

Real Time Implementation of Automated Inspection in Current Transformer

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Abstract— The automatic vision based inspection system has become an important role in the quality monitoring process of an industry. The machine based vision inspection system is highly advantageous than human vision system because of its high speed, reliability and accuracy. In this paper the image processing techniques are taken for machine vision system such as the edge detection, image masking, and region extraction from an image. The image is captured and the required application to be processed over the image is carried out by LABVIEW tool. The automated inspection parameters of the device are to scan barcode data from an product, perform edge detection of a product for label identification, masking an region of an image for defect identification, pattern matching and the pass fail status is exported in the excel sheet format for the online view of data to be saved in the database for future usage.

Index Terms- LabVIEW, machine vision, current transformer, MY Rio

I. INTRODUCTION

Machine vision[1] is a technology which deals with images or sequences of images with the objective of manipulating and analyzing them in order improve quality, to restore images, to understand and interpret the images. It is a method used to provide imaging based automatic inspection and analysis for applications such as automatic inspection, process control, and robot guidance in industry. Vision technology is a broad technology that combines lighting, optics, electronics, information technology, and software and automation technology.

Vision based automated inspection had a significant impact on various quality control applications. It is highly used in small and large scale industries for various processing of product under inspection[2]. It involves accurate feature extraction and on-line capabilities, both considering robustness and low processing time.

The fact that machine vision systems are noncontact, fast and can easily be computerized make them a potential tool for online quality monitoring during actual production in such processes. Automated Visual Inspection can estimate dimensions of work parts using visual information and is most often automated by employing machine vision techniques.

Machine vision is a tool used to control products in automated production lines in different fields. Such a tool has the advantage of non-contact measurements without running off the production process.

II. MACHINE VISION INSPECTION

A. Current Transformer

A current transformer is used for measurement of electric currents. When current in a circuit is too high to directly apply to measuring instruments, a current transformer produces a reduced current accurately proportional to the current in the circuit, which can be conveniently connected to measuring and recording instruments. A current transformer also isolates the measuring instruments from what may be very high voltage in the monitored circuit. Current transformers are commonly used in metering and protective relays in the electrical power industry.

B. Image Processing In Current Transformer

The parameters to be inspected in current transformer for the real time are barcode scanning, glue spillage, edge detection, colour lead matching. These parameters are inspected by various process first the image is captured by placing it in a conveyor using NI smart camera the captured image is processed in various ways.

- Barcode scanning

The current transformer having barcode pasted on the top is captured using camera, the region having barcode label is chosen by the region of interest property node in labview software. The barcode value printed is an interleaved 2of 5 barcode type using labview tool the coding is done in block diagram panel and the result of image display and barcode value is seen in front panel the printed value is taken as the output.

- Glue spillage

The glue spillage identification is mainly for the presence of glue observed in the current transformer while the top and bottom of the product is closed. For this the edge detection concept is carried out. Similarly the object is captured using camera shown in figure.1 and the processing is done.

- Colour lead matching

Colour lead matching is similar to the colour pattern matching, in industry the current rating of the different transformers are varied so in order to find the type of current

transformer the current rating is needed. The LabVIEW coding is made for the required inspection and the identification can be made.



Fig. 1. NI smart camera with mounting setup

C. LabVIEW TOOL

LabVIEW features you use to build data acquisition and instrument control applications. LabVIEW programs are called virtual instruments, or VIs, because their appearance and operation imitate physical instruments, such as oscilloscopes and multimeter. LabVIEW[4] contains a comprehensive set of tools for acquiring, analyzing, displaying, and storing data, as well as tools to help you troubleshoot code you write. In LabVIEW, you build a user interface, or front panel, with controls and indicators. Controls

are knobs, push buttons, dials, and other input mechanisms. Indicators are graphs, LEDs, and other output displays. After we build the front panel, we add code using VIs and structures to control the front panel objects. The block diagram contains this code. We can use LabVIEW to communicate with hardware such as data acquisition, vision, and motion control devices, as well as GPIB, PXI, VXI, RS232, and RS485 instruments. The front panel is the user interface of a VI. We build the front panel by using controls and indicators, which are the interactive input and output terminals of the VI, respectively. Controls and indicators are located on the Controls palette. 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 in the following ways: from controls to VIs and functions, from VIs and functions to indicators, and from

