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Manual Robot-Assisted Laser Inspection for Railway Track Flaw Detection and Reporting

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A B S T R A C T

A laser-based railway track inspection robot utilizes advanced technology to autonomously scan tracks for defects. Equipped with laser diode sensors, it detects cracks, misalignments, and wear, triggering alarms upon detection. The system's GSM navigation eliminates manual intervention, increasing efficiency and accuracy. Remote monitoring and control via ESP12E base and Micro controller ensure prompt response to identified issues. Overall, the project aims to reduce labor-intensive inspection efforts and enhance railway safety.

Keywords: Robotics, technology, Sensors, Track

INTRODUCTION

Robotics is the technology that deals with design, construction, operation, and use of robots. The goal of robotics is to design machines that can help and assist humans.

Robot is a reprogrammable, multifunctional manipulator, design to move material and it consists of anthropomorphic characteristics.

Indian Railways being not only Asia's second largest transport organization with around 11,000 trains daily but also the fourth largest rail network in the world with a route length of 66,687 kms faces its biggest challenge in the railway tracks. The main reasons underlying this menace are mainly the reason behind it is to identify defects in the railway tracks. has a robot which will run automatically on the tracks. System having Laser sensor assembly, laser must be placed opposite to each other and also the environment needs to be perfect to detect the track. To overcome this here proximity sensor is used, which will detect the crack accurately. The existing system is slow, tedious and time consuming. This system has coordinates in the form of Short Message Service (SMS) to the nearest railway station. To identify defects in the track These machines are larger in size and are manually operated by a person. Proposed system is small and efficient to use Thus, our work aims to bridge the gaps between autonomy and active track operation while being light weight and effective.Indian Railways faces challenges in track maintenance, necessitating innovative solutions.

LITERATURE SURVEY

[1] G Jing, X Qin, H Wang, C Deng - Automation in construction, 2022 - Elsevier… During the measurement, a laser projects a laser beam over each rail … track inspectionrobots are reviewed in this section. Table 3 shows a summary of existing track inspection robots.

[2]H Zhou, C Xu, X Tang, S Wang, Z Zhang - Sensors, 2022 - mdpi.com… classifier to inspect various types of defects in railway tracks. In … Besides an extensive literature review study, the most … by non-contact infrastructure inspection and monitoring

[3]I Daniyan, K Mpofu, S Nwankwo - International Journal of Quality & …, 2023 - emerald.com … /approach – In this study, an inspection robot was designed for … of this paper presents the literature review, materials and … loosened parts or to initiate an alarm for maintenance cal

[4]N Karthick, R Nagarajan, S Suresh… - International Journal Of …, 2017 - researchgate.net … In the literature survey, the commonly employed rail crack … But the robotics possesses the inherent advantage of … the driver by using some kind of alarm. Some times in midnight .

[5]M Kostrzewski, R Melnik - Sensors, 2021 - mdpi.com … [271], where a track geometry measurement system equipped with a laser, a camera, and… Rapid and accurate identification of the location and exact time and date of an alarming

[6]S Agnisarman, S Lopes, KC Madathil, K Piratla… - Automation in …, 2019 – Elsevier … deck inspection robot Robotics Assisted Bridge Inspection … 3 automation as it triggers an alarm to inform users of the condition … The robotic systems reviewed in this literature survey were …

[7]W Gong, MF Akbar, GN Jawad, MFP Mohamed… - Coatings, 2022 - mdpi.com… give a risk warning forecast. This paper provides an in-depth … 3D linear laser inspection technology for rail surface defect … However, robot-based detection systems can still not achieve …

[8]ZA Alrahman, A Adham - AIP Conference Proceedings, 2024 - pubs.aip.org… This research aims to fill a gap in the literature by studying … The designed system is anautonomous robot with PIR and … Natural catastrophe early warning systems and high-speed rail …

[9]NR AlNaimi - 2020 - qspace.qu.edu.qa… and available solutions in the literature are covered. … selection method based on laserultrasonic detected signals. The … is proposed that mitigates the false alarm rate such as vegetation, …

[10]MZ Shaikh, Z Ahmed, BS Chowdhry, EN Baro… - IEEE …, 2023 - ieeexplore.ieee.org… Set a 100% false alarm rate, for good system performance … robotics and AI for the automatic inspection and monitoring of … in railway transport systems: a literature review and research

[11RKW Vithanage, CS Harrison, AKM DeSilva - Computers, 2019 - mdpi.com… The study shows that laser-based WPMS indicates a … available automated rail inspection robotic platform has been … of humans, melody chime, alarm lamp, emergency stop switches, …

[12]H Ahmed, HM La, N Gucunski - Sensors, 2020 - mdpi.com… methods for conducting a review of the relevant literature. … , the health monitoring of bridges, railway tracks, tunnels, roads and … A multi-functional inspection robot for civil infrastructure

CONCLUSION

In conclusion, the laser-based railway track inspection robot with an alarming system offers a comprehensive solution for maintaining the integrity and safety of railway tracks. Its ability to detect and report anomalies swiftly contributes to the overall reliability and efficiency of railway infrastructure management. As technology continues to evolve, further enhancements and optimizations can be made to enhance its performance and effectiveness in ensuring the smooth and secure operation of railway networks

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