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Vision Based Railway Inspection and Fault Indication Using GSM

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ABSTRACT: The detection of fastener defects is an important task in railway inspection systems, and it is frequently performed to ensure the safety of train traffic. Traditional inspection is usually operated by trained workers who walk along railway lines to search for potential risks. However, the manual inspection is very slow, costly, and dangerous. The detection of fastener and sleeper defects is an important task in railway inspection systems.This project proposes an automatically fault indication in railway track and also using binarizationmethod**.** For this first develop a set of image and video analytics and then propose a novel global optimization framework to combine evidence from multiple cameras, Global System for mobile communication, and distance measurement instrument to further improve the detection performance. If any defect found means at present, this system sent information to the control room and defect can be frequently detected. In proposed project automated inspection is done to improve the performance. Global system for mobile communication will send the location of presence of error. So identification of location will be an added advantage to the system.

KEYWORDS: Fault indication system, Binarization, Difference algorithm, LabVIEW, GSM.

I. INTRODUCTION

Railway inspection is a very critical task for ensuring the safety of railway traffic. Traditionally, this task is operated by trained human inspectors who periodically walk railway lines to search for any damages of railway components. However, the manual inspection is slow, costly, and even dangerous. With the extension of high-speed railway network, the inspection and maintenance face more challenges than ever before. Recently, the railway companies of all over the world are interested in developing automatic inspection systems, which are specialized trains and are able to detect railway defects very efficiently. An automatic railway inspection system is composed of a number of functions such as gauge measurement, track profile measurement, track-surface defects detection and fastener defects detection.

The three major problems in current fastener inspection systems.

- There are lots of partially worn fasteners that have already lost Effectiveness. However, most of the researches aim at searching for missing fasteners and they usually fail to identify the partially worn ones.
- A railway line is always installed with various types of fasteners for various reasons. Therefore, it is necessary for an automatic inspection System to recognize all these types without manual intervention.
- The qualities of the captured images are not uniform in illumination. Generally speaking, the cameras are installed in the open area under a train coach. The sun light will significantly affect the brightness of the acquired images. Although active light sources and sun shields are used, this problem is still unsolved. On the other hand, fasteners are always shielded by stone, leaked grease, or litter.

For avoiding this problem introduce a new system called vision based railway inspection. For this first develop a set of image and video analytics and then propose a novel global optimization framework to combine evidence from multiple cameras, Global System for mobile communication, and distance measurement instrument to further improve the detection performance. Then image comparison can be taken place in the PIC controller the captured image was

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compared to stored image and if any defect occurred in the captured image that information can be sent to the control room by using GSM. By using GSM particular location can be identified and defect can be corrected in short time.

II. RELATED WORK

In "Composite real-time image processing for railways track profile measurement" [1] the authors explained that checking railway status is critical to guarantee high operating safety, proper maintenance schedule, and low maintenance and operating costs. This paper presents an efficient composite technique for track profile extraction with real-time image processing. In "Track gauge dynamic measurement based on 2D laser displacement sensor" [2] the authors explained that Track irregularities can cause deterioration of riding comfort and derailment. Track gauge variation is one of the basic track irregularities. This paper presents a novel technique for the measurement of track gauge variation, a new measurement system was introduced and been in assembled on a new type underground track recording car. In "An embedded system methodology for real-time analysis of railways track profile" [3] the authors explained that inspecting railway status is decisive to assure high operating safety, appropriate maintenance schedule, low maintenance and operating costs. This paper presents a methodology to design an embedded composite system, regarding the tradeoff between the accuracy and the computational complexity. In "characterization of defects in the railhead using ultrasonic surface waves" [4] The ability to detect defects in rail, and in particular surface defects such as gauge corner cracking, is essential. The design of EMAT used is discussed, with consideration of signal, frequency content and directionality of the signal and the effect of standoff above the sample. In "A real-time visual inspection system for railway maintenance: Automatic hexagonal headed bolts detection" [5] Rail inspection is a very important task in railway maintenance, and it is periodically needed for preventing dangerous situations. The correspondence presents a patent-pending real-time Visual Inspection System for Railway (VISyR) maintenance, and describes how presence/absence of the fastening bolts that fix the rails to the sleepers is automatically detected. In "Visual recognition of missing fastening elements for railroad maintenance" [6] Rail inspection is very important for ensuring safety and preventing dangerous situations. Two different types of classifiers analyze the images in order to evaluate the preprocessing technique that gives the highest rate in detecting the presence of the bolts. In "An efficient direction field-based method for the detection of fasteners on high-speed railways" [7] Railway inspection is an important task in railway maintenance to ensure safety. The Direction Field is extracted as the feature descriptor for recognition. In addition, the appropriate weight coefficient matrix is presented for robust and rapid matching in a complex environment.

