Advance Railway Line Crack Detection System

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Abstract— Railways provide the most cost effective and most convenient mode of passenger transport both for long distance and suburban traffic. Also, most of the transport in India is being administered by railway network. Still, accidents are the main concern in terms of railway track crossing and unidentified crack in rail tracks in Indian railway. More or less 60% accidents are occurring at railway track crossing and the fault or crack in railway tracks leading to loss of precious life and loss of economy. Therefore, there's got to believe new technology which is strong, efficient and stable for both crack detection in railway track and object detection. This paper proposes faulty rail track detection. This project discusses a Railway track crack detection using image processing and may be a dynamic approach which mixes the utilization of GPS tracking system and WIFI module to send alert messages and therefore the geographical coordinate of location. A Raspberry Pi 3 is employed to regulate and coordinate the activities of those devices. This project prevents train accidents by detecting a crack in railway track using Internet of things technology. Keyword: Raspberry Pi 3B, Pi Cam, Image Processing, Ultrasonic Sensors, GPS, GSM (SIM900A), Crack Detection.

Keywords: Railway Line Crack Detection

I. INTRODUCTION

The idea of the project deals in designing railway crack detection using Raspberry Pi 3B, Image Processing and ultrasonic sensors, GPS, GSM (SIM800A). The central component of the entire system may be a Raspberry Pi 3B. When any crack or deformation is detected on the track the situation of the crack is identified and the location latitude and longitude coordinates are procured. The GPS module and therefore the WIFI module is employed to send these location coordinates within the sort of Short Message Service (SMS) to the pre-defined interface device or railway station India has one among the world's largest railway networks, manual Inspection and detecting a crack on these railways tracks is extremely tedious process and consumes lot of time and human resource.

In all transport systems, particularly just in case of railways, safety and reliability are highly considered. There is a view that the present regulatory framework doesn't provide a full set of tools to effectively affect railway accidents and main-track derailments. There is also a view that the present framework must be modernized and better aligned with safety legislation that applies to other modes of transport in India. In recent years, with the development of railways, the capability of the trains is constantly improving. Rail track inspection could also be a necessary task in railway maintenance and is required to periodically inspect the rail track by the trained human operator, who is walking along the track & searching for defects.

Such sort of monitoring system is unacceptable for slowness and lack of objectivity. This inspection will take an excessive amount of time to get over faults. Hence to scale back delay our propose system deals with automatic Visual Inspection of Railway track and dedicated to numbers of tasks. Automatic vision-based inspection systems enable to research the stipulation of rail track. In this way system increases the efficiency of inspection, reduces the specified time and giving a more accurate and frequent information of the railway track. To provide the real-time is monitoring and structural condition of the railway track is identified by “vision-based".

Objective of Project the most aim of the project is to style and develop an automatic railway crack detection system supported image processing technology and obstacle detection system supported ultrasonic sensing technology where in on board robot circuitry are often wont to detect crack and obstacle on railway using the camera and ultrasonic sensors, GPS, GSM(SIM900A).

The Indian Railways apparently lacks new technologies; therefore chances of human error are more and it's one among the main causes of rail accidents in India. Reasons, why safety measures are compromised, are a coffee investment, delay in installing anti-collision devices and lack in manpower. Image Processing has been utilized in variety of tasks involving automatic detection and monitoring. In this project, a computer-based methodology has been discussed to automatically detect railway track cracks and inform the authorities to require maneuver in time.

II. EXISTING METHOD

In the existing methodologies for the automated railway line crack detection system it includes only the microcontroller, LCD display, IR sensor, GSM, and motors. The micro controller controls the overall devices in which all the IR sensors and the GSM module and the motors driver are connected the IR sensors are responsible for the detection of the crack and the GSM will used to send the alert messages to the server room that the crack is been detected and the LCD display is used to display that the crack

III. PROPOSED METHOD

The purpose of this paper is to detect the accurate crack in the railway line so that a new method is proposed in this paper which uses raspberry pi 3B, pi-cam, ultrasonic sensors, GPS & GSM, and a driver motors to run the kit. Motors are responsible for the movement of the kid therefore the pic cam which is connected to the raspberry pi is responsible for the accurate detection of the crack and the overall components which is connected in the kit is controlled by the raspberry pi 3B in which the ultrasonic sensors, GPS, GSM and the motors are connected.

A. Methodology

In this, a computer vision based method is proposed for analyzing the track of railway systems. By means of image processing techniques the cracks in the rail are identified. If any crack or objects occur in the track means longitude and latitude are messaged by means of GSM module. This project also concentrates on the use of ultrasonic sensors which are needed to detect humans or any object being pursuing on the track. The recording and sending of the location are done by GPS and WIFI module. The activities of various devices are controlled by a Raspberry Pi 3B.

