International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 02 | Feb 2019 www.irjet.net p-ISSN: 2395-0072

Railway track crack and obstacle detection using Arduino

Benitta N[1], Belfya JV[2], Jancy J[3], Prof ShriSaranyaa J[4]

[1,2,3]*Students , Dept. of Eletrical Engineering, Jeppiaar SRR Engineering college, Chennai, Tamil Nadu*
[4]*Assistant Professor, Dept. of Electrical Engineering, Jeppiaar SRR Engineering college, Chennai, Tamil Nadu*

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.*

Key Words: **Arduino, Ultrasonic sensor, IR sensor, GSM module, GPS module, DC motor, L293D motor driver**

1. INTRODUCTION

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, so that many lives can be saved.

2. OBJECTIVE

The main objective is to detect the cracks on the railway track and to detect the obstacles entry on the track in order to avoid train accidents and derailment. This model proposes a cost effective solution to the problem of railway track crack detection utilizing IR sensor and ultrasonic sensor assembly which tracks the exact location of faulty track, then inform to nearby control room through SMS, so that many lives will be saved.

3. EXISTING SYSTEM

In the existing system cracks on the track can be identified by techniques like visual inspection, video streaming, , eddy current, magnetic field methods. Visual inspection is the oldest of all these methods in which the components are scanned visually. In India this method is used widely although it produces poorest result. In video streaming a web camera is used to continuously monitor the track. In this technique minute hairline cracks cannot be seen and high cost method. In eddy current method, current is made to pass through the track for flaw detection and the results produced are not accurate. All these techniques take a lot of processing power and an extreme amount of time causing the robot speed slow and thereby inconvenient.

4. PROPOSED SYSTEM

The proposed system overcomes the limitations of the existing system that are used for the detection of faulty tracks. In this proposed system we are using Arduino UNO board. The Arduino is an open source integrated development environment which simplified the coding greatly. The proposed system consists of Ultrasonic sensor for crack detection and IR sensors for obstacle detection. Motor driver L293D is used to drive the DC motors. The Arduino controller is used to control the sensor outputs and transmit the information through a GSM module whose function is to send the signal whenever it detects a crack or obstacle to the base station through an SMS. The GPS module is used to get the exact latitudinal and longitudinal position of the faulty track. The hairline cracks which are not visible to the naked eye can also be detected using this system. Hence the proposed system is efficient and cost effective.

5. BLOCK DIAGRAM

The fig 1 shows the block diagram of the proposed system.

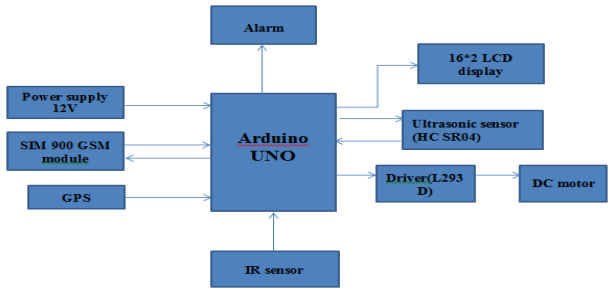

Fig -1: Block diagram

6. SYSTEM DESIGN

6.1 Arduino UNO

Fig -2: 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.

6.2 Ultrasonic Sensor

Fig -3 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.

6.3 IR Sensor

Fig -4 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.

6.4 GSM module

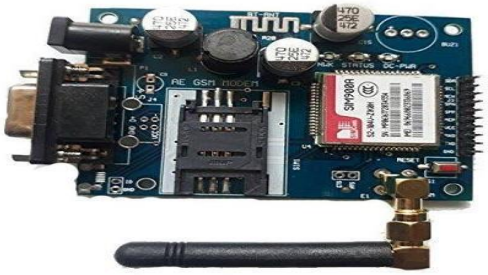

Fig -5: GSM module

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.

6.5 GPS module

Fig -6: 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.

6.6 DC motor

Fig -7: DC motor

A DC motor is as shown in figure. It is a device that converts direct current (electrical energy) into mechanical energy. The speed of the DC motor can be controlled by using either a variable supply voltage or by varying the strength of current in its field windings. Higher the input voltage higher will be the rpm of motor. The proposed design uses two dc motors of 300 rpm.

6.7 Motor driver

The Motor Driver is a module which allows to control the movement of the motors and also the speed of the motors. The motor driver used here is L293D IC. L293D is a 16 Pin Motor Driver IC. This motor driver is designed in order to provide bidirectional drive currents at voltages ranging from 5 V to 36 V.

7. METHODOLOGY

The method showcased here is the detection of faulty rail track using sensors and sending the information to the nearby control room through an SMS in case faulty track is detected. In this module, we are using two inputs namely, IR sensor and ultrasonic sensor. The Ultrasonic sensor produces ultrasonic sound waves which hits the object and returns back. In case the object has any crack the time taken for returning the echo signal varies. It measures the distance by using the formula, Test distance = (high level time * sound velocity (340M/S) / 2. The IR sensor works based on the intensity of light falling on the sensor. Set values are assigned for both the sensors. When the testing teach exceeds the set value, it stops and the latitude and longitude position of the faulty track is obtained using GPS module and send to the base station through GSM modem.

