

# Railway Track Structural Health Analyzing System

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**Abstract**—Most of the transportation and commercial activities are carried by railway network. Any trouble in this transportation increases crucial damage to the society also loss of human life. In general railway system to operate flawlessly constant monitoring of railway tracks, obstacle detection on the railway tracks and proper railway gate opening and closing without error is required. Currently railway track monitoring, obstacle detection and railway gate opening and closing is all done manually which is time consuming and not accurate, which involves high human errors. The monitoring process involves time and manpower for thousands of miles. Our proposed system is designed for continuous monitoring of railway track for crack detection and obstacles at the railway tracks using a combination of sensors. These sensors collect data and through computational false analysis the crack and obstacles are identified at the railway track. The collected data can help in finding the crack and obstacle at the railway track and avoid the major accidents of railway. In addition to it this prototype also provides an automated gate opening and closing system. This system saves time and is designed with low cost.

**Keywords**- Microcontroller, IR sensor, ultrasonic sensor, Proximity sensor, GSM.

## I. INTRODUCTION

Railways being the largest cheapest mode of public transportation, still it is most safe and easy way of transport. On average more than 10 million people use the railway services annually. Railway is facing major challenges in its operation. In recent days due to increase in railway traffic a large number of accidents are happening due to the crack on the track, obstacles on the track, so it is necessary to implement an automated system that will overcome the human errors and overcome the railway accidents. This automated system will help in saving the human life from accidents.

This project aims at the development of a prototype which consists of railway track object detection in railways crack detection, automatic opening and closing of railway gate and to implement at a minimized cost.

## II. RESEARCH BACKGROUND

G Kohila Warnan al., [1], in their work introduced the Prevention of Train Accidents using Android supported Embedded Systems. This paper presented a new technology with the embedded systems. For obstacle detection to prevent

the accidents the ultrasonic module is incorporated. The proposed system would overcome the existing wireless sensors based Anti- Collision Device (ACD).

Rajesh L V al., [2], in their work introduced the Crack Detection and Collision Avoidance in Railway using arm cortex this paper utilizes the benefits of embedded system and sensors to replace traditional crack detection system. Detecting crack and collision avoidance will be analyzed in the simulation platform using embedded system. We have opted GSM and GPS technology.

Fathima Imdad al., [3], in their work introduced the Railway Track Structural Health Monitoring System This paper presents a prototype for monitoring the structural health of the railway tracks. The prototype is still under development with many new sensors to be incorporated for efficient study and monitoring of railway tracks. We plan on incorporating an IR module

Karthik Krishnamurthy, Monica Bobby al....,[4], in their work introduced the Sensor based automatic control of railway gates. This paper presents Automatic railway gate control system is centered on the idea of reducing human involvement for closing and opening the railway gate which allows and prevents cars and humans from crossing railway tracks.

## III. DEVELOPMENT MODEL

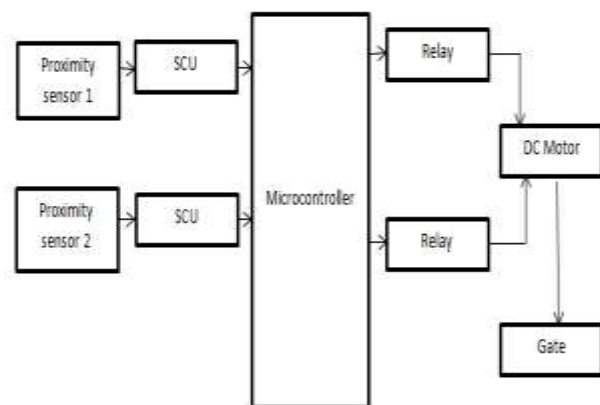


Fig 1: Block Diagram of Automatic Gate System

## DESCRIPTION

Automatic control of Railway Gate, Using simple electronic components, we have tried to automate the control of railway gates. As a train approaches the railway crossing from either side, the sensors placed at a certain distance from the gate detects the approaching train and accordingly controls the operation of the gate.

