

# External Defect Analysis using Image Processing in Labview

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**Abstract**—Analysis and identification of defects is of prime importance in the industrial sector. As automation has become the ruling strategy in recent days, recognition of perfect objects and isolating them from the defect ones not only help the industries to keep up their standards high but also help in avoiding loss of time and power. Image processing is one of the modern methodologies adopted to accomplish the removal of defective products. As technological developments have sensed the advantages of image processing many industries adopt this technique. External defect recognition is well achieved by processing the image of the object. Image processing could be done using many of the already available techniques such as fuzzy systems, intelligent systems or using hardware. This paper presents an approach to implement image processing using graphical user interface software named LabVIEW. Image processing in LabVIEW involves capturing the image of the object to be analysed and comparing it with the reference image of the perfect one both geometrically and pattern wise. The essence of this technique in LabVIEW is that the accuracy and the percentage of matching could be set manually using the NI Vision Assistant Module.

**Keywords**—Defect recognition; Image processing, LabVIEW, NI Vision Assistant

## I. INTRODUCTION

Defect recognition modules in manufacturing sectors are mandatory. Defects could be either visible on the external surface or could be hidden inside as cracks and lacuna. External defects include defects in size, shape, colour, alignment, orientation, edge defects, surface defects etc. Though colour defects do not need much attention yet it demands mechanisms for detection in applications such as painting sectors.

Manual identification of external defects in objects could be tedious. Accuracy level of manual checking of defects is not optimum and is unreliable. There are various technological advancements to replace manual defect checking. One such advancement to replace human interference in defect checking is the tool of image processing. Though image processing has its roots deep back many years it has attained its zenith level of application only in the recent years.

Image processing technique is a methodology adopted to perform complex and tedious operations on an image. Some unknown useful information about the image could be brought out as a result of image processing procedure. The output of this technique may yield another

image sometimes but in many cases it may bring out the characteristics or features associated with the original image. Image processing includes image display and printing, image editing and manipulation, image enhancement, feature detection and image compression. The original image for processing is acquired through USB camera or web camera. The second step is the analysis of the acquired image. Finally, the output is presented as the processed image or processed output.

There are many techniques of implementing image processing. They range from ancient algorithm based techniques to modern intelligent techniques. The two major classification of image processing technique is analog image processing technique and digital image processing technique. When an acquired image is altered by means of electrical parameters it is termed as analog image processing. A very common example of analog image processing is the image processing technology adopted in televisions. As there was a compromise in analog image processing technique, there arose a need for an alternate methodology. Henceforth, next category of image processing that emerged was the digital image processing in which the image is processed by means of more accurate and reliable digital computers and other digital systems. The acquired image is first converted into a digitized format and then allowed to undergo the process.

[1]. Describes a recognition scheme based on the colour co-occurrence histograms embedded in a classical learning framework that facilitates a 'winner-takes-all' strategy across different views and scales

[2]. Elaborates a method to detect the defects by using several filters as a part of the processing technique. Initially, images were taken by scanner, later the obtained images were modified by using several filters. Then, the yarn defects were identified base on their geometric shape and surface area. As the results show, image processing methods is excellently reliable in evaluating number and type of yarn defects.

[3]. Describes the attempt to develop and implement neoteric algorithm for the automatic defect detection in radiographic image by digital image processing. The various defects are identified by means of image processing algorithm.

[4]. Proposes a PCB defect detection and classification system. Using Image subtