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RAILWAY TRACK CRACK DETECTION

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Abstract –

The Indian Railways has one of the largest railway networks in the world, criss- crossing over 1,15,000km in distance, all over India. However, with regard to reliability and passenger safety Indian Railways is not up to global standards. Among other factors, cracks developed on the rails due to absence of timely detection and the associated maintenance possess serious questions on the security of operation of rail transport. A recent study revealed that over 25% of the track length is in need of replacement due to the development of cracks on it. Manual detection of tracks is cumbersome and not fully effective owing to much time consumption and requirement of skilled technicians.

This project work is aimed towards addressing the issue by developing an automatic railway track crack detection system. This work introduces a project that aims in designing robust railway crack detection scheme using Ultrasonic sensor assembly system which avoids the train accidents by detecting the cracks on railway tracks. And also capable of alerting the authorities in the form of SMS messages with GSM modules. It reduces human efforts due to automation. In the present of days, we are using the measurement of track distance by using high cost LVDT with less accuracy, but we use the less cost ultrasonic sensor for above process with high accuracy. The importance of this project is applicable both day and night time detection purpose. The advantages include less cost, low power consumption and less analysis time. By this proposed system the exact location of the faulty rail track can easily be located which will mended immediately so that many lives can be saved.

***Key Words*:** SMS, GSM Modules, LVDT, Ultrasonic sensor, Internet of things

1.INTRODUCTION

The Indian railway network is the fourth largest railway network in the world. Indian rail network is still on the growth trajectory trying to fuel the economic needs of our nation. Though rail transport in India growing at a rapid pace, the associated safety infrastructure facilities are still not up to the mark.

As a result, there have been frequent derailments that have resulted in severe loss of valuable human lives and property as well. On further analysis of the factors that cause these rail accidents, recent statistics reveal that approximately 60% of all the rail accidents have derailments as their cause, of which about 90% are due to gaps on the rails either due to natural causes (like excessive expansion due to heat) or due to antisocial elements. This project deals with one of the efficient methods to avoid train accidents.

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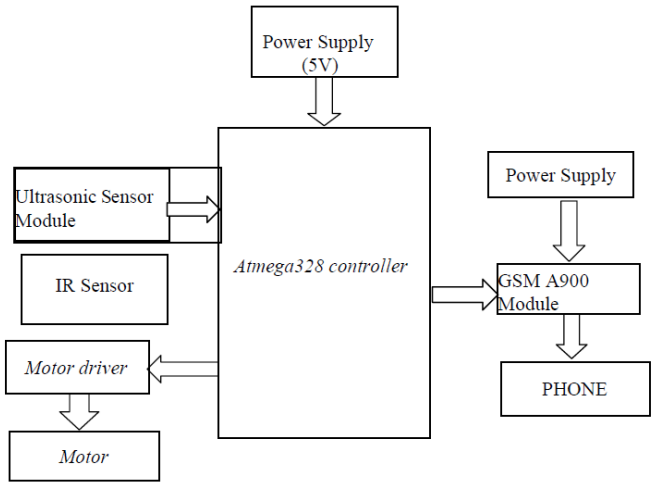
Transport is a key necessity for specialization that allows production and consumption of products to occur at different locations. Transport has throughout history been a spur to expansion as better transport leads to more trade. Economic prosperity has always been dependent on increasing the capacity and rationality of transport. But the infrastructure and operation of transport has a great impact on the land and is the largest drainer of energy, making transport sustainability and safety a major issue. In India, we find that rail transport occupies a prominent position in providing the necessary transport infrastructure to sustain and quench the ever-burgeoning needs of a rapidly growing economy. Today, India possesses the fourth largest railway network in the world. However, in terms of the reliability and safety parameters, we have not yet reached truly global standards.

2. LITERATURE SURVEY

Cracks in rails have been identified to be the main cause of derailments in the past, yet there have been no cheap automated solutions available for testing purposes. First LVDT was used instead of ultrasonic, but LVDT was costly and sensitive to temperature. Due to disadvantages of LVDT next it was implemented using IR [1]. IR sensor is sensitive to sunlight it supports shorter range and hence its performance degrades with longer distance [2]. In our project we used highly efficient ultrasonic sensor for crack detection.

3. PROPOSED SYSTEM

This system involves the design of crack finding robot for finding cracks in railway tracks. This system uses controller for interfacing the robotic vehicle and crack detection sensor. The sensing device senses the voltage variations from the crack sensor and then it gives the signal to the microcontroller. The microcontroller checks the voltage variations between measured value and threshold value and controls the robot according to it. The robotic model is interfaced with the microcontroller with the help of motor driver circuit. If any crack occurs in the rail, the robot will be stopped and then a SMS will be send.



In this system we are using Arduino Uno microcontroller, which acts as a brain of the system. This microcontroller controls the circuit function. Various components are interfaced with this microcontroller to perform desired operation of the system. The hardware components used in this system requires regulated power supply for the operation.

