Rail Defect Detection with Real Time Image Processing Technique

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Abstract— Railway track or crack on rail path defect detection is a more important process for railway transportation. Because defects on the rail track cause to problems such as the cost, the disruption of transportation and security, railway accident. In this study, based real-time video processing algorithm used Morphological feature extraction is recommended to detection defects on train path. The rail is detected by applying big Transform and image processing techniques to rail track defect images obtained from the real time camera or IR sensors. Features of the detected train track defect images are extracted with applying morphological operations and defected regions are identified. In this study, results with low uptime and high success rate are acquired by performing all steps of proposed algorithm to the images of rail taken under different lighting and direction.

Key words: Rails, Acoustics, Phased Arrays, Field Programmable Gate Arrays, Logic Gates, Fasteners, Rail Defect Detection, FPGA, High Precision

I. INTRODUCTION

Rail transport, in specific, a type of transport used for many years because of cost and secure advantages. Security and maintenance of railroads use increased with the development of technology in this field is important at the same rate. In particular, it can continue to use in a healthy manner and in condition monitoring of rail tracks directly affects the safety of the track. Traditionally these processes are generally provided in a manner based on human power. However, these methods are having some disadvantages in terms of both cost and get good results [1]. In recent years, advances in technology have led to development of methods based on the power in this area. With falling costs of computer and electronic hardware and developing software techniques provide effective results of the work in this area. There are number of way to studies in the field of monitor of computer based vision of railways [2]-[4]. In one of these studies, Khan et al., have proposed a machine vision method to determine the anchor and ties [5]. In this study, E-type anchors are tried to be determined. Feature extraction methods are used in the presence of fault. The test results and the success rate obtained by the method are given in the results section. A block diagram of this study are given in Fig. 1. Singh et al., a control method is proposed to detect faults of tie plates

Computer vision-based condition monitoring methods, the methods are increasingly used on railway systems. Rail condition monitoring process can be performed using data obtained with the help of computers using these methods. In this study, a computer-based visual rail condition monitoring is proposed. By means of a camera placed on top of the train the rail that the train is on and the neighbor rail images are taken. On these images, the edge and feature extraction methods are applied to determine the rails. The resulting several faults between railways were studied to determine if there is a failure. The results obtained are given at the end of the study. Experimental results show that the proposed method is examined, it is observed that a healthy and effective results.

Images from a railway order to test the actual work performed is examined with the proposed approach. These images using the proposed method, the distance between the rail cruising on and neighboring rail was calculated respectively. Between the rails with this approach it is determined whether any expansion or contraction. Image processing algorithm has been carried out on images taken at the study. Rails mainly are determined initially by the image processing algorithm. The distance between the marked tracks is calculated using image processing algorithms. The distance between the rails pixels values are obtained. In the proposed approach, and finally it analyzed the change of the pixel value. According to a user-defined threshold value determined as the sudden changes in the pixel values examined it offers detailed information about whether any contraction or expansion between the rails. If the obtained distance above a determined threshold value, means that the expansion of the rails. Likewise, in case of falling below the threshold value it is determined to be contraction in the rails. Such problems are important conditions that could prevent trains to travel safely, the detection of this fault with the work previously done will prevent major accidents will happen in the future. A flow diagram summarizing proposed image processing algorithm used in the approach and example outputs obtained from the image processing algorithm an image is as shown in below Fig.

II. FLOWCHART OF PRAPOSED SYSTEM

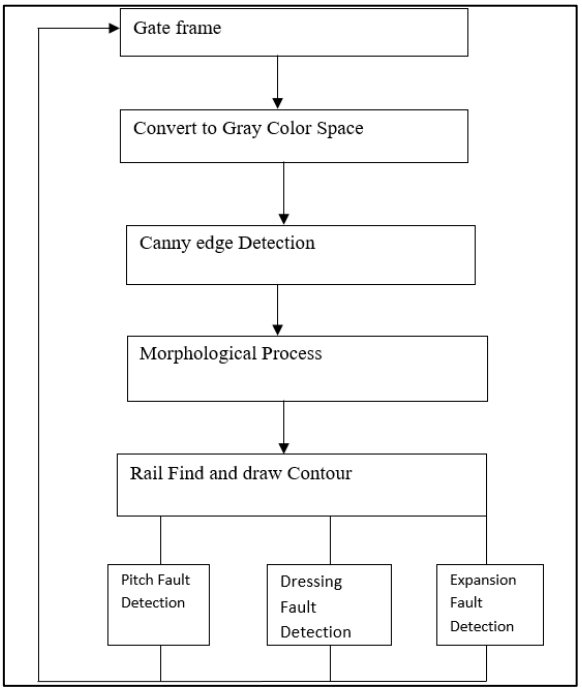

Fig. 1:

The rails are determined by means of image processing techniques using the proposed method. The distance between the rails is determined again by image processing. Thus, it is determined that there is any problem between the rails. In order to perform these operations on the locomotive it was placed one camera. In the proposed approach, the rail locomotive cruising on and neighboring the rail are analyzed. In these analyzes, the several fault types between the rails is calculated. Thus, significant problems can be avoided that might occur in the future. A block diagram illustrating the operation principle of the proposed approach is given in Fig. 2. Also, the detected faults are presented in Fig. 3. Mainly used for a camera system can be seen from Fig. 2. Images from the camera are used to calculate the several faults such as pitch, expansion between the rails.

