

Railway Track Crack Inspection Trolley

Harshit Sahu¹, Anirudh Dubey²

^{1,2}Student, Department of Mechanical Engineering, Madhav Institute of Technology and Science, Gwalior, Madhya Pradesh, India

³Professor, Department of Mechanical Engineering, Madhav Institute of Technology and Science, Gwalior, Madhya Pradesh, India

Abstract – Indian Railways has large network in the world. It is backbone for freight and passengers movement this scenario is being changed the world by automation i.e., many process performing without human interference or with minimum human interference. Ultimately the aim of the automation point of view increases the efficiency with in effective cost and minimizes the bottlenecks during the process. It requires establishing secure control unit using a microcontroller, transmitter and receiver unit and using a ultrasonic sensor (NDT) the whole system is mounted railway inspection trolley the transmitter and receiver unit are mounted between gap the wheel when view from side view. Ultrasonic sensor detects the flaws. Manually inspect the track is increasing the probability of risk to fail the track. the important value of this paper it is use railway bridge, tunnel, day and night inspection.

The importance of this paper is that, it is applicable in the detection during both day and night

Key Words: Microcontroller, Transmitter and Receiver unit, LCD screen, Ultrasonic sensor, DC motor, Battery etc.

1. INTRODUCTION

Indian Railways has large network in the world. It is backbone for freight and passengers movement. comprising over 1,15,450Km (72,156 mi) of track length over a route of 67,210 Km (4200 mi) spreading to almost all the areas of the country. Modern track structure and machines are used on railway track inspection somewhere are not available all technique railway used conventional method. recent study 25% track need to replacement and some area where are improving and provide safety passenger. according to Indian railway are used various type of inspection method track monitoring like –visual inspection, riding quality, track geometry measurement, track parameter, rail profile measurement is already done on Indian railway. Manually inspect the track is increase the probability of risk to fail the track during running the train on the track and increase the time consumption to inspect. In this project our aim to reduce the time consumption, cost and reduce time failure. In this scenario the world travel by technology. in this project to inspect railway track with NDT method and implement ultrasonic testing to inspect the railway track in effective manner in this project create a model railway track on that track run a chassis attached ultrasonic sensor,

transmitter, receiver, microcontroller and integrated circuit. Hence the power is provide by battery (12 volt). working ultrasonic sensor transmitted the ultrasonic waves the frequency is above is 20khz when echo is not receive there will found crack and graph is show on LCD screen less than 100% if echo is receive there will be found no crack. This information is show on LCD screen showing 100% graph between amplitude and time and alarm is on when found crack.

2. Literature review-

There are many extensive amount of literature has been published but this type of relevant on surface waves in non destructive method use specially Rail inspection context. Sir Rayleigh showed 1885 wave propagate free surface elastic half space wave length is decay in depth another method is developed NDT method. Rail inspection 1976 fatigue testing of rails lack of accurate model glass molded and photo elastic visualizations complex scattering behavior. in 1990 NDT application are using li van time of flight spec tropic method use its only about length of surface where defect is large as compare to length. Another paper published pecorani was present model compression residual stress would reduce effect caused by crack field.

Modern Era point of view there is two method use crack detection-Visual Inspection- It is conventional method use to determine the crack in rails. Visual method is following by in a year. There are performing two times in a year first inspection six month and later six month. In this method broadly inspect the railway track number of workers are increase and required man hours increase this process track are divided in section. The section recommended as per guideline Indian railway 50 meter length and of worker are divided according the train traffic on this route. information is record in photograph and video recording save the data. Under this process check the high gradient tracks, joints curve the rails, track geometry, weld joints. this process are not effected in tunnel.

2. Eddy Current Testing- EC is based on the electromagnetic interaction between magnetic field and sensor this process effected in tunnel checks the track. There is variation of eddy current due to in homogeneity of rail structure and surface under this process defect is detected below 0.2 mm.

Development of Modified Railway Inspection Trolley System. In this project system inspect the rail I-section expose the

fault in the rail track using NDT (ultra sonic) method. When the crack is found by the system LED light are blinking and LCD shown graph .This can be done by transmitter and receiver unit. NDT technique is the most dominant method which exposes minor cracks and also computes the growing rate of the crack. When transmitter unit propagates ultrasound wave signal from one culture medium to some other specific medium, a limited amount of proportion of the signal take energy, propagates over to the other culture medium at the same time the remaining amount of energy gets reflected back. After getting the reflected signals they evaluate the asset such as time distinction of arrival (TDOA).then we calculate thickness of flaws in rails material by using time difference of arrival.

