Railway Track Security System

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Abstract – *In this project we have built the train track security and Monitoring application. In which we monitoring the rails i.e. tracks of trains with an automated robot which we are passing through this track which will detects and inspects the track status like curve and damages etc. and we are controlling this bot remotely so we are getting all these data via an android app this way are monitoring the track in real time with the track fault detection. So with this data we can prevent the remedies like accidents and train sleeping due to those faulty tracks.*

Key Words: CCTV, ESP8266, HC04, L293D, PIC,

1. INTRODUCTION

Today in India transportation through rails is growing rapidly. The rail network traverses every length and breadth of India and is known for carry over 30 million passengers and 2.8 million tons of freight daily. Despite boasting of such impressive statistics, the Indian rail network is still on the growing trajectory trying to fuel the economic needs of our nation. Though rail transport in India growing at a rapid pace, the associated safety infrastructure facilities have not kept up with the aforementioned proliferation. Our facilities are inadequate compared to the international standards and as a result, there have been frequent derailments that have resulted in severe loss of valuable human lives and property as well. On further analysis of the factors that cause these rail accidents, recent statistics reveal that approximately 60% of all the rail accidents have derailments as their cause, of which about 90% are due to cracks on the rails either due to natural causes (like excessive expansion due to heat) or due to antisocial elements.

Hence these cracks in railway lines have been a perennial problem, which has to be addressed with utmost attention due to the frequency of rail usage in India. These cracks and other problems with the rails generally go unnoticed due to improper maintenance and the currently irregular and manual track line monitoring that is being carried out. The high frequency of trains and the unreliability of manual labor have put forth a need for an automated system to monitor the presence of crack on the railway lines.

So, in our project we have built the automated robotics-based solution for this. In which we have build a robot which continuously checks the track before train is going through this root so if any tracks is damaged then we can get immediate alert based on it so that we can avoid this problem of Train sleeping through the rails and can save the life of many peoples.

2. System Description

In this project we have designed a robot which having the assembly of rail inspection by using the HC04 Ultrasonic Distance sensor. And we are controlling this robot through a mobile app designed in an android studio. So, through this app we give the command signal to the ESP8266 WiFi module connected to the Main PIC Microcontroller. For controlling the wheels movement of the robot using the L293D Motor Driver. As shown in Fig-1.
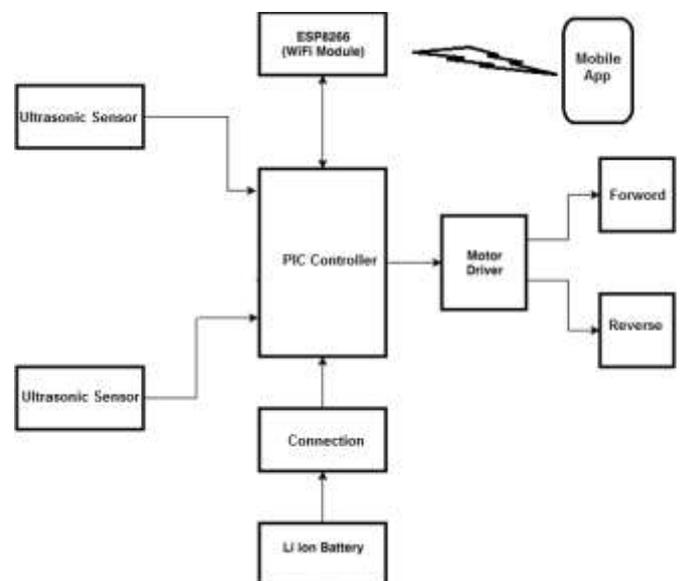

Fig -1: Block Diagram

So, when we start our robot it moves through the train tracks and measures the distance of rails from the distance where I is mounted. We have given an specific threshold distance value in our program. So whenever this distance value is gets increases we indicate an Warning message flag with this microcontroller takes the decision, and send

the Command regarding this fault to the ESP8266 WiFi module through the serial lines then this command ESP8266 module again further send to our mobile app this way we get the alert message and fault status via an android app.