VIs and functions to other VIs and functions. 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. Functions are the fundamental operating elements of LabVIEW. Unlike VIs, functions do not have front panels or block diagrams. Functions provide the basic building blocks for programming a VI, interfacing with hardware and software, and performing other essential tasks in LabVIEW.

D. National Instruments myRIO

The National Instruments myRIO-1900 is a portable reconfigurable I/O (RIO) device that can be used to design control, robotics, and mechatronics systems The NI myRIO-1900[3] provides analog input (AI), analog output (AO), digital input and output (DIO), audio, and power output in a compact embedded device. The NI myRIO-1900 connects to a host computer over USB and wireless 802.11. NI myRIO-1900 Expansion Port (MXP) connectors A and B carry identical sets of signals. The signals are distinguished in software by the connector name, as in Connector A/DIO1 and Connector B/DIO1 and zynq chip and the hardware block diagram is shown in figure 2.

Zynq is the new generation of All-Programmable System-on-Chip (SOC). The feature of Zynq is that it combines a dual-core ARM Cortex-A9 processor with traditional Field Programmable Gate Array (FPGA) logic fabric. The processors have been coupled with FPGAs before, it has never been quite the same proposition. In Zynq, the ARM Cortex-A9 is an application grade processor, capable of running full operating systems such as Linux, while the programmable logic is based on Xilinx 7-series FPGA

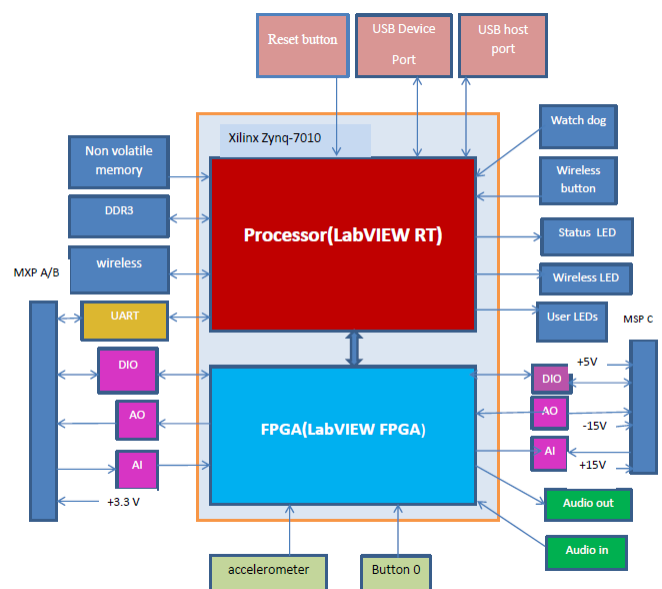


Fig. 2. Hardware Block Diagram of NI myRIO1900

III. EXPERIMENTAL RESULTS

BARCODE SCANNING RESULT

The current transformer image shown in figure.3 having barcode information is captured using smart camera and coding is done in labview and the barcode value is taken as the output.



Fig. 3. Input image of a current transformer

The image having barcode string value shown in figure.4 is taken as output with the region of interest placed over the barcode which is an interleaved 2 of 5 type having 13 numeric.