III. PROPOSED SYSTEM

The detection of fastener and sleeper defects is an important task in railway inspection systems.This project proposes an automatically fault indication in railway track by using GSM and also using binarizationmethod. The binarization method and the difference algorithm isapplied to identify the differences of images. The collected information is sent to the control area by using GSM.

A. BLOCK DIAGRAM

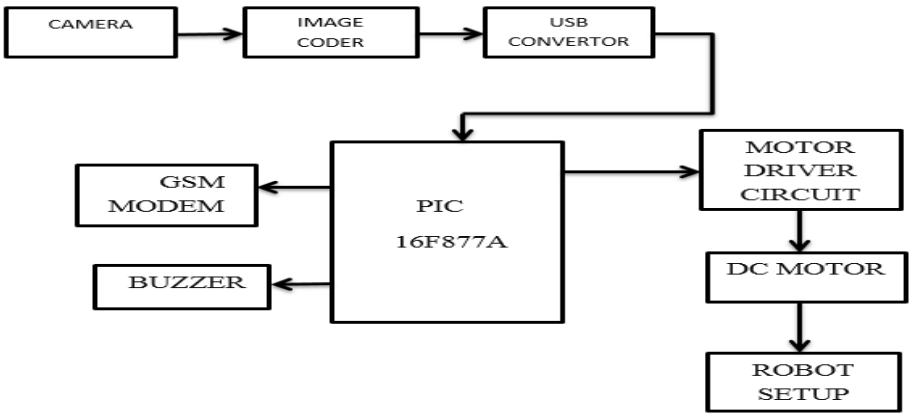

Figure 1. Block diagram of proposed system

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In the figure 1, the camera is used to capturing the images from the train track. By using the image coder, the captured image can be converted into the digital form and also the error can be removed. The output of the image coder can be given to the PIC controller through the USB converter. The original image of train track can be default stored in the PIC controller. The comparison of the captured image and default image can be done in the PIC controller by using image comparison method. If any defect occurred in the captured image means that information can be passed to the control room by using GSM modem. The buzzer is used for alarm purpose. And DC motor is used for to drive the circuit and robot setup is used for to carry the circuit.

TRANSMITTER SECTION

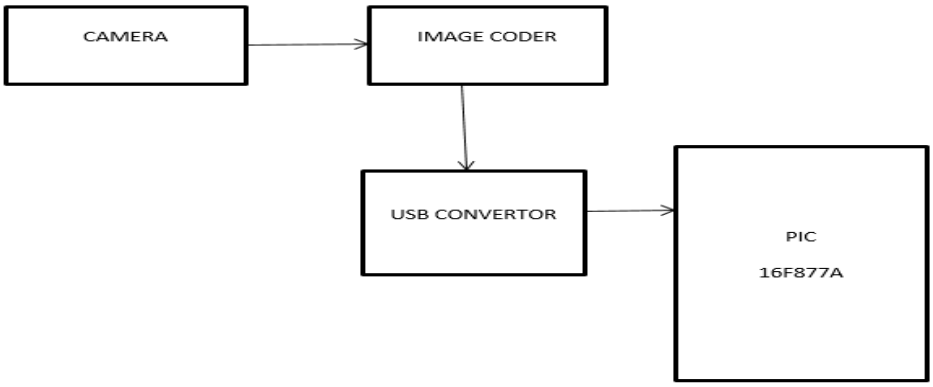

Figure 2. Transmitter section

In the figure 2, the camera is used to capturing the images from the train track. By using the image coder, the captured image can be converted into the digital form and also the error can be removed. The output of the image coder can be given to the PIC controller through the USB converter.

