Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 4, Issue. 3, March 2015, pg.121 – 125

RESEARCH ARTICLE

AUTOMATED VISUAL INSPECTION OF RAILROAD TRACK

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Abstract— Today's , most of railroad investigation are manually conducted by track examiner. Practically, it is not easy to investigate the thousand of railway track by trained human examiner. Hence it takes too much time to inspect the defected railway track and then inform to the railway authority people. In this way it may lead to disaster. Due to these we have to avoid delay and improve the accuracy, our propose structure will automatically investigate the railway track by using vision based method and vibration based pattern. This method proposes continuous examine and assessment of the condition of the rail tracks which prevent major disasters. Our proposed structure will investigate the rail track component such as missing bolts, tie plates, anchors etc by using vision based method and simultaneously do the calibration of railway track by using vibration based method. The system provides monitoring and structural condition for railway track using vision based method and calibration to search the fault location on the track. Investigation include detecting defects on tracks, missing bolts, anchor, tie plate and clips etc. In vision based method camera we will use to capture the images or videos. In vibration based method some sensors we will use to detect the vibrations on the railway track

***Keywords*— Railway track inspection, Vision based and vibration based method, Image processing, Data acquisition.**

I. INTRODUCTION

Rail track investigation is a necessary task in railway maintenance and is required to timely investigate the rail track by skilled human operator, who is walking along the track & finding for defects. Such type of monitoring pattern is inappropriate for slow ness and lack of objectivity. This investigation will take too much time to recover from defects. Therefore to reduce delay our propose system deals with automatic Visual Investigation of Railway track and devoted to numbers of tasks. Automatic visual based investigation systems are enabling to analyse the requisite of rail track. In this way our pattern increases the effectiveness of investigation, reduces the required time and giving a more appropriate and frequent information of the railway track. In visual based pattern our device will capture videos of railway track component using vehicle-mounted Cameras, image improvement using image Processing and assisted automation using a real time tracking algorithms [1]. In

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vibration based method our device will do calibration of the rail track by using vibration sensors. Vibration sensors will feel the vibration on the track. If the track vibration are in the range of predefined grade values it means there is no faults otherwise track is defected. Damage content and faulty track details will broadcast to the server through wireless media i.e. (wifi). By using both the techniques we can investigate the railway track in appropriately. Our propose system aims on visual based and vibration based techniques to detect irregularities in track and default contents such as tie, tie plate, anchor, missing bars. Investigated data will be saved in digital format that's why supervision of track component condition is possible by data processing. In this way our propose mechanism will perform a function of automatic inspection of track content and calibration of track and it provides an interim improvements to current track inspection practices.

II. LITERATURE REVIEW

We first systematized a survey of present technology of automatic visual investigation of rail track and track contents. Result gave us understanding with respect to which projects were best suited to visual based assessment for which technology were previously not under progress. This review encompassed well-established investigation technologies and experimental technologies currently under modification. In this section, we provide a brief survey of the technologies currently in use or development that are of advance relevance in the determination of the scope of our research. Security in railways is one of the main issues for public transportation organization and a fast and effective investigation system is vital to ensure the security of railways. Authors had tried to provide efficient solution on the problem. Let us examine problem and solution. Pre-existing, rail investigation methods include disastrous techniques, such as coring, and non-destructive techniques, such as hammer sounding. But these techniques just "cover small space and have limited efficiency in identifying the defects. Further non-disastrous evaluation techniques for rail track investigation had built. These technologies include visual investigation, ground penetrating radar (GPR), infrared, X-ray and laser light.

Esther Resendiz, (june, 2013) it is an active research topic in a computer system, having field-acquired video and subsequent analysis, could boost the effectiveness of the current methods. Such a structure is prototyped, and the following milestones are addressed: the detection, segmentation, and defect assessment of track components whose aspects vary across different tracks and the identification and investigation of special track areas such as track turnouts. An algorithm that deploy the periodic manner in which track components repeat in an inspection video is developed and Results are demonstrated on field acquired images and video

J. Riley Edwards and John M. Hart, (2009) it illustrates inspections are manual and are handled visually by railroad track examiner. Inspections involve detecting defects relating to the ties, fasteners, rail. Enhancements to the current manual inspection pattern are possible using advanced structure such as machine vision, which recording digital images of track elements of interest and scanning them using custom algorithms to identify faults or their symptoms. This paper will address the development of machine-vision algorithms as well as interim solutions to improve the effectiveness and efficiency of track inspections

III. PROBLEM STATEMENT

The inspection vehicle will detect the flaws of the rail tracks using two methods:

1) Image Segmentation.
2) Vibration Calibration.