The major advantage of the proposed system is, it provides accurate result compared to the traditional methods by using the image processing technique. The crack detection depends on the dimensions of image. For practical crack detection, a wide range of images are used. The processing speed is improved in the proposed model so the crack will be easily detected and the information can be sent within a short period of time.

The steps involved in the detection of crack are as follows:

- Initially the vehicle will be in movement for a delay time over every five seconds.
- The image will be captured and the crack will be detected by following the python code open source CV(Computer Vision)
- Based on the threshold value given in the code crack over the railway line can be identified by the Pi cam connected to the Raspberry pi 3B.
- The crack detection will be noticed here and the image is stored.
- Once the crack is detected the alert message is send by the GSM with the location using GPS via WIFI module is sent to the station point.

In the obstacle detection module, redundant ultrasonic sensors are want to increase detection resolution and sensor data reliability. The sensor detects objects by emitting a brief ultrasonic burst then listening for the eco

Under the control of Raspberry pi, the sensor emits a wave of certain frequency. The emitted wave travels and hits a piece of writing and travel back to the sensor. The sensor provides an output pulse to the host which can terminate when the echo is detected. Once the thing is detected the alert message is send by the GSM with location using GPS to the station point.

1) Block Diagram

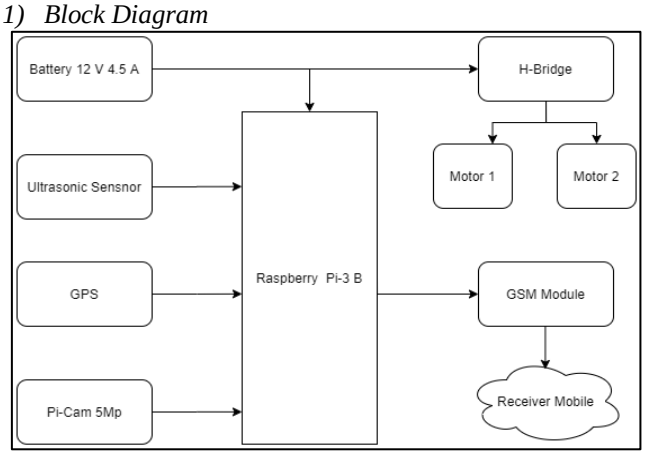

Fig. 1: Block Diagram

2) Flow Chart

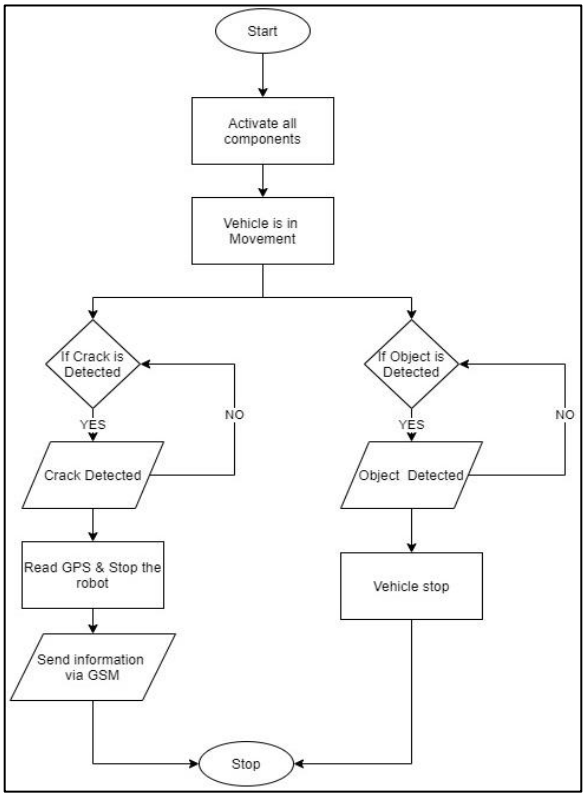

Fig. 2: Flowchart

B. Components Description

1) Raspberry Pi 3B

Raspberry Pi 3 Model B was introduced in 2016 which has a quad core processor that shows robust performance which is 10 times more than Raspberry Pi 1. And speed exhibits by Raspberry Pi 3 is 80% quite Raspberry Pi The raspberry pi has skilled variety of variations in terms of peripheral support and memory capacity. Every new edition comes with a little improvement in terms of design where advance features are added in the device so it can do as many functions as possible like a regular computer. Wi-Fi and Bluetooth that lack in older versions (Pi 1 and Pi 2), are added in the new addition of this devices (Pi 3), allowing to maintain the connection with the peripherals without the involvement of any physical connection.

