AUTOMATIC INSPECTION OF RAILROAD TRACK: A DESIGN APPROACH

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Abstract- Currently, most of railway track inspections are manually conducted by railroad track inspectors. Practically, it is not possible to inspect the thousands of miles of railway track. Hence to avoid delays, our propose system will automatically inspect the railway track by using vision based and vibration based method. This method proposes continuous monitoring and assessment of the condition of the rail tracks which prevent major disasters. 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. 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 monitors 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.

In vision based method our device will capture videos of railway track component using vehicle-mounted Cameras, image enhancement using image processing and assisted automation using a real time tracking algorithms.

In vibration based method our device will do calibration of the rail track by using vibration sensors. Vibration sensors will sense the vibration on the track. If the track vibration are in the range of predefined standard values it means there is no faults otherwise track is defected. Damage component and faulty track information will broadcast to the server through wireless medium. By using both the method we can inspect the railway track in accurately. Our propose system focus on machine vision based and vibration based method to detect irregularities in track and defected component such as tie, tie plate, anchor, missing bolts. Inspected data will be stored in digital format that’s why analyses of track component condition are possible through data processing. In this way our propose system will perform a function of automatic inspection of track component and calibration of track and it provides an interim improvements to current track inspection practices.

II. LITERATURE REVIEW

Recently, research and development of rail track inspection have received a great deal of attention to save passengers life. There are some methods which based on inspection technology are as follow:

One such method is inspection of railroad track inspection with the help of vision based Automatic railroad track inspection with the help of vision based method. Vision based system there are some cameras for collecting the images or videos of rail track and process the frame image by using image processing. In such manner it could enhance the efficiency of the traditional methods. The System challenges the following addressed: detection, fragmentation, and deformity evaluation of track components whose physically appearance vary across number of tracks and the identification and inspection of track areas such as track turnouts. A MUSIC (multiple signal classification) algorithm is used to detect number of signal in the presence of noise. Another method is to inform the train in case of any dislocations in the track or change in strength of the soil. The vibrations on the track are sensed by these sensors and this method can process the data from the sensor network and inform the train giving sufficient time to stop.

Machine vision technique are divide into two parts are as follow:

2.1 Data acquisition

In automated visual based inspection of rail track off the shell cameras are used for obtain rail track images and record this data to a laptop [1]. Digital cameras are used to capture the images or videos of rail track.
3. Surf View comes with on board computer, data acquisition and software along with six cameras scanners and cables [5]. A calibrated CCTV camera is used to capture the image frame at resolution 640x480 at 30 frames per second which was mounted the rail track [9]. High speed line scan cameras are used to obtain videos of rail track [10].

2.2 Image analysis
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. Gabor transformation technique are used to convert into digital signal from track image [1].In vision based system image processing is used to recognize of clips, smoothing and edge detection [8].Machine learning technique is used to process the acquired data [9]. 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]. Gabor wavelet features is used for frame analysis and it provide a comprehensive result evaluation [11]. To extract rail track image, we first examine evaluating the captured input image with the help of Sobel operator. Hough transform process is used for the detection of railway track lines and removes the noise in the binary image.

2.3 Data analysis
In this section resulting data compare with the pre loaded standard values, if resulting data lays between the pre specified values for verification purpose.

III. RESEARCH METHODOLOGY TO BE EMPLOYED

Our proposed system consists of two models:
1. Vision based automatic tracking of rail track.
2. Vibration based automatic tracking of rail track.

1. 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.

2. 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.3.1

Our system will capture the video of rail road track by using camera. The captured image will verify whether the conditions match or not. If the frame is matched then the system will process the data and will then track the data. If the frame is not matched then it will jump to the video frame as shown in fig.3.2.

IV. EXPECTED OUTCOME AND FUTURE WORK

Thousands of miles of railroad track must be humanly inspected in a week to maintain safety standards of railway track [1]. But this method is quite tedious and consumes more time. Hence to avoid delay our proposed method will inspect the rail road track by using some advance techniques. In this way we can solve the problem by using vision based method and vibration based method. While inspecting the tracks our system will monitor the track for any fault. If the track is damaged due to certain conditions, the fault will be recognized by the system using machine vision algorithm. If there is any defect then location of the defected track will be broadcasted to the server.
through wireless network. This concept is used in various applications such as to find the defect in railway transmission line, Road inspection etc.

CONCLUSION

Our proposed system will automatically inspect the rail track component and calibrations of the rail track by using vision-based and vibration-based methods. Our proposed system consists of two parts: A vision-based and Vibration-based method. In the vision-based method, machine vision algorithms will extract a signal from 2-D signal. In the vibration-based method, we will perform the calibration of rail track. We will perform two tasks at a time so that the system will enhance the capacity of inspection and provide the accurate result. Inspections include tie, tie plates, spikes, anchor etc.

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Automatic Inspection of Railroad Track: A Design Approach

31