

DESIGN OF RAILWAY TRACK BREAK DETECTION WITH OBSTACLE DETECTION AND ALERT THROUGH IOT

Shaikh Afsar Jahan Gulam Husain¹, Mayuri kaluram Lahange², Mansi Santosh Duggelwar³

Prof. N. A. Amodkar⁴

¹ Student, Electrical Department, Sandip Institute of Technology and Research Center, Maharashtra, India

² Student, Electrical Department, Sandip Institute of Technology and Research Center, Maharashtra, India

³ Student, Electrical Department, Sandip Institute of Technology and Research Center, Maharashtra, India

⁴ Professor, Electrical Department, Sandip Institute of Technology and Research Center, Maharashtra, India

ABSTRACT

As the track forms the backbone of the railway transportation system, it must be maintained properly. Any break or crack in the track poses a serious risk of accidents. Given that railways are the primary mode of transportation in India, train accidents can lead to significant loss of human life and property damage. Therefore, there is a need for a system to be designed that can monitor the track for obstacles, cracks, or breaks. To address this need, a battery-operated robot will be deployed on the tracks. This robotic vehicle will travel along the track, inspecting for any signs of damage or obstacles. The robot will transmit the location coordinates and the status of any faults or obstacles detected to a web server. This information, including the robot's location, will be accessible through an IoT webpage. Consequently, trains operating on that particular track can be halted, and immediate maintenance can be carried out. To implement this system, IR sensors will be utilized for crack detection, ultrasonic sensors for obstacle detection, and a GPS module for obtaining location coordinates. These components will be integrated with an Arduino Uno board. The robot will be powered by DC motors, and the entire vehicle will be powered by a 12V sealed lead-acid battery.

Keyword: - Automation, IOT, Transportation, Railway track

1. INTRODUCTION

The Indian railway network, as the largest in Asia and second-largest globally, operates under a unified management system, serving as a lifeline for transportation due to its capacity, speed, and reliability. Given its pivotal role in facilitating economic growth and social connectivity, even minor advancements within this sector can yield significant benefits for national development.

However, the sheer magnitude of this railway system presents formidable challenges in ensuring timely monitoring and maintenance of its tracks. Neglecting these crucial tasks can have dire consequences, with potential accidents resulting from track defects such as cracks. As such, the detection and rectification of such faults are paramount to ensuring the safety and efficiency of railway operations. Rail transport, being a cornerstone of many nations' economies, provides an efficient mode of land-based transportation for goods and passengers alike. The infrastructure supporting railway tracks is engineered to provide smooth, durable surfaces, minimizing friction and evenly distributing the weight of passing trains. However, the increasing demands placed on these tracks, including higher speeds, heavier loads, and greater traffic volumes, have intensified the need for rigorous inspection and maintenance protocols. Despite substantial investments in maintenance efforts, safety records within the railway industry have not shown commensurate improvements. Current fault detection and maintenance procedures rely heavily on manual labor, which is not only labor-intensive but also prone to human error. To address these shortcomings, innovative solutions are necessary.

In response to these challenges, a real-time fault observation system leveraging microcontroller technology is proposed. This system offers a cost-effective and robust approach to track monitoring and maintenance. Sensing modules strategically positioned along the tracks provide continuous data on track conditions. These modules transmit data to a central microcontroller-based control unit, which processes the information to identify potential

faults or abnormalities. By implementing a proactive approach to continuous monitoring and evaluation, this system aims to enhance safety standards within the railway industry. Such advancements not only mitigate the risk of accidents but also safeguard the lives and assets of passengers and railway personnel alike. Moreover, by optimizing maintenance efforts and minimizing downtime, this innovative solution contributes to the overall efficiency and reliability of railway operations, further solidifying the role of railways as a cornerstone of modern transportation infrastructure.

2. LITERATURE SURVEY

2.1 Advanced Automatic Detection of Cracks in Railway Tracks[1]

The main objective of this paper is to detect fault in track. At this point the microcontroller is connected with the Robot, ZigBee, GPS, LCD and crack sensor. The controller confirms the voltage difference of the calculated assessment with the threshold rate. If the controller perceives the split, it instantly gets the position in sequence via global positioning system and sends that location and crack in order to the control division. The control section displays the location in map. The LCD is used to show the current condition of this structure. This method is used to point out the exact location and is easy to avoid major accident. It reduces human interference and has high efficiency.

