International Journal of Research in Engineering, Science and Management
Volume-2, Issue-3, March-2019
www.ijresm.com | ISSN (Online): 2581-5792

Automatic Railway Track Crack Detection System

B. D. S. Prasad[1], P. H. Devika[2], J. N. V. S. Manikanta[3], A. Sahith[4], S. T. S. N. V. Sai[5], P. Rajesh[6]
[1]*Assistant Professor, Department of Electrical & Electronics Engineering, SVIET, Nandamuru, India*
[2,3,4,5,6]*UG Student, Department of Electrical & Electronics Engineering, SVIET, Nandamuru, India*

***Abstract*: Indian Railways system is still plagued by a number of problems which require immediate attention. So that we are considering the major problems that lead to accidents. During summer and winter seasons the tracks may expand and contract due to which cracks may occur. The ultrasonic sensor setup is placed to a tested cart to detect cracks. Here we are using Arduino microcontroller. After crack detection the motor driver stops the motors placed and the longitudinal and latitudinal positions will send SMS by using GSM & GPS modules.**

***Keywords*: railway track crack detection**

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 burg owing needs of a rapidly growing economy. However, in terms of the reliability and safety parameters, global standards have not yet been truly reached. The principal problem is the lack of efficient and cost effective technology to detect problems in the rail tracks and the lack of proper maintenance. the cracks occurring in Railway tracks due to expansion and contraction.

The proper operation and maintenance of transport infrastructure has a great impact on the economy. In this we have proposed a proto type of testing train for detecting obstacles and cracks, which is similar to that of line following testing train. The sensors used for obstacle detection are bump sensor, infrared sensor and ultrasonic sensor.

Ultrasonic sensor is most suitable for crack detection due to its high ranging capability and low cost. Whenever a crack comes ahead of it, the ultrasonic waves are reflected back from an object and that information is passed to the microcontroller and the cracked location is shared to registered mobile number.

2. Rail track inspection using vision based system

Most of the common drive assistant systems for detection of obstacles work unstructured environments. These environments generally include many non-planer surfaces which pose a big challenge for vision system. Similar problem exists for railroad environment which often contain complex shapes and surface likes hills and vegetation along railroad tracks.

In railroad transportation, the main task of a train driver is to focus on the track. Therefore, the field of view of a train driver must contain space between two rails in front of the train and the near lateral area (left and right side) of these rails. An algorithm is used to extract the train course and railroad track space which is fixed in front of the train using dynamic programming

Our method does not need any static calibration process. From this purpose, a camera system was installed in front of a locomotive. As proposed by J. Jaiswai (2006).

3. Implementation

A. *Experimental result*

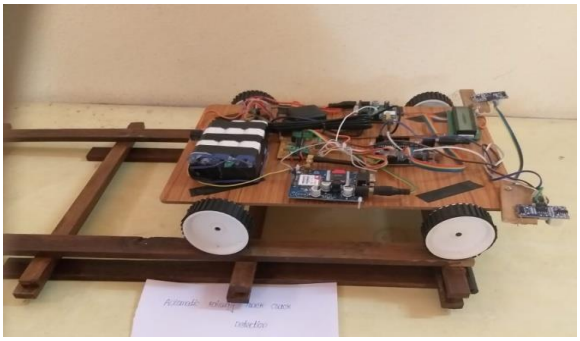

Fig. 1. Hardware setup

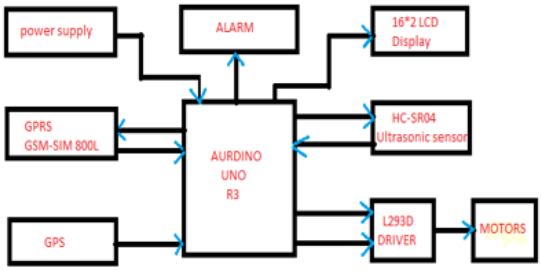

Fig. 2. Block diagram

B. *Components*

1. Arduino Uno
2. LCD Display
3. GSM Module
4. GPS Module

5. Ultrasonic sensor
6. Voltage regulator
7. Rechargeable batteries
8. L293D motor driver IC
9. Chassis and wheels
10. 2 DC motor
11. Breadboard
12. jumper wires

C. Main components

1) Arduino Uno

Arduino UNO Microcontroller. The Arduino UNO is a microcontroller board based on the ATmega328. Arduino is an open-source electronics prototyping platform and it is intended for designing, creating interactive objects or environments. Arduino boards are relatively inexpensive compared to other microcontroller platforms. A basic Arduino Uno board has been shown in Features:

1. Cross-platform the Arduino software runs on Windows, Macintosh OSX, and Linux
2. Simple, clear programming environment The Arduino programming environment is easy-to-use for beginners and flexible enough for the advanced users.
3. Source and extensible software The Arduino software is published as open source Open tools, available for extension by experienced programmers.

