Crack Detecting Robot for Railway Tracks

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Abstract— In the Indian economy the major share is contributed by the transport railway network. So, problems of crack detection in railway network when encountered may be dealt with a robust and cost effective solution, else, there may be a small decrease in the nation's economy. Most of the accidents in the train are caused due to cracks in the railway tracks, which are hard to identify. And more time is required for this purpose; therefore we have implemented a crack detecting robot, which identifies the cracks and gives an alarm. In this paper we have tried to give an exact solution by the technical details and design aspects. The project consists of microcontroller and IR-photo diode assembly based crack detector robot.

Key words: Railway Tracks, Robot, IR Photo Diode Assembly, LCD, Voice & Playback Circuitry

I. INTRODUCTION

Most of the train accidents occur due to crack in rail tracks. Because of this problem major train accidents are unnoticed due to irregularity in manual track line checking and maintenance of them. So, to avoid this hazardous condition of Indian railway networks, an automated system which do not depend upon the manual labour is implented.

This paper has the design of crack detecting robot for finding cracks in a railway tracks. In this system we will use IR photo diode assembly for detecting cracks in railway track and controller for interfacing the robotic vehicle and crack detection sensor. [1]

The sensing device senses the voltage variations from the crack sensor and then it gives signal to the comparator. The comparator checks the voltage variations between measured value and threshold value and gives binary data to the microcontroller. According to the received data; microcontroller takes decision and transmit the appropriate encoded signal through RF transmitter.

At the receiver side decoder HT12D decodes the data received by the transmitter and is fed to the microcontroller, then microcontroller take appropriate decision and send instruction to the voice & playback circuitry, LCD display & alarm.

II. LITERATURE SURVEY

The survey in 2011 until the month of July stated that the frequency of accidents is going to increase and in that year 11 accidents were occurred. The accidents in railways are due to 60% derailments and 90% crack problems. Hence, this problem of cracks on railways became a serious problem.[2]

There are many techniques for detecting cracks in rail tracks .Some of them are mentioned below:

A. Robust Rail Crack Detection Scheme Using LDR And LED Assembly:

In this assembly, implementation results of the RRCDS; using simple components such as LED-LDR assembly and GPS module based crack detector assembly is done. The proposed system has been utilised for robust implementation in the Indian technology. [2]

B. Crack Detection Using Microwave Horn Antenna:

This technique was found to obtain very accurate results in lab based testing but it required spectrum analyzer, which are costly and cannot be place onboard of moving robot as they are easily breakable. [3]

C. Machine Vision Inspection of Rail Road Track:

In this technique powerful digital signal processors have been explored to calculate solution of the problem occurring in railway crack detection. This method uses techniques like image segmentation, morphology and edge detection.This technique take a lot of processing power and large amount of time and therefore this technique is unsuitable. [4]

After studying above literature survey we decided to implement the technique of crack sensing scheme using IR photodiode assembly in rail tracking system. [1]

Solution of this serious problem is overcome in our project and proper solution for this problem stated in our project. This project can be effectively used in large scale application. And also it provides good accuracy, as well as it is cheap. It is simple scheme with sufficient ruggedness suitable to the Indian technology that uses an IR-Photo diode arrangement to detect the crack in railway lines.And as a result of this it is less costly and reliable than other methods. [1]

III. PROPOSED SYSTEM

Crack detection in railway tracks by manual checking takes large amount of time and also it reduces the accuracy too. But this method is time consuming as compared to other methods.