RECEIVER SECTION

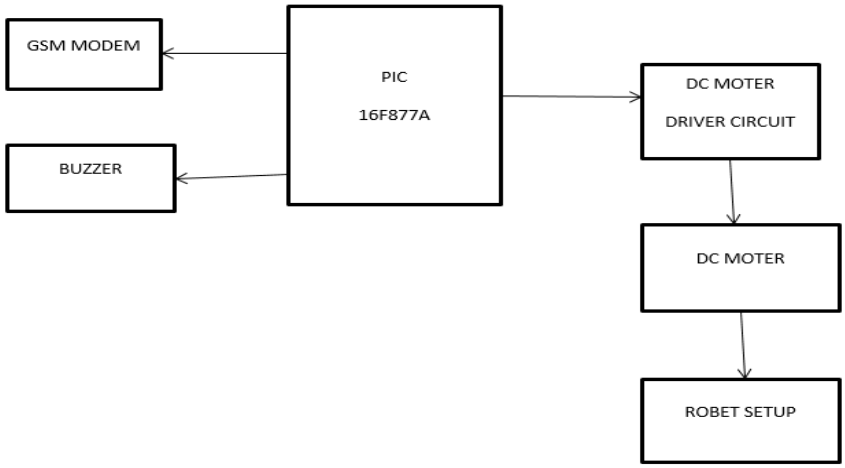

Figure 3. Receiver section

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In the figure 3,the original image of train track can be default stored in the PIC controller. The comparison of the captured image and default image can be done in the PIC controller by using image comparison method. If any defect occurred in the captured image means that information can be passed to the control room by using GSM modem. The buzzer is used for alarm purpose. And DC motor is used for to drive the circuit and robot setup is used for to carry the circuit.

B. BINARIZATION

A new method is presented for adaptive document image binarization, where the page is considered as a collection of subcomponents such as text, background and picture. The problems caused by noise, illumination and many source type-related degradations are addressed. Two new algorithms are applied to determine a local threshold for each pixel.

The performance evaluation of the algorithm utilizes test images with ground-truth, evaluation metrics for binarization of textual and synthetic images, and a weight-based ranking procedure for the final result presentation. The proposed algorithms were tested with images including different types of document components and degradations. The results were compared with a number of known techniques in the literature. The benchmarking results show that the method adapts and performs well in each case qualitatively and quantitatively. In multi threshold method the image is converted multi pixel values. So that every pixel is converted as binary information. The simplification is performed to benefit the oncoming processing characteristics, such as computational load, algorithm complexity and real-time requirements in industrial-like environments.

More than two different levels are visible in textual areas due to transparency of the next page. Then, a binarization algorithm should cope with at least two different thresholds candidates: background-transparent text and background-text. The binarized example presents a correct binarization result. optimize the image processing tasks in terms of image data at hand. While the image types have become more complex the algorithms developed have gained wider theoretical grounds. Current trend seems to move forward image domain understanding based binarization and the control of different source image types and qualities. Binarization technique is aimed to be used as a first stage in image processing.

The pixel information is converted into binary information either by directly or by compared with neighbour pixels these values are used to collect the original outcome of the binarization by a threshold control module. The technique also enables the utilization of multi-thresholds region by region of globally, if desired. Document image contains different texture types that can be divided into uniform, differentiating and transiently changing. As in soft control applications, our algorithm analyses the window surface by calculating descriptive characteristics. Then, the soft control algorithm is applied to every *n*th pixel. . In binarization method global threshold value is used in grey scale conversion in image processing technique in this project. Global threshold value uses the value from 0 to 255. In this project value from 0 to 150 is used for black values (binary 0) and from 151 to 255 is used for white values (binary 1) in grey scale conversion.

