Vol-08 Issue 05, May -2024 ISSN: 2456-9348
Impact Factor: 7.936

iJETRM
International Journal of Engineering Technology Research & Management

PROTOTYPE OF LASER BASED RAILWAY TRACK INSPECTION WITH ROBOT

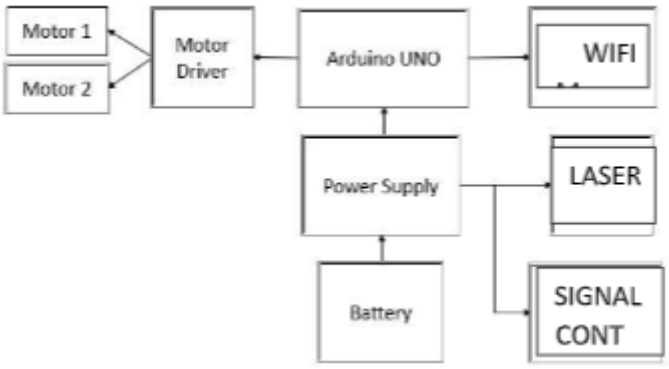
Mr.T.V. Seshi reddy[1]
[1]Assistant professor (Department of Mechanical Engineering) GNITC, Hyderabad, Telangana
S.Vivek Sairam[2], N Shivakumar[3], P Ganesh[4]
[234] UG students (Department of Mechanical Engineering) GNITC, Hyderabad, Telangana

ABSTRACT
Prototype of laser-based railway track inspection robot detection system inspects every large and small-sized metals to detect any faults or defects in the railway. This system canbe actively used by the railway key man who walks 8kms every day to inspect the defects.Traditional methods of inspection are often labor- intensive and time-consuming,leading to potential risks and delays in identifying track anomalies.
The robotic inspection system utilizes advanced laser technology to perform efficient and accurate inspections of railway tracks. The robot is equipped with a laser diode sensor (RX, TX) array that scans the track surface, detecting irregularities such as cracks, misalignments, and wear. The robot is designed for autonomous navigation by using GSM along the railway tracks, eliminating the need for manual intervention. And also used for detecting a potential issue. The robot's operation monitored remotely and control by using "ESP12E base and Micro controller", providingrailway authorities with instant access to inspection data and alerts. The overall content of this project is to reduce the human efforts in the railway track inspection.

INTRODUCTION
Robotics encompasses the technological field focused on the designing, building, operating, and application of robots. Its primary objective is to create robotic machines that can aid and support human tasks. A robot is essentially a reprogrammable and versatile device designed to handle materials, possessing human-like traits and the ability to perform various functions.
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 aroute length of 66,687 kms faces its biggest challenge in the railway tracks. The mainreasons 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 address this issue, a proximity sensor is employed to precisely detect cracks. The current system is characterized by its slowness and cumbersome nature, making it a lengthy process. It sends the location coordinates as an SMS to the closest railway station. The machines used to spot track defects are bulky and require manual operation. In contrast, the suggested system is compact and user-friendly, enhancing efficiency. Consequently, our project seeks to close the gap between autonomous functioning and active railway maintenance, offering a solution that is both lightweight and potent.

WORKING PRINCIPLE
Firstly, the supply voltage of 12V through battery is given to the Distribution Board, through which step-down supply is given to Arduino UNO (Microcontroller) and Motor driver. The Motor driver is connected to Motor- 1, Motor-2 (Robot wheels) and Motor-3 (LASER). The Arduino UNO is interfaced with Wi-Fi module through an app called Roboman App or IP code. This app is used for controlling the robot movements i.e. left, right, backward, forward. Wireless LASER setup is connected to Arduino UNO and it is used for inspection and we can observe live stream of the railway track from obstacles. The laser sensor receives the laser signal, which is initiated the moment the robot receives power. This laser is instrumental in identifying track defects, which are then reported to a web platform. Manual commands via IP CODE allow for the robot's meticulous operation. Equipped with an L298D, the robot can run two DC motors concurrently while also controlling their direction separately. The L298 IC, available in two different packaging options, is a multifunctional driver capable of handling high voltage and current, suitable for various applications. Further specifics on the L298 will be shared in due course.. This powerful dual full-bridge driver handles high voltages and currents. It works with common TTL logic signals, making it compatible with various loads like DC motors, stepper motors, and relays.

iJETRM
International Journal of Engineering Technology Research & Management



Consequently, the inspection of railway tracks is efficiently conducted by the ROBOT.

APPLICATIONS:

Robots are often employed in scenarios where human safety is at risk or where the task is too complex. They are also utilized to streamline repetitive tasks that are more cost-effectively completed by robots, such as in car manufacturing, retail environments, and hospitality services. Additionally, robots excel at executing monotonous tasks that require precision, including material management, transportation, machine operation, processing tasks, and quality control processes\

Railway stations

It is used between the tracks for monitoring it and also collects the trash. The robot operates with its sensors when you teach it, it makes a map of the environment, so it knows from a static perspective where everything is. With thesoftware that's on the machine the robot can see the difference between a static object and a dynamic object, and it will change its behavior based on what it sees.

Metro stations

Also be used in the metro stations where we can achieve security in the track Robots are also being used to ensure passenger safety by carrying out health checks, and security measures.

