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AUTOMATED RAILWAY TRACK CRACK DETECTION USING ESP32

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Abstract - *In this system of robust railway crack detection scheme using IR sensor assembly for railway track geometry surveying system by detecting the cracks on railway tracks. Most of the accidents are happen due to cracks in the railway tracks, which cannot be easily identified. The manual inspection of railway track took more time and human weariness. The proposed system introduces Bluetooth based technology to intercept the train accident. Two IR sensors are installed at front end of the inspection robot which monitors the track and gives the status to microcontroller. If there is crack, this system identified soonly and sends the location of crack via Bluetooth to mobile phone. The proposed broken rail detection system automatically finding the faulty railway track without any human interference. There are many advantages with the proposed system as compared to the traditional detective techniques. The advantages incorporate less cost, low power usages and less analysis time and also facilitate better security standards for rail tracks and provide effective testing infrastructure.*

Key Words: **Bluetooth, IR sensor, Node MCU 32s, Railway track, Ultrasonic Sensor**

1. INTRODUCTION

The Indian Railway network is the largest rail-passenger transport and it is presently the backbone of the country's transport infrastructure. In India, most of the commercial transport is being convey out by the railway network because it is being abase way of transportation choice over all other means of transportation such as buses, flights etc. The rapidly improving economy of India has resulted in an exponentially higher demand for transportation in recent years and this has resulted into a very big rise in the volume of traffic in the Indian Railway network.

Safety and reliability are considered in one of the main theme at all transport system, particularly in railway. There is a view from the experts that the present regulatory framework does not clarify effective deal with railway accidents and derailments, approximately 60% of a rail accident is due to the derailment, of which 90% are due to crack fault. In recent years developing country like Bangladesh needs more diversification and innovation in the transportation system. With the increasing number of the population the current safety framework needs to be equipped with safety legislation and more invulnerable. Safe railway track plays a important role to carry more than 70,000 people at a time. Therefore, a consistent system is required to detect the cracks in the railway tracks.

Transport is a key necessity for specialization that allows production and consumption of products to occur at various locations. Economic affluence has always been underlet on increasing the capability and rationality of transport but the infrastructure and operation of transport has a great impact on the land and is the largest resource of energy, making transport sustainability and safety a major issue transport is very important to carry the passengers and goods from one place to another. The better transport leads to more trade. In this, use of IR sensor to detect the crack in railroads is done. When the crack is identified its latitude and longitude values are send as a message to mobile phone or to control room. Then IR sensor is used to detect the clack fault. This system is designed using Node MUC 32s, IR sensors, Ultrasonic sensor and Bluetooth to perform railway safety monitoring system.

It's an effective method to inspect the cracks, which increase the cost of the system. There are also some other systems exists to solve the crack problem using different sensors. It is a cost effective autonomous railway crack detector robot is proposed for Indian railway. This device can generate a complete solution for the railway track that starts with crack detection, fault analysis using IR sensor and that end up with an SMS alert to the concerned authority which consists of the location of the crack.

2. LITERATURE SURVEY

In order to design this project, literature review has been made from various sources like journal, books, article and others. This chapter includes all important studieswhichhave been done previously by other research work. It is importance to do the literature review before doing the project. The review of the work is given as follows:

The use of powerful digital signal processors, image process technique [7].This system work on like image segmentation, morphology associated edge detection. In this image processing technique is used. Recent analysis has investigated the utilization of microwave antennas such has a horn antennas for crack detection[5]. But it needs spectrum analyzer that are each pricey. A colossal majority of the work exhausted the field of crack detection uses the infrared sensing technique[8

3. Existing System

The existing system railway tracks are surveying manually. Images processing input images are noisy system, high cost, and it's not give accurate output. Automated Visual Inspection method is complex system because video colour analysis is used to identify the crack in rail track under the bad weather condition is not giving perfect output. The existing system delays in passing the information

4. Working of Proposed System

This system deals with one of the cost and efficient method to avoid train accidents by formulate solutions to the problem of railway crack finding. This technique is used for outside of base station to avoid the drastic condition of Indian railway networks from stopping down still more, an automated system which does not depend upon the manual labor is fetched into bright. It proposes a cost effective remedy to the problem of robust railway crack detection scheme by utilizing Node MCU based ESP 32s , IR sensor, buzzer, GPS, Ultrasonic sensor, Bluetooth, assembly to ensure robustness, repeatability and easy fulfill the principle idea has been kept very easy. IR sensor is used to detect the crack. In order to locate present position of the crack find, GPS service is used. It calculates latitude and longitude of place and proselyte them into analog signals. To communicate the received data, bluetooth module is used. Using this message sent wirelessly to appropriate authority. Then an alarm rings with the help of buzzer indicating the detection of crack, thereby they find the exact location of track damage soonly, so that many lives will be saved.

