RAILWAY TRACK INSPECTION SYSTEM FOR RAILBOLT AND CRACK FAULT DETECTION

Yuvashree G[1], S. Murugappriya[2]

[1]PG Scholar, Embedded System Technology, Easwari Engineering College (India)

[2]Asst. Prof, ECE, Easwari Engineering College (India)

ABSTRACT

Railway track inspection system plays a vital role in railway maintenance and it is habitually needed to avoid dangerous situations. The abnormalities of the railway tracks are mostly due to Rail crack and misplacements of bolts in Railway Track. These are cause due to the vibration in railway track by running trains. Normally trained railway employees will manually inspect the railway track by walking along with the track to search for visual abnormalities. This system has many faults because of delay, accuracy and objectivities. To prevent such scenario, the proposed system will automatically inspect the rail crack, misplaced bolts and deadheaded spikes in the railway track. In vision based method camera will be used to capture the video. The proposed system captures the video of the track from the vehicle which has camera on the base of the vehicle. This system detects the rail cracks and misplaced bolts in the tracks. The system the monitoring and structural condition for railway track using vision based method and calibration to search the fault location on the track. The percentages of abnormalities are sent to the maintanence vehicle Driver by hardware unit placed on the driver cabin.

Keyword: Railway Track, Abnormalities, Automatic inspection System, Video, Detection, Misplaced Bolts.

I. INTRODUCTION

Railway track inspection system is to go through the railway tracks for its component inspection. The failure in railway track may leads to extremely large scale accidents. This track defects are the second leading cause of accidents on railroad travel. This may leads to the derailment of train from the railway tracks. To maintain railroad travel a safety and efficient, railway must inspect their track on periodic basis. The railway track consists of rails, ties (sleepers), tie plates and bolts must to be inspected.The railway track maintenance normally covers a wide spectrum, ranging from detecting surface cracks in the rail, measuring rail profile and gauge, to monitoring the conditions of joint bars, spikes and bolts. However other inspection, like spiking and anchor pattern and detecting raised or missing spikes are still manually and visually conducted by railroad track inspector. These spikes may be misplaced due to the cause of corrosion, vibration caused from train movement. When the bolts come out from its position, they may loosen the rails in railway track which is more dangerous to the railroad travel. It may lead the train to derailment from the track. To avoid such situation on the railroad travel we going for the system called real time vision based railway inspection system to detect the misplaced bolts and spikes in the railway track.

Fig No: 1.1 Clamps in Southern Railway Track

1.1 Goals of The Project

The main goal of the project is to provide more security to the railway passengers and to protect the loss of properties for the railway department by avoiding the derailment of the train. It is used to find the missing bolts in the railway track. These missing bolts in the railway track will loosen the rail in the railway track. When heavy waited trained goes in high-speed, the track may loosen which leads to the derailment of railcars from the track. This derailment happens to both passenger and cargo trains. Accidents in train will leads to a big disaster. This is to implement on testing vehicles of the railways by using cameras fixed in the bottom of the maintenances vehicles. The video will be taken from the camera and send for the process. The process involves the segmentation of the images from camera and applies the algorithm. This detects the bolts and rail cracks in the railway track and checks the number of bolts present in the track. If the number of bolts in the tract is less than the maximum number of bolts, the ratio is checked and the level of danger is calculated. This displays the percentage of bolts present in the railway track.

Fig no: 1.2 Broken Clamps in Railway Track

1.2 Existing System

This system is a very important system in railway department to avoid derailment of train because of the missing bolts. This system is not implemented all over the world. Moreover Rail crack detection system is much familiar and it will be implemented in some of the railroad authorities where railway track bolts detection system is notimplemented. In India this process of checking the bolts in railway track is still manually happening. This manual process will have many disadvantages. Railway department will provide well trained worker for this detection process, but sometimes worker cannot detect the missing bolt because of his carelessness and many issues will be created. Sometimes because of field survey, in busy track, there is a chance of causing accident by hitting train. To avoid these types of incidents there is a need for automatic railway track component detection system.

II. PROPOSED SYSTEM

The video of the railway track is taken and sent to the rail component detection and optimization block. This consists of components detections life ties, tie plates, rail cracks and bolt detections. Tie plate detection is the

first step in our detection pipeline since it provides information to define the region of interest, in which other components can be located. In our current imaging setup, the rail always occupies the upper portion of the image and presents a very distinct horizontal dividing line from the rest. On the other hand, when a tie plate is present, its bottom edge would present another approximately horizontal line.

