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Research Article

Unmanned Safety Survelliance For Railroad Crevices

Durga Lakshmi M[1], Monisha K[2], Moumita Ruj[3], Yesheshwini B.A[4], Anil Kumar C.S[5]

[1]School of Electronics and Communications Engineering, REVA University, India
[2]School of Electronics and Communications Engineering, REVA University, India
[3]School of Electronics and Communications Engineering, REVA University, India
[4]School of Electronics and Communications Engineering, REVA University, India
[5]School of Electronics and Communications Engineering, REVA University, India

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Abstract: Railroads give the least expensive and most helpful method to travel and goods transportation for both short and long distance. Still mishaps are the significant worry due to unidentified break in rail lines, resulting in the loss of precious lives and economic loss. As a result, a durableand reliable invention for crack detection in railroad tracks is needed. In the proposed system, a robot is developed that automatically navigates using the L293D motor driver and detects the railroad crevices. The system automatically detects the crack using IR sensor attached to the robot, which will continuously monitor the crack. The IR sensor detects a crack and transmit a signal to the Raspberry Pi, which triggers the GPS receiver. The global positioning system(GPS) receiver will trace the exact location and trigger a message to the concerned person through GSM module. Furthermore, itwill activate the webcam, which will provide a live feed of the rail line. In case the robot detects any object using ultrasonic sensors the warning message will be sent with the location to take the further action and Vibration sensor is used to detect vibrations of the upcoming train.

Keywords: Raspberry pi, GPS module ,GSM module, ultrasonic sensors, Vibration sensor, IR sensor

1. Introduction

Indian Railways is the second largest transportation network among the citizens of India. The Transportation of train systematically depends upon the railroad tracks (rails). If there's a crack in rails, it makes the foremost regarding issue. The bulk of accidents within the train are caused owing to cracks within the railroads, that cannot be recognised by our naked eyes.Inspections of such cracks when done by conventional method, consumes more time and does not provide the exact location of the crack and hindrances. So there is a necessity to use the crack detector automaton to find cracks and hindrance within the lines efficiently and effectively.Temperature fluctuations, rail ageing, or the use of faulty rails during construction may all cause the breach on the railway line.Likewise it requires some investment to redress the issue, we are utilizing the crack indicator robot, which will identify the crack in the rail road and gives caution.When implemented, the GSM (Global System for Mobile Communications), GPS (Global Positioning System), and microcontroller-based broken railway track identification is a cost-effective method of detecting gaps in the tracks and preventing train derailment. This framework is installed in the middle of two stations and uses infrared sensors to detect cracks. When a crack is observed, the IR detector will send a signal to the Raspberry Pi, causing the GPS receiver to turn on.The GPS receiver can pin the precise location which can then be messaged to the authorities. Once the Raspberry pi gets the signal, it will initiate the digital camera which can give the live feed of the track. This sensible technology would be a part of the brave new digitalized future, capable of preventing the loss of valuable life or property.

The following are the various sections listed below: Segment II examines similar work, Segment III explains the technique, and Segment IV displays the results. Segment V summarises the findings and concludes. of the document.

2. Literature survey

In the studies from [1]the proposed system uses a LPC2148 microcontroller, a GSM module, and a GPS receiver in the device. IR sensors are used to locate cracks in the track, and when a crack is found, the data is sent to a GPS receiver. This crack detection data is sent to the appropriate authority via GSM.

In [2] the main objective of this advanced method rivets intend of automation for verdict fissure in the railway path. At this point the microcontroller is connected with the Robot, ZigBee, GPS, LCD and crack sensor. The controller checks the measured voltage difference with the threshold point. If the controller detects a break, it uses the global positioning system to obtain the position in sequence and sends the direction and crack order to the control division. The map of the area is shown in the control section.This structure's current state is shown on the LCD. This method is used to point out the exact location and is easy to avoid major accident.

In [3]the different techniques used in this paper for detection of crack are IR, Limit switch, Ultrasonic sensor. .All these sensor are interfaced with controller ARM7. LCD display is used to Display the all conditions that happen in railway tracks and also display distance. When the fault is detected the data is sent is to the control room.

In [4] the proposed system is used to detect various faults and its severity in the railway track. Image processing was done to detect vertical broken rail, horizontal split head and broken base. For the detection of crushed head and misalignment, ultrasonic sensor is employed and tested. Faulty area was determined with the help of vibration sensor. The type of fault with its severity was send to the control center using GSM module.

