that sends out IR energy and looks for reflected IR energy to detect presence of any obstacle in front of the module. The sensor has on board potentiometer that enables the user to adjust detection range. Even in dim light the sensor has very good and stable response.

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4. GSM module

The above figure shows SIM 900 GSM (Global System for Mobile communication) module. A GSM modem is dedicated modem with a serial, USB, Bluetooth connection, or it can be mobile phone that provides GSM modem capabilities. A GSM modem allows application such as SMS to send and receive message over the modem interface. The charges for this message receive and sending will be same as if it was performed directly on a mobile phone. In order to perform this task, it is necessary that a GSM modem must support an "extended AT command set" for sending/receiving SMS messages.

5. GPS module

Global Positioning System (GPS) is a satellite navigation system used to locate the ground position of an object. A GPS receiver calculates its position precisely by timing the signals send by the GPS satellites high above the earth. The position is then displayed with a moving map display or latitude and longitude.

VI. 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.

VII. 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. Thereby 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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