The proposed system is as follows:

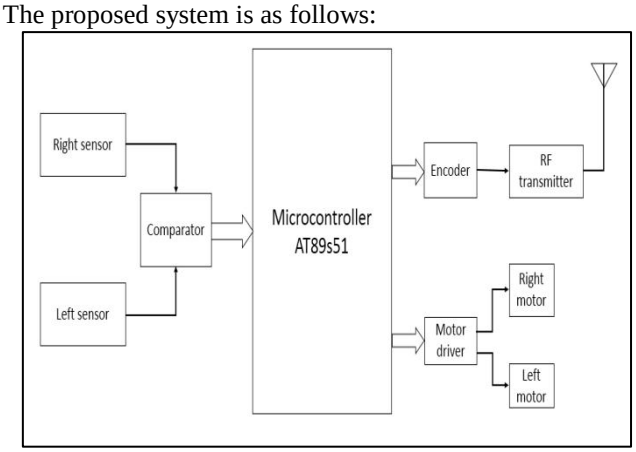

Fig. 1: Block Diagram of Transmitter

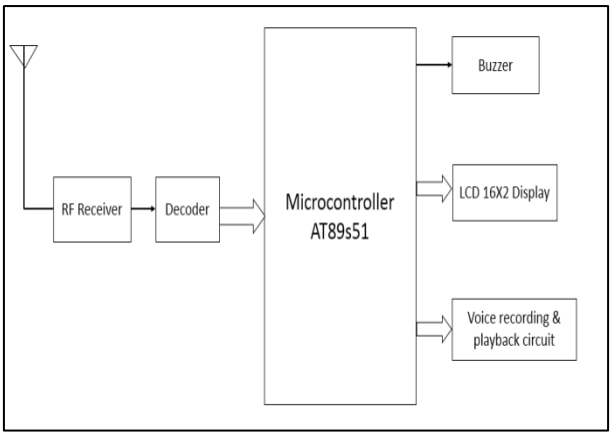

Fig. 2: Block Diagram of Receiver

The main component of the proposed crack detection scheme consists of an IR-Photo diode assembly that works as the rail crack detector in the system. The main principle in crack detection is the concept of photo diode. In the implemented design, the IR will be attached to one side of the rails and the photo diode to the other side. During normal condition, when there are no cracks, the Infrared light doesn't fall on the photo diode and as a result of it the photo diode resistance is high. Similarly, when the Infrared light falls on the photo diode, the resistance of the photo diode gets decreased and the amount of reduction will be approximately proportional to the intensity of the incident infrared light.[1]

Therefore, when light from the IR deviates from its path(track of the rail) due to the presence of a crack or a break; a sudden decrease in the resistance value of the photo diode is occurred. This instantaneous change in resistance shows the presence of a crack or some other similar defect in the railway tracks. In order to find the crack APR9600 voice recording and playback IC and 16X2 LCD display will be used to indicate that error. DC motors drives the robot and relays are used to control the motors.

IV. WORKING

We use IR photodiode technique to detect the crack. The sensor converts physical space quantity to the electrical quantity that is if the space is more in the track then the voltage is increased and vice versa.

Comparator converts the analog quantity into digital quantity by comparing with threshold voltage and gives binary output to microcontroller.

If voltage level is greater than 1.5 volt then the comparator gives +5 volt to the microcontroller and if voltage level is less than 1.5 volt then comparator gives 0 volt to the microcontroller.

Microcontroller is a decision making device were we can write program and get a desired output. Microcontroller encodes binary signal and transmit on the radio link through RF transmitter.

At receiver side received signal are decoded and microcontroller gives indication to the LCD display and buzzer.