C. DIFFERENCE ALGORITHM

The difference-map algorithm is a search algorithm for general constraint satisfaction problems. It is a meta-algorithm in the sense that it is built from more basic algorithms that perform projections onto constraint sets. From a mathematical perspective, the difference-map algorithm is a dynamical system based on a mapping of Euclidean space. Solutions are encoded as fixed points of the mapping.

Although originally conceived as a general method for solving the phase problem, the difference-map algorithm has been used for the Boolean satisfiability problem, protein structure prediction, Ramsey numbers, Diophantine equations, and Sudoku, as well as sphere- and disk-packing problems. Since these applications include NP-complete problems, the scope of the difference map is that of an incomplete algorithm. Whereas incomplete algorithms can efficiently verify solutions (once a candidate is found), they cannot prove that a solution does not exist. The difference-map algorithm is a generalization of two iterative methods: Fienup's Hybrid input output (HIO)

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algorithm for phase retrieval and the Douglas-Richford algorithm for convex optimization. Iterative methods, in general, have a long history in phase retrieval and convex optimization. The use of this style of algorithm for hard, non-convex problems is a more recent development.The problem to be solved must first be formulated as a set intersection problem in Euclidean space: find an x in the intersection of sets A and B. Another prerequisite is an implementation of the projections $P_A$and $P_B$that, given an arbitrary input point x, return a point in the constraint set A or B that is nearest to x. One iteration of the algorithm is given by the mapping method.

The projection to the Fourier modulus constraint, say P_A, is accomplished by first computing the discrete Fourier transform of the signal or image, rescaling the moduli to agree with the data, and then inverse transforming the result. This is a projection, in the sense that the Euclidean distance to the constraint is minimized, because (i) the discrete Fourier transform, as a unitary transformation, preserves distance, and (ii) rescaling the modulus (without modifying the phase) is the smallest change that realizes the modulus constraint.

To recover the unknown phases of the Fourier transform the difference map relies on the projection to another constraint, P_B. This may take several forms, as the object being reconstructed may be known to be positive, have a bounded support, etc. In the reconstruction of the surface image, for example, the effect of the projection P_B was to nullify all values outside a rectangular support, and also to nullify all negative values within the support.

D. LAB VIEW

Lab view is an effective virtual instrument contains a comprehensive set of tools for acquiring, analysing, displaying, and storing data, as well as tools to help you troubleshoot code. It was developed by national instruments and it is a graphical programming tool that helps to design and test small and large systems. This system uses the special feature called clamp region. In clamp region method the edge area of grey scale image. In clamp region method error is identified by the method called region identification. The current image is compared with the existing image in grey scale pattern. If there is any missing part found the outer region of that error region is shown as output.The block diagram contains the graphical source code, also known as G code or block diagram code, for how the VI runs. The block diagram code uses graphical representations of functions to control the front panel objects. Front panel objects appear as icon terminals on the block diagram.

Wires connect control and indicator terminals to Express VIs, VIs, and functions. Data flows through the wires from controls to VIs and functions, from VIs and functions to other VIs and functions, and from VIs and functions to indicators. The movement of data through the nodes on the block diagram determines the execution order of the VIs and functions. This movement of data is known as dataflow programming.The Lab VIEWHelpcontains information about lab VIEW programming concepts, step-by-step instructions for using Lab VIEW, and reference information about Lab VIEW VIs, functions, palettes, menus, tools, properties, methods, events, dialog boxes, and so on. The lab VIEWHelp also lists the Lab VIEW documentation resources available from National Instruments.

