

Automatic Railway Track Crack Detection System

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Abstract: The fourth largest railway organization in the world is the Indian railway. The maintenance of the very big transport system can be difficult and human error can cause a trouble Commercial level is mainly depends on increasing the capacity and level of transport. Till date there are cases of rail derailment due to track break. The proposed organization is a solution to automatically railway track crack detection along with video streaming. Internet of Things is the most studied field and its applications are endless. Internet of Things (IOT) is implemented to give an up to date update on the railway management. In this mode IR sensor is used for detection and GPS receiver is used to track the location of the crack. A camera is fixed to provide the live video data to review the crack from the base stations.

Keywords: IR sensor, GPS, Raspberry pi, etc.

INTRODUCTION

Railway is one of the most common methods of travelling and is the most commonly used means of transport The fourth largest railway organization in the world is the Indian railway. The detection of crack in such costly organization of 121,407 km of track around the country increases the expectation of error rate. Many derailment cases due to track crack have been cited even to this date. A few cases are cited below

- a) On November 2016, a tragic derailment of the Indore- Patna train claimed the lives of 147 passengers and 180 passengers were injured. The train derailed due to rail fracture near Kanpur.[3]
- b) On 28th December 2016, Sealdah-Ajmer Express derailed near Kanpur, which reportedly has many rail fractures, and 22 passengers were severely wounded.[4]
- c) On August 2016, 12 coaches of Thiruvananthapuram-Mangalore Express derailed due to broken rails. Though there weren't any casualties, it caused a lot of traffic issues and property loss.
- d) Jagdalpur-Bhubaneswar Express derailed on its way to Bhubaneswar claiming the lives of 27 passengers and 36 passengers were injured.
- e) On January 2017, the Hirakhand express derailed near kuneru in Andhra Pradesh killing 41 people and inflicting injuries on 68 people in an accident whose cause is suspected to be due to rail fracture.

The above cited scenarios are horrible events due to rail crack. The railways extend all throughout the country and accidents have been recorded since 1890. Large numbers of people were died due to the reason of improper crack detection. The rupture may happen due to temperature changes, aging of the rails or by using defective rails during the construction. If a crack is detected at an immediately, the derailment and loss of lives can be saved.

GPS (Global Positioning System) and microcontroller railway track crack detection when implemented is an efficient method of detection of cracks which is present in the tracks and thus avoiding derailment of the trains. Fast growing technology in the present times, is Internet of Things (IOT). This system is used in-between two stations which will detect the cracks present on the track using IR sensors. If a crack is detected the IR sensor will send a signal to the Raspberry Pi which will activate the GPS receiver. The GPS is use for locating the actual location of the crack. Once the IR 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 website. This smart technology will be a part of the brave new digitalized world which will be able to prevent the loss of precious life or property as the above mentioned case

METHODOLOGY

Raspberry pi 3 which acts as the processing unit for the other peripherals interfaced with the IR sensor, GPS and video camera. Raspberry pi controls the robot and the video camera. The Raspberry pi is also used for synchronising the data received into the website.

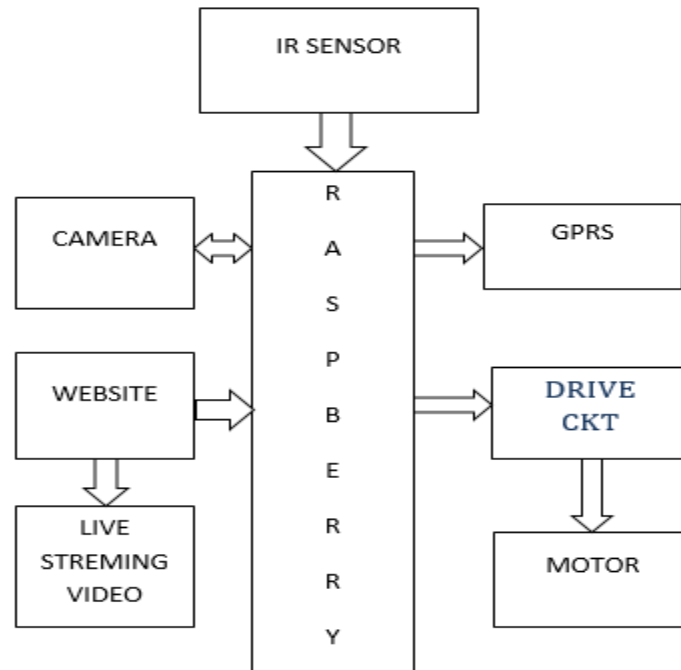


Fig1: Block diagram of a purposed system

The complete model is placed on a four wheeler robot which travels along the rails. Using commands, the robot moves along the track. The robot is able to move forward and reverse and the video camera, which is placed in front of the robot, can move in all four directions of up, down, right and left. This model works on a simple principle i.e. the bot will move on the railway track continuously and immediately the IR sensors gets the input signal low. It will stops the bot and sends the exact location to the server via internet. Python code is return in such a manner that it gives the data value in latitude and longitude form.