IV. PROPOSED SYSTEM

OUR PROPOSED SYSTEM CONSISTS OF TWO MODELS:

1. Vision based automatic tracking of rail track.
2. Vibration based automatic tracking of rail track.

A) Vision Based Method

In machine vision, digital camera will be used to capture the video. Collected videos or images will be processed by using machine vision algorithm in image acquisition system and the algorithm will segregate the defects according to the class. In data analysis the present images are compared with the preexisting healthy status of track and verify

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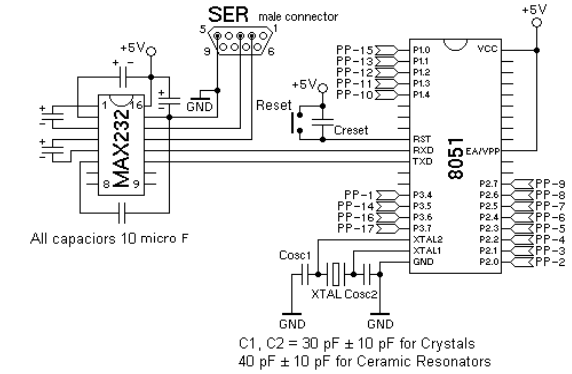
whether the condition matches or not. If any two conditions are matched then there will be no error otherwise the track has some defects. After that this details will broadcast to the server.

B) Vibration Based Method

In this technique a sensors will sense the vibration with the help of vibration sensor and filter for removing external noise and then it passes to the microcontroller for programming. There is on communication protocol to establish the connection between the hardware and system. In system processing will be done and then will be broadcasted to the server through wireless media.

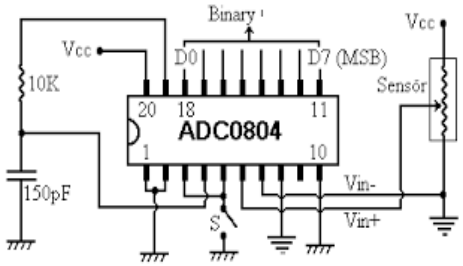
C) Microcontroller 89C51 IC with max 232

The following standard features are provided by AT89C51: 4K bytes of flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, five vector two-level interrupt architecture, a full duplex serial port. The Idle Mode bar the CPU while letting the Random Access Memory, timer/counters, serial port and interrupt system to continue working. The Power-saving Feature saves the Random Access Memory contents but stops the oscillator disabling all other chip functions until the next hardware reset. The Universal Asynchronous Receiver/Transmitter (UART) controller is the key constituent of the serial communications subsystem of a computer. The data which is taken by UART is transmitted the individual bits in a sequential manner. A second UART reassembles the bits into complete bytes at the destination. Serial transmission is commonly used with modems and for non-networked communication between computers, terminals and other devices. There are two forms of transmission: Synchronous and Asynchronous



D) ADC Circuit

A temperature sensor LM35 is interfaced with 8051 by an ADCO804.The output voltage from the LM35 is equivalent to the measured temperature. The output voltage from the LM35 is converted into digital signal by ADCO804.



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V. RESEARCH METHODOLOGIES

A) Vision Based Investigation Technology

Automatic railroad track investigation with the help of visual based method. Visual based system there are some cameras for gathering the images or videos of rail track and process the frame image by using image processing. In such way it could increase the effectiveness of the traditional methods. The System dares the following addressed: detection, fragmentation, and deformity examination of track contents that's physically look vary across millions of tracks and the identification and investigation 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.