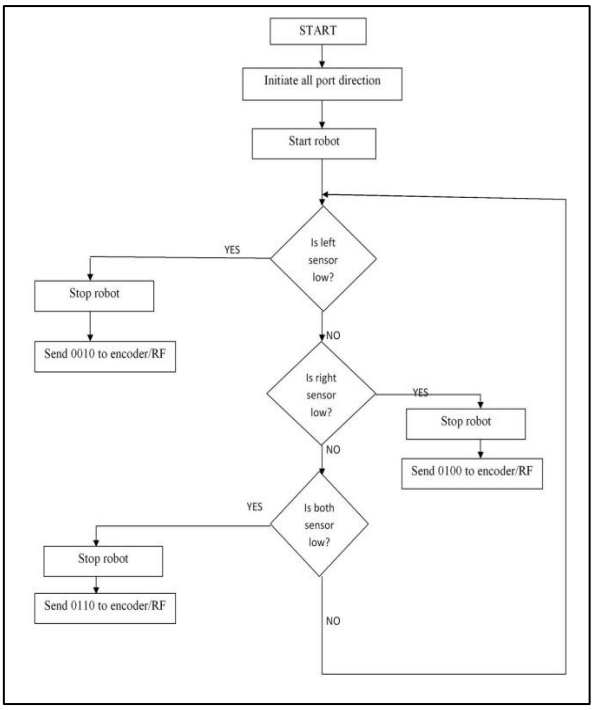

Fig. 3: Flowchart for Transmitter

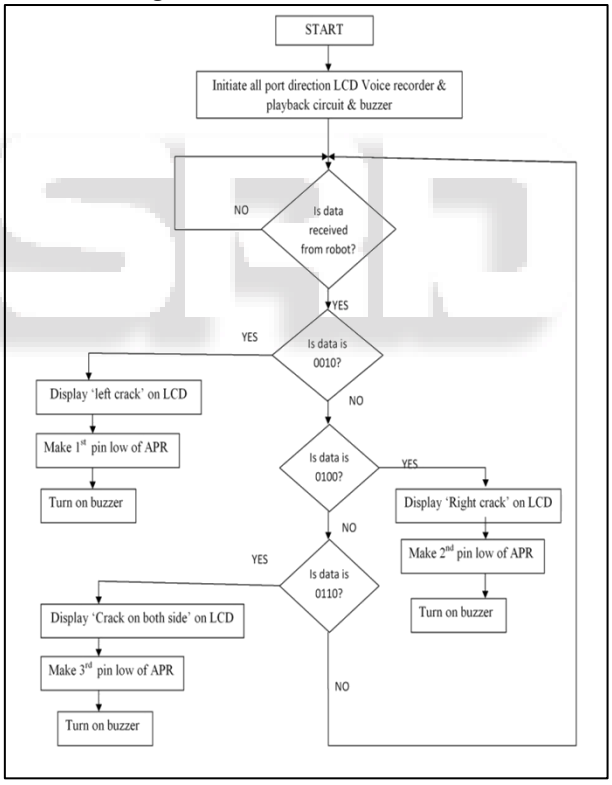

Fig. 4: Flowchart for Receiver

- Component Specifications:

A. *AT89s51 Microcontroller:*

- 4.0V to 5.5V Operating Range.
- 128 x 8-bit Internal RAM.
- 32 Programmable I/O Lines.
- Two 16-bit Timer/Counters.
- Six Interrupt Sources.
- Interrupt Recovery from Power-down Mode.

B. *Sensor-TSOP1738:*

- Single-chip, high-quality voice recording solution.

- Non-volatile Flash memory technology.
- User-Selectable messaging options.
- User-friendly, easy-to-use operation.

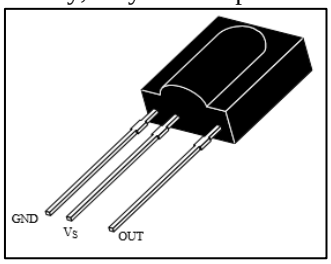

Fig. 5:

C. APR9600 Voice & Playback Recording Circuitry:

- Single-chip, high-quality voice recording & playback solution.
- Non-volatile Flash memory technology.
- User-Selectable messaging options.
- User-friendly, easy-to-use operation.

V. RESULT AND CONCLUSION

This paper provides an effective solution in making the railway tracks crack free by using IR-photo diode based railway detection scheme. The main idea of the project can be implemented on a large scale for better results in future.

VI. FUTURE SCOPE

For the future scope with the help of GPS (Global Positioning System) we can detect the cracks in railway tracks via satellite control.

VII. ACKNOWLEDGMENT

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