ISSN:2229-6107

INTERNATIONAL JOURNAL OF PURE AND APPLIED SCIENCE & TECHNOLOGY

E-mail :
editor.ijpast@gmail.com
editor@ijpast.in

www.ijpast.in

INTERNATIONAL JOURNAL OF PURE AND APPLIED SCIENCE & TECHNOLOGY
IJPAST

ISSN :2229-6107
www.ijpast.in
Vol 13,Issue 3.Aug 2023

RAILWAY LINE CRACK DETECTION SYSTEM USING ESP32

PRANEETHA CHINNOLLA M.Tech Student Mrs. JYOTHI LAVUDYA Assistant Professor

I. ABSTRACT

China's high-speed rail system has seen unprecedented growth, and the monitoring of its safety has emerged as a key area of study. Since ancient times, man has devised several strategies to keep himself safe from disasters of the natural world. Predicting, detecting, and avoiding natural disasters by the use of cutting-edge technology is the only scientific response. Many people have been killed by landslides along the section of the Konkan railway line that is particularly vulnerable to such disasters. The current manual detecting systems set up along this railway are far beyond their prime and need to be replaced. Railway defect detection systems in Russia must meet demanding standards as the country expands its high-speed rail network. The assessment of the dynamic interaction between the rail car and the railway is where those needs really shine. Everything is managed by a Raspberry Pi. The system is based on the idea of Internet of Things. The current position may be tracked through the GPS Module. Current methods of inspecting and keeping tabs on railway lines are labor-intensive, error-prone, and inefficient. In addition, the railway track runs for hundreds of kilometers, making it almost difficult to check and monitor manually. We suggest a prototype system to prevent this from happening, one that uses many sensors to keep an eye on train lines around the clock. Railway track problems may be detected thanks to the data collected by these sensors and analyzed computationally. By analyzing the data, potentially fatal track defects may be identified and prevented.

II. INTRODUCTION

The primary objective of this project is to create an infrared-based, automatically operating rail crack detection system, with on-board robot circuitry capable of using obstacle detection in concept using an infrared LED and a photodiode. In this suggested project system employing infrared technology, where the hardware & software produced may collect the live data of number of crack & the moment at which the fracture is discovered. A message may be sent to the main office through the IOT module as soon as the infrared module detects the specific position of the fracture. This unit has two DC motors for transporting the robot along the rails. This has a low impact on the budget while yet contributing to the overall system's effectiveness. Information on the instantaneous crack is being sent straight to headquarters.

praneethachinnolla@gmail.com [1] jyothijntuh@gmail.com[2]
HOLY MARY INSTITUTE OF TECHNOLOGY AND SCIENCE(UGC AUTONOMOUS)

ISSN :2229-6107
www.ijpast.in
Vol 13,Issue 3.Aug 2023

III. LITERATURE SURVEY

In modern world, passengers may choose from a wide range of transportation options, as stated by Karthick et al. [1]. They feel safer using public transportation, thus they choose bus and rail rides. At the same time, safety procedures are double-checked by inspectors from the transportation department. Railroads could employ the recommended device to discover flaws in the track before they generate substantial delays. The study recommends installing a sensor in the train to check for damage. At the point where the rails have been cut, the train will come to a stop, and the control center will be updated on its precise position. Second, the engine will automatically apply the brakes and halt after a certain distance if a collision between two trains traveling in opposing directions on the same track is imminent. Several lives are lost whenever a train derails. The proposed system employs Bluetooth technology to improve railway safety. A Bluetooth receiver is installed at the front of each locomotive. The signal is cut, the engine driver is notified, and the

opposing track's emergency brake is deployed if the train starts to derail. The initiative's principal focus is on eliminating or greatly reducing electrical railway accidents.

Lad, et al. [2] This research developed ultrasonic fracture detection technology and full station integration for use in a real-time railway track geometry monitoring system. The system's two-way communicative GPS component, GSM modem, infrared (IR), and PIR (passive infrared) sensors can detect and identify any living being crossing the tracks. The problem spot is located with the help of the GSM modem and GPS module, and the geometric parameters of the region are sent to the subsequent stop along the train's route for further examination. This study also details the potential integration of ultrasonic non-destructive testing (NDT) with WSNs for real-time monitoring and documentation of the material's improved performance. Human patrols along the route are unneeded because to the passive infrared (PIR) sensor's ability to detect movement and live creatures. This could do its job well both during the day and at night. The price of wireless material scanning in real

time will decrease as more and more cutting-edge and widely utilized applications emerge that integrate WSN with NDT technologies.

