Railway Track Crack Detection Using IR Sensor

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Abstract – The Indian Railways has one of the largest railway networks in the world. It provides the most important role of public transport in India which is most commonly used and cost effective long distance transport system of the country. The main problem about a railway analysis is detection of cracks. If these deficiencies are not controlled at early stages, they might lead to a number of derailments resulting in a heavy loss of life and property.

In this work we are introducing a project that aims in designing Railway Crack detection scheme (RCDS) using IR SENSOR assembly system which avoids the train accidents by detecting the cracks on railway tracks. The Robotic model is designed with a camera which sends pictures, live videos and also capable of alerting the authorities in the form of SMS messages along with location by using GPS and GSM modules. The system also includes distance measuring sensor which displays the track deviation distance between the railway tracks. This will save several trains in India from an unwanted discontinuity from the rail track and accidents.

Keywords – Arudino Uno (At mega 328) Microcontroller, GPS, Telegram, IR Sensors.

INTRODUCTION

Depending on the fast developments in railway systems, high speed trains are used and rail transportation is increased day by day. The most of the people uses railway for transportation, to transfers the goods and passengers from one place to another place. The railway system is providing facility such as high speed, low cost, environment friendly. These characteristics can be performed by time to time maintenance and control measurements. But depending on different factors, deformations and derailment may occur on the superstructure of railways. These derailments and other problems of railway system like improper maintenance, the currently irregular and manual track line monitoring mistakes from workers. Such deformation and derailment are determining on time and taking precautions is very important for the safety of railway systems.

Therefore, solution for this problem is introducing in this project. For providing protection to the railway accident because of cracks occurs on the track. This system is used in between two stations which will detect the cracks present on the track using IR sensors

which transmit sine waves for an ideal track. If a crack is detected, then this sensor will send a signal to the Adriano Uno board which will activate the GPS receiver. The GPS receiver will pin point the exact location which will then be messaged to the authorities. Once the sensor sends a signal to the controller, the controller will initiate the webcam. The webcam will provide the live feed of the track. The live feed and the data from the GPS will be updated in the designed application of the wireless camera. By using this technology, we will be able to prevent the loss of precious life or property.

II RELARED WORK:

In this paper, "Henrique Oliveira Member, IEEE, and Paulo Lobato Correia, Senior Member, IEEE "Automatic Road Crack Detection and Characterization", IEEE TRANSACTION ON INTELLIGENT TRANSPORTATION SYSTEM, VOL.14, NO. 1, MARCH 2013" [1], the 2D feature space used for detecting the crack. The crack is detected by capturing the images, based on the images calculated the length and width of the crack and also it will check whether the track is over lapping or non over lapping. The crack detection is considered a one of the procedure for the collection of data about the condition of the pavement surface.

In this paper, "Lad, P., & Pawar, M.(2016) " Evolution of Railway track crack Detection system" 2016 2nd IEEE International Symposium on Robotics and Manufacturing Automation (ROMA). doi:10.1109/roma.2016.7847816 [2]", this system consists of GPS module, GSM modem and IR sensor and PIR sensor. To check the crack detection, communication and identification of the railway track. The GPS module and GSM modem used to identification and transmission of railway geometric parameter of crack detection to the nearby railway station. The PIR sensor is used to finding of living beings across the tracks. This can operate during the night as well as the daytime.

In this paper, "Rijoy Paul, Nima Varghese, Unni Menon, Shyam Krishna, "Railway Track Crack Detection Rijoy", International Journal of Advanced Research and Development, Volume3, Issue3(2018), [3]", this project aims at designing railway track crack detection using Raspberry Pi 3, Image Processing and ultrasonic sensors. When any crack or deformation is detected on the track the location 0f the crack is identified and the location latitude and longitude coordinates are procured. The GPS and the WIFI module are used to send these location co-ordinates in the form of Short Message Service (SMS) to the pre-defied number or railway station. The manual Inspection and detecting a crack on these railways tracks is very difficult and it takes lot of time and human resource.