3. Construction and Working Methodology-

There are mainly three parts are make the complete the inspection trolley-

- 1-Chassis
- 2-Integrated circuit
- 3-Controlling panel

Chassis-chassis is a collective term all the body part except the body work .it include the wheels and brake.

Integrated Circuit- it is a semiconductor chip which is mounted resistance, capacitor, diode and connected are encoder and decoder ic through transmitter receiver connection.

Controlling panel- here in this project we use to microcontroller to use controlling the transmitter and receiver signal.

Here in this project the system is based on NDT (ultra sonic) technique. There is a combination of hardware and software can check the total number of flaws on the railway tracks. This system is mounted on the chassis of robot that is checking to move on the railway track and detects the number of flaws. In controlling panel microcontroller is installed in the integrated circuit robot to operate the movement of the robot and permit to show number of flaws on the crack.

The LCD screen is mounted on the robot to display the flaws graph or shown. The robot is driven by the dc motors in this project we use twice motor both the dc motor is connected to the wheel power provided every wheel of robot providing movement to it. The main advantage of this system is that it dilutes the human intervention by making complete of the system automation. It is low cost. This system eliminates the manual detecting flaws as done.

The whole unit consists of a power supply unit (battery), crack detection sensor (ultrasonic sensor), microcontroller, display unit (LCD) and D.C.motor controlling driver.

