

REVIEW PAPER ON RAIL TRACK FLAW DETECTION USING MATLAB

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Abstract: The purpose of this paper is to provide readers with in-depth presentation of the rail track flaw detection using matlab. This is achieved through a step by step process starting from the basic rail track inspection in railway maintenance. This self-contained volume will be valuable to all engineers, scientist, and practioners interested in the analysis and processing. The system provides real-time monitoring and structural condition for railway track using vision based method and calibration to search the fault location on the track. Inspections include detecting defects on tracks, missing bolts, anchor, tie plate and clips etc. In vision based method camera we will use to capture the images or videos. In vibration based method some sensors we will use to detect the vibrations on the railway track. Finally, conclusions are presented.

Keywords: Histogram, k mean clustering, image processing, data acquisition, railway track inspection.

I. INTRODUCTION

In today's scenario, In all transport systems, particularly in case of railways, safety and reliability are highly considered. There is a view that the current regulatory framework does not provide full set of tools to effectively deal with railway accidents and main-track derailments. There is also a view that the current framework needs to be modernized and better aligned with safety legislation that applies to other modes of transport in India. In recent years, with the development of railways, capability of the trains is constantly improving. Rail track inspection is a necessary task in railway maintenance and is required to periodically inspect the rail track by trained human operator, who is walking along the track & searching for defects. Such type of monitoring system is unacceptable for slowness and lack of objectivity. This inspection will take too much time to recover from faults. Hence to reduce delay our propose system deals with automatic Visual Inspection of Railway track and devoted to numbers of tasks. Automatic vision based inspection systems is enable to analyze the stipulation of rail track. In this way system increases the efficiency of inspection, reduces the required time and giving a more accurate and frequent information of the railway track. To provide the real time is monitoring and structural condition for railway track using "vision based" and "vibration based" method for safety purpose. In this way we can boost accuracy, efficiency and reliability. An electromagnetic system for rail detection and traction enhancement comprises, in a preferred embodiment, wheel axles, wiring coils around the wheel axles, respectively. It also consists of a power source coupled to the wiring coils for supplying

power to produce electromagnetic flux. The wiring coils produce opposite magnetic north and south pole pairs on the axles [4]. The system also has provision for monitoring the flow pattern for locating the position where the crack pattern is detected as open. Detection of cracks in rails is a challenging problem, and much research effort has been spent in the development of reliable, repeatable crack detection methods for use on in-service rails. Rails inspection methods include destructive techniques and non-destructive techniques, such as hammer surrounding, but these methods just cover limited space and have limited effectiveness in identifying the faults. Non- destructive evaluation techniques for rail track inspection had developed. These technologies include ultrasonic and eddy current methods, neither technique is particularly effective for detection of cracks in the rail foot. The existing systems are more complicated and time consuming. Hence, this paper proposes a more reliable and less time-consuming mode of crack detection in the railway tracks. This is a real time application which can be performed easily. The result of these studies confirms the ability of the proposed method to locate and quantify surface- connected notches and cracks. In visual inspection system (VIS), a high speed digital camera, which is installed under a test train, is used to capture image of rail track and then the obtained images are analyzed automatically using a customized image processing software. The organization of paper is as follows: Section II discusses the literature review of rail accidents in India along with the recent methods used for crack detection in railway system. Section III proposed work which gives details about the proposed architecture of this project and section IV discusses results and conclusion.

II. LITERATURE REVIEW

A. Vision inspection system

In vision based method our device will capture videos of railway track component using vehicle mounted camera, image enhancement using image processing and assited automation using a real time tracking algorithms. The block diagram of this system is as follows:

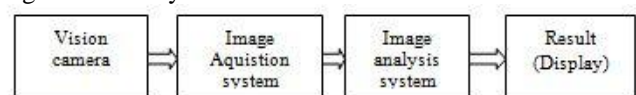


Fig1. Vision Inspection System

B. Image Acquisition System

Digital cameras are used to capture the images or videos of rail track. Surf views come with on board computer, data acquisition and software along with six cameras scanner and

cables. A calibrated CCTV camera is used to capture the image frame at resolution 640*480 at 30 frames per second which was mounted on the rail track. Different types of camera are used for data acquisition purpose in different vision based system.

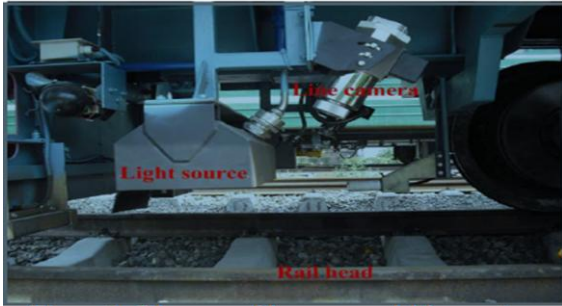


Fig.2 Image Acquisition System

C. Image analysis

The captured data send to PC with DSP and FPGA boards for real-time frame analysis. Cutting the stream of lines into the frame and then examine frame [10].The frames of image are proceeds by using algorithm to identify the defected component and assess the stipulation of railway track [3]. The MUSIC algorithm is signal processing technique that extract signal from a 1-D.It provide robust solution against noise and give the accurate result in efficient way. Gabor transformation technique is used to convert into digital signal from track image [1].Machine learning technique is used to process the acquired data [9]. Gabor wavelet features is used for frame analysis and it provide a comprehensive result evaluation [11]. To extract rail track image, we first resume evaluating the captured input image with the help of Sobel operator. Hough transform process is used for the detection of railway track.

D. Histogram equalization

Histogram equalization is a simple and effective image enhancing technique. Histogram equalization is a technique for adjusting image intensities to enhance contrast. It is a challenge to inspect rail track defects in a vision system because of illumination inequality and the variation of reflection property of rail surfaces. Histogram equalization is widely used for contrast enhancement in a variety of applications due to its simple function and effectiveness.

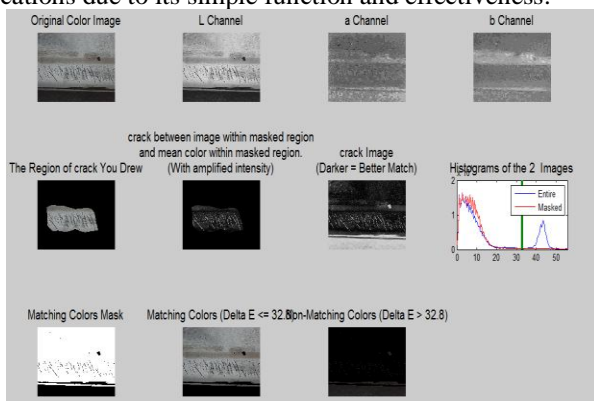


Fig.3 Histogram Equalization

III. PROPOSED WORK

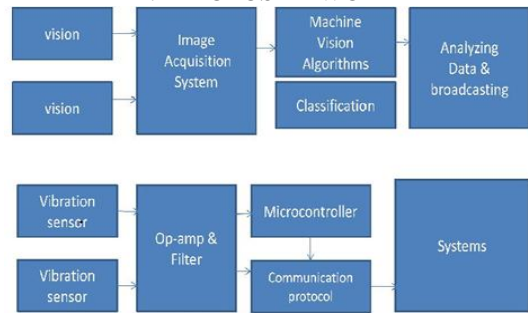


Fig.4 Proposed Architecture

Our proposed system consists of two models: One is vision based automatic tracking of rail track system and another is automatic tracking of rail track.

A. Vision Based Method:

In machine vision, digital camera will use to capture the video. Captured videos or images will process by using machine vision algorithm in image acquisition system and the algorithm will classify the fault according to class. In data analysis the current images compare with the preloaded healthy status of track and verify whether the conditions match or not. If two conditions are matched then there will be no error otherwise the track has some faults. After that this information will broadcast to the server.

B. Vibration Based Method

In this method a sensors will sense the vibration with the help of vibration sensor and after that it will pass to the op-amp and filter for removing external noise and then it pass to the microcontroller for programming. There is one communication protocol to establish the connection between the hardware and system .In system processing will be done and then it will broadcast to the server through wireless medium. All the procedure is as shown in lower portion of the fig.4.

IV. CONCLUSION

Our proposed system will automatically inspect the rail track component and calibrations of rail track by using vision based and vibration based method. Our proposed system consists of two parts: A vision based and vibration based method. In vision based method machine vision algorithm will extract a signal from from 2-D signal. In vibration based method will perform the calibration of rail track. It will perform two tasks at a time so that the system will enhance the capacity of inspection and provides the accurate result.

REFERENCES

[1] Esther Resendiz, Member, IEEE, John M. Hart, and Narendra Ahuja, Fellow, IEEE " Automated Visual Inspection of Railroad Tracks" IEEE transaction on intelligent transportation systems, vol 14, no.2, June 2013
 [2] Abhisekh Jain, Arvind, Balaji, Ram Viyas N.P." Onboard dynamic rail track safety monitoring system" International conference on advanced co

mmunication systems, January 10 - 12, 2007

- [3] J. Riley Edwards, John M. Hart, Steven Sawadisavi
"Advancements in railroad track inspection using machine-vision technology" Edwards et al. 2009.
- [4] Feng- Sheng Chen, Chih-Ming Fu, Chung-Lin Huang, " Hand gesture recognition using a real-time tracking method and hidden Markov models" Institute of electrical engineering, national tsing hua university, hsin chu 300,taiwan, roc received 15 January 2001; received in revised form 2 January 2003; accepted 20 March 2003.
- [5] Beena vision " Automated Rail Surface and Track Inspection"
- [6] Isabelle Tang and Toby P. Breckon, "Automatic road environment classification" IEEE transaction on intelligent transportation systems, vol 12, no.2, June 2011.
- [7] Hoang Trinh Norman Haas Ying Li Charles Otto Sharath Pankanti "Enhanced rail component detection and consolidation for rail track inspection" IBM T. J. Watson Research Center 19 Skyline Dr, Hawthorne, NY 10532.
- [8] Maneesha Singh, Sameer Singh, " Autonomous rail track inspection using vision based system" IEEE international conference on computational intelligence for homeland security and personal safety alexandria, va, usa, 16-17 October 2006.