Sensors are fixed at 1km on both sides of the gate. We call the sensor along the train direction as 'foreside sensor' and the other as 'after side sensor'.

When foreside receiver gets activated, the gate motor is turned on in one direction and the gate is closed and stays closed until the train crosses the gate and reaches after side sensors. When after side receiver gets activated motor turns in opposite direction and gate opens and motor stops. Buzzer will immediately sound at the fore side receiver activation and gate will close after 5 seconds, so giving time to drivers to clear gate area in order to avoid trapping between the gates and stop sound after the train has crossed.

The gate opening and closing can be done with the help of DC motor by the specific instruction of microcontroller.

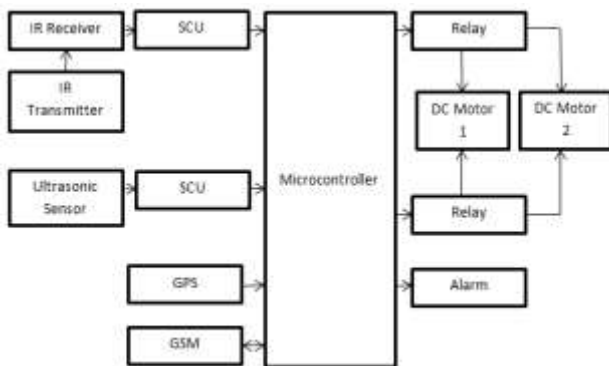


Fig 2: Block Diagram of Railway Track Crack and Obstacle Detection

## DESCRIPTION

The above block diagram shows the operation of railway track crack and obstacle detection. IR sensors used to detect the crack in railway track. Two IR sensors are fixed in front of the train is used to find out the crack on the rail. Each sensor will produce the signal related position with the rail. Infrared (IR) transmitter is one type of LED which emits infrared rays generally called as IR transmitter. Similarly, IR Receiver is used to receive the IR rays transmitted both IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other.

If the track is normal on its position both the sensor gives the constant Sensed output. If anyone misses their

output condition to fail then there is defect on that side. It will inform this by giving alarm

The GPS module is being used to send the current latitude and longitude data to the relevant authority as an SMS through GSM. The importance of this project is applicable both day & night time detection process.

The ultrasonic sensor is used to sense the obstacle in front of the train. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

## IV. METHODOLOGY

Techniques and methods involved in the proposed system include:

### Railway track crack detection system

This module is used to overcome the disaster from railway track crack using a processor and the IR sensor. Four wheel robot which contains DC motors are placed on tracks. Robot consisting of the microcontroller and IR sensor. IR sensor are having both transmitter and receiver module. Both the transmitter and the receiver must be placed at certain angle, so that detection of the object happens properly. The module involves transmitting message through GSM once it detects the crack and sends it to the higher authority for further proceeding.

### Obstacle Detection

This module is designed to avoid accidents due to the presence of the obstacles. To detect obstacle on the track the proposed system consists of a ultrasonic sensor which generates high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

### Automatic railway gate control system

The module is designed using microcontroller to avoid railway accidents happening at unattended railway gates. This project utilizes two powerful proximity sensors, which is used to control the railway gate automatically. An alarm is set before the train arrival which will automatically alerts the public and shuts the railway gate.

This project aims at the development of a prototype which consists of railway track crack detection, automatic opening and closing of railway gate and also to implement object detection in railways at a minimized cost.

### GSM and GPS technique

This crack detection and collision take the

opportunity of GSM and GPS techniques. Any abnormalities happened over the track will get the pulse and immediately GPS gets the exact location of the abnormality and sends it to the higher authorities ,engine drivers and nearby stations in the form of message through GSM . The message can be either the crack found on the track or the obstacle found on it but the exact location of any is given in the message.