Paul and the rest [3] No of the distance, using a train is the most cost- and time-effective alternative. Because of this, the transportation needs of the whole nation of India may be met by the country's extensive railway network. Unseen faults in Indian rails and hazard at railway crossings are constant threats. Cracked rails are a significant cause in over 60% of accidents that take place at railroad crossings, resulting in human suffering and financial losses. Therefore, cutting-edge instruments for damage monitoring on railway lines and precise item tagging are required. This research gives valuable information for designing a system that can detect both foreign objects on the tracks and technical problems. This research utilizes a GPS monitoring system, a WIFI module, and location-specific alarm signals to explore the detection of railway track fractures using image processing. There is a Raspberry Pi 3 computer in charge of coordinating the various parts. Navaraja suggests installing Internet of Things sensors along train lines to check for damage and predict potential derailments. [4] We pioneered the use of a combined ultrasonic and total station to precisely measure the length of a railroad line. This study investigates the use of infrared (IR) and passive infrared (PIR) sensors for communication purposes, fracture diagnostics, and human presence detection along railroad tracks. Using the GPS module and the GSM modem, we can pinpoint the nearest station and send the rails' geometry for fracture analysis. This method utilizes a low-cost and dependable ultrasonic sensor, as opposed to our present method of using an expensive LVDT with mediocre accuracy. We followed the trend in recent software advancements toward using passive infrared (PIR) sensors to detect the presence of humans. The impact of this effort might be felt at any time of day or night.

Kumar, M., et al. [5] You no doubt already know that the majority of people use the train since it is both fast and cheap. Faulty equipment or neglected rails are only two examples of the many apparently minor reasons that may be traced back to a larger disaster. In-depth checks can ensure the security of rail travel. Better security and more thorough checks are possible with a reliable crack detection system. Humans do frequent checks. In order to ensure the rail line's security, trained personnel must physically examine the whole route. Time is of the essence. To visually inspect for issues and address them, we propose a VIS. We

provide a method for visual fracture identification that is more accurate than existing methods. It simplifies operations and reduces wasted time. In this system, pictures are captured using a digital scan line camera. Depending on the technology used, VIS may provide superior functionality and image quality compared to other capturing techniques. Before tracks can be extracted from the photos, the digital data must be processed. The Otsu analysis approach increases contrast, which aids in the detection of audio disruptions. This system's capacity to

identify breakage and instantly warn the next station greatly reduces the risk of injuries occurring. This device is completely silent when in use on a moving train.

Experts in the field who have worked extensively with [6]. Everything from buildings and bridges to roads and pavement to railway tracks and automobiles and even airplanes may develop cracks in the real world. Cracks in civil infrastructure lower the asset's value, hence assessing their severity is crucial. Quantitative crack identification and categorization methods are crucial for determining the severity of a fracture. Length, breadth, and even surface area are just some of the measurements that might shift. With the fast development of technology, the number of scientific photographs taken has expanded tremendously. Automatic fracture diagnosis and classification systems are very useful for civil infrastructure. This essay aims to do three main things: Crack detection and classification algorithms evaluation based on crack types

(ii) Conducting a search for discrepancies with Otsu's based thresholding method. Building the proposed setup (iii).

Thendral clan or group. [7] Improved safety and more thorough inspections would result from a more effective approach of detecting fractures in railway rails. In this article, we provide a computer-vision-based method for automatically detecting fractures in railway tracks. A camera attached to the bottom of a rolling autonomous car provides the system with images as it travels.

ISSN :2229-6107
www.ijpast.in
Vol 13,Issuse 3.Aug 2023

Images from both broken and intact cameras are considered. Afterwards, the Gabor transform is applied to the data. The Gabor magnitude picture is used to obtain first-order statistical properties. The characteristics are then sent into a deep learning neural network, which uses them to determine which parts of the music are cracked and which are not. The proposed method yields pictures with an average accuracy of 1.5%.

