International Journal For Technological Research In Engineering
Volume 4, Issue 7, March-2017 *ISSN (Online): 2347 - 4718*

RAILWAY TRACK CRACK DETECTION USING VIBRATION ANALYSIS

Mahmood Aldobali[1], Mohit Kumar Dodval[2]
[1]M.Tech Scholar, [2]Assistant Professor
Department of Electronics &Instrumentation Engineering ,Nims Institute of Engineering And Technology, Jaipur.

Abstract: Our proposed system will automatically inspect the railway track by using Real Time Image Processing with vibration module. The proposed system is presented to detect the cracks in the railway tracks by Using Real Time Image Processing through wireless module. The information is passed to the control section and the location can be found out by using networking module in the system. Hence this will reduce the accident rates and loss of precious life. The proposed framework will consequently review the rail track segment and adjustments of rail track by utilizing vision based and vibration based strategy. Our proposed framework comprise of two sections: A dream based and Vibration based strategy. In vision based strategy machine vision calculation will separate a sign from 2-D signal. In vibration based technique will perform the adjustment of rail track. We will perform two errands at once so that the framework will improve the limit of assessment and gives the exact result. Investigations incorporate tie, tie plates, spikes, and grapple and so on.

I. INTRODUCTION

Railroad and Tramway track has an ordinary in-life administration of around 45 years. This is dependent on various components, yet essentially: development volume i.e. the amount of vehicles using the rail; development load i.e. the vehicle's heaviness using the track and the territory i.e. rail on twisted parts of track have a lower future as they are obligated to more critical burdens. The 45-year point is the point in which potential cracks of the rail can be ordinary, despite the way that rail has been known outlast this period. Deformities of the rail can slice this lifespan to as small as couple of months. As of now, the dominant part of rail line track examinations are physically coordinated by railroad track assessors. In every way that really matters, it is unrealistic to investigate an immense number of miles of railroad track. There are two classifications of deformities, inside deserts and surface bound imperfections. Inside deformities happen in the midst of rail creation remembering inside investigation of the rail does happen subsequent to moving, some internal imperfections may very well start to show up after a period of use. Inside defects such a disappointment of steel crystalline structures to bond can make breaks structure after nervousness is associated with the rail. Internal surrenders can likewise be blemishes, for instance, cavities and breaks under simply under the rail surface. External surface rail imperfections come in numerous structures, basic erosion can achieve issues, yet rail wheel participation with vehicles causes the bigger piece of deformities. Surface bound imperfections are achieved by twisting and shear anxieties, wheel/rail contact stresses, warm hassles, remaining burdens and component impacts that all cause through the rail head when a wheel of a vehicle disregards its running surface. The basic abandons that fall inside of the degree of this hypothesis are moving contact weariness (RCF) splits, squats, wheel smolders, and crease. Wheel slip happens when the erosion coefficient between the rail and the wheel is overcome from the torque associated with the wheel set. This slipping of the wheel creates a considerable measure of warmth and tension inciting a plastic mis-shapening of the railhead, this sort of flaw is known as a wheel smolder. Finally, crease is occasional wear and distortion of the rail surface brought on by the wheel set and the intruders' suspension system responding to a defect, for instance, a squat or an anomaly in rail situation. An oscillatory response occurs as the suspension system reacts to the effect on the wheel set. This causes increased stress in sections of the track between 2o to 2oo mm after the source. The stress leads to strange wear further engendering the oscillatory activity along the rail. Underneath specified outline shows the regular railway track features.

II. RELATED WORK

Automatic Inspection of Railroad track: A Design approach: As per AshwiniBelkhade and SnehalKathale 20l4, [l] in the late scenario, greatest of the railway track inspections are physically controlled and controlled by railroad track inspectors. For all intents and purposes, it is unrealistic to look at the thousands of miles of railway track. From this time forward to maintain a strategic distance from delays, our propose system will naturally analyze the railway track by using vision based and vibration based technique. This technique proposes continuous observing and appraisal of the state of the rail tracks which neutralize significant catastrophes. The system provides constant observing and structural condition for railway track using vision based technique and alignment to look the deficiency area on the track. Inspections incorporate distinguishing imperfections on tracks, missing bolts, grapple, tie plate and clips et cetera.
Vision based platform monitoring system for Railway station safety: A Survey According to Shehchan goodness ET. al, [2] Traveler prosperity is an essential worry of railway structure at the same time it has been desperate issue that dozens of individuals are killed consistently when they are tumbled from train platforms. In this paper, proposal of a vision based checking structure for railway station platform. The structure promptly sees dangerous factors of travelers on

the platform by using picture processing innovation. To screen almost entire length of the track line in the platform, we use several camcorders. Each camera conducts surveillance its own preset checking district whether human or dangerous article was fallen in the zone. Besides, to manage the mishap instantly, the system provides neighborhood station, focal control room employees and train driver with the video data about the mischance situation including caution message. This paper introduces the system outline and recognition process with test results. As indicated by the results, we expect the proposed structure will assume a key part to establish profoundly savvy checking system in railway.

Programmed railroad track inspection with the assistance of vision based strategy. Vision based system there are some cameras for gathering the images or videos of rail track and process the casing picture by using picture processing. In such way it could upgrade the proficiency of the conventional methods. The System challenges the accompanying addressed: recognition, discontinuity, and distortion assessment of track components who's physically appearance fluctuate across number of tracks and the distinguishing proof and inspection of track areas such as track turnouts. A MUSIC (various signal classification) calculation is used to distinguish number of signal in the presence of noise [1].

Computer vision based visual inspection and crack detection of Railroad tracks [3] Agreeing to MohammadFarukh Hashmi and Avinash G. Keska et al, Surface analysis is an imperative measurement for track support for Railroad Tracks, because deviations in surface geometry demonstrate where potential defects may exist. A rail surface imperfections inspection strategy based on PC vision structure is proposed in the paper. Various algorithms related demising, separating, thresholding; segmentation and highlight extraction are connected for processing the pictures of Railroad surface abscond and splits. It has mostly been actualized on computers. For better speed and many-sided quality, the algorithms should be executed on installed platforms. These methods were designed for various software setups, specifically MATLAB and C++ using the Intel open CV library. By then correct locale of Interest in individual to blemish is separated and perceived by versatile thresholding and highlight organizing methods. Rate of wear of rail head and length of splits in surface are ascertained next as an assessment of defect on assessed rail head section. Test results of the proposed algorithms are displayed in the results sections alongside seat checking with software algorithms.

Figure 2.2: Railway track with spelling

Composite Real Time Image processing for Railway track profile measurement [4] According to CesareAlippi, Extorted Casagrande, Fabio Scotti and Vincenzo Piuri in 1999, Checking railway status is basic to ensure high working safety, legitimate support schedule, low upkeep and working costs. This operation consists of the analysis of the rail profile and level as well as general geometry and on length. Conventional system is based on the mechanical devices in contact with the track. Inventive methodology based on the laser scanning and with picture analysis. This paper presents and successful composite procedure for track profile extraction with continuous picture processing. High throughput is acquired by calculation profiteering to restrict the picture territory containing the track profile, while high exactness is accomplished by neural reconstruction of the profile itself.

Detection of faults in Railway track,its classification and restricting the faults with the assistance of scientific morphology and Image processing Tools, According to Malge P.S. besides, Nadaf R. S. in 20l4, [5] Their test proposes a Rail track uncertainty location and classification system using a morphological picture segmentation calculation and simple the photo processing theories. Nonetheless, other than the need to distinguish the deformities, it is also essential to classify and find these imperfections so that the source and area of these deformities can be perceived. Based on introductory considers, some track deformities can just exist in specific groups. Hence, clearly the photo processing calculation could be enhanced by applying a segmentation exercise. This anticipate uses format and test images of single layer, exposed, grayscale PC produced.

