DESIGN AND MODELLING OF A SINGLE RAIL VEHICLE FOR INSPECTION OF RAILWAY TRACKS

[1]Prof.Mr.V.Muralimohan, [2]Sourabh D. Apte , [3]Omkar V. Pol, [4]Mitali M .Hatiskar, [5]Varun V. Kambli

[1]Associate professor, [2]Student, [3]Student, [4] Student, [5] Student
[1] Department of Mechanical Engineering,
[1]Finolex Academy of Management and Technology, Ratnagiri, India

Abstract : Railroad tracks has emerge need to inspected on a regular or periodic basis for detecting physical defects or crack in railway track to maintain safety. If, it is not detected in a certain period of time, it may lead to severe consequences such train derailments or train accidents. Inspection must happen weekly by a human inspector to maintain safety, but in such type of manual inspection, there are many drawbacks and limitation that result in the poor inspection of the track. To avoid kind of intimated errors might lead to severe accidents. There are hundreds and thousands of miles of railroad track, therefore to increase the speed of inspection this set up battery driven single rail vehicle system is designed. Such a concept will surely increase the speed of inspection process of railway track and can help to avoid mishaps and severe accidents due to faults in the track as early as possible without disturbing railway schedules.

Index Terms **- Battery driven, Single rail**

I. INTRODUCTION

This is an era of fastest developing world and transport is a key necessity to empower the economy of world. Indian railway is one of the largest transporting network in world. Economic prosperity is always dependent on capacity and rationality of transport. Indian Railways are fourth largest transport network in the world. It is occupying prominent position to provide transport infrastructure [1]. Kokan railway is one of the corporation of Indian railway working between Roha, Maharashtra to Thokur ,Karnataka whose line length is about 736 km, but upto Madgoan it is running on a single track. On the route of kokan railway the principle problem is lack of cheap and efficient technology or system to detect problem in rail tracks as fast as possible and lack of proper maintenance of tracks which resulted in the formation of cracks [2]. Cracks in rail is identified as main reason to derailment, yet there have been no single rail vehicle mechanical system for testing & increasing the speed of testing purpose. Hence to find the solution of this problem, project is focused on designing and modelling of an efficient and cost effective solution i.e. easy handled, low weight single rail vehicle system for crack detection for increasing speed of inspection without disturbing railway schedule.

A. PROBLEM DEFINATION

Problem acquisition searched through the literature survey from available literature on the topic, it observed gaps to define this problem statement and objective. According to railway statistics, major rail accidents occur due to following reasons:-

- **Train derailment:** A derailment occurs when a vehicle such as a train runs off its rails. This does not necessarily mean that it leaves its track. Although many derailments are minor, all result in temporary disruption of the proper operation of the railway system, and they are potentially seriously hazardous to human health and safety.
- **Improper maintenance of rail track:** Due to improper maintenance schedule crack on track could not be identified andchances of rail accident increases[3]
- **Faulty equipments:** By using faulty equipment and testing instrument crack could not be properly identified.
- **Collision with another train:** Collision of the train can happen due to faulty signaling system or manual errors.
- **Collapesed bridges:** It is difficult to identify collapsed bridges due to irregular inspection of the rail track. Most of which happen due to rail track errors despite periodic inspection and less effectiveness in daily span of inspection, hence according to this study our problem definition is “Design and Modelling of A Single Rail Vehicle for Inspection of Railway Tracks.

B. OBJECTIVES

1. To design vehicle which reduce effort of trackman by reducing fatigue.
2. To fabricate self-propelled, fully functional inspection vehicle.
3. Improve inspection efficiency
4. Low cost
5. Light weight to Easy handling.
6. Develop Time saving method for inspection

II. THEORETICAL FRAMEWORK

1. EXISTING SETUP:

Existing setup on kokan railway for inspection of rail tracks shown in figure 1. The crack detection is done by Ultra Sonic Flaw Detection method [4] by using probes of various angles for various defects but still on curve of I-section of track it impossible to detect the crack. Current system is manually driven so the speed of inspection and crack detection is vey low than required. Kokan railways inspect the track 1.5 km. daily. Due to this periodic time of inspection of track once in three month which very poor than required.[5] This is very severe to the safety of rail tracks amd causes derailment or accident.