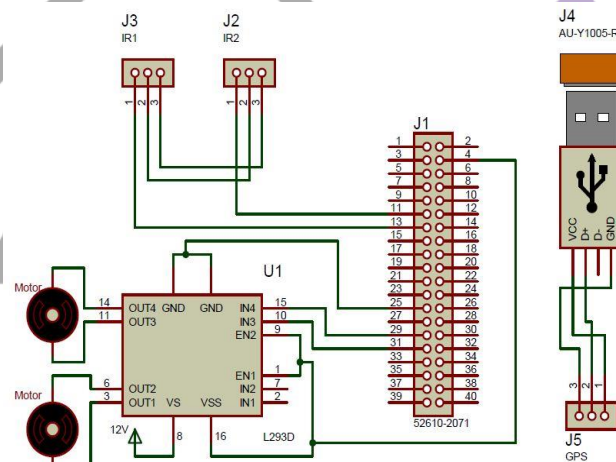


Fig2: Circuit diagram

HARDWARE

The various section of the crack detection system is as

- **Raspberry Pi**
- **IR sensor**
- **GPS**
- **Web Camera**
- **Website**

RASPBERRY PI

The Raspberry Pi is a credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It’s capable of doing everything you’d expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games.

IR SENSOE

An IR LED, also known as IR transmitter, is a special purpose LED that transmits infrared rays in the range of 760 nm wavelength. They, along with IR receivers, are commonly used as sensors. Since the human eye cannot see the infrared radiations, it is not possible for a person to identify whether the IR LED is working or not, unlike a common LED. A photodiode is a type of photo detector capable of converting light into either current or voltage, depending upon the mode of operation. Photodiodes are similar to regular semiconductor diodes.

GPS MODULE

The Global Positioning System (GPS) is a satellite-based navigation system consists of a network of 24 satellites located into orbit. The system provides essential information to military, civil and commercial users around the world and which is freely accessible to anyone with a GPS receiver. A GPS receiver must be locked on to the signal of at least three satellites to estimate 2D position (latitude and longitude) and track movement. With four or more satellites in sight, the receiver can determine the user's 3D position (latitude, longitude and altitude). GPS receiver is used for this research work to detect the vehicle location and provide information to responsible person through GSM technology.

WEB CAMERA

A Logitech camera is used for this model. The Logitech webcam HD C270H has in-built microphone with right sound technology. It provides with a 3 megapixels resolution images with an innovative right light Technology, high speed USB 2.0, and video capture at 1280 x 720 pixels.

WEBSITE

A website is created for the purposes of this module. A Wi-Fi modem is provided to connect to the internet through which the particular website can be obtain. The remote controlled robot and the webcam transmit data onto this website which can be visible by the privileged authorities to inspect and investigate the defective site.

SOFTWARE

Guido van Rossum created Python, and very early on recognized its use as a first language for computing. In 1999, van Rossum put together a widely read Proposal called Computer Programming Python is an interpreted language, which means that you can write a program or script and execute it directly rather than compiling it into machine code. The Python interpreter can be run in two ways: as an interactive shell to execute individual commands, or as a command line program to execute standalone scripts. Python is high level programming language which highlights on the importance of code readability and the codes involved reduced code lines than other high level languages such as Java, C, C++ .

CONCLUSION

The railway is the most commonly used method of transportation by the people and for goods. The transport organization must always be secure. The proposed of the organization is an combination of conventional method of crack detection and the innovative method of live video streaming and IOT. The entire system is placed on a four wheeler bot which travels along the rails. When compared to existing system which uses IR transmitter and receiver, the proposed system is an innovative technique which lowers the burden of the authorities and increases the accuracy of the crack detection. The process is done at a periodic rate to check for cracks so that causalities can be avoided entirely. The entirety of the model is to ensure that defective rails can be found in time to stop derailment of trains, to save the loss of lives and property.

ACKNOWLEDGMENT

We express our sincere gratitude to Dr. S.A.Nagtode, Head of department of Electronics & Telecommunication, for her valuable guidance during our project work and to colleagues and friends for supporting dursing this period and finally thanks to anonymous reviewers who have worked in this area.

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