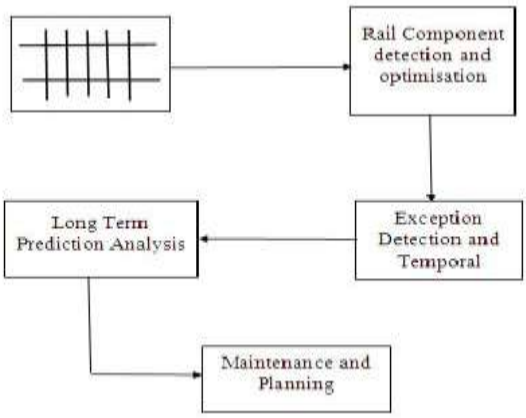

Fig 2.1: Overall Architecture of the System

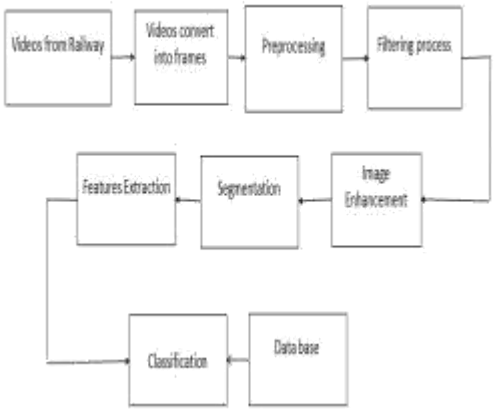

Fig No: 2.2 Steps for Detection

Railway track video is track from the base of maintenance vehicle and sends it to the preprocessing block for frame conversion and gray conversion. Gray converted frame is taken for filtering (Anistropic Diffusion Filter) processes to remove noise. Enhancement is done based on histogram based processing and CLAH. Segmentations of frames are done by Sobel, Prewitt and Canny. Feature classifications are extracted according with mean, standard deviation, CNR and SNR. Classifications are done by SVM algorithm which is for classifiers. The detecting result is then interfaced with the hardware units which consist of PIC microcontroller and LCD display. Result percentage of abnormal bolts is displayed in the LCD display.

2.1 Algorithm

To ensure safety, railroad companies require different anchor patterns for different rail types. For instance, for jointed rail, there should be eight boxed ties per segment, whereas for continuously welded rail, only alternate boxed ties are required. By boxed tie, we mean a tie with all four anchors in good condition, Note that, since we process the images, we need to constantly check if we have covered a limited track segment. If yes, we perform the number comparison and identify any exception; otherwise, we update the counter C and read in the next tie. A confidence score will be also measured for every detected exception based on the confidence of anchor detection. Note that we continuously perform this inspection for every possible limited segment thus, when a new tie moves into this limited segment window, the earliest tie will move out, and the inspection will be kicked off again.

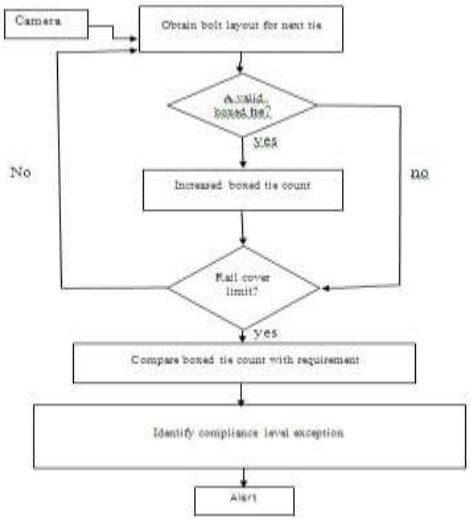

Fig no: 2.3 Flow of Algorithm

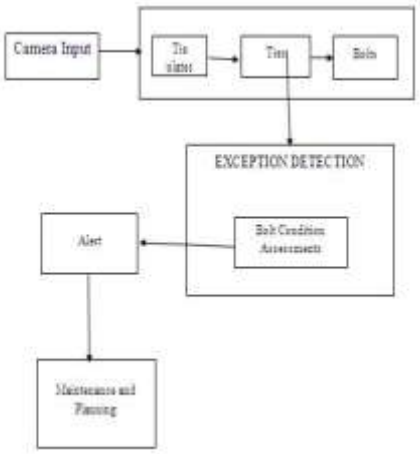

Fig no: 3.1 Block Diagram

III. SYSTEM IMPLEMENTATION

The System is implemented by fixing the field cameras on the bottom of the testing vehicles used in the maintenance purpose of the railway department. This field camera can capture the images in the track and send that images to the processing system. This processing system involves certain algorithms which will perform the detection of ties, tie plates and bolts which present in the railway track to avoid the rails moves in latitudinal and longitudinal moves. After detecting the rail components, it checks for exception detection in that. This exception detection will detect the number of ties present in the video as well as number of tie plates and bolts present in the railway track. This detects the bolts and holes present in the tie plates. This detection gives a number of percentages the bolts present in the certain length and whether the track is efficient for train travel or not. This alert the railway department maintenance employee team who will replace the bolts on the holes present in the tie plates for the certain distance of the track which are tested using this system.