Fig. 3. Arduino

Technical Specifications:

1. Microcontroller: ATmega328
2. Operating Voltage: 5V
3. Input Voltage: 7-12V
4. Digital I/O Pins: 14 PWMo/p
5. Analog Input Pins: 6

2) Ultrasonic sensor

The Arduino Ultrasonic Range Detection Sensor with Arduino calculates distance from objects. The output of an LED alters with PWM according to how close an object is to the sensor This Sensor works by sending an ultrasound pulse at around 40 KHz. It then gets the echo back and calculates the time taken in µsec. We can trigger a pulse as fast as 20 times a second and it can determine objects up to 3 meters away and as near as 3cm. It needs a 5V power supply to run. Arduino can be added to Ultrasonic Range Detection Sensor using only 4 pins Power, Ground, Trigger and Echo.

Since it needs 5V and Arduino provides 5V, we will use this to power it. The out pin of this module is used as a switching output when anti-theft module.

Test distance = (high level time * sound velocity (340M/S)/2

Fig. 4. Ultrasonic sensor

3) GSM modem

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 exposes an interface that allows application such as now SMS to send and receive message over the modem interface. The mobile operated charges for this message receive and sending as if it was performed directly on a mobile phone. To perform this task, a GSM modem must support an “extended AT command set” for sending/receiving SMS messages.

Fig. 5. GSM modem

4) GPS module

A GPS receiver calculates its position by precisely timing the signals sent by GPS satellites high above the Eart. Each satellite continually transmits messages that include

- The time the message was transmitted
- Satellite position at time of message transmission.
- The receiver uses the messages it receives to determine the transit time of each message and computes the distance to each satellite.
- These distances along with the satellites locations are used with the possible aid of trilateration, to compute the position of the receiver.
- This position is then displayed, with a moving map display or latitude and longitude. Many GPS units show derived information such as direction and speed, calculated from position changes

5) Motor driver

Motor Driver ICs are primarily used in autonomous robotics only. Also most microprocessors operate at low voltages and require a small amount of current to operate while the motors require a relatively higher voltages and current. Thus current cannot be supplied to the motors from the microprocessor. This is the primary need for the motor driver IC. When the motor is applied positive voltage on both sides then the voltage from both the sides brings the motor shaft to a halt. Depending upon

the values of the Input and Enable the motors will rotate in either clockwise or anticlockwise direction with full speed (when Enable is HIGH) or with less speed (when Enable is provided with PWM). Let us assume for Left Motor when Enable is HIGH and Input 1 and Input 2 are HIGH and LOW respectively then the motor will move in clockwise direction.

Fig. 6. Motor driver

D. Circuit connection

Ultrasonic sensor-1 is connected to A0, A2 pins of Arduino and Ultrasonic sensor -2 is connected to A3 and A4 pins of Arduino. vib sensor is connected to

2 pin Buzzer is connected to 3 pin, LCD is connected to 8,9,10,11,12,13 pins, two motors are connected to the 4,5,6,7 pins of arduino and other pin is connected to Vin of 12 v pin another is ground pin of Arduino, GSM module and GPS module are also connected to the arduino Tx and Rx.

4. Working

When supply is switch ON to the kit, then the motors gets started travelling on the railway tracks and when the ultrasonic sensors senses the crack in railway track and sends signal to the Arduino then Arduino will send signal to motor driver to stop the motors then motors automatically stops and then Arduino will activate Buzzer and LCD display displays that the crack is detected. Now intimation message will come from GSM module and GPS module to the registered mobile number. The message contains that "CRACK IS DETECTED STAY ALERT" and the link. When the link is opened the latitude and longitude location of the crack is Identified.

5. Conclusion

In this paper we have designed a cost effective, low-power embedded system, which facilitate better safety standards for rail tracks for preventing railway accidents due to cracks and obstacles on railway tracks. The Prototype of testing vehicle can efficiently detect cracks and obstacles on railway tracks. The result shows that this new innovative technology will increase the reliability of safety systems in railway transport. By implementing these features in real time application, we can avoid accidents up to approximately 70%.

The regions where manual inspection is not possible, like in deep coal mines, mountain regions and dense thick forest regions can be easily done using this vehicle. By using this vehicle for the purpose of Railway track inspection and crack detection and automated SMS will be sent to predefined phone number whenever the vehicle sensors detect any crack or deformation.

References

[1] Akhil N, Dinu Mohan, Fayis P, Sija Gopinath "Railway Crack Detection System" International Research Journal of Engineering and Technology (IRJET), Volume 3, Issue 5, May 2016.
[2] S. Ramesh "Detection of Cracks and Railway Collision Avoidance System", International Journal of Electronic and Electrical Engineering, Volume 4, Number 3, 2011.
[3] B. Paulch "Automated Visual Inspection of Detecting Cracks and Obstacles on Rail Road Track Using Robot and Automatic Gate Control," International Journal of Innovative Research in Technology & Science, 2008.
[4] P. Navaraja "crack detection system for railway track by using ultrasonic and PIR sensor", International Journal of Advanced Information and Communication Technology IJAICT Volume 1, Issue 1, May 2014.