3. System Hardware Design:

A. Microcontroller:

This System is Equipped with microchips PIC 18F4550 Microcontroller. It is an 8 Bit Microcontroller with NANO Watt technology. It has 13 Channel, 10 Bit ADC Pins and various resources. We have chosen this microcontroller just because of it has sufficient GPIO pins to connect our various Sensors and it has 1 UARTS, 1 SPI, 1 I2C in our System Major Sensors are based on digital communication interface of information exchange this microcontroller best suits for this application.
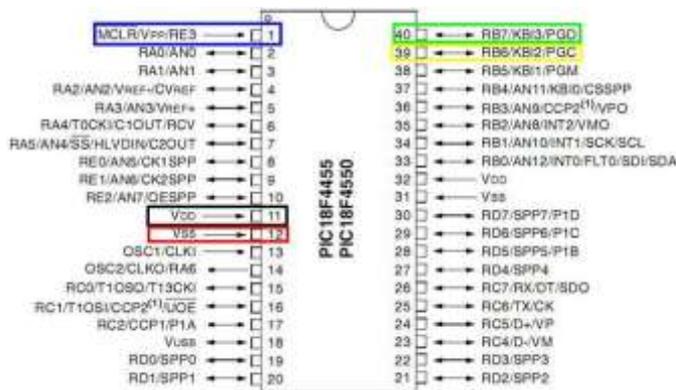
Fig -2: PIC 18F4550

B. ESP8266-12E WiFi Module:

This is the WiFi Module with Inbuild 32-bit Microcontroller It is made by Espressif System Inc. Shanghai Based Chinese Company in 2014. It has inbuilt TCP/IP Stack, so we will use it for Communication purpose with our Server. For that we will Operate this chip in STA(Station) mode and will connect to our main Internet Enabled Hotspot or gateway Router, so it can Access internet.[6]

Fig -3: ESP8266 12E

C. HC04 Ultrasonic Distance Sensor:

For measuring the distance between an know point to another unknown point we are using this HC-SR 04 Ultrasonic Distance sensor. Which works on ultrasonic radar principal it has two dishes mounted on this module of them is transmitter and another one is receiver. Transmitter sends a wave high pulse for 2ms in each 1 Sec interval, and If there is any object in front of this module then this transmitted wave will reflect through it and come to receiver dish. The total time duration that this wave took will give the Distance between those two point by simply using the formula of speed. This way we get the value of distance, we can interface this module to any controller with two Digital GPIO lines. One of them is trigger and another one is Echo.

Fig -4: HC-SR 04 Ultrasonic Distance Sensor.

4. Result & Discussion:

Result Shows that whenever the ultrasonic distance sensor gives the value higher than that of threshold value then Microcontroller shows the Flag in serial Window. Means we have successfully detected the Cracks in the Rails of train
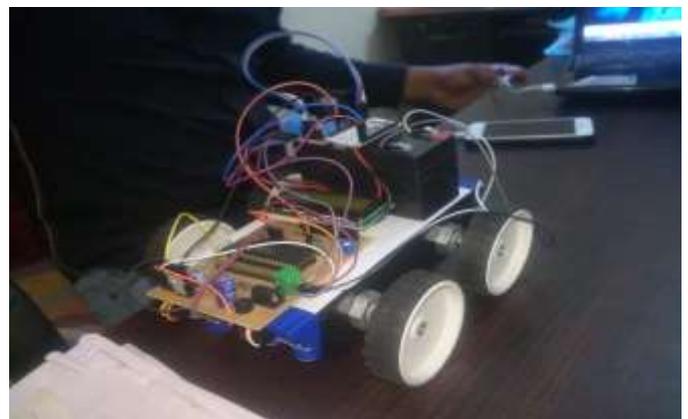
Fig -5: Prototype

Track. And we immediately get the alert message on our android app.

5. CONCLUSION

The ultrasonic sensors are used in this system. As the scheme is completely automatic it can be used in remote villages where no station master or line man is present. It saves lot of time whereas manual systems take time for the line man to inform the station master to close and open the gate which will consume a considerable amount of time. In future work some more sensors can be adopted to fasten the detection, we may also use the CCTV systems with IP based camera for monitoring the visual videos captured from the track. Thus the design is very useful in railway applications. Hence it is expected that major train mishaps can be prevented and human life saved if this system is implemented.

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