

Remote Management Rail-track Inspection System

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Abstract--- Railways is an important part of public transport. But, when it comes to safety parameters improvements are much needed. Major accidents are caused due to train derailment, defects in the track, large obstacles on track. The cracks must be identified and resolved. The process of identification includes ultrasonic sensor which detects the crack and the data is sent to Raspberry Pi and the data is transmitted to the web server which can be managed by the users. Managing data sent from the sensors are important for analysing. Thus, remote management of sensors is time and cost efficient.

Keywords —IoT, Railways, Track, Crack, IR, Accidents, Derailment

I. INTRODUCTION

The railways tracks are prone to develop cracks which can cause major accidents. Internet survey states that 60% of the derailments are caused due to cracks developed in the railway track. A robust method that utilises ultrasonic sensor and a microcontroller that can effectively identify the crack

and whenever a crack is detected, the voltage to the microcontroller falls below the threshold value which triggers the further process. The DC motors are connected to the microcontroller through a relay and a relay driver circuit to ensure that the motor is maintained at the correct speed. The LCD is used to indicate the current condition of the module. The main advantage of the module is that it is efficient, low cost and it reduces human interference.

III. HARDWARE DESCRIPTION

A. Raspberry Pi Controller

Raspberry Pi is a single-board computer with many features like a built-in wireless LAN and Bluetooth intended to make the application more flexible. Many external components can be connected to the Raspberry Pi using the 40 GPIO pins. Raspberry Pi has more computational power than most microcontrollers. It has a Quad-core 1.2GHz processor, 1GB RAM, built-in Ethernet port, Wi-Fi module, Bluetooth module, 2 USB and a full-sized HDMI port for ease of use. The Raspberry Pi is connected to the ultrasonic sensor, DC motor, relay and relay driver circuit.

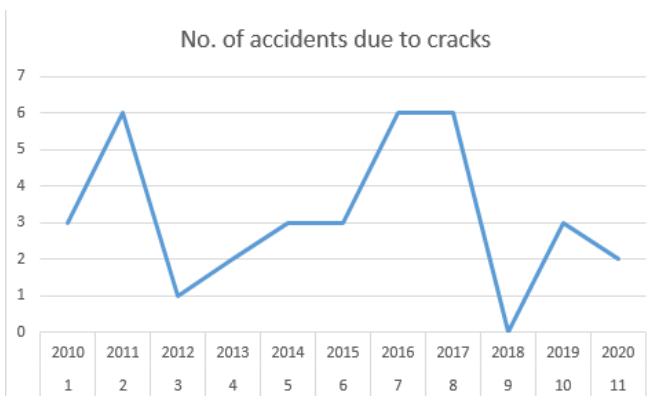


Fig.1 Accidents Due to derailments (2010-20)

II. RELATED WORK

A. Remote Management Of Track Inspection System

The main objective of the model is to detect the location of the crack and send the location data to the railway board. This module consists of an Arduino microcontroller, DC motors, LCD, IR sensor and WiFi module. The IR sensor emits IR radiation and the controller observes the voltage received from the IR sensor



Fig.2 Raspberry Pi

B. Ultrasonic Sensor

A ultrasonic sensor is an electronic gadget that quantifies the distance of an object by transmitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel quicker than the speed of discernible sound. Ultrasonic sensors have two segments i.e. the transmitter which emits the sound utilizing piezoelectric crystals and the receiver which encounters the sound after bounces off the object. The ultrasonic

sensor emits the sound waves that fall on the track are received by the receiver. When there is a crack the sound waves do not return to the receiver. Thus the crack is identified using an ultrasonic sensor and the data is sent to the Raspberry Pi



Fig 3 Ultrasonic Sensor

C. Iot Webserver

It is a server that responds when a user requests a process and stores the data sent by the host. In this case, the host is the microcontroller and the user is the railway board. The railway board fetches the data from a Single Application page by entering their login credentials. These login credentials are verified by the webserver. After a handshake process, a secure gateway is established through which the data is presented to the user. On the server-side, the microcontroller sends the data through a secure gateway to the webserver which stores the data in a cloud data centre that can be accessed by the user.

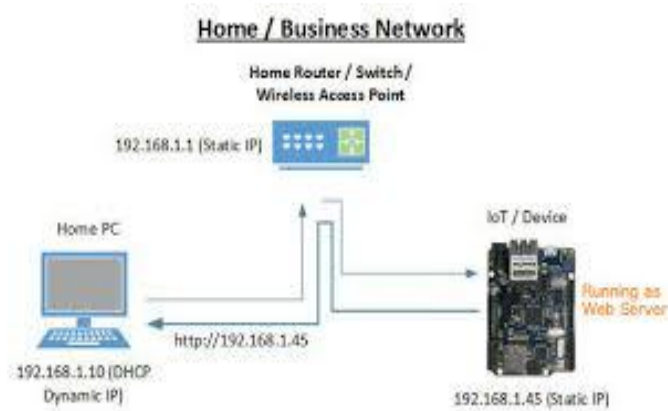


Fig.4 Web Server

D. Secure Gateway

A secure gateway is a barrier designed to spot and hold unapproved traffic back from accessing the data. It monitors all the incoming and outgoing connections. It prevents malignant site

traffic, infections, and malware from getting to the information. The web gateway just permits clients who have login privileges to access the data. This is the place where the user enters their login credentials which are verified with the webserver. An acknowledgement is sent that the credentials are verified, then the user has access to the data. This is where the railway board enters the login credentials to access the data on the location of the crack using which they can take necessary actions.