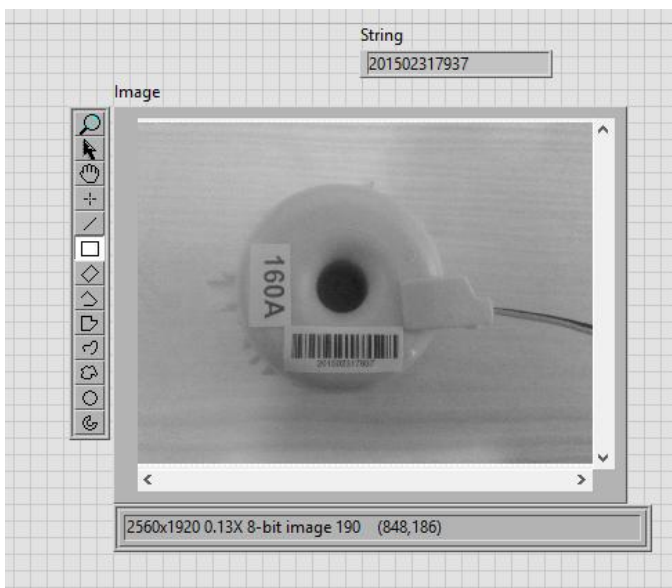


Fig. 4. Barcode scanning of a current transformer

The excel report providing barcode details of the current transformer is used for saving the data for future usage is shown in figure.5.

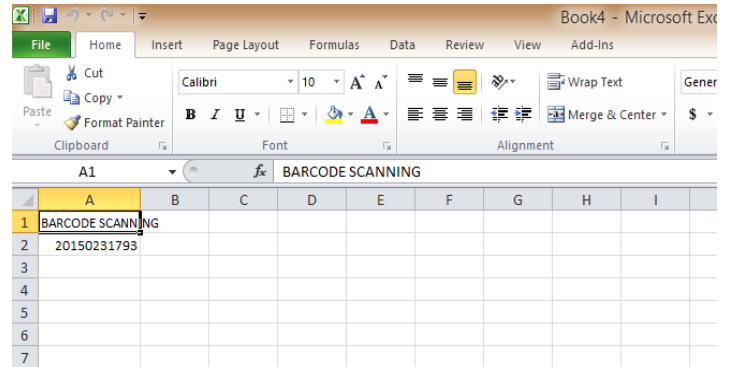


Fig. 5. Excel report of barcode value result

EDGE DETECTION

The edge detection is an image processing technique in which the edges are calculated with the certain threshold value where the glue spillage identification can be done by focusing the Centre region having more number of white pixels as the image is converted in gray scale is shown in figure.6 and gray scale images reduces memory to store images .

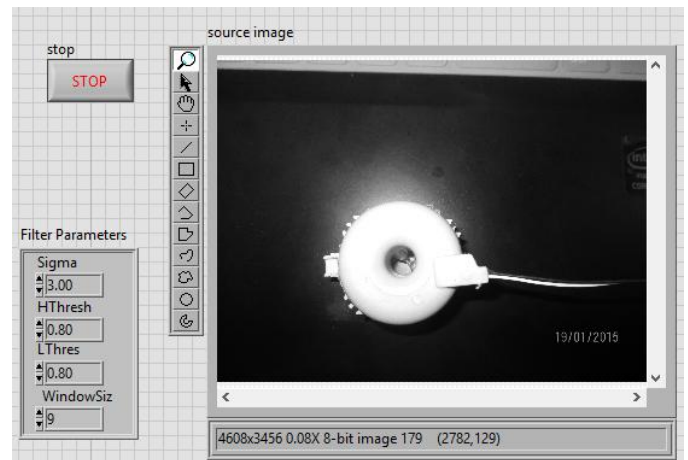


Fig. 6. Source image of glue spillage detection

In the output image of edge detection the center region of current transformer is mainly processed as the more number of white pixels shows that there is a presence of glue if the glue is present the result is obtained as fail or else pass status is obtained is shown in figure.7.