In [5]the suggested framework is an IoT-based solution that uses live video streaming to automatically locate a crack in the railway track. In this model, ultrasonic sensor for identifying cracks, GPS receiver for locationdetection, and GSM module for sending warningmessage to authorities, are used .The bot is operated remotely, and commands are used to monitor its movement. The bot cannot restart itself because it is controlled remotely.

3. Methodology

In the proposed System the rule associated with crack recognition is the idea of IR (HW-201). The IR transmitter will be connected to one side of the tracks, while the IR detector will be connected to the other. When there are no disruptions in normal operation, the transmitter light does not reflect on the receiver. Therefore, when the transmitter light falls on the recipient,it implies break is identified.

SIM800C is used for the communication purposes. It makes the proposed system wireless. Through GSM, data can be transferred anywhere throughout the world. GSM is connected with Raspberry pi 3 in order to receive and transmit the data to the user.

The working principle of ultrasonic sensor (HC-SR04) is similar to IR Sensor except an ultrasonic sensor provides distance between obstacle. It uses a trigger and echo pin to send and receive ultrasonic pulses. Based on the time taken to receive pulses and speed of sound in air, distance from the obstacle is calculated.

The vibration sensor is additionally called a piezoelectric sensor. These sensors are adaptable gadgets which are utilized for estimating different cycles. This sensor utilizes the piezoelectric impacts while estimating the progressions inside speed increase, pressure, temperature, power in any case strain by changing to an electrical charge.

The NEO-6M is a GPS module basically used for navigation and checks its area on earth thereafter , yields information about the longitude and scope of its position. With the power and signal indicators, one can monitor the status of the module.

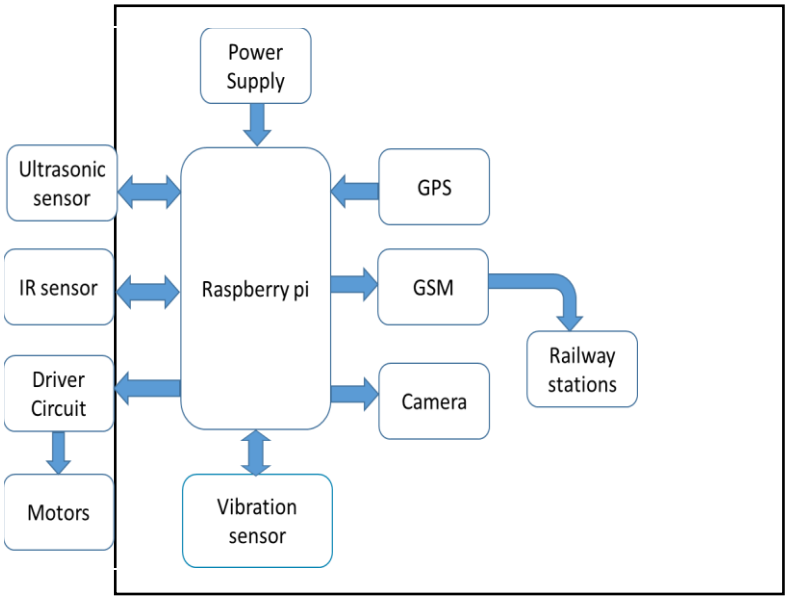

Fig 1

The Raspberry Pi 3 microcontroller used in the above image, serves as the operating unit for the other input and output devices connected to the Controller. The entire system will be placed on bot.The automaton was designed to self-configurate prior to the start of the railway line. The automaton waits for a time frame after configuration and then begins reading the spatial coordinate.The idea of this crack prediction model is that the intensity of light absorbed by the IR receiver is equal to the severity of the crack, i.e., when the transmitter absorbs optimum light, the crack depth is considerably higher.When the light from the sender does not reach the receiver during usual operation, the bot goes forward spontaneously. An emergency warning is sent when light from the transmitter departs from its direction due to the existence of a crack. The working principle of ultrasonic sensor is like IR Sensor except an ultrasonic sensor provides distance between obstacles. It uses a trigger and echo pin to send and receive ultrasonic pulses. Based on the time taken to receive pulses and speed of sound in air, distance from the obstacle is calculated. If the calculated value differs from the calibrated value an alert message will be initiate. When crack detection is necessary, the device employs a GPS receiver, which receives precise location data. A GSM modem is used by the device to transmit the received data to the relevant authority with the current location information. The L293D drives the dc motor which helps in the movement of the robot. From this information received necessary action can be taken.