2.2 A Survey on Crack Detection Technique in Railway Track[2]

Author says human inspections are done periodically. But it needs skilled persons walk through the track for inspection. It takes much time. In order to overcome these situations a visual inspection system (VIS) is proposed. We propose a visual based crack detection system that provides accurate result than other existing systems. It makes the things smooth and fast. This system use images captured by a digital scan line camera. VIS provide better performance and quality based on the capturing device. The digital data is preprocessed and then it cut the track images into sub images using some track extraction algorithm. The image contrast can be enhanced using Otsu method for analysis and then crack is identified if any in the track. This system automatically detect crack and generate appropriate warning to nearest station to avoid risk of accidents. This system doesn't disturb the running of train while the system is working.

2.3 Railway Track Fault Finding Robot [3]

In the proposed system ultrasonic sensor is attached in the train path. In this project, automatic accident preventing system for train is designed. The ultrasonic sensors are used to detect the obstacles in the train path. The module can easily be interfaced to micro controllers where the triggering and measurement can be done using two pins. If any obstacles are found in the path of the train the message will be conveyed to the monitoring unit of the train

2.4 Railway Track Fault Finding Robot [4]

In this we design a robot which can help to detect the faults in railway track, whether it is crack in track or the slipper misplace. There is transmitter and receiver side of the system. In transmitter side the robot is run on the track and finds the faults and send signal to receiver side through ZIGBEE and show its distance from source station using ultrasonic module [4]. At receiver side when this signal is received the message is displayed on LCD and the siren is ring. In our design we detect two faults on railway track, and when the first fault is occur then “ Fault occur at 200m ” it will display on the LCD screen. For second fault “Fault occur at 400m” it displays” on LCD screen. After crack is detected robot will continue moving on track without any stop. This system reduces the work of railway worker and increase the accuracy also it prevent from accidents.

2.5 Automatic Rail Fault Track Detection for Indian Railways [5]

The fault detection and maintenance in Indian railway is being carried out manually now a days, which is a tedious task. A real time fault observation system based on microcontroller is proposed in this paper which is capable of tackling the demerits of manual monitoring and maintenance process. The proposed system is cost effective and sturdy. The sensing modules are placed on the outer surfaces of the tracks alternatively and equidistantly. The outputs from independent modules attached to the microcontroller based control module which will further process the signals and evaluates whether any rail fault existing. .The effective methodology of continuous observation and assessment of track conditions might facilitate to eliminate accidents and to save lots of life and assets of the people.

3. NEED OF PROJECT

Since track is the major component for railway transportation system, it needs to be proper and maintained. Any break or crack in track will cause to accident. Since railways are the major transportation method in India, train accident will cause huge damage to the humane life and collateral. So to avoid this, a system need to be design, which will monitor obstacles on track and crack or break in track.

4. OBJECTIVES OF PROJECT

In this project we aimed to monitor railway track and detect any crack in track or obstacle on track so that alert signal can be generated to avoid accidents. Major objectives of our project are:

- To avoid accidents & identify need of maintenance
- To reduce manpower for track surveillance.
- To identify the obstacles on automatic railway gate.
- To detect cracks or break of railway track.
- To generate immediate alert in critical situations like obstacle on track and crack in track.
- To show all the parameters & alert on webpage so signals can be received from anywhere in the world.