Fig.1. Existing base model for USFD test machine [4]

2. PROPOSED SETUP:

- Specification of proposed setup are as follows **:**

It is a single rail vehicle which is running on battery & the thrust given by motor. It is equipped with mechanical brake. It is a light weight vehicle as the material of aluminium & steel shown in fig 2. The main frame made of steel & supporting members of aluminium. The motor is of 2.5 kW & the speed of the vehicle is 20km/hr max. Battery is specified by 36V 5AH Li-Ion. The vehicle is designed in such a way that the hub motor attached at the rear end of the vehicle to give the push or forward force. There will be grooved wheels designed for balancing the vehicle & to give the grip when running on railway tracks.

Fig.2. Proposed setup

III. RESEARCH METHODOLOGY

Following methodology shown in fig.3, we implement while developing our project.

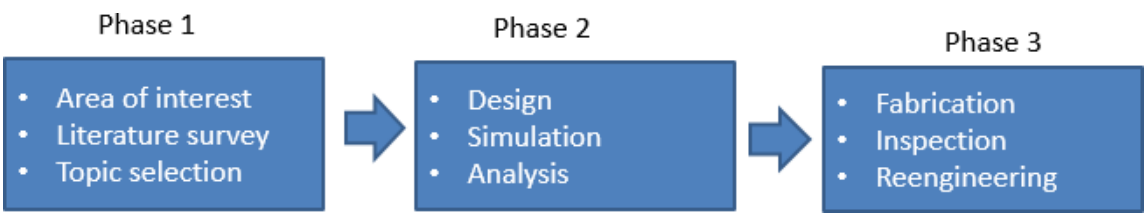

Fig 3.Methodology

- **Phase 1**

❖ **Literature survey** Literature survey for train accidents and rail testing methods has done widely for targeted application. From statistical data it found that majority accidents are due to train derailment. There are various equipment's for inspections of rails, also manual inspection is carried out. But these equipment's are heavy and costly and manual inspection is very fatigue to the trackman due to which they ignore to do manual inspection.

❖ **Topic selection**: From the literature survey it found that majority accidents are due to lack of track inspection . Therefore it name to research work as in Design and fabrication of portable rail inspection vehicle.

- **PHASE 2:**

❖ **Design:** As per the selected topic our main aim is to reduce the rail errors by inspection. The designed system required to have light weight that the trackman can easily remove it from the track. It is easy to handle by single man. For these objectives the design is to be done.

❖ **Analysis:** For the designed model first selection of the material is important, Hence selection of the material is to be done. After selecting material analysis is done in the software "ANSYS".

- **PHASE 3**

❖ **Material procurement:** After the design and analysis of the model the material required for the fabrication of the model is procured. The material is selected for after the selection procedure.

❖ **Fabrication:** The fabrication stage beholds the manufacturing of the inspection of prototype of vehicle as per the design [6].

❖ **Testing:** The model will be tested on tracks of konkan railway to check the on-site functioning and its accuracy in inspection. If any flaws are detected reengineering could be done.

IV. RESULTS AND DISCUSSION

a) CONCLUSIONS:

To provide more security to the railway passengers and to protect the loss of properties for the railway department by avoiding the derailment of the train. This derailment occurs due to missing bolts and cracks in the railway track. These missing bolts and cracks in the railway track will loosen the rail.[6] When heavy weighted train goes at high-speed, the track may loosen which leads to the derailment of railcars from the track. This derailment happens to both passenger and cargo trains.The vehicle designed and fabricated is fully operated on electrical power i.e. battery and motor. Speed of vehicle is 20kmph is satisfactory for increase in rail testing efficiency distance covered by trackman. By using aluminum & steel the weight of the vehicle is less hence trackman can easily lift it up and keep away from the track when train is passing through same track. Trackman can check track by visual inspection as well as some devices could be attached to vehicle. The system is able to detect important rail failures with accuracy and efficiency based on visual inspection by trackman.

b) FUTURE SCOPE:

The work carried out successfully to design the rail inspection to reduce the fatigue of the trackman however following modification may improve the efficiency of the testing the rail for better results.

1. The vehicle is now driven by the battery and motor system so chain and sprocket mechanism can be used to drive the vehicle by manual power to reduce the danger of stopping of vehicle due to electrical failure.
2. To drive electric motor, solar panels can be installed to charge the battery and this power could be used to drive the vehicle.
3. GPS and GSM module could be installed to detect exact location of the vehicle.
4. Various sensors such as ultrasonic sensors, electromagnetic acoustic transducer, eddy current testing can be installed in the vehicle along with manual visual inspection to improve the inspection accuracy.

V. FIGURES

Table 1 figure Type

Figure head	Figure name
Fig.1	Existing base model for USFD test machine
Fig.2	Proposed model
Fig.3	Methodology

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VI. REFERENCES

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