In this system we have interfaced two Ultrasonic sensors with the microcontroller for the distance and detection of the crack present in the track of the railway line. To communicate the received information, we used a GSM modem. It sends message when crack is detected along with the distance from where the vehicle started. So we get the distance at where the crack is located. The GSM send message to the control room. Immediate crack repairing can be done with this automatic vehicle.

Two DC motors are used to move the robot in forward direction. These motors are interfaced and controlled through the microcontroller with the help of driver circuit. We used L293D driver IC, it starts and stops the motor as and when required

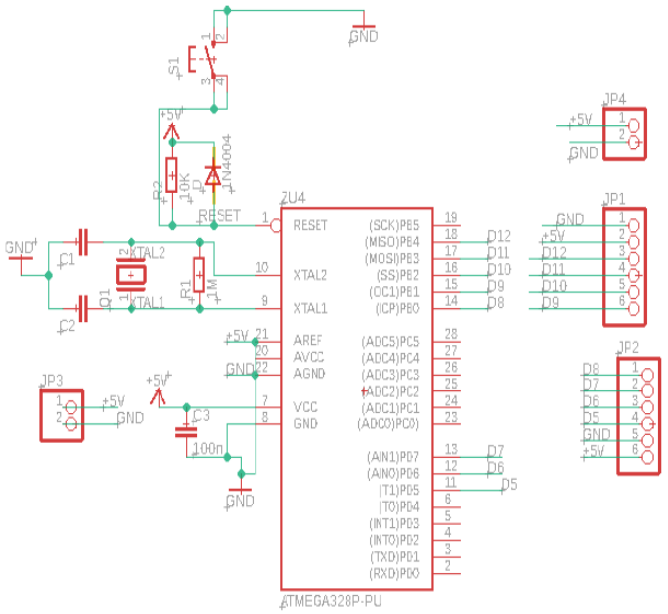


Figure 2: Circuit Diagram

The hardware is provided with a 240V power supply from source. This supply is converted into 5V for the controller IC. At this instant, the dc motors start rotating at 10 rpm initiating forward, movement of the vehicle. The GSM module is powered on by 12V. The ultrasonic sensor which is attached on one side of the vehicle, starts sensing and measuring the distance between the track and the sensor. If this distance is greater than the threshold value set for the sensor, crack is detected. At this point, the vehicle stops for a brief period of time. During this time, the controller signals crack detected through the GSM module.

After the message is received by the concerned authority, the motor starts again and moves the robot in forward direction. If there is no crack detected, that means the distance between the sensor and the track is below or equal to the threshold value set, the vehicle continues to move along the track.

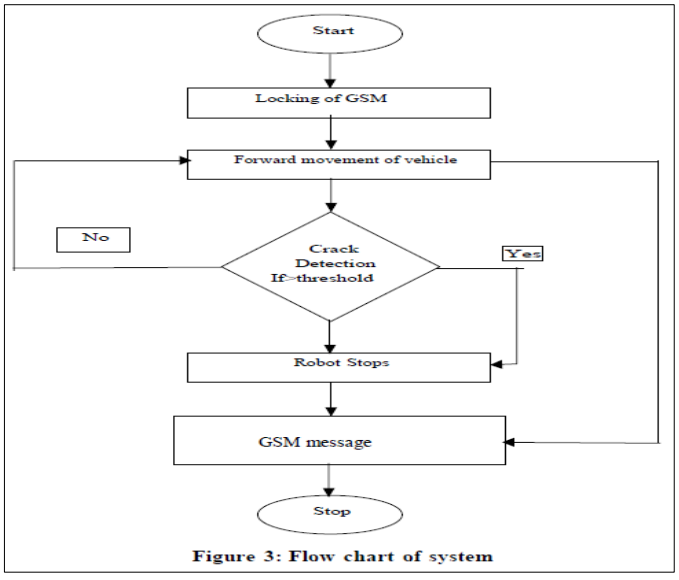


Figure 3: Flow chart of system

4. CONCLUSIONS

By using this automatic vehicle for purpose of railway track inspection and crack detection, it will have a great impact in the maintenance of the tracks which will help in preventing train accidents to a very large extent. The regions where manual inspection is not possible, like in deep coal mines, mountain regions and dense thick forest regions can be easily done using this vehicle. By using this vehicle for the purpose of railway track inspection and crack detection and automated SMS will be sent to pre-defined phone number whenever the vehicle sensors detect any crack or deformation.

This will help in maintenance and monitoring the condition of railway tracks without any errors and thereby maintaining the tracks in good condition, preventing train accidents to very large extent railway track crack detection autonomous vehicle is designed in such a way that it detects the cracks or deformities on the track which when rectified in time will reduce train accidents.

4. FUTURE SCOPE

Although work can be done in order to provide a better speed to the automated vehicle robot. Also, enhancement can be done to get better accuracy about the location of the place where the fault had occurred. Also, the robot can be made large so that by using its weight track shiftiness i.e. stress and strain parameters of the track can be determined so as to make this system more effective.

A Zigbee module can also be incorporated for low-cost short distance scrutinizing mechanism in order to provide good connectivity at a low input cost. It can be powered using Solar Supply. As solar energy is green and can available widely.

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