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FAULT DETECTION IN RAILWAY TRACK

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ABSTARCT *- The railway stands for the biggest means of transportation in India. Due to its advantages of fast and capacity, it became most frequent choice for passengers. As a result, the load and crowd of train has been increasing and this increase the risk of producing rail defects. Therefore, rail inspection is an important task in railway track maintenance. So, Automatic image based crack detection is proposed. In this project, a computer based methodology has been discussed which will help in detecting the cracks on the tracks appropriately with less human effort. Image processing techniques are applied to detect the fault of track using a computer.*

Key words **– railway network, image processing, top-hat transform, fault detection.**

I. INTRODUCTION

Rail transport, in particular is a type of transport used from many years because of its cost and safety as advantage. Security and maintenance of the railway track are the key factors for the train to move properly. Though it has many advantages like safety, cheapest transport system, a minor accident of train causes a great loss in human lives. Traditionally the rail track inspection has been done manually with human power. However, there are some disadvantages in terms of both cost and safety. In recent years, with the advancement in technology various development methods have been done in this area. As of now with the falling costs of computer and electronic devices and new software techniques will provide effective results of the work in this area. Due to the limitation in the human inspection that has led to an non-destructive testing techniques, that can know the condition of the train by using a certain sensors. These sensors will detect the faults with the help of a software. The NDT techniques for rail inspection now a days uses a visual cameras, eddy current, ultrasonics etc. ultrasonic testing gives best performance but the inspection speed is low that is only up to 75km/hr. moreover, it cannot detect the surface faults. This technique is only capable of detecting the internal faults. But this method cannot achieve its performance in detecting the surface defects.

Eddy current is another type of NDT technique which is also used to detect the faults in railways. It relative speed of inspection in detecting the surface faults is high. Mostly, with the help of using ultrasonic sensors it can detect the faults in tracks. The sensor that is used in the eddy current testing is very sensitive to lift the variations that occur in the probe which is been positioned at a constant distance from the surface of the rails. Therefore, the eddy current testing is a complex and a sensitive one.

Various studies in the field of monitoring of computer base vision of railways has done, one of the studies, Singh et al., has proposed a control method to detect the faults of tie plates. In this a light source and a camera is placed under the train. After obtaining the pictures, using these clips the edge extraction algorithm, hue of the clips can be determined. Khan et al., have proposed a mission vision based method that can determine the ties and anchor. Finally some extraction methods have been used to determine this method, that is shown in the Fig.1.

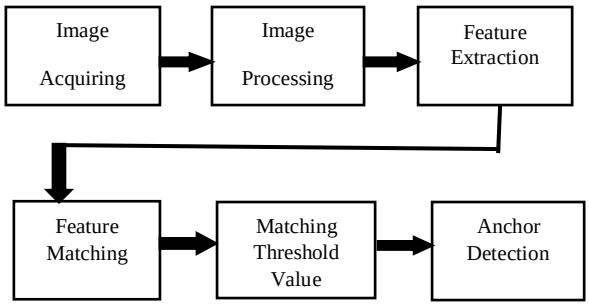

Fig1.Block Diagram of anchor method

Trinh et al., determined to study the damage to the elements on the rails. In this model four cameras and a distance measuring device is used, which is used to determine the

damage structures and pattern of in appropriate components. In another model sobel edge detection is carried out with the aid of a camera taking the clips. Where object extraction processing is done using Hough transform method

Chan et al., aims to determine a method in order to know the damage caused by the load on rails. In this method image processing techniques has been used in order to determine the faults in the rails. In recent years, visual inspection has been developed by using image processing techniques. In this process a high speed digital camera, which is kept under a test train that is used to capture the images of the tracks. Then the obtained images are analyzed using the image processing software. Visual inspection has many advantages such as speed, low cost and good performance. Therefore, it is one of the most attractive techniques for detecting the faults in rails.

In this a computer vision based method is proposed for analysing. Here a camera is taken, which is placed on the upper part of a moving train, where the camera captures the pictures of the rail tracks. The image that are acquired are processed by using image processing techniques and feature extraction methods are also applied in order to detect the defeats on the rail tracks.

II. PROPOSED METHOD

In this study, image processing techniques are used to detect the faults in railway track. The rail track is inspected based on the image processing techniques. In the proposed approach, the rail on which the train is running is monitored and the faults are detected. A block diagram illustrating the operating principles given in Fig.2.1.

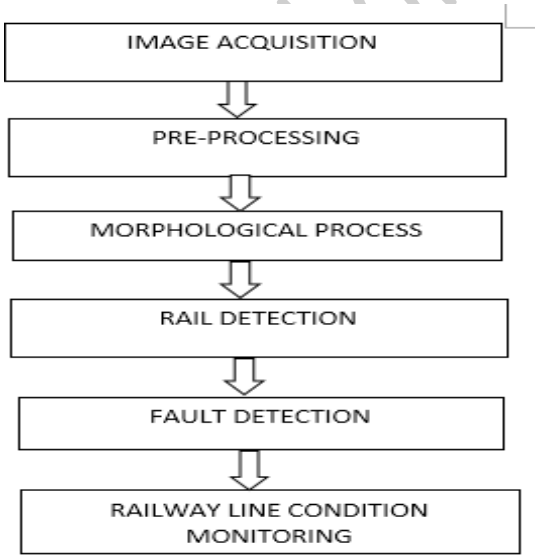

Fig.2.1 Proposed Method

The main objective of the proposed approach is by comparing the image to be processed or to be detected with the image provided in the database. Accordingly, it is determined whether there is any fault process or not.