III. MATERIALS & METHODS

In this work, rail defect detection method is improved according to the past work. Accuracy rate of the defect detection is increased with adaptive block. Value of the area parameter is greater than past work. Thus both accuracy rate of the algorithm is increased and noisy areas of the image aren't labeled as defect areas. When the proposed method is compared with algorithm existed in literature, this algorithm is superior. Because this algorithm can detect with a single algorithm multiple faults. Moreover this algorithm is not affected from foreign objects which are existed around the rail track and from the reflection of sunlight. Experimental results of the rail track detection and the rail defect detection are respectively.

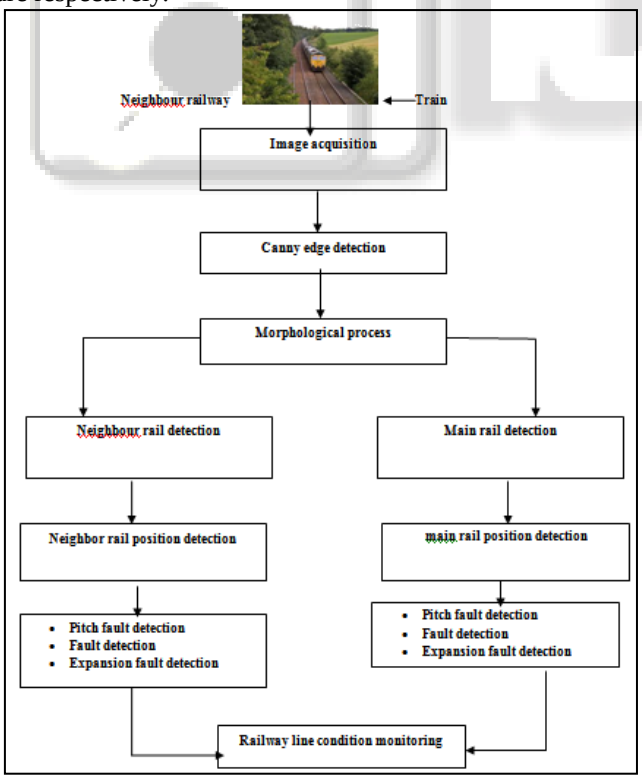

Fig. 2: Block dia. of Rail Defect Detection System

Fig. 3: Original Image Scanned Image

IV. RESULT

In order to test the proposed approach one camera was placed on a real locomotive. In the images from this camera is recorded and analyzed by computer image processing algorithm. Real-time images taken on this camera sees both the rail cruiding on and the neighboring rail. These two rails are fully determined by the image processing algorithm performed. Finally, the distance and several faults between the rails are calculated from the pixels and observed changes in the pixel values

V. DISCUSSION

VI. CONCLUSIONS: (OPTIONAL)

Our system can perform in real time at the vehicle velocity of 10 mph, at frame rate 20 fps. It robustly invention important rail components such ties, tie plates, anchors with high accuracy and efciency. The condition of detected anchors a real so evaluated to invention shifts and spreads. Invented objects are then consolidated beyond video frames and beyond camera views to map to physical rail objects, by fusing the video data with GPS and DMI information. After these rail components are invented and consolidated, further data integration and analysis is followed to invention anchor pattern non-compliances, or exceptions. Quantitative analysis performed on a large video data set captured on different track conditions demonstrates that our system achieves very promising performance in terms of anchor condition assessment, and compliance-level exception detection. To our knowledge, our system is the RST to address and solve these two problem in rail inspection.

VII. ACKNOWLEDGMENTS: (OPTIONAL)

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REFERENCES

[1] I. Aydin, M. Karakose, and E. Akin, "An approach for automated fault diagnosis based on a fuzzy decision tree and boundary analysis of a reconstructed phase space," ISA Transactions, vol. 53, no. 2, pp. 220-229, 2014.
[2] I. Aydin, E. Karakose, M. Karakose, M. T. Gencoglu, and E. Akin, "A new computer vision approach for active pantograph control," in Proc. IEEE International Symposium on Innovations in Intelligent Systems and Applications, 2013, pp. 1-5.