Fig.4 Secure Gateway

E. Cloud Data Center

A cloud data centre is a remote version of a physical data centre from which the data can be accessed through the internet. There are service providers for the cloud data centre which can be rented for an amount of time to reduce the cost of setting up traditional data centres. In this module, the cloud data centre is used to store the sensor data and related location data transmitted by the Wi-Fi module. The stored data is used to analyse the defects and the process for maintenance of the railway track can be started



Fig.6 Cloud Data Center

F. Application Page

Single-page applications help keep the client in one web space where content is presented to the client simply and functionally. SPA is quick, as most assets are just stacked once all through the lifespan of the application. Just the information is communicated back and forth. SPA can reserve any cache data effectively which will help us reduce the cache storage. An application sends just one request, for which the server responds by sending all the information. In this case, the data sent by the controller is stored in the cloud data center and the user can access

the data with the help of the application page. By using this information, safety measures can be performed. The page does not reload at any point in the process, nor does it transfer control to another page.

IV. RESULTS

The web-server is used to provide a secure gateway that can be used to access the location data that is stored in the cloud which can be used by the railway board to provide maintenance of the track. Thus, remote management is easier and efficient way of analysing sensor data that helps us resolve the problem as soon as possible.

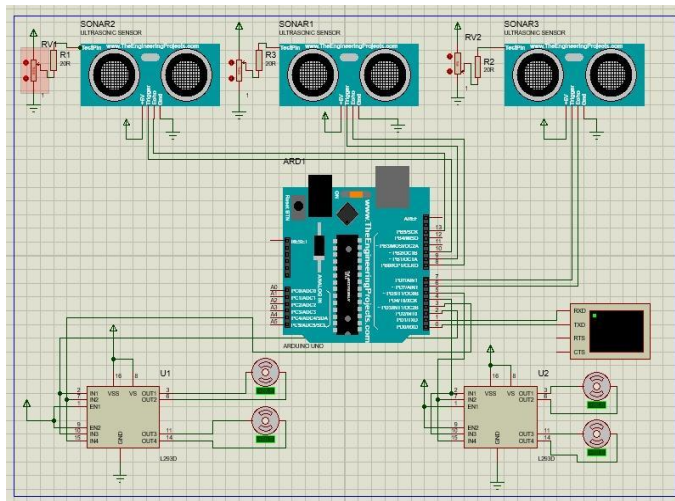


Fig 7.Circuit Layout

Row#	Value	Column
32	N_0.48.0.00,169200_N	9/16/2020 11:11:02 AM
31	N_0.39.0.00,169200_N	9/16/2020 11:11:02 AM
30	N_0.39.0.00,169200_N	9/16/2020 11:11:02 AM
29	N_0.39.0.00,169200_N	9/16/2020 11:11:01 AM
28	N_0.39.0.00,169200_N	9/16/2020 11:11:01 AM
27	A,1055.4155,N,07658.9568,E,9/16/2020 11:05:18 AM	
26	A,1055.4155,N,07658.9568,E,9/16/2020 11:05:18 AM	
25	A,1055.4155,N,07658.9568,E,9/16/2020 11:05:10 AM	
24	A,1055.4155,N,07658.9568,E,9/16/2020 11:05:10 AM	
23	A,1055.4155,N,07658.9568,E,9/16/2020 11:05:09 AM	
22	A,1055.4155,N,07658.9568,E,9/16/2020 11:05:02 AM	
21	A,1055.4155,N,07658.9568,E,9/16/2020 11:05:02 AM	
20	A,1055.4155,N,07658.9568,E,9/16/2020 11:05:02 AM	
19	A,1055.4155,N,07658.9568,E,9/16/2020 11:05:00 AM	
18	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:57 AM	
17	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:56 AM	
16	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:56 AM	
15	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:56 AM	
14	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:55 AM	
13	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:54 AM	
12	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:48 AM	
11	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:46 AM	
10	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:45 AM	
9	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:45 AM	
8	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:45 AM	
7	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:44 AM	
6	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:44 AM	
5	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:43 AM	
4	A,1055.4155,N,07658.9568,E,9/16/2020 11:04:43 AM	
3	10°55.7532'N,76°59.0680'E	9/16/2020 10:44:44 AM

Fig.9 Output 2

IV. CONCLSUION

The remote management is useful for monitoring the sensors 24/7 and data can be stored in an efficient storage space. The data can be accessed by entering login credentials through a secure gateway. When the crack is detected, a notification informing the location of the crack will be sent to the railway board. The location data and status of the module can be accessed by the railway board and further safety measures can be taken.

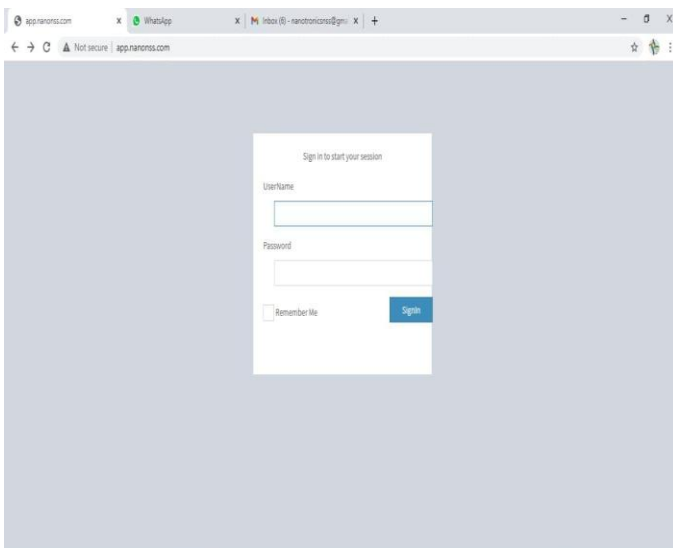


Fig.8.Output 1

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