The controls and indicators located on the Express sub palette of the Controls palette are a subset of the complete set of built-in controls and indicators available in Lab VIEW. You can find all the controls and indicators that you can use to create the front panel on other sub palettes. However, sub palettes other than the Express sub palette categorize controls and indicators by functionality instead of having a sub palette for controls and a sub palette for indicators.

E. MP LAB

MPLAB IDE is a software program that runs on a PC to develop applications for Microchip microcontrollers. It is called an Integrated Development Environment, or IDE, because it provides a single integrated "environment" to develop code for embedded microcontrollers. Experienced embedded systems designers may want to skip ahead to Components of MPLAB IDE. It is also recommended that MPLAB IDE On-line Help and MPLAB IDE Updates and Version Numbering be reviewed. The rest of this chapter briefly explains embedded systems development and how MPLAB IDE is used.

A development system for embedded controllers is a system of programs running on a desktop PC to help write, edit, debug and program code - the intelligence of embedded systems applications - into a microcontroller. MPLAB IDE runs on a PC and contains all the components needed to design and deploy embedded systems applications. After the application is running correctly, you can program a microcontroller with one of Microchip's

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device programmers, such as PICSTARTPlus or MPLAB PM3. These programmers verify that the finished code will run as designed. MPLAB IDE supports most PIC micro MCUs and every ds PIC Digital Signal Controller.