[3] C. Mair and S. Fararooy, "Practice potential of computer vision for railways," IEE Seminar, Condition Monitoring for Rail Transport, pp. 10/1-10/3, 1998.
[4] O. Yaman, M. Karakose, E. Akin, and I. Aydin, "Image processing based fault detection approach for rail surface," in Proc. Signal Processing and Communications Applications Conference, 2015, pp. 1118-1121.
[5] R. A. Khan, S. Islam, and R. Biswas, "Automatic detection of defective rail anchors," in Proc. IEEE 17th International Conference on Intelligent Transportation Systems, 2014, pp. 1583–1588.
[6] M. Singh, S. Singh, J. Jaiswal, and J. Hempshall, "Autonomous rail track inspection using vision based system," in Proc. IEEE Int. Conf. on Computational Intelligence for Homeland Security and Personal Safety, 2006, pp. 56-69.
[7] H. Trinh, N. Haas, and S. Pankanti, "Multisensor evidence integration and optimization in rail inspection," in Proc. IEEE 21st International Conference on in Pattern Recognition, 2012, pp. 886-889.
[8] H. Trinh, N. Haas, L. Ying, C. Otto, and S. Pankanti, "Enhanced rail component detection and consolidation for rail track inspection," in Proc. IEEE Workshop on Applications of Computer Vision, 2012, pp. 289–295.
[9] B. Sun, J. Zhuang, J. Lin, Q. Zhang, and S. Chen, "Research on the new rail auto-inspection system," in Proc. IET International Conference on Smart and Sustainable City, 2011, pp. 1-4.
[10] S. V. Sawadısavı, "Development of machine-vision technology for inspectıon of railroad track," Graduate College of the University of Illinois at Urbana-Champaign, 2010.
[11] C. Limin, L. Yin, and W. Kaimin, "Inspection of rail surface defect based on machine vision system," in Proc. 2nd International Conference on Information Science and Engineering, 2010, pp. 3793–3796.
[12] H. Trinh, N. Haas, and S. Pankanti, "Multisensor evidence integration and optimization in rail inspection," in Proc. 21st International Conference on Pattern Recognition, 2012, pp. 886– 889.
[13] L. Qingyong and R. Shengwei, "A real-time visual inspection system for discrete surface defects of rail heads," IEEE Transactions on Instrumentation and Measurement, vol. 61, pp. 2189-2199, 2012.
[14] S. Zheng, X. Chai, X. An, and L. Li, "Railway track gauge inspection method based on computer vision," in Proc. International Conference on Mechatronics and Automation, 2012, pp. 1292-1296.
[15] L. Ying, T. Trinh, N. Haas, C. Otto, and S. Pankanti, "Rail component detection, optimization, and assessment for automatic rail track inspection," IEEE Transactions on Intelligent Transportation Systems, pp. 760–770, 2014.
[16] E. Karakose, M. T. Gencoglu, M. Karakose, O. Yaman, I. Aydin, and E. Akin, "A new arc detection method based on fuzzy logic using S-transform for pantograph–catenary systems," Journal of Intelligent Manufacturing, pp. 1-18, 2015.
[17] M. Karakose, M. Baygin, N. Baygin, K. Murat, and E. Akin, "An intelligent reconfiguration approach based on fuzzy partitioning in PV arrays," in Proc. IEEE International Symposium on Innovations in Intelligent Systems and Applications, 2014, pp. 356-360.
[18] I. Aydin, O. Yaman, M. Karakose, and S. B. Celebi, "Particle swarm based arc detection on time series in pantograph-catenary system," in Proc. IEEE International Symposium on in Innovations in Intelligent Systems and Applications Proceedings, 2014, pp. 344-349. Mehmet Karakose re
[19] TG. Karaduman, M. Karakse and E. Akn, Experimental Fuzzy Diagnosis Algorithm Based on Image Processing for Rail Profile Measurement, in Mechatronika 15th International Symposium, pp. 1- 6, 2012.
[20] Aydn, M. Karakse and E. Akn, A Robust Anomaly Detection in Pantograph-Catenary System Based on Mean-Shift Tracking and Foreground Detection, in IEEE International Conference on Systems, Man and Cybernetics, pp. 4444-4449, 2013.
[21] V. R. Vijaykumar and S. Sangamithirai, Rail Defect Detection using Gabor filters with Texture Analysis, in 2015 3rd International Conference on Signal Processing, Communication and Networking (lCSCN), pp. 1-6, 2015.
[22] Susiripala, Arunoda - Bulletproof Meteor, 2014.
[23] Susiripala, Arunoda - Meteor Explained - A Journey Into Meteors Reactivity, 2014.
[24] Strack, Isaac - Getting started with Meteor.js JavaScript framework, 2012. Department of Computer Engineering ,Shree Ram chandra College Of Engineering Lonikand,Pune412216
[25] Rail Defect Detection With Real Time Image Processing Technique
[26] "Meteor releases". GitHub. Retrieved 23 September 2015.
[27] Vanian, Jonathan (27 December 2014). "Meteor wants to be the warp drive for building real-time apps". Gigaom.
[28] Tan, Garry. "Meteor (YC S11) raises 11:2Mf romAndreessenHorowitzandMatrixPartnerstocreatethen extRubyonRails"10.3.10 Finley, Klint (25 July 2012). "Andreessen Horowitz Keeps Eating The Software World With 11:2MillionInvestmentInJavaScriptFrameworkCompa yMeteor": TechCrunch:
[29] Lardinois, Frederic (2014, October 7). "Meteor Acquires YC Alum Fathom DB for Its Development Platform". TechCrunch.