The proposed approach can detect the main faults such as pitch fault, expansion fault and dressage fault as shown in Fig.2.2, 2.3, 2.4.

Fig.2.2. Pitch Fault

Fig.2.3. Dressage Fault

Fig.2.4. Expansion Fault

Image processing algorithm has been applied on images at the study. Initially the images a acquired are pre-processed to enhance the quality and to remove the noise from the image. Now the processed image is processed using morphological techniques to get the rail completely without any noise. And now the rail image is compared with the processed image provided in the database to give whether there is any fault or not.

A flowchart summarizing proposed image processing algorithm is as shown in Fig.2.5.

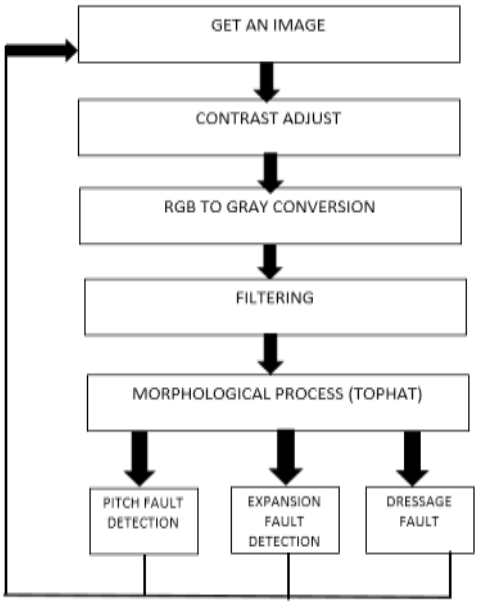

Fig.2.5 Flow Chart for Proposed Method

The first step of the proposed approach is to get the image of the railway track. After getting the image to be processed, contrast adjustment is performed.in order to enhance the quality of the input image the intensity values of the image are stretched throughout the range of intensities, Histogram equalization is employed to perform contrast adjust.

The contrast adjusted image is converted into grey scale image. As the analysis of grey scale image is more comfortable than analysing a color image. Also grey scale image consists of 256 intensity levels which is far less than color image intensity levels.

Now, the grey converted image is filtered inorder to remove noise. Here median filter is applied as to detect rail, edge preservation is more important. Whereas median filter is known for noise reduction while preserving edges.

After filtering to detect the rail, morphological processing techniques such as top hat transform is employed. This tool will detect only the rail while removing all the unnecessary portions of the image. The outcomes of the proposed process are as shown in figure.

Fig 2.6 Original Image

Fig 2.7 Top-hat Transform

In this image, the rail sections as white color, and the remaining background and objects are represented as black color. The purpose of the process is to provide easy comparision with the data base.

III. EXPERIMENTAL RESULTS

The acquired images for the detection are processed using

image processing techniques. If the distance between the two rails is either increased or decreased then it is known as pitch fault. Consider the image having pitch fault. After applying pre-processing techniques to the image top hat transform is applied and after highlighting the rail image its is compared with the database image and the obtained will give the fault on the rail track.

Similarly when processing expansion fault, input image having expansion fault is taken as shown in Fig.3.1. If one of the rail track is having a small bend on its surface, then it is known as expansion fault. This image is processed using contrast and filter techniques. After applying top hat transform the resultant image is given in Fig.3.2. The final output image obtaining after comparing with the database image is shown in Fig.3.3

Fig 3.1 Expansion fault image

Fig 3.2. Top-hat transform

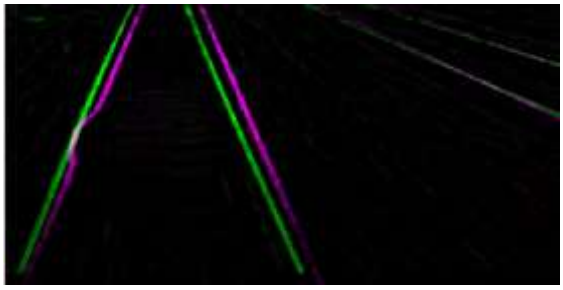

Fig 3.3. Detected Fault

Similarly, to detect dressage fault image having dressage fault is taken as shown in Fig.3.4. If both the rail tracks are having bends on their surfaces then the fault is known as dressage fault. The taken image is processed using contrast adjust and median filter methods. After that top hat algorithm is applied and the obtained output is given in Fig.3.5. After comparing with the database image the detected fault is as shown in Fig.3.6.

Fig 3.4. Original Image

Fig 3.5. Top-hat Transform

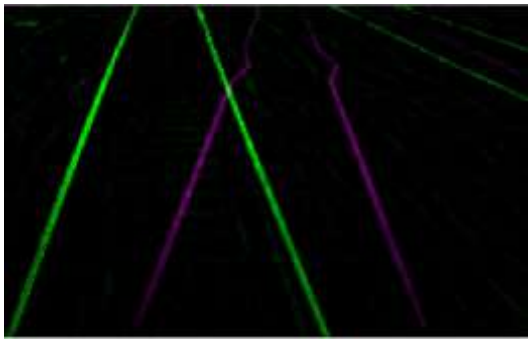

Fig 3.6. Detected Fault

IV. CONCLUSION

In this study, a computer based method is provided to reduce the train accidents. In this approach, image processing techniques are used to detect the faults. Hence, this method provides an easy and cost efficient method for the railway network. And the results indicates that this approach gives better results in detecting faults in railway network.

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