Literature Survey on Smart Solutions for Railways

Done by Monica. S, Sindu Mithra M K,

Swathi. S, Nivedhitha. P.

ABSTRACT: The railway industry is in a position where it is able to explore the opportunities created by the IoT (Internet of Things). Due to its large size, it is difficult to monitor the cracks in tracks manually. This paper deals with this problem and detects cracks in tracks with the help of an ultrasonic sensor. it gives information to the cloud server through which the railway department is informed on time about cracks and many lives can be saved. This is the application of IoT, due to this it is cost-effective system. This effective methodology of continuous observation and assessment of rail tracks might facilitate to stop accidents. This methodology endlessly monitors the rail stress, evaluate the results and provide the rail break alerts such as potential buckling conditions, bending of rails and wheel impact load detection to the concerned authorities.

INTRODUCTION:

Internet of Things refers to interconnection or communication between two or more devices without human-to-human and human-to-computer interaction. Connected devices are equipped with sensors or actuators to perceive their surroundings. IOT has four major components which include sensing the device, accessing the device, processing the information of the device, and providing applications and services. In addition to this, it also provides security and privacy of data.

Existing System:

Existing train tracks are manually researched. LED (Light Emitting Diode) and LDR (Light Dependent Resister) sensors cannot be implemented on the block of the tracks. The input image processing is a clamorous system with a high cost and does not give the exact result. The Automated Visual Test Method is a complicated method as the video color inspection is implemented to examine the cracks in rail track which does not give accurate result in bad weather. This traditional system delays transfer of information.

Table 1: Literature survey of smart railway track fault detection system

Author	Title	Source	Findings
Naveen Bhargav et al. (2016)	Automatic Fault Detection of Railway Track System Based on PLC (ADOR TAST)	International Journal of Recent Research Aspects	The sensor is used to detect defect in the train track and the ultraviolet sensor is used to detect the obstruction in front of the train.
B. Siva Rama Krishna et al. (2017)	Railway track fault detection system using IR sensors and Bluetooth technology	Asian Journal of Applied Science and Technology (AJAST)	In the event of any defect on the track it will detect track defect using IR sensors and then it sends a message to the android phone using a Bluetooth module.
Mansi R. Sarwan et al. (2018)	Self-Powered For Railway Track Monitoring Using IoT	IOSR Journal of Engineering (IOSR JEN)	This has resulted in a rapid increase in surveillance of systems, buildings, vehicles, and machines using sensors.
S. Mishra, A. Shrivastava and B. Shrivastav (2019)	A Smart Fault Detection System For Indian Railways	International Journal of Scientific & Technology Research	The device built will be attached to a train engine and contains a sensor that can detect a few meters cracks

			and as soon as any cracks are found the train driver will receive a signal to install emergency brakes and the authorities will be notified of the correct location of the fault.

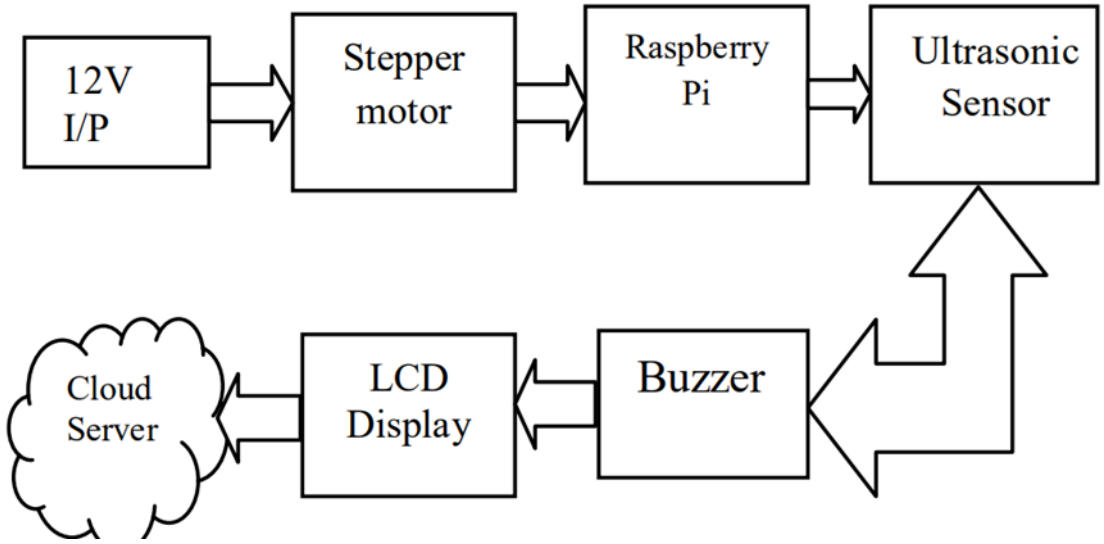
An Ultrasonic sensor is installed that monitors the track and provides status to the Raspberry pi controller. If any crack is detected it immediately sends the cloud crunch to the user's mobile phone. The paper uses a stepper motor assembly in which the ultrasonic sensor is attached and the ultrasonic sensor moves to the side of the track and in case of error anywhere the track receives and provides information to the railway department.