Recognition of equivocalness in the tracks of railway circuits using Dempster-shafer classifier fusion, Accordant to Lautifa Oukhellou in l999, [6] venture signifies the issue of uncertainty identification and isolation in railway track circuits. A track circuit can be considered as an extensive scale system composed of a game plan of trimming capacitors situated between a transmitter and a recipient. A lacking capacitor influences not just its own inspection data (short circuit current) however also the estimations identified with all capacitors found downstream (between the blemished capacitor and the beneficiary). Here, the worldwide flaw location and isolation issue is separated into several nearby case acknowledgment problems, each gave to one capacitor. The outputs from nearby neural system or decision tree classifiers are conveyed using Dempster-Shafer hypothesis and joined to settle on a definite choice on the location and confinement of a flaw in the structure. Explores distinctive avenues with respect to simulated data show that right discovery rates more than 99% and right limitation rates more than 92% can be accomplished using this methodology, which speaks to a noteworthy change over the state of the workmanship reference technique.

Railway Track Derailment Inspection System Using Segmentation based Fractal Texture Analysis Agreeing toS. Arivazhagan and R. NewlinShebiah et al,Derailments occur when a train runs off its rails and are seriously hazardous to human safety. Most of the Railway Track defects which lead to wrecking are recognized physically via prepared human operators strolling along the track. To conquer this trouble, an Automatic Railway Track Derailment Inspection System using Machine Vision Algorithm to recognize the cracks in the railway track is proposed here. The info picture is decomposed by Gabor channel and surface features were separated using Segmentation based Fractal Texture Analysis (SFTA) and the features are classified as deformity and imperfection free classes using AdaBoost Classifier.

The proposed algorithm is tested on a set of constant samples gathered and the classification rate got was satisfactory. The

wheels transmit the heaviness of the train to the rails, which then transfer it by means of the sleepers to the track substructure. At the point when rehashed stresses of sufficient greatness are connected to a rail section, a break is started after a specific number of cycles, which goes on engendering when stresses are over and again connected [10]. Rail break or crack is the last result of the split advancement process succeeding break start and engendering. Two widespread techniques to assess the properties of a material: destructive techniques and non-destructive techniques. Because of their constrained effectiveness and the restricted zone secured by the destructive techniques such as Coring, Pullout test, tensile test and Flexure test techniques [11], non-destructive techniques have been as of late created. Machine vision is one of the methods of non-destructive techniques

III. PROBLEM DESCRIPTION

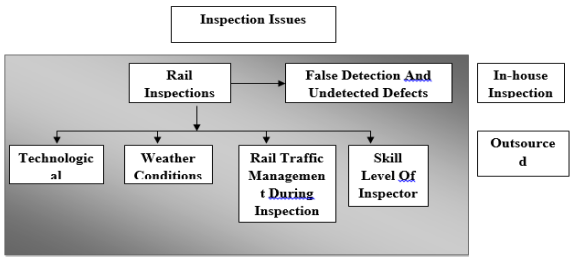

Fig 1. Railwy Inspection Issues

Rail maintenance issues can be comprehensively grouped into:

- Inspection issues
- Issues related to rail wear, RCF and rail welding
- Rectification and replacement issues.

Inspection is additionally represented by climate conditions. In cool nations, similar to Sweden, inspection of rail gets to be troublesome and expensive undertaking in winter. Another imperative issue is administration of rail traffic amid inspection. In Netherlands and Italy a portion of the rail courses are busy to the point that it turns out to be exceptionally hard to stop train traffic and do rail inspection and support, in these courses rail inspection and upkeep is done amid evening time (see Bocciolone et al, 2006). The workers and inspectors must be paid more to work amid night hours. Rail support should be possible all the more successfully amid the day time gave the tracks are free. Keeping the tracks free relies on upon a proficient traffic administration framework. Still it is a test to adequately complete inspection and support methodology keeping ideal rail inspection and upkeep cost and insignificant traffic disturbance. Expecting yearly vehicle ultrasonic inspections took after by manual check of identified defects, inspection expenses are assessed at about €70 million every year for a 0.5 million kilometer framework (considering the aggregate track length in the European Union is around 0.5 million kilometers) (Cannon et al, 2003). This demonstrates the significance of the inspection innovation, recurrence of inspection and the detection of undetected defects. Subsequently, there is requirement for point of interest study and examination of inspection systems to distinguish rail defects.

