

Crack Detection and Track Cleaning Systems for Railway Tracks

Mr. V. L Kadlag, Gaurav Ananda Kute, Sumit Maruti Ilag, Shrikant Jagannath Guddalli, Sudarshan Sopan Kasar

Department of Mechanical Engineering
Sir Visvesvaraya Institute of Technology (SVIT), Nashik, Maharashtra

Abstract: *In Indian railway system, railway track security is a prime concern. Some approaches have been implemented concerning the track breakage detection. From the starting of railway transportation to this date, similar cleaning rail tracks has been a social issue. In this, humans have to clean human waste and other garbage thrown on rail tracks is a situation that needs immediate remedy. This manual scavenging is leads to health problems. In this project proposing an idea to solve both the problems. For this an inspection trolley is used for detecting the railway track crack and cleaning the track path automatically. This system comprises of IR sensor to bring into operation the crack detection and mechanical as well as vacuum cleaner system to clean the track path. This project aims to present a Robot Based mechanism for cleaning the railway track. it will a cost- efficient railway track cleaning machine which would prove to be a wonderful alternative to the current system in place if implanted. The proposal prototype is designed to overcome all the disadvantages of the current machine, and would help materialize the idea of super clean railway platform tracks across the nation.*

Keywords: Track crack detection, cleaning, IR sensor, vacuum, mechanical cleaner

I. INTRODUCTION

Indian Railway (IR) being the eighth largest organization in the world. Being such a huge organization make life very much difficult for the employees to maintain a hygiene environment at railway stations and tracks. Many necessary steps have been made to tackle such problems and awareness camps are being made at various places. In addition to it, the railways have installed various track cleaning machines located at different places. They are huge and would require an entire line to be cleared for them to proceed with their cleaning actions, which is a hectic process. The main disadvantage was that it was impossible to use it very frequently as it had to follow a very tight schedule. Considering all such factors we have come up with an idea to design a working prototype that could be mounted to the underside of the wagon/coach which would perform the same action of cleaning without hustling of a railway line and other factors. Keeping this a base, we have gone through various research papers on autonomous track cleaning machines which were built and used from the early 1980s. Drawing inspirations from each of them, we have designed a system that can be mounted to the underside of the coach/wagon in a neat manner without disturbing the existing nearby equipment. A collector tank of decent size with the suction system mounted to it is placed ahead of the bogie where the pollutants will be stored. The dust on the track will be picked up with the help of a rotating cylindrical brush. The brush will be covered up appropriately to aid the dust to circulate within a closed environment. Various mechanisms are responsible for the different defect types that appear in rails of railway tracks. Commonly, ultrasound inspection is used for finding internal defects that are formed during the cyclic loading of rails [1].

Indian Railways represent the pride of an Indian. Indian Railways is an Indian state- owned enterprise, owned and operated by the government of India through the Ministry of Railways. Railways have been good medium of transportation for its passengers since 1851 when it was introduced in India (Bombay to Thane). During these 150 years, it has approximately touched each and every part of the country. It covers about 1, 15,000 km with 7500 stations. As of December 2014; it transported over 27 million passengers daily.[2] Indian Railways is one of the largest railway networks in the world. Railways cover the entire length and breadth of the country. Indian Railways is also the largest employer in the country. It has come up as one of the nation's fast growing and profit-making

organizations. However, sadly enough, it has been years since the railways achieved complete sanitation. Open defecation through railways, unclean toilets, choked basins, and littered bogeys and tracks are the causes of the present poor sanitary condition of India's Railways.[3] India is travelling towards the dream "clean and green". Mere words create no impact on people. Preaching by action is our motto; our railway track cleaning machine keeps the railway track and its surroundings clean. This will motivate people to keep the city clean which will in turn help build a clean nation.[4].

Garbage is a major problem worldwide attention. It can be seen from organizations that support and fix this problem. The process of making things automatic is being exploited in almost all the major fields of life. Making things automatic reduces burden on the humans. The cost and effort used in manually controlled products is much higher than the automated systems. Considering the fact, that the problem of efficient waste management is one of the major problems of the modern times, there is an utmost need to address this problem. The proper waste management system is must for the hygienic society in general and for world as a whole. [5] Indian Railways is one of the largest railway networks in the world. Railways cover the entire length and breadth of the country. Indian Railways is also the largest employer in the country. It has come up as one of the nation's fast growing and profit-making organizations. However, sadly enough, it has been years since the railways achieved complete sanitation. Open defecation through railways, unclean toilets, choked basins, and littered bogeys and tracks are the causes of the present poor sanitary condition of India's Railways [7].

1.1 Objective

Considering the necessity of a clean and healthy environment, we intend to maintain a hygienic environment on a railway track. Indian railways being one of the largest rail networks in the world is taking serious steps to maintain a hygienic environment. There are existing railway track cleaning machines which require a periodic time allotment of a line to perform the cleaning action.