This project is very helpful in preventing accidents and provides information before the railway department about the cracks so they can get information about the cracks and can be fixed soon. Further sections of the paper deals with the block diagram with components description of the proposed work under section II followed by working of the device and its specifications in section III. At last, section IV concludes the paper and section V explains the future scope of the proposed work.

WORKING:

As shown in block diagram, First of all we give power supply to stepper motor which is 12V and 5A from power adapter and 5V Supply to Raspberry Pi. Since ultrasonic sensor is connected through stepper motor with the help of pulley system, the ultrasonic sensor continuously moves back and forth across the railway track and checks for the fault. If any fault is found on railway track anywhere on the track, it immediately stops and send ultrasonic waves to find the fault (i.e. where the fault is) and measure the distance and again reflect back the signal and gives the detailed information of the fault to the cloud

server from where the railway control room officer knows about fault in advance and accidents can be prevented. In this circuit we have used stepper motor, ultrasonic sensor, motor driver IC (A4988), Raspberry pi and LCD display.



The stepper motor will rotate back and forth across the whole railway track. If there is any fault detected on the track, the ultrasonic sensor attached to the system will send out ultrasonic waves and indicates the distance which is less than the preset distance and indicates a fault in track and the fault information to monitor screen of the railway department. The motor driving belt is tied to a pulley to which ultrasonic sensor is connected and moving back and forth with help of stepper motor and if fault is detected then it shows on LCD display and information is showed on cloud server. In this system the main use is of Ultrasonic Sensor which is a kind of active sensor i.e., it has component for both reception and transmission in it. So this sensor is mounted on a wooden plate which has given support by two smooth steel rods.

The steel rods are there for the support of the wooden plate on which the infrared sensor in mounted. The wooden plate and the smooth rod are kept in contact to each other with the use of linear bearings, these bearings will let the rod to pass through them and simultaneously provide the support required for wooden plate. There are two smooth rods in this project which are fixed from both the ends and they are separated to each other by the breadth of the wooden plate. Now this wooden plate is fully supported and fully mobile. So this wooden plate is attached to a timing belt from beneath. And this timing

belt is tied from a pulley from one end and from the another end it is wrapped around on a gear which is in the rod coming out of the Stepper Motor, this timing belt is tied in such a way so that when the gear on the stepper motor revolve then the timing belt also rotates and correspondingly the pulley will also rotate and accordingly the wooden plate on the smooth rod will also move in forward and backward direction. A wooden plank is used as a base for this whole project.

On which these pulley, stepper motor and the other things will be screwed down to it to give it Support and make it Rigid. Now the stepper motor is controlled by the stepper motor module and the program fed in the raspberry pi so the speed and the steps of the stepper motor are controlled accordingly. The ultrasonic sensor which is mounted on the wooden plate is also connected to the raspberry pi. Now this sensor is used to sense the faults in the railway track. The ultrasonic sensor which sends emf waves to the railway track and the waves which are transmitted and reflected then the time in between this interval is calculated and accordingly the distance is calculated which is the main principle of this project. So to automate this project a IOT is used. So, a blynk app is used which is connected to the raspberry pi through internet so by which the whole project will be turned on and turned off.

Conclusion:

Accidents occurring in Railway transportation system cost a large number of lives. So this system helps us to prevent accidents and giving information about faults or cracks in advance to railway authorities. So that they can fix them and accidents cases becomes less. This project is cost effective. By using more techniques they can be modified and developed according to their applications

In this paper the system is presented to detect the cracks in the track effectively. We have implemented the Ultrasonic sensor based railway crack detection system using wireless technology. By this system many lives can be saved by avoiding accidents. The idea can be implemented in large scale in the long run to facilitate better safety standards for rail tracks and provide effective testing infrastructure for achieving better results in the future.

Reference:

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