F. SYSTEM IMPLEMENTATION

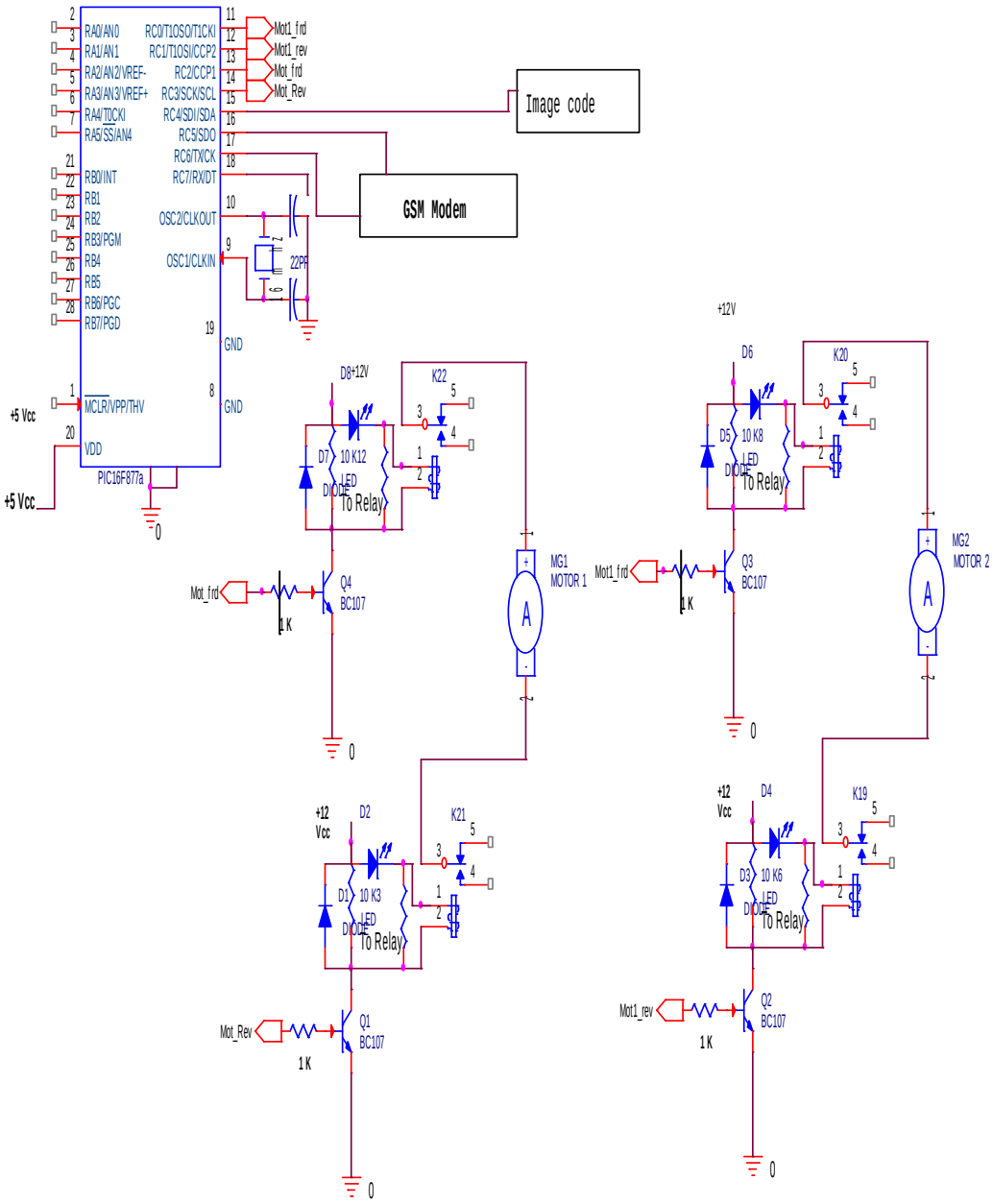

Figure 4. Circuit diagram of the system

In the figure 4, the image information is received from camera as either in digital or analogue form. Binarization method is used as image coding method here. Image signals are converted as binary information and the

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signals are send to image processor. If any error occurred, then the micro controller is activated and it sends command to GSM to send message as error.

IV.RESULTS

A. HARDWARE IMPLEMENTATION OF THE SYSTEM

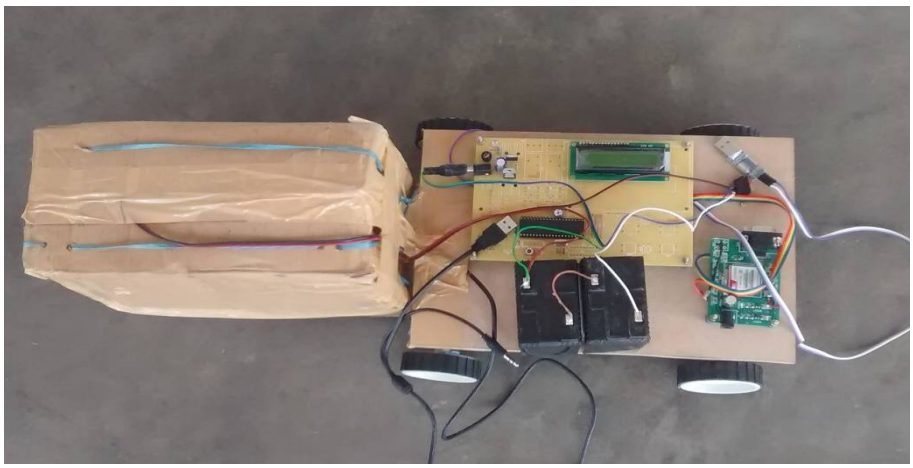

Figure 5. hardware system image

The complete system is shown in the figure 5. In this project camera is placed inside the closed area to avoid natural light and LED is used to provide required light because the natural light will vary in different levels. It will affect the system performance. A 12v battery is used for supply required energy. When the system found error continuously for more than three times it will send message as error to control area.