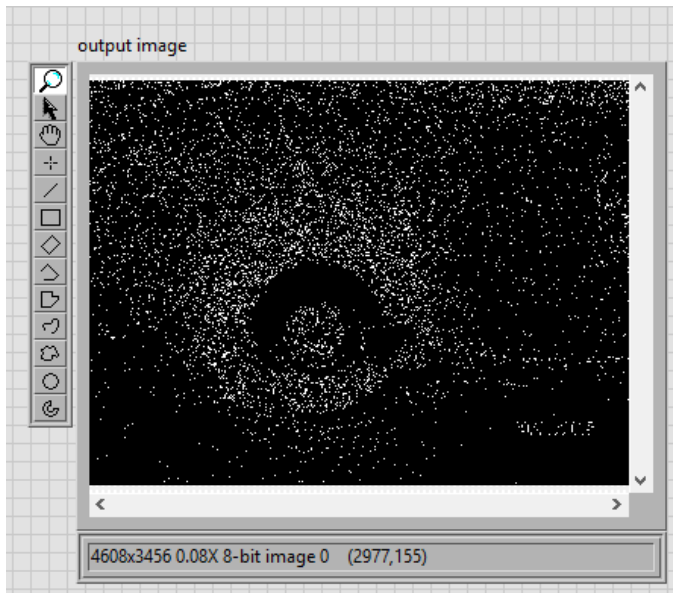


Fig. 7. Edge detected output image having glue spilled in the current transformer

The excel report generation of glue spillage identification is carried out by canny edge detection operator is shown in figure.8 and the pass or fail status is obtained.

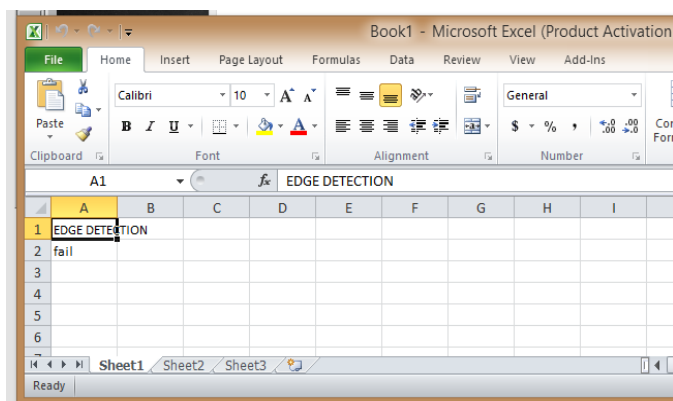


Fig. 8. Excel report generation of pass or pail status of glue spillage

The code of barcode scanning is deployed in my RIO kit for implementation in real time to run and make it as stand-alone application is shown in figure.9

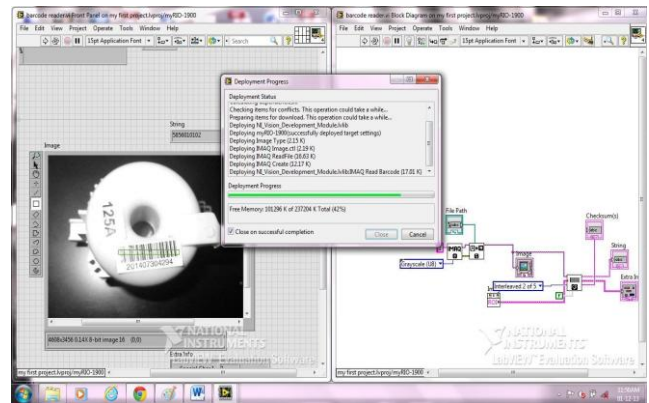


Fig. 9. Deployment process of labview code in my RIO kit

IV CONCLUSION

The real time implementation of automated machine vision inspection of a current transformer is done by using NI my RIO hardware and the inspection parameters are measured using labview tool from National Instruments. The image is captured by NI smart camera to process the images in real time for various inspection to check the pass or fail status and the results are generated in the excel sheet format to store data in database for future preference of usage.

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