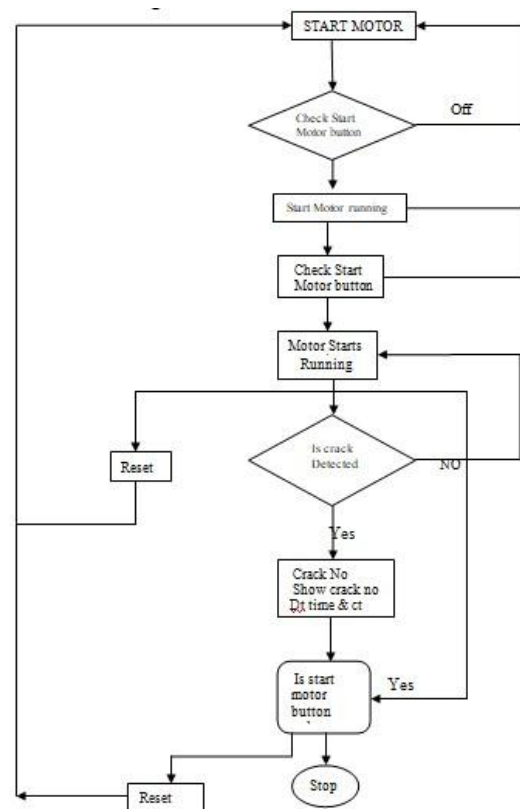


Fig. Flow Chart Working Process

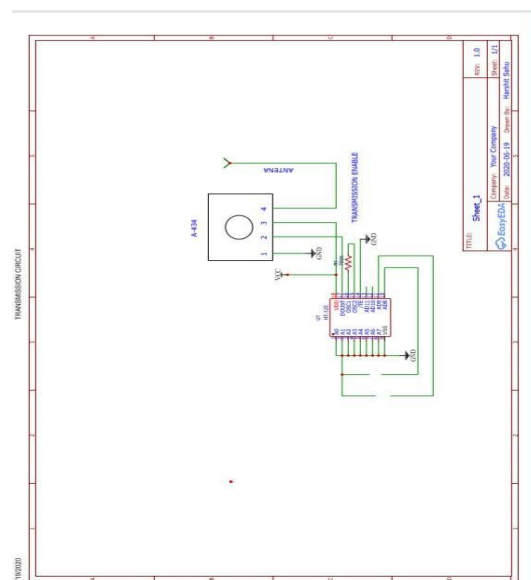


Fig -1: Transmitter Circuit Diagram

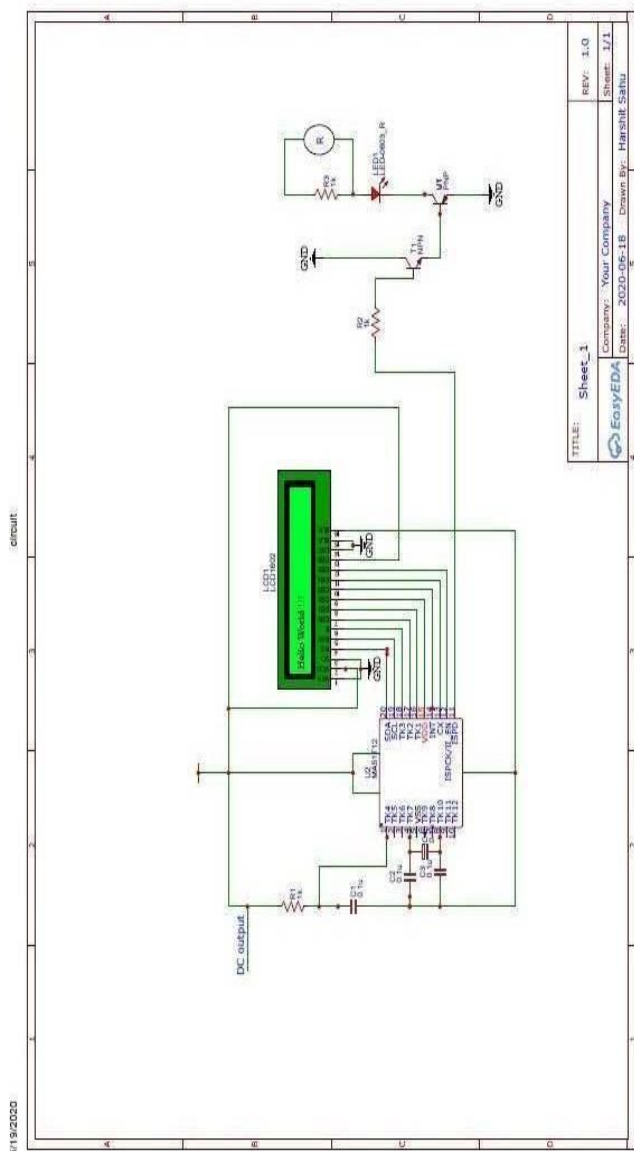


Fig -1: Main Circuit

4. Calculation- FOR DRIVING TROLLEY-

Assuming battery is fully charged and remains same over its consumption. Motors are parallel connected with the battery source of 11 volt.

Voltage is same in the circuit assuming 0.5 A current.

$$\text{Power} = \text{Voltage} \times \text{Current} = 11 \times 0.5 = 5.5\text{W}$$

Assuming all these power is consumed in rotating the wheel and the Trolley and the power is equally divided

TORQUE IN EACH WHEEL

$$\text{TOTAL POWER} = 5.5\text{W}$$

$$\text{Power used in each Wheel to rotate} = 5.5/4 = 1.375\text{W}$$

$$\text{AND } P = 2\pi NT/60$$

Where N = NO. of Revolution

T= Torque in Wheel

P= Power consumed in Wheel as per specification

$$N = 500\text{RPM}$$

$$P = 1.375\text{W}$$

$$P = 2\pi NT/60 \quad 1.375 = 2 \times \pi \times N \times T/60$$

$$T = 0.024 \text{ N-M}$$

$$R = \text{Radius of Wheel} = 1\text{CM} = 0.01\text{M}$$

F= force acting on wheel to rotating.

$$T = F \times R \quad 0.024 = F \times 0.01$$

F=2.4N Thus, force acting on each wheel to move the vehicle

MAXIMUM WEIGHT OF THE BODY

Taking $\mu = 0.3$

$$F = \mu N$$

$$2.4 = 0.3 \times N \quad N = 8\text{N}$$

$$N = Mg/4$$

$$8 = M \times 9.81/4$$

$$M = 3.26\text{KG}$$

Maximum weight of the body as well as assembly is 3.26KG

5. Future Scope- IN future to use more automation use technology and implement various things like image capturing and use of automatic repairing through programming so that less worker is required redesign the model make a compact and robust to sustain all weather application. To use inspect the railway bridge track monitoring. Here in this project we use of wave reflection concept .we assume the assumption to take low price, customer friendly, make easily operated. Operation of model simple in effective manner to reduce inspection cost and reduces the probability of accidents. It could be used in remote area where rail Inspection car is not going frequently.

6. CONCLUSION

Ultimately project aim to design the project keeping mind engineering point of view, customer and producer. Main reason of this feature is used (NDT) method others are in comparison are not liable. Our team has conducted a survey finding the various parameters like weight, capacity, frequency of train and friction. These parameter to take suitable scale .many difficulties but we learn how to conduct survey. We also found the some realistic and variable value to reach around the exact value by completing the project we have checked it practically. The project has been successfully made and is working satisfactorily. This project work was very useful and advantageous to us.



2. Anirudh Dubey, was born in Hoshangabad. Currently I am a final year student pursuing a Bachelor of Engineering in Mechanical Engineering from Madhav Institute of Technology and Science, Gwalior. My areas of interest Strength of Material Engineering and Thermodynamics.

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BIOGRAPHIES



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