Coal mining

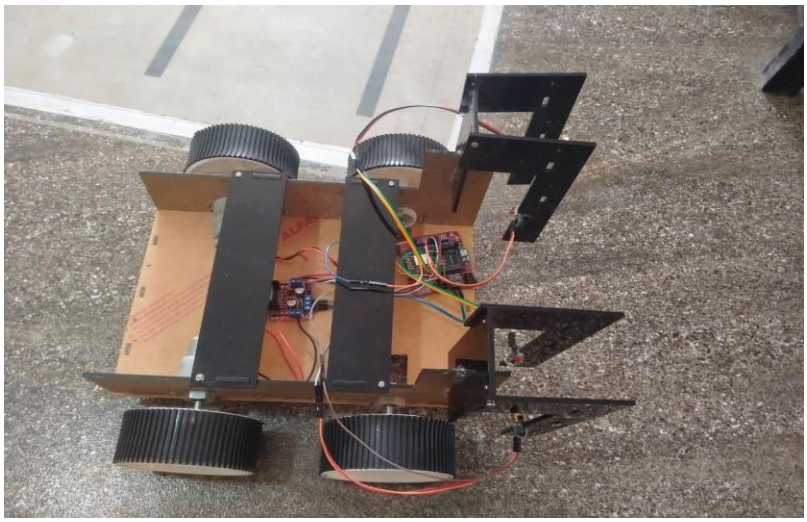
Where we can provide laser senor and placed to the track. It is known for detecting the objects and providing security to the asset

iJETRM
International Journal of Engineering Technology Research & Management

CONCLUSION:

The Laser based Railway track inspection with Robot provides an efficient monitoring process and promises to find defect in the tracks at stations with minimal human interaction. The proposed application of robotics can also be utilized for emergency interventions. This Robot are evolutionary, new way to find around switching points. Railway track inspection and trash collection Robot is a time-saver and defect indentification.

Our proposed robotic application may serve in scenarios where manual is excess amount of hard work. The system can be displaced and operated by external support making it user-friendly. It is eco-friendly as well. It maintains a defect identifier. It can be made fully automatic. This Robot also finds the crack in the track that prevents train accidents. Our robot can be worked only in specified range.



FUTURE SCOPE:

The existing system operates on designated tracks. It allows for additional modifications to the robot. By equipping the robot with a tracked pair, it can switch between tracks. Furthermore, advancements in IoT technology may eliminate the need for a dedicated control channel, as the robot could be controlled via the existing network infrastructure. Additionally, with the progress in machine learning, the train alarm unit could be redesigned to detect approaching trains using vibrational and proximity sensors, as well as real-time image processing. Instead of human inspectors, the robot could be programmed to find cracks in train tracks with a reliable system. With more trains carrying heavier cargo at faster speeds, quicker and better ways to check railway health are crucial. Lasers already examine track shapes, and in the future, they might be able to analyze the rails themselves without touching them.

The future likely involves using laser light and sound waves to examine rails without touching them. This would allow for super-fast crack detection. Additionally, a full railway inspection system is needed. One approach is using low-frequency electrical currents to probe deeper into the rails. Other possibilities include using computer programs trained on past data to improve finding and identifying defects, as well as special sound waves that travel along the length of the rail..

By making rails from better materials, putting them together stronger, and using improved techniques, they could last much longer and show less wear. Studies on a type of steel called "banitic steel" seem like a good starting point. A safe and easy way to take X-rays on-site would also help find problems in the rails quickly. These are just a few ideas being explored to improve railways in the future.

REFERENCES:

• Balasaheb Kasure , Rohit Sondulkar , Rohit Zagade, Hatim Jalal &, Akash Chavan (2019), “A Review on Semi-Automatic Track Machine International Journal of Research in Engineering, Science and Management”, Vol. , No. 2, ISSN : 2581-5792, pp 704- 707.

- Dr. Manoj Hedaoo, Dr. Suchitra Hirde, Ms. Arshi Khan. “Sanitation in Indian Railway premises a great cause of concern”, International Journal of Advanced Engineering Technology, 2015.
- G.Kasthuri1 , E.Rosevangelin2 , J.Kiruba Golda3 Guided by Mrs.A.Mabel Rajakumari4, Rail Robot: Autonomous robot can TRACK and monitor your railway tracks database to smart phone, International Journal of Research in Engineering, Science and Management, volume number, issue number, 704-707. [ISSN: 2581-5792]
- Jesin James, Jesse Wilson,JovnaJetto,AlnaThomas,Dhahabiya V K, Intelligent Track robot, Proceedings of 2016 IEEE International Conference on Mechatronics and Automation August 7 - 10, Harbin, China www.nr.indianrailways.gov.in.
- Novel Kumar Sahu, B.Shahique Raza, Ashu Kumar Pandey &Rupendra Marre, “To Study Of Speed Controlled Railway Track System“, International Journal of Mechanical And Production Engineering, , Vol. 5,No. 11,ISSN: 2320- 2092, pp.52-57.
- P. Vamsi Krishna, Dr. S.Prakash, “Intelligent Railway Track Robot with Waste Segregation”, International Journal of Advanced Engineering Technology, Vol.20, No 7s, 2020, pp 4895-4899.
- S.Sam Jai Kumar1 , T.Joby Titus2 , V.Ganesh3 , V.S. Sanjana Devi4, Automotive Crack Detection for Railway Track Using Ultrasonic Sensorz, International Journal of Engineering Technology and Computer Research (IJETCR), Volume 4; Issue 6; November-December; 2016.