In this paper, "Rizvi Aliza raza, Khan Pervez Rauf, Ahmad shafeeq, "Crack Detection Railway Track Using Image Processing", International Journal of Advanced Research, Ideas and Innovations in Technology, volume3, Issue4 (2017)" [4], a method to detect cracks in railway tracks has been presented using image processing techniques. The method replaces manual inspection of the track section, by automatic inspection. A video camera can be installed in separate sections of the track to take images of the track section and to detect any cracks in the track section. This will help to detect cracks immediately and reduce the possibilities of accidents. Since the system would be automatic and will require less manual resource.

In this paper, "Mr. Anand S. Muley, Mr. Siddhant B. Patil2, Prof. A.H.Shelar, "Railway Track Crack Detection based on GSM Technique", International research journal of engineering and technology(IRJET), Volume: 04 Issue:01/jan-2017 [5]", the proposed system provides easy method for railway track crack detection using op amp and microcontroller. The GSM is also used to send the SMS to main branch. He also explained different method to identify the crack that present on the track.

III METHODOLOGY

Fig 3.1 shows block diagram of "Railway track crack

detection using IR sensor", there are one set of IR sensor units fitted to the front sides of the vehicle. The IR transmitter and IR receiver circuit is used to sense the cracks. It is fixed to the front sides of the vehicle with a suitable arrangement. When the vehicle is Powered On, it moves along the model track. The IR sensors monitor the condition of the tracks. In normal condition the motor, LDR, Serial transmission is in initial stage. When the power supply supplies the microcontroller then it starting the motor in forward direction and serial transmission is used to send the messages to the microcontroller.

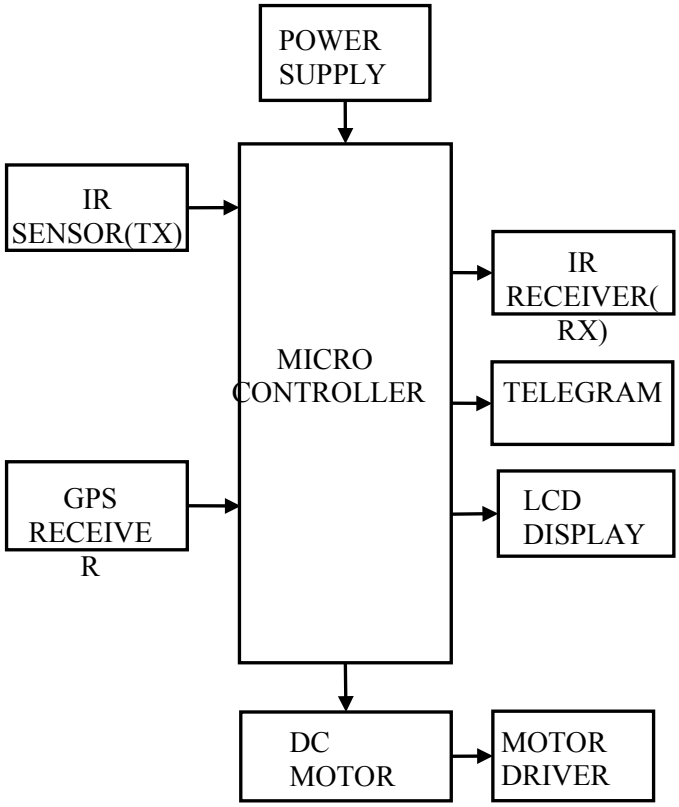

Fig 3.1 Block diagram of Railway track crack detection

When a crack is detected by the IR sensor the vehicle stops at 0nce, and the GPS receiver triangulates the position of the vehicle to receive the Latitude and Longitude coordinates of the vehicle position, from satellites. The Latitude and Longitude coordinates received by GPS are converted into a text message which is done by microcontroller. The Wi-Fi Module sends the text message through IOT (Telegram APP).

At Normal Condition

The IR transmitter sensor is transmitting the infrared rays. These infrared rays are received by the IR receiver sensor. The Transistors are sent as an amplifier section. At normal condition Transistor is OFF condition. At that time relay is OFF, so that the vehicle running continuously.

At Crack Condition:

At crack detection conditions the IR transmitter and IR receiver, the resistance across the Transmitter and receiver is high due to the non-conductivity of the IR waves. When the track is in continuous without any cracks then output of IR LED and Photodiode will be high.