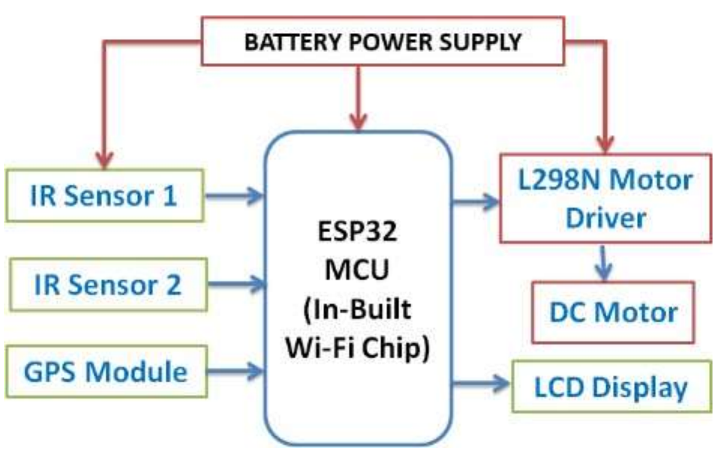
IV. EXISTING METHOD:

Visual inspection, live video, eddy current, and magnetic fields are some of the current technologies used to identify track fractures. One of the earliest techniques involves a human visually inspecting the parts. Despite its poor return on investment, this strategy is popular in India. A webcam overlooks the track during live video broadcasting. Unfortunately, this expensive technology cannot detect even the tiniest hairline fractures. The eddy current approach, which involves forcing a current that flows through the track in order to identify defects, is unreliable. All of these methods require substantial amounts of time and computing power, which slow down the robot and makes it more difficult to control.

V. PROPOSED METHOD:

The suggested approach is an improvement over the current system in terms of incorrect track detection. The suggested system utilizes an ESP32 board. The ESP32 is an open-source IDE that considerably reduced the complexity of the programming. The suggested method uses an infrared (IR) sensor to identify any visible cracks. The DC motors are powered by the motor driver L293D. The sensor outputs are managed by the ESP32 controller, and data is sent through Wi-Fi. Using the GPS module, the precise longitude and latitude of the off-kilter track may be determined. This device is so sensitive that it can even identify tiny flaws that are invisible to the human eye. Therefore, the suggested approach is both effective and economical.

SYSTEM DESCRIPTION:



ISSN :2229-6107
www.ijpast.in
Vol 13,Issue 3.Aug 2023

Hardware:

- ESP32 MCU
- IR Sensors
- GPS Module
- LCD Display
- L298N Motor Driver
- DC Motors

Software:

- Arduino / Thonny IDE
- Embedded C/Micro Python Programming Language

VI. CONCLUSION & FUTURE SCOPE

The suggested technology can identify rail flaws and potential obstructions. Low cost, low consumption of electricity, The proposed system has several advantages over current detection techniques, including a faster detection technology that requires no human contact and less time spent on processing. With this approach, we can easily prevent railway accidents and derailments, saving many lives in the process.

VII. REFERENCES

[1] Er.Kunduru Umamaheswari and Er.Polepogu Rajesh, " An Arduino based Method for Detecting Cracks and Obstacles in Railway Tracks" International Journal of Electronics, Electrical and Computational System ISSN 2348-117X Volume 6, Issue 4 April 2017.

[2] N.Karthick, R.Nagarajan, S.Suresh and R.Prabhu, "Implementation of Railway Track Crack Detection and Protection" International Journal Of Engineering And Computer Science ISSN: 2319-7242 Volume 6 Issue 5 May 2017.

[3] Mr Shridhar Doddmani, "An Inspection System for Detection of Cracks on the Railway Track using a Mobile Robot" International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Vol. 4 Issue 05, May2015.

[4] K.S Vidhya, M. Lavanya, A. Abinayapriya, S. Kaaviya, R.Saravanan, C.Sivapragash, " An approach with sensor for real time railway track surveillance system" International conference on breakthrough in engineering, Science & Technology– 2016 (INC-BEST'16).

[5] P.Sureshpandiarajan, S.Nithya, P.Sathya and S.Pradeepa "A nondestructive sensing robot for crack detection and deck maintenance "International Journal for Research in Applied Science & Engineering Technology ISSN: 2321-9653 Volume 3 Issue IV, April 2015.

INTERNATIONAL JOURNAL OF
PURE AND APPLIED SCIENCE & TECHNOLOGY
IJPAST
ISSN :2229-6107
www.ijpast.in
Vol 13,Issuse 3.Aug 2023