IV. PROPOSED WORK

The automated inspection of Railway track is done with a motive to remove the manual inspection effort, it is so in light of the fact that it's not worthy and it also consumes human effort in high scale. The inspection might leave some considerable part, so automation is done through the machines however there are also some major downsides in the framework. So objective of our work is to develop a framework which automatically catches the video of the framework and sends it to the server where it is controlled specifically through the MATLAB coding where picture is taken of the required section on the off chance that it is found faulty.

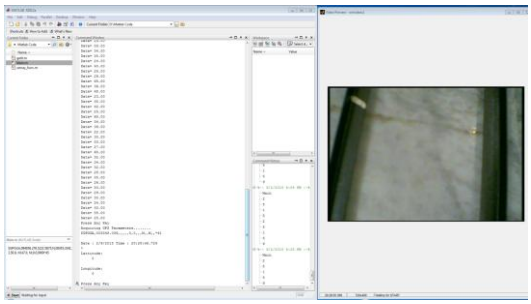

Figure 2. Fault detection in the system with location

In figure 5.1 we can see the errors are present in the railway track with specific longitude and latitude. Data will give the complete information of the faults which are found in the track and exact location of the fault that were present in the track with its specific longitude and latitude, which helps the server to locate the place and for the further action that should be taken for the improvement of the railway track.

1. All operations using GUI and hardware based:

our complete system is consist of the hardware and software. The inspection part is done through the hardware section where the hardware system used to inspect the area region of the track and when it sends the video of the defected part to the receiver through the RF which is attached in the hardware part then MATLAB functions are used to resolve the issues by locating the exact place of the problem where it persists.

2. Detects cracks present in railway track :

In our examine, we found that the image of the defected Railway track that we capture from the camera can come through the noisy source, so our system also helpful in removing the noise from the source and it's also used for Contrast enhancement. Also the color of the inserted image is also to be changed from colored to the gray scale.

Figure 3. Detects cracks present in railway track by using camera

3. Integration of Fault detection technique:

To find faults in the railway track several techniques are summarized in our system such as vibration sensor, ultra sonic sensor, detection of track using infrared. Vibration sensor method is although the conventional method but we are fractioning our system on that and also with that we are working on ultrasonic sensor also which is used to detect the faults of track which are present at a long distance. With these systems we are also integrating client and server system, which is used to send the information of the fault track from the point of consideration to the server and it also helps to find the actual distances with longitude and latitude that where the problem actually persists.

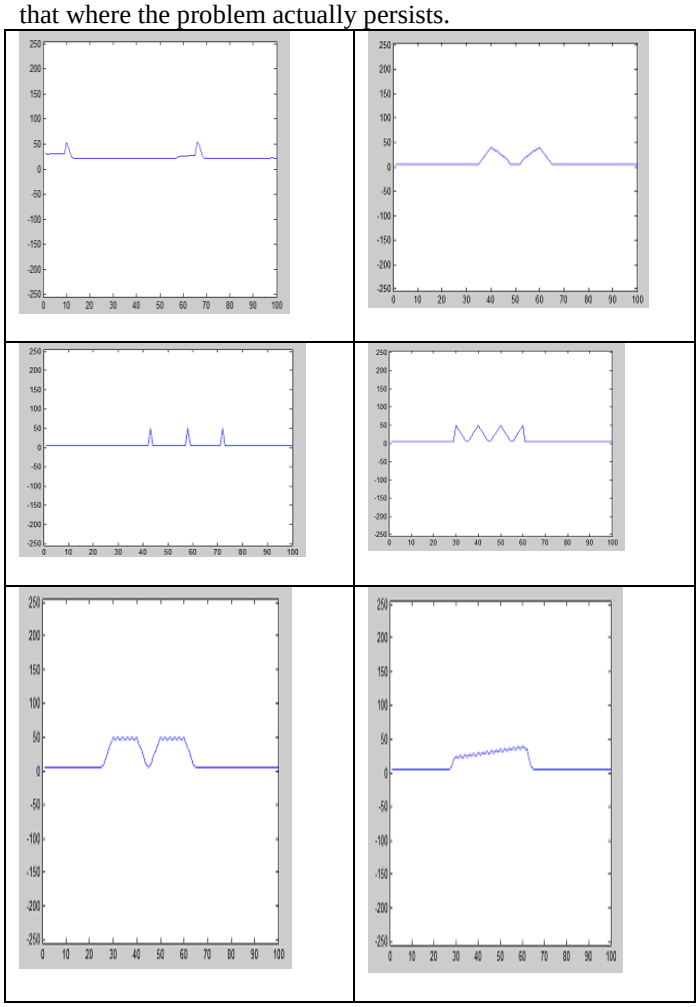

Figure 4- Stored Pattern in Database (Trained Neural Network)