IV. RESULT and DISCUSSION

This inspection system is to detect the bolts in the tie plates to improve efficiency of the railway track. The sample image where in this work a set of images where taken as input. Figure 4.1 represents loading video from camera.. From this the stages of frames be selected which is shown in Figure 4.2. The final result of the algorithm and the alert is shown in Figure 4.3, 4.4 and 4.5.

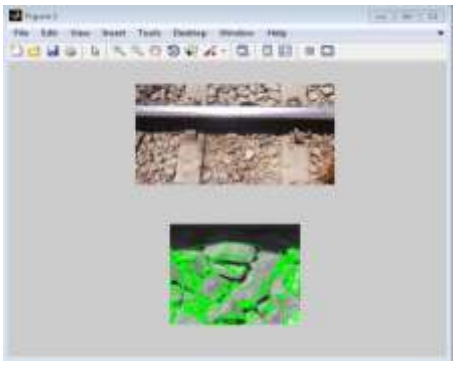

Fig 4.1: Loading Video

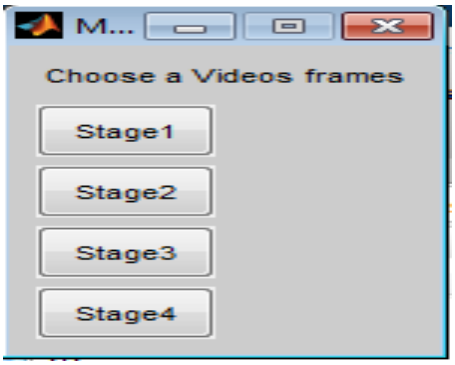

Fig 4.2: Selecting Stages of Frames

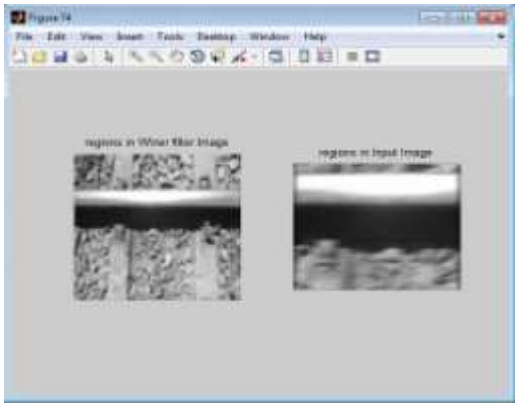

Fig 4.3: Using Winer Filter

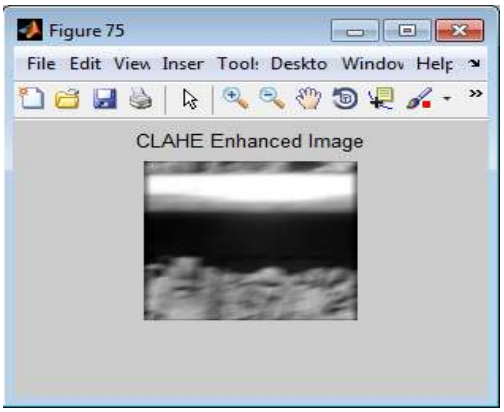

Fig 4.4: CLAHE Enhanced Image

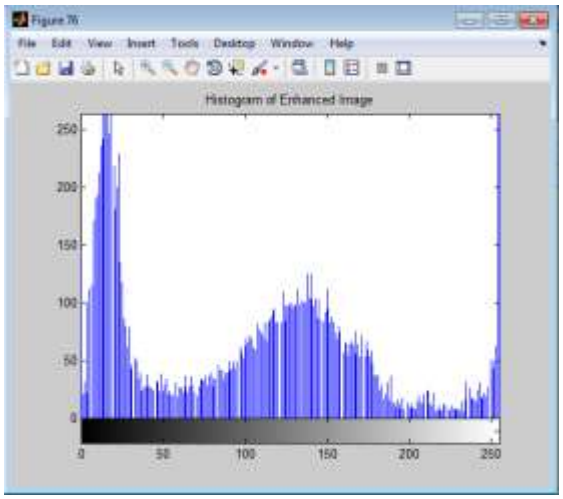

Fig 4.5: Histogram of Enhanced Image

V. CONCLUSION AND FUTURE WORK

Missing bolts is the vital problem in railway track. When it is predicted, we can prevent the heavy loss of human lives and properties. The system is able to detect important rail components with high accuracy and efficiency based on visual, location, DMI, and contextual information. We have further discussed anchor exception detection at both single tie and compliance levels. This system is implemented and tested with the rail component images. The system is tested accordingly and the performance of the system is efficient. The main challenge for the system in near future is to improve the current tie detection approaches and the global component optimization approach needs to be evaluated on other rail object other than tie plates. Finally need to enhance the algorithm with modified imaging system to accommodate a faster and more desirable inspection speed.

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