Fig. 3: Raspberry Pi 3B

2) PI-CAM

The 5mp Pi cam is a portable light weight camera that supports in Raspberry Pi. It is connected through camera serial interface to the raspberry Pi. It is normally used in machine learning, image processing, and in surveillance project. In the proposed system Pi cam is used to detect the cracks.

Fig. 4: Pi-Cam

3) Ultrasonic Sensor

Ultrasonic sensors uses sound waves to detect the distance. It emits the sound waves at high frequency and collects the reflected waves to calculate the distance. In proposed system ultrasonic sensor are used to stop the vehicle if it finds any object pursuing on the track.

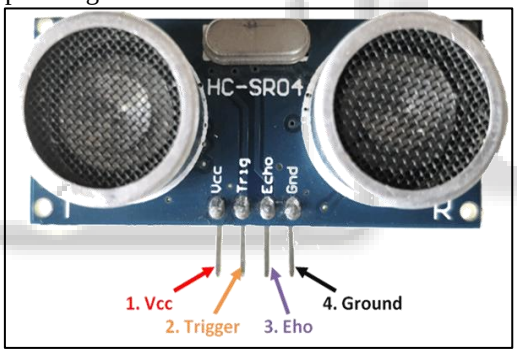

Fig. 5: Ultrasonic Sensor

4) GSM

The GSM module used is SIM900A.It is designed with power saving technique where in sleep mode the power consumption is 1.5Ma.The dimensions of the module is 24mmx24mmx3mm. It can be used in circuits where demand of compactness takes place.

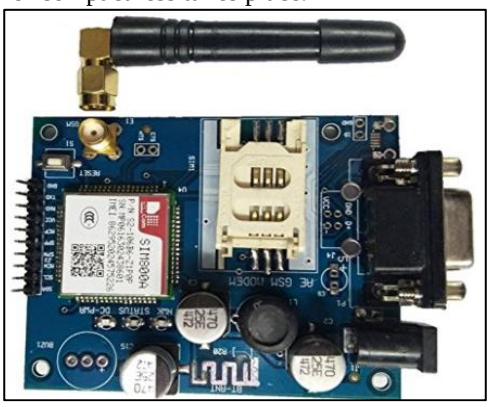

Fig. 6: GSM

5) GPS

The GPS module is the device which is used to find the latitude and the longitude coordinates of the device so that it locates the position of the crack.

6) H Bridge

H bridges are available as integrated circuits. It is used to control the motors either in forward or backward direction. It consists of four switches. When switches S1 and S4 are closed the switches S2 and S3 should be in open. A positive voltage can be applied across the motor by opening S1 and S4 and closing S2 and S3 switches. The voltage is reversed, and allowing the operation of motor to be reversed

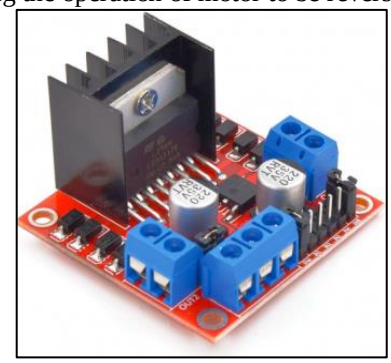

Fig. 7:

C. Software Description

The Raspberry pi 3B is a hardware platform so that it involves the programming language to setup and it involves a separate OS to perform the tasks. Python is used as a programming language.

IV. WORKING DESCRIPTION

The hardware are interconnected with eachother to the raspberry pi 3B. All the inputs for the hardware are already given to the raspberry pi so that the default performance of the kit will be performed simultaneously. When the vechile start to move it will first capture the image then it checks wheather the railline has a track or not . the crack can be identified by using the camera which process the neural network based upon the thresold value . The GSM is used to send the alert messages if crack is detected and the GPS is used to send the location of the crack detected. The ultrasonic sensors are used to stop the vechile in case of obstacle.

V. ADVANTAGES OF PROPOSED SYSTEM

- Establish management structure based on performance evaluation and monitoring process.
- Enhance the percentage of efficiency.
- Facility to send alerts/warnings to particular train drivers on possible collisions, derailment through the system.

VI. CONCLUSIONS

The proposed system replaces manual inspection of the railway line by automatic inspection. It will help to detect the crack immediately and help to reduce the accidents. Since the system is automatic and require less manual work, the utmost efficiency of the system can be guaranteed.

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