4. Flowchart

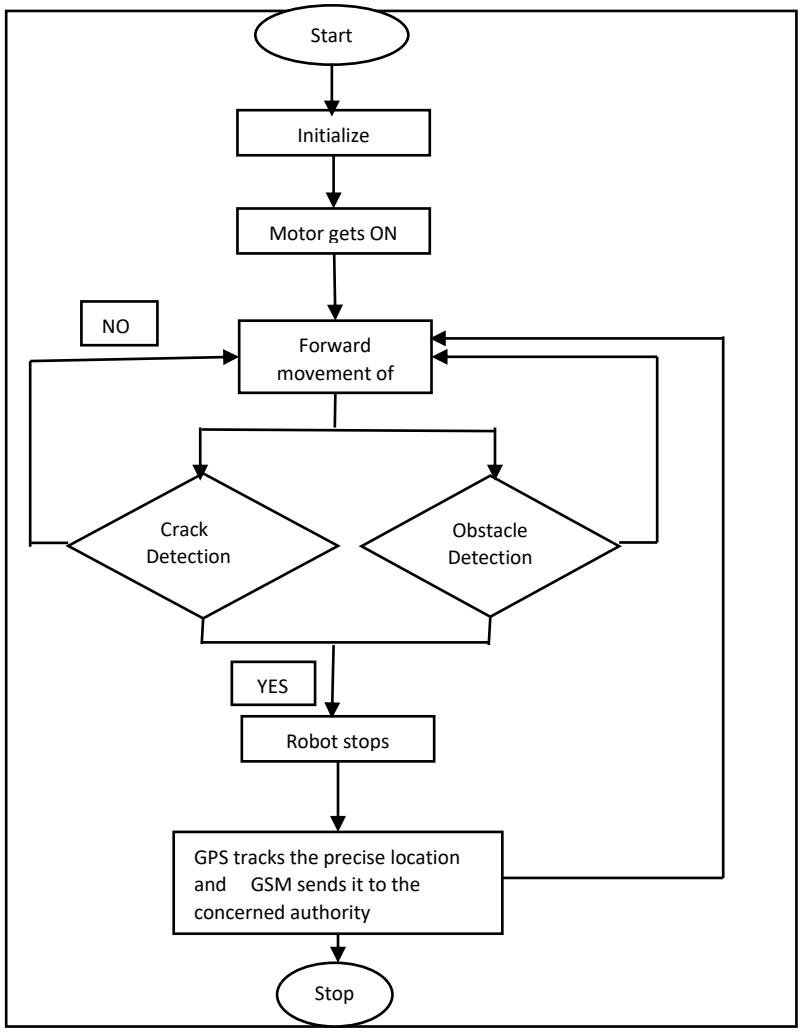

Fig 2

This structure serves as a link between two junctions that uses IR and UV sensors to detect track breaks and hindrances respectively. If a split or hurdles is detected, the respective sensors will send a signal to the Raspberry Pi, instructing it to enable the GPS beneficiary. The GPS system will stick point a certain location, which will then be relayed to the experts. When the Raspberry pi gets the sign, it will start the webcam which will give the live feed of the track.

5. Results and analysis

The screenshots below shows how the device works and how we are achieving proper results.

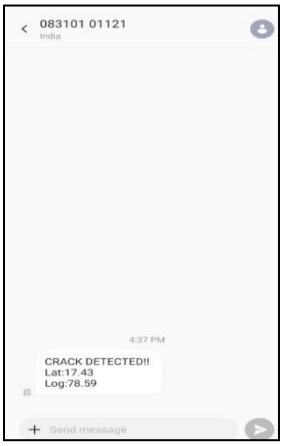

Fig 3

Whenever a crack and an obstacle is detected, an alert SMS is sent to the control section's registered number, as shown in fig.3 and fig4. The SMS contains the details about the crack and obstacle discovered.

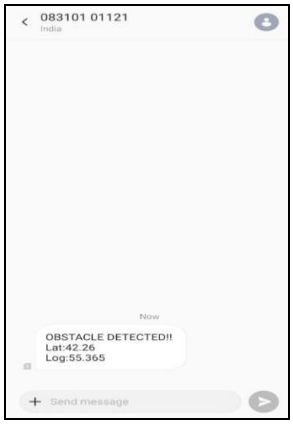

Fig 4

6. Conclusion

The above project idea is very useful for railway system and it saves the life of a human being. If any crack is detected, raspberry pi will initiatethe GSM and send a message to the concerned persons. And it will initiatethe camera,giving the live feed of thecrack detected. In future we may enhance this prototype service inside the trains like cleanness of trainsthe device affects train track control in a variety of ways. This device can be combined with a variety of other track tracking modules, such as washing, anomaly detecting, and so on, increasing the robot's autonomy and lowering manual errors. In difficult circumstances, the machine can easily reduce human labour while optimising performance. And above proposed work will also support the digital India concept.

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