B. SYSTEM WITH NORMAL OUTPUT

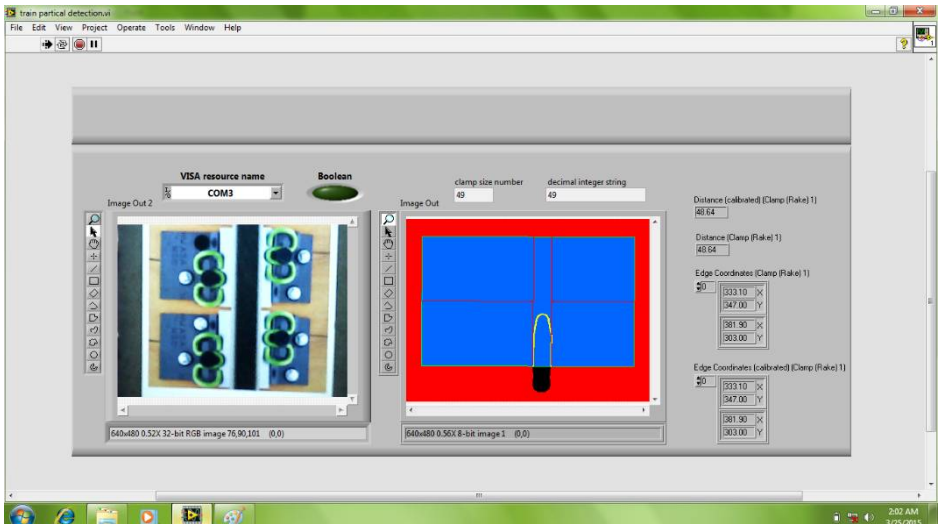

Figure 6. System with normal output

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The figure 6 shown here is for normal conditions. The system continuously monitors the track for missing fasteners and clamps if there is no such error then system continue its process. It continuously monitors for missing fasteners and clamps.

C. SYSTEM WITH ERROR OUTPUT

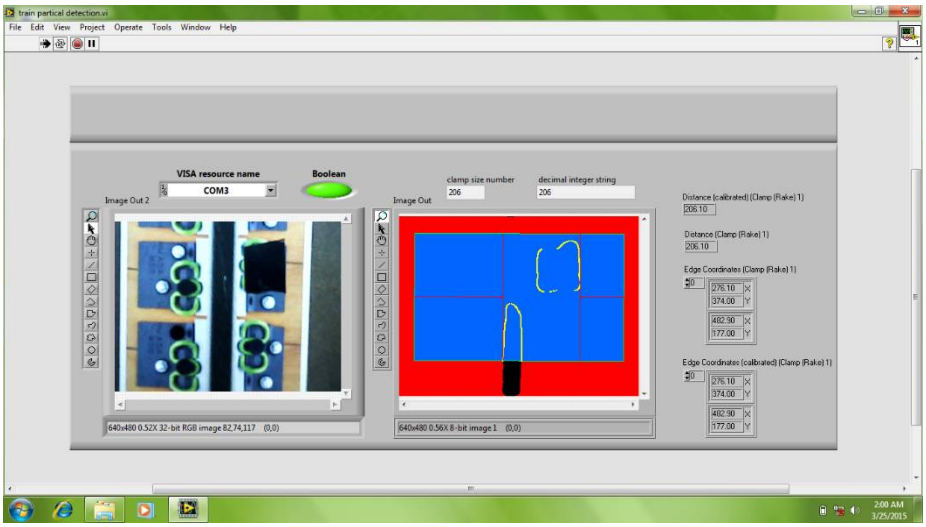

Figure 6. system with error output

The figure 6 shown here is for system with error output. If any error found in the tracks the boundary region of the error and track in which error occurred is shown as an output.

V. CONCLUSION

The detection of worn and missing fasteners is an important task in railway inspection. However manual inspection is poor of efficiency. On the other hand, the earlier automatic inspection systems based on classifiers are of low reliability. In this system, an automatic railway inspection is proposed, which is able to simultaneously assess the damage of multiple types of fasteners. The proposed inspection system has the following major advantages:

- Different types of fasteners can be simultaneously modeled using unlabeled data
- The system is robust illumination changes
- The status of fasteners is ranked

VI. FUTURE WORK

The automatic railway inspection system is useful for partially worn and missing fasteners. On the other hand, in future this system will useful for bridge damages identification and building crack identification. Now a day's bridge defect identification is not an easy task. By using this system bridge defect can be easily identified and also many of accidents will be controlled. In the building crack identification this system will be helpful for engineers.

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