5. BLOCK DIAGRAM

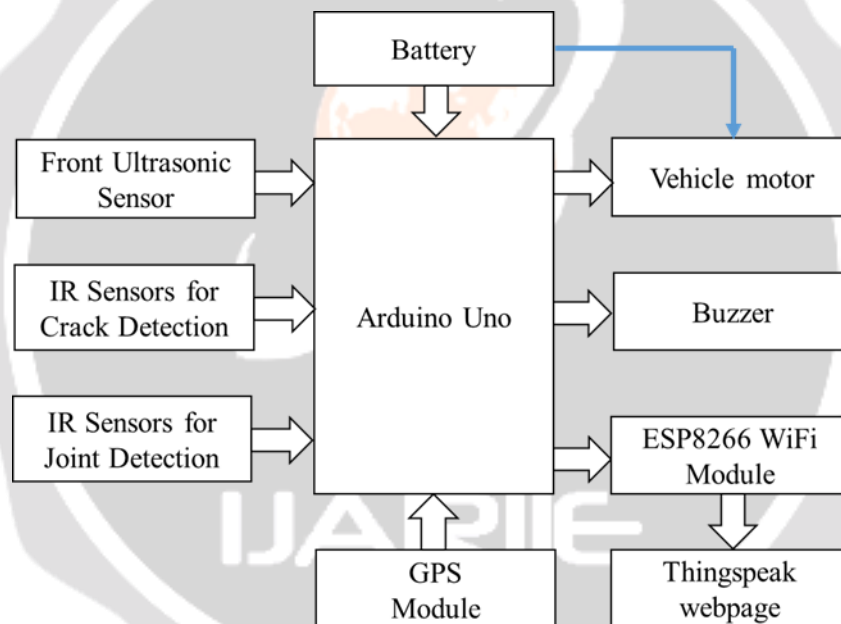


Fig -1: Block Diagram of System

6. CONNECTION DIAGRAM

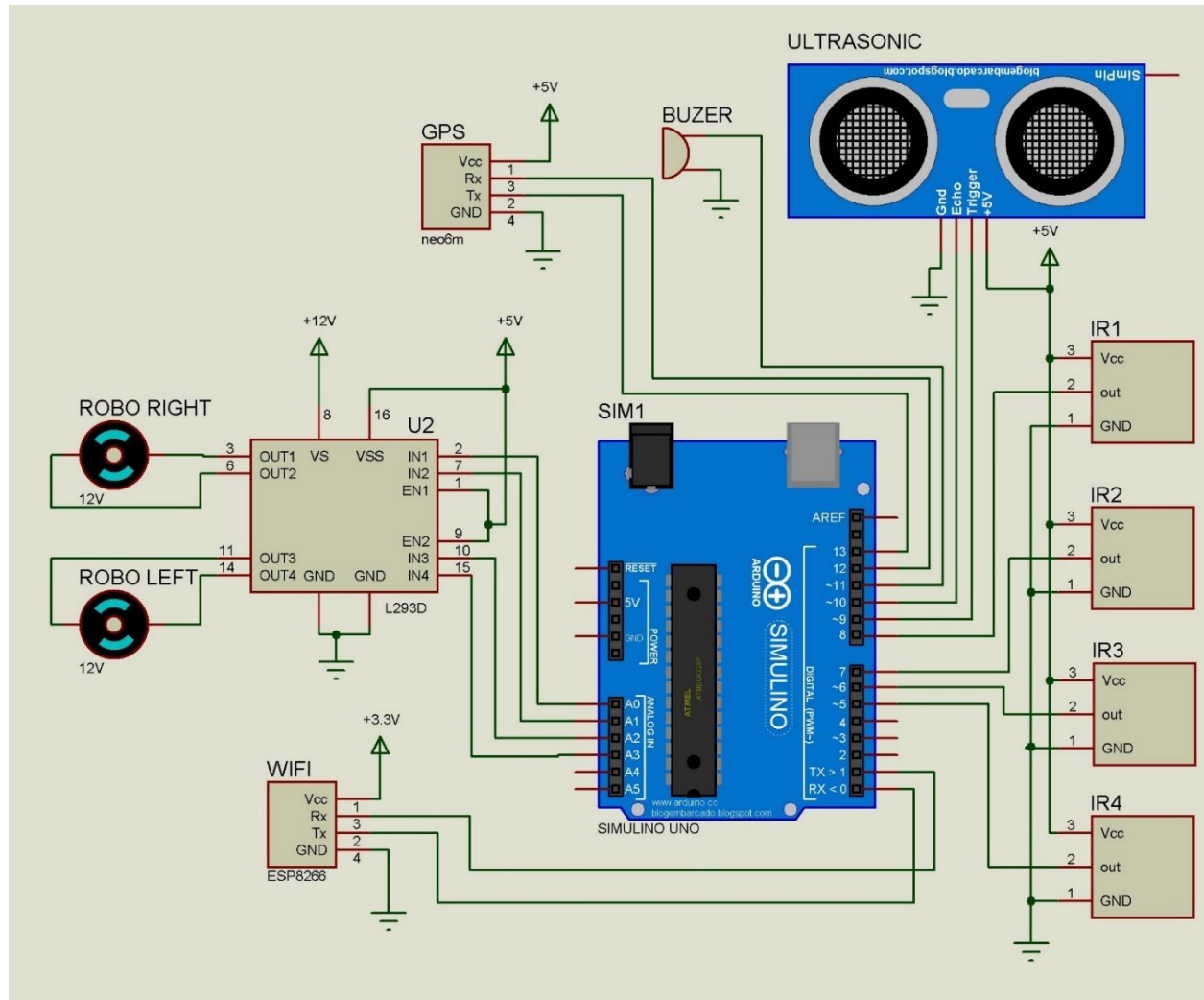


Fig -2: Connection Diagram

7. RESULTS

As per the results of system, time required to upload data on varies with internet connection speed and network. But most of the time its minimum 15 seconds which is the limitation of ThingSpeak server.

GPS module neo6m provides very fast location update. But its location accuracy observed is within 15 meter radius. GPS provides most accurate readings with accuracy of less than 5meters when tested in open environment. But it loses accuracy when vehicle is not in open environment. This situation can be avoided by using the better antenna for module.