V. FLOWCHART

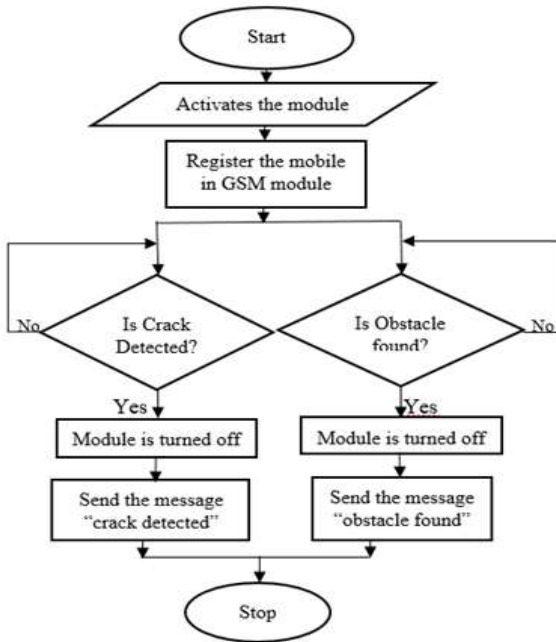


Fig 3: Flowchart for Railway Track Crack and Obstacle Detection

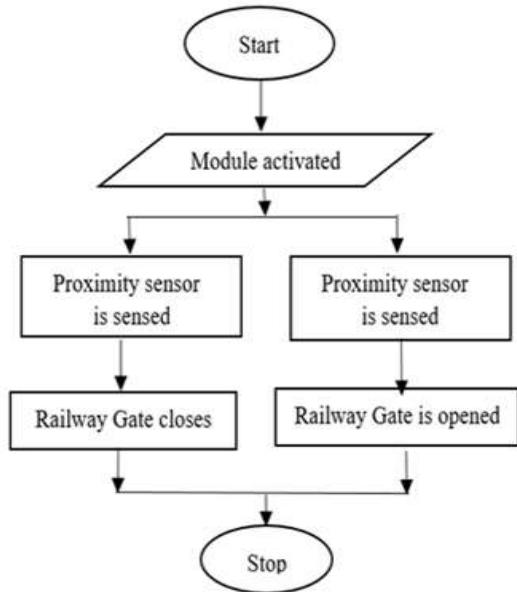


Fig 4: Flowchart for Automatic Railway Gate System

VI. CONCLUSION

This project presents a prototype for the automatic monitoring of the railway track for the cracks and obstacle on it; also it includes the automatic operation of gate. The prototype contains a four-wheel trolley which is shown as a train which contains sensors that continuously senses the track for the cracks and obstacles on it and finds the exact fault location in rail track and which will takes the remedy action immediately so that time many people lives can be saved. Also, a sensor is used to detect the arrival of the train kilometers ahead and passes a message in the form of an alarm at the crossing. Then after a delay the railway gate closes automatically and after the train passes automatically the railway gate is opened. This prototype is used for the safety of railways at the low cost and can be implemented in the real time. Hence it is expected that, major train mishaps can be prevented and human life saved if this system is implemented.

REFERENCES

- [1]. G. Kohila Warnan and R. Balamurugan, "Prevention of Train Accidents using Android supported Embedded Systems", Indian Journal of Science and Technology 2016.
- [2]. Rajesh L V, Manjunath G Asuti and Mukunda Swamy M S, "Crack Detection and Collision Avoidance in Railway using ARM CORTEX", IRF International conference 2016.
- [3]. Pranav Lad and Mansi Pawar, "Evolution of Railway Track Crack Detection System", Robotics and Manufacturing Automation(ROMA), 2<sup>nd</sup> IEEE international symposium, 2016.
- [4]. Fatima Imdad, Muhammad Tabish Niaz and Hyung Seok Kim, "Railway Track Structural Health Monitoring System", 15th International Conference on Control, Automation and Systems 2015.
- [5]. Karthik Krishnamurthi, Monica Bobby, Vidya V and Edwin Baby, "Sensor based automatic control of railway gates" International Journal of Advanced Research in Computer Engineering & Technology 2015.