Fig. 1: Overview of Proposed System

The proposed crack detector robot is a microcontroller based low-cost intelligent device. The cracks in the railway track can be sensed by using infrared sound wave. This sensor is connected to Node MCU based ESP 32s which is the central control unit of this system. DC geared motor is used to move the wheels on the track. A motor driver circuit that passes commands to the dc gear motor and two wheels run the robot. The chassis of this prototype robot made with the wood material. This device also has a feature of sending the location information using GPS and about the fault via SMS alert using a IoT. LCD display is connected with Node MCU 32s to print the real-time crack status. An optical encoder is used to measure the speed of the robot in revolutions per minute (RPM). In this structure robot is used to detect the crack.
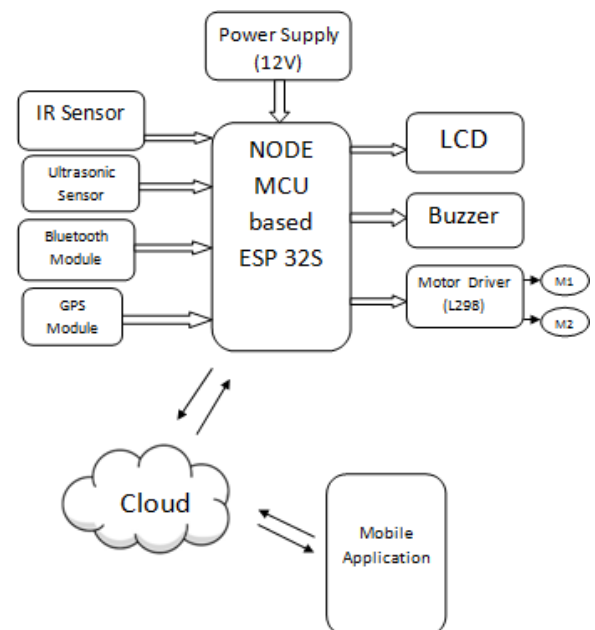

Fig. 2: Block Diagram of Railway Track Detection Robot

5. Circuit Components

5.1 : IR Sensor

The 5 VDC supply input is given to the VCC pin and the supply negative is connected to the GND terminal of the module. When a crack is found it detected by the IR sensor. It send the signal to the microcontroller.

5.2 : Node mcu32s

Node MCU is an open source IoT platform. ESP32 is a series of low cost, low power system-on-chip (SoC) microcontrollers with integrated Wi-Fi & dual-mode Bluetooth. It can receive the signal from IR sensor and make operation on it.

5.3 : GPS Module

This is a complete GPS module that is based on the Ubox NEO-6M. This unit uses the latest technology from Ublox to give the best possible positioning information. It gives the location of that particular crack.

5.4 : L298

L298 is a high power version of L293 motor driver IC It is a high voltage, high current, dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and Stepper motors.

5.5 : DC Motor

DC Motor 45RPM 12Volts geared motors are generally a simple DC motor with a gearbox link to it. This can be used in all-terrain robots and variety of robotic applications.

5.6 : Ultrasonic Sensor

It can detect the obstacle or object. It send the signal to the microcontroller. When object is found then it stop the robot.

6. RESULT

The robot continuously find the crack. It detect the crack by using IR sensor. It sends the location of crack to control room by using GPS system; Fig. 3 shows the location of crack fault.

Fig .3: Location of Crack Fault

7. CONCLUSIONS

It is concluded that the main causes of rail accidents are a collision between trains and derailment. Derailment of trains occurs mainly due to cracks in railway tracks. In this system, an autonomous system is designed for railway track security by developing a microcontroller-based robot. This device brings a digital solution for the real-time problem that is a huge threat for thousands of people who are using the train as a major transport in their daily life. The crack can be detected without any error. In the long run, it will facilitate better security standards for rail tracks and give effective testing infrastructure for achieving better results in the future.

8. ACKNOWLEDGEMENT

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