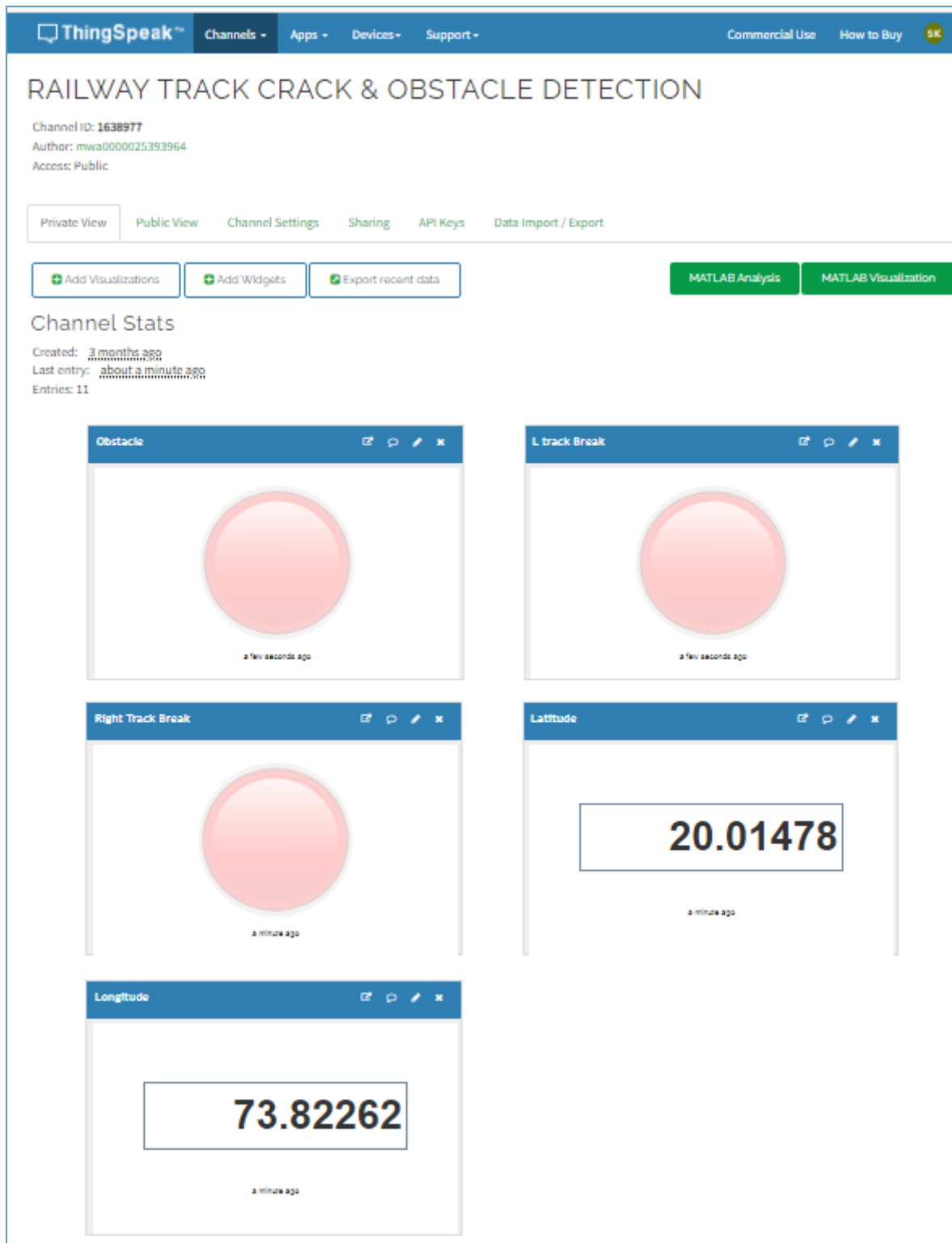


Fig -3: Screenshot of Webpage Result

8. CONCLUSION

We believe that track are the lifeline of railway transportation system and it need to be maintained. Whereas manual maintenance takes long time and also can cause the error, automation for railway track crack detection is important.

In this project, we studied the ground situation and understood the importance of track maintenance. On the bases of this we decided the specifications of system.

Though the project sounds good, there is always scope in future for increasing the accuracy and reliability. In this project, we are using and Ultrasonic sensors & IR sensor for detecting the cracks and obstacles in track. In future, we will also using the CCTV systems with IP based camera for monitoring the visual videos captured from the track

9. REFERENCES

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