8. PROPOSED HARDWARE MODULE

Here the proposed module consists of hardware that was explained above in system design hardware description.

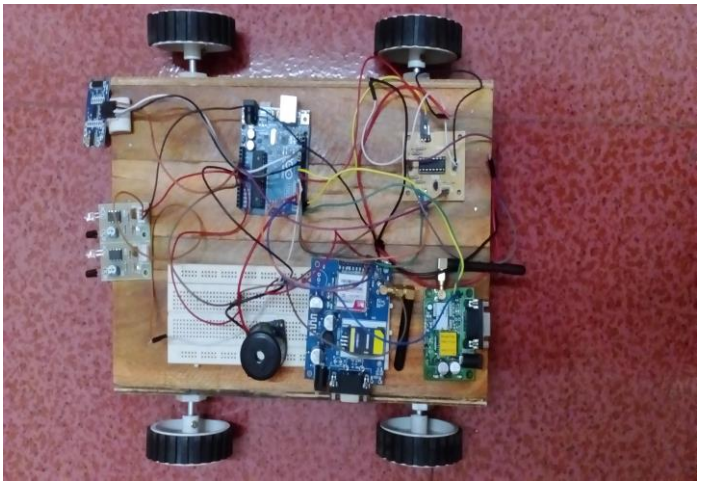

Fig -8: Hardware module

The below figure shows the SMS received on the mobile phone along with the latitudinal and longitudinal position in the place a crack or obstacle is detected.

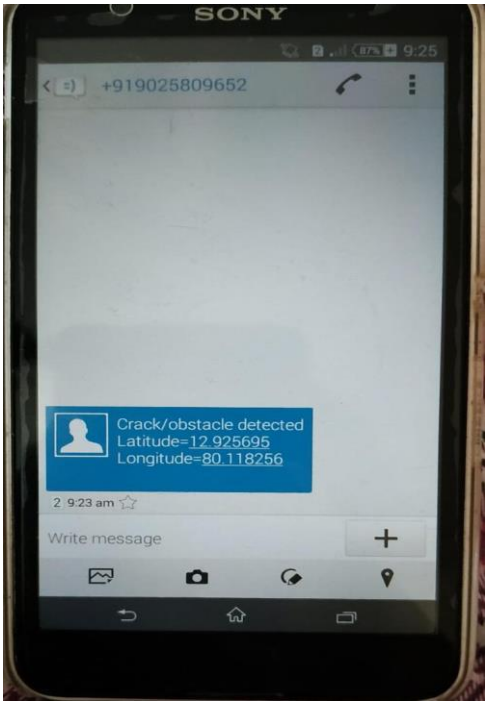

Fig -9: SMS with location

3. CONCLUSION

The proposed system has the ability to detect the cracks and obstacles if any on the track. There are many advantages with the proposed system as compared with the traditional detection techniques which include low cost, low power consumption, fast detecting system without human intervention and less analysis time. By this model we can

easily avoid train accidents and derailments so that many human lives can be saved.

REFERENCES

[1] Er.Kunduru Umamaheswari and Er.Polepogu Rajesh, " An Arduino based Method for Detecting Cracks and Obstacles in Railway Tracks" International Journal of Electronics, Electrical and Computational System ISSN 2348-117X Volume 6, Issue 4 April 2017.

[2] N.Karthick, R.Nagarajan, S.Suresh and R.Prabhu, "Implementation of Railway Track Crack Detection and Protection" International Journal Of Engineering And Computer Science ISSN: 2319-7242 Volume 6 Issue 5 May 2017.

[3] Mr Shridhar Doddmani, "An Inspection System for Detection of Cracks on the Railway Track using a Mobile Robot" International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Vol. 4 Issue 05, May-2015.

[4] K.S Vidhya, M. Lavanya, A. Abinayapriya, S. Kaaviya, R.Saravanan, C.Sivapragash, " An approach with sensor for real time railway track surveillance system" International conference on breakthrough in engineering, Science & Technology– 2016 (INC-BEST'16).

[5] P.Sureshpandiarajan, S.Nithya, P.Sathya and S.Pradeepa "A nondestructive sensing robot for crack detection and deck maintenance" International Journal for Research in Applied Science & Engineering Technology ISSN: 2321-9653 Volume 3 Issue IV, April 2015.

BIOGRAPHIES

Benitta N
Pursuing Degree in Electricals and Electronics Engineering in Jeppiaar SRR Engineering College, Chennai, Tamil Nadu.

Belfya JV
Pursuing Degree in Electricals and Electronics Engineering in Jeppiaar SRR Engineering College, Chennai, Tamil Nadu.

Jancy J
Pursuing Degree in Electricals and Electronics Engineering in Jeppiaar SRR Engineering College, Chennai, Tamil Nadu.

ShriSaranyaa J
M.E., Assistant Professor EEE in Jeppiaar SRR Engineering college from Tamil Nadu, India.