- The objective of the project is to design and fabricate a rail track cleaning & track crack detection machine with similar moto but on a miniature scale.
- To make a machine will be directly mounted to the railway coach or wagon. A rotating cylindrical brush is lowered in order to make contact with the ground which helps to pull out the pollutants from the track.
- To make a machine a blower fan is placed beside the brush to suck in the dirt into the collector tank. The dirt collected is compressed into cakes and disposed of periodically.
- To design & fabricate a system creates clean environment and reduce the human resources. The main objective of this proposed system is to provide better working environment and hygienic surroundings.
- To design robust, light weight and sturdy mechanism to clean the rail track.
- To design economical system & provide solution to social problems using solar energy application.
- To ensure the safety of the person who work to clean unhealthy railway track cleaning.

II. METHODOLOGY

Initially, the concept drawings of the coaches and wagons were collected and analysed to place our system without the need for any alterations on the existing equipment. Then a chassis will be built according to the dimensions of the underside of the coach, with tires mounted to it. A wooden plank will be placed on top of the chassis to provide a flat surface. A collecting tank will be made from sheet metal of thickness 2mm. All the mounting points were marked earlier and the entry and exit points were fabricated. A metal paste along with silicone adhesives will be used to seal off the complete tank. The cylindrical brush will be fabricated by placing a shaft & bearing supports. The brush will be mounted on the rods connecting the two discs. The brushes are placed at 45° to collect garbage. A 12V DC motor will be placed above the cylindrical brush to rotate using belt drive. This also helps to easily check the efficiency of the brush at various speeds. To balance the forces the batteries and the motor are placed on either end of the chassis. The collector tank is placed at the rear end as a counterweight to the cylindrical brush. A suction unit is placed above the tank and the particles raised from the brush is sucked into the tank. The crack detection system will be placed above the track. The below Methodology shows the sequential operation/steps that will be performed during the project process.



III. FUTURE SCOPE

This study reviewed the recent progress in the inspection of rails of railway tracks & garbage collection methods. The project reviews the technologies currently employed along with examples of recent field applications. The current automated inspection systems include many different methods. However, the project model developed by us does not satisfy all objectives, but there are some restrictions on speed, dimensions & load carrying capacity due to scale model. Calibration of the electronics units is an important step in the whole inspection. Some new studies will have to do in Crack detection of defects. However, it will need further development before they can become commercial automated systems with widely acceptance in railway track inspection protocols. Efforts are on in several directions for development of Environment Friendly Toilets in trains. Through this project we are just giving an idea that this track cleaning mechanisms. This system can be easily get installed on the existing track cleaning system. If further modification could be done, then this system can also be very useful for work long distances continuously with reliability. If this all works well than this model will not only solve the world's biggest track cleaning & crack checking problem (Indian Railways) but gives alternate source of low-cost alternatives.

IV. ADVANTAGES & APPLICATION

Advantages:

- Cost of system development is low & No need to purchase heavy machine.
- Working principle is quiet easy & Manual assistance is not required.
- Portable. Autonomous self-track cleaning & crack detection mechanism that can be attached to vehicle and operated without human operation.
- It is easy to construct, low cost and low maintenance.
- No man power is required for track cleaning.

Applications:

- This system work as an autonomous self-track cleaning & crack detection mechanism that can be attached to vehicle run on track and operated without human operation.

V. CONCLUSION

In this project, we will have used the one rail track; it is our expectation that this track will be monitored by one IR obstacle sensor. Whenever there is a crack on the track, the IR obstacle sensor senses the crack and will activates buzzer indicator instantly. The proposed prototype will be designed to overcome disadvantages of the available manual track cleaning with low cost alternatives. The existing cleaning process on the tracks at Indian railway platform is manual, which is tedious particularly to clean, when the frequency of the trains is very high. In this, track mechanical cleaning system and the vacuum dust collector is used to suck the garbage which is below the track simultaneously. Intelligent Railway track cleaning and crack detection vehicle will a time-saver and garbage collector. Our proposed robotic application may serve in scenarios where manual track cleaning is unhealthy. The system can be displaced and operated by external support making it user-friendly. It is eco-friendly as well. This vehicle also finds the crack in the track that prevents train accidents. Intelligent Railway Track cleaning and Crack detection Robot will be worked in as specified range along the station.

Effective Features of Robot Based Wire-Less Railway Track Cleaning.

- No direct Human involvement in Cleaning High
- degree collection and cleaning of waste
- Accidental safety
- Minimum wastage of water and maximum area coverage for cleaning
- Attachment for cleaning drainage
- Attachable collection tank
- Wireless operation
- Less Time consumption for overall cleaning as compared traditional

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