4. Match the pattern with Database:-

To find faults in the railway track several techniques are discusses in our system such as vibration sensor, ultra sonic sensor, detection of track using infrared. Then We got a real time pattern or graph.so after match the graph with Database store in client side database then find fault .If pattern is match then fault is detected then send the information to server Side thought wire or wireless.

V. CONCLUSION

Our proposed system will automatically inspect the railway track by using Real Time Image Processing with vibration module. The proposed system is presented in order to detect the cracks in the railway tracks by making use of Real Time Image Processing through the wireless module. The information is passed to the control section and the location can be found out by using networking module in the system. Hence this will reduce the accident rates and loss of precious life. The proposed framework will consequently review the rail track segment and adjustments of rail track by utilizing vision based and vibration based strategy. Our proposed framework comprise of two sections: A dream based and Vibration based strategy. In vision based strategy machine vision calculation will separate a sign from 2-D signal. In vibration based technique will perform the adjustment of rail track. We will perform two errands at once so that the framework will improve the limit of assessment and gives the exact result. Investigations incorporate tie, tie plates, spikes, and grapple and so on.

REFERENCES

[1] Ashwini Belkhade, Snehal Kathale, "AUTOMATIC INSPECTION OF RAILROAD TRACK: A DESIGN APPROACH", Proceedings of 4th IRF International Conference, 06th April-2014, Hyderabad, India, ISBN: 978-93-84209-00-1.

[2] Ashwini, Snehal Kathale, "AUTOMATIC VISION BASED INSPECTION OF RAILWAY TRACK" Belkhade, A REVIEW, IJRET: International Journal of Research in Engineering and Technology, Volume: 03 Issue: 02 | Feb-2014

[3] Mohammad Farukh Hashmi, Avinash G. Keska, "COMPUTER-VISION BASED VISUAL INSPECTION AND CRACK DETECTION OF RAILROAD TRACKS", Recent Advances in Electrical and Computer Engineering, ISBN: 978-1-61804-228-6

[4] Rio de janeiro, "TOWARDS ADAPTIVE IMAGE PROCESSING - AUTOMATED EXTRACTION OF RAILROAD TRACKS FROM EXTREMELY HIGH RESOLUTION AERIAL IMAGERY" proceedings of the 4th geobia, may 7-9, 2012 - brazil. P.536

[5] Cesare Alippi, Casagrande, Fabio Scotti, Vincenzo Piuri, "COMPOSITE REAL-TIME IMAGE PROCESSING FOR RAILWAYS TRACK PROFILE MEASUREMENT", 0-7803-5276-9/99/$10.00 @ 1999 IEEE.

[6] Boggle Ramesh Reddy, K.Srinivasa Reddy, Geetha Reddy.Evuri, " ADVANCED RAILWAY SECURITY SYSTEM (ARSS) BASED ON ZIGBEE COMMUNICATION FOR TRACK FAULT DETECTION", International Journal of Engineering Science Invention Research & Development; Vol. I Issue III September 2014 , e-ISSN: 2349-6185

[7] Kalpana Sharma, Jagdish Kumawat, Saurabh Maheshwari, Neeti Jain, "Railway Security System based on Wireless Sensor Networks: State of the Art", International Journal of Computer Applications (0975 – 8887) Volume 96– No.25,

June 2014

[8] P. Kiran Kumar, B.S. ShivaShankara, "PLC Based Automatic Fault Detection of Railway Track and Accidence Avoidance system", International Journal of Engineering Research and General Science Volume 3, Issue 2, March-April, 2015, ISSN 2091-2730

[9] Esther Resendiz, Member, IEEE, John M. Hart, and NarendraAhuja, Fellow, IEEE "Automated Visual Inspection of Railroad Tracks" IEEE transaction on intelligent transportation systems, vol.14, no.2, June 2013

[10] Abhisekh Jain, Arvind, Balaji, Ram Viyas N.P."Onboard dynamic rail track safety monitoring system" International conference on advanced communication systems, January 10 - 12, 2007.