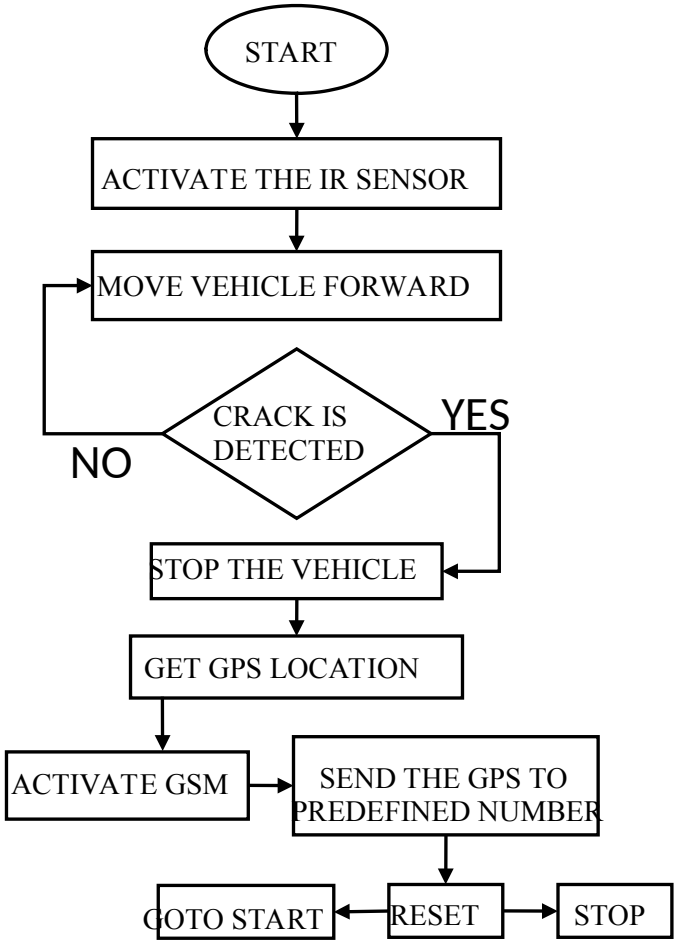

Fig 3.2 Flow chart

As soon as the crack detected by the system the TSOP sensor reflection will be equal to zero and the robot will be stopped automatically. Another TSOP sensor is used to monitor the pit on the way of the

railway track. When this output is high then it is concluded that there is no pit in the track. But if any pit is detected by the sensor the output of the sensor given to the microcontroller will be zero and again the microcontroller will stop the robot. When a crack is detected by the IR sensor the vehicle stops at once, and the GPS receiver triangulates the position of the vehicle to receive the Latitude and Longitude

coordinates of the vehicle position, from satellite.

IV WORKING

Fig 1 shows the block diagram of "**Railway track crack detection**". The system consists of Arduino Uno, LCD Display, GPS, IR sensors, and DC Motor. The Arduino Uno microcontroller, which acts as a brain of the system. This microcontroller controls the circuit function. Various components are interfaced with this microcontroller. The hardware components used in this system requires regulated power supply for the operation. This power is provided by the rechargeable battery connected in the system. In this system we have interfaced two IR sensors with the microcontroller for the distance and detection of the crack present in the track of the railway line. The ESP8266 is a low-cost Wi-Fi microchip with full TCP/ IP stack and microcontroller capability produced by manufacturer Expressive Systems in Shanghai, China. The chip first came to the attention of Western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer Ai-Thinker. A GPS receiver is also interfaced with the microcontroller to determine the exact location of the crack on the railway track. Two DC motors are used to move the robot in forward direction. A wireless camera provides the live video to the device in which the application of that camera is installed. The architecture of the proposed system also consists of a 16x2 LCD display, interfaced with the microcontroller for the display purpose.

V CONCLUSION

The "Railway Track Crack Detection Using GPS & GSM" is a helping unit which identifies the crack that present on railway track using IR Sensor. Sensor will checks whether the crack is present or not and the message is displayed on LCD display. So, this proposed system reduces the railway accidents and saves the people life and also reduces the economical losses.

VI REFERENCES

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[2] Lad, P., & Pawar, M.(2016) " Evolution of Railway track crack Detection system" 2016 2nd IEEE International Symposium on Robotics and Manufacturing Automation (ROMA). doi:10.1109/roma.2016.7847816.

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