B) Data Acquisition

In automated vision based investigation of rail track off the portable cameras are used for gaining rail track images and record this data to a server. Digital cameras are used to cover the images or videos of rail track [3]. Surf View comes on board desktops, 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. The camera will process and start to obtain video of track [9]. High speed line scan cameras are used to gain videos of rail track [10].Plenty types of cameras are used for data acquisition purpose in number of visual based system.

C) Image Analysis

The frames of image are proceeds by using algorithm to detect the default content and assess the requisite, of railway track [3]. The MUSIC algorithm method is signal processing technique that extract signal from a 1-D. It provides accurate solution against noise and gives the appropriate result in effective manner. Gabor transformation method is applied to convert into digital signal from track image [1]. In visual based system image processing is used to detect the clips, smoothing and edge detection [8]. Machine learning technique is used to process the required data [9]. The covered data send to PC with DSP and FPGA boards for frame analysis. Fragmenting the stream of lines into the frame and then examine frame [10]. Gabor wavelet features is used for frame analysis and it gives a comprehensive result evaluation [11]. To take rail track image, we first resume evaluating the captured input image with the help of Sable operator. Hough transform process is used for the reorganization of railway track Hough transform process is used for the reorganization of railway track lines and removes the noise in the binary image. It is the most efficient way for detecting parallel lines [12]. In feature extraction and determination technique, each image frame is expressed by a vector which is composed of colour. A different merging of original RGB and YCrCb is selected for each of the detected sub regions of interest with regarding to both established practice within this area, prior advance classification work within the road domain and related work on other domains where colour variance isolation is vital [6].

D) Data Analysis

In this sector resulting data compare with the pre existing graded values, if resulting data lays between the pre determined values for examined purpose [3]. This method enable us not only to inform the train in case of any dislocations in the track but also change in strength of the soil.[2]This method has two modules, primary is the sensor network that supervises the rail track before the train crosses over the railway track and secondary is the wireless network that gains the data from the sensor network and inform the corresponding train about the disaster. The vibrations on the track are felled by these sensors and this method can process the data from the sensor network and inform the train giving ample of time to stop .The piezoelectric transducer used to sense the vibration of the rail track and activates the sensor network. The sensors fixed on both side of the tracks gathers the data of the track, the collected information of which is given to the Operational amplifier based circuit. The result from the piezo-electric transducer (7bits) is feed to an ADC. The digital output from the ADC is processed to the encoder circuit which functions the linear block coding and transmits to the destination. The RF receiver is used to collect data. Receiver used in this system AC4490, the range of which is 1.6 Km [2].

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E) Detecting Rail Track Component

In automated visual based investigation system a music algorithm is used [1].This algorithm is used to detect the rail contents. In algorithm a coarse-to-fine approach is applied for detecting objects [3].

F) Tie Plate and Tie Detection

Tie plate is fixed between the wooden tie and rail to firm the track with the tie. The ties are identified with the help custom filter based on Gabor texture [1]. In tie detection, both shift and spread are used to locate out the distance between an anchor and its associated tie [7].

G) Anchor Detection

Anchors are investigated and the space between the tie and tie plate are measured .They are investigated by their parallel edges. Colour intensity info is also integrated to assure that parallel edges have equal intensity distributions [3].

H) Spike Detection

Two dimensional filters are applied for identification purpose [3].This system solves the problem of finding missing clips and finding blue clips which have been fixed on destroyed rail track [8]. A default recognition system is continuously supervises the defects before stationary background. The system comprises of three modules: a real time track tracking and extraction, emphasize extraction, hide Markov model prepares and identify recognition. First, they apply a real-time rail track tracking and extraction algorithm to trace the track and extract the track area, and then they use the Fourier descriptor (FD) to characterize spatial features and the motion analysis to characterize the temporal features [4].

VI. CONCLUSION

Our proposed technology will automatically investigate the rail track component and calibrations of rail track by using vision based and vibration based method. Our proposed system consist of two parts: A vision based and Vibration based method. In vision based pattern machine vision algorithm will extract a signal from 2-D signal. In vibration based, patter will perform the calibration of rail track. We will perform two tasks at a time. Therefore due to this the system will enhance the capacity of inspection and provides the accurate result. Investigation includes tie plates, anchor, tie, spikes etc.

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