[11] J. Riley Edwards, John M. Hart, Steven Sawadisavi"Advancements in railroad track inspection using machine-vision technology" Edwards et al. 2009.

[12] 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 tsinghua university, hsinchu 300,taiwan, roc received 15 January 2001; received in revised form 2 January 2003; accepted 20 March 2003.

[13] Isabelle Tang and Toby P. Breckon, "Automatic road environment classification" IEEE transaction on intelligent transportation systems, vol.12, no.2, June 2011.

[14] Hoang Trinh Norman Haas Ying Li Charles Otto SharathPankanti "Enhanced rail component detection and consolidation for rail track inspection" Ibm T. J. watson research center 19 skyliknedr, hawthorne, ny 10532.

[15] 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.

[16] Avinash Kumar and NarendraAhuja "A vision system for monitoring intermodal freight train" IEEE workshop appl. computer 2007.

[17] J. Velton "Image processing algo for real time tracking data".2006

[18] B.S. Manjunathi and W.Y. Mab, "Texture Features for Browsing and Retrieval of Image Data"IEEE transaction on pattern analysis and machine intelligence, vol.18, no.8, August 1996.

[19] Yoda, K.Sakaue. "Ubiquitous Stereo Vision for Controlling Safety on Platforms in Railroad Station," IEEJ Tr. on Electronics, Information and Systems, Vol. 124, No. 3, Mar., pp.805-811, 2004.

[20] F.Kruse, S.Milch, H.Rohling. "Multi Sensor System for ObstacleDetection in Train Applications," Proc. of IEEE Tr., June, pp.42-46, 2003.

[21] Y.Sasaki, N.Hiura. "Development of Image Processing Type Fallen Passenger Detecting System, " JR-EAST Technical Review Special Edition Paper, No. 2, pp.66-72, 2003.

[22] J. Vhzquez, M. Mao, "Detection of moving objects in railway using vision," IEEE Intelligent Vehicles Symposium University of Parma, Parma, Italy Jun. 1447, 2004.

[23] N. Paragios and V. Ramesh. An MRF-based approach for real-time subway monitoring. In IEEE Conference on Computer Vision and Pattern Recognition, 2001.

[24] I.Yoda, "Image processing technology for advanced safety to people in railroad transportation - For railroad crossing and station platform ," IPSJ Magazine Vol.48, No.1, pp.10-16, Jan. 2007.

[25] I.Yoda, D. Hosotani, and K. Sakaue, "Multi-point Stereo Camera System for Controlling Safety at Railroad Crossings," Proc. of the IEEE International Conference on Computer Vision Systems, 2006.

[26] Shigeki Sugimoto, Hayato Tateda, Hidekazu Takahashi, Masatoshi Okutomi, "Obstacle Detection Using Millimeter-Wave Radar and Its Visualization on Image Sequence," icpr, pp. 342-345, 17th International Conference on Pattern Recognition (ICPR'04) - Volume 3, 2004

[27] Ze Liu, Wei Wang, Xiaofei Zhang, Wei Jia, "Inspection of Rail Surface Defects Based on Image Processing", 2nd International Asia Conference on Informatics in Control, Automation and Robotics, 2010,pp 472-475.

[28] Tomas Karis, "Track Irregularities for High-Speed Trains" , Master of Scienc Thesis,Stockholm, Sweden 2009.

[29] PavelBabenko, "Visual Inspection of Railroads Tracks", Fall term, MS. University of Central Florida, 2009.

[30] Cesare Alippi, Ettore Casagrande, Matteo Fumagall', Fabio Scotti, Vincenzo Piur, Luigi Valsecchi, "Embedded System Methodology for Real-time Analysis of Railway Track Profile", IEEE Instrumentation and Measurement Technology Conference Anchorage, AK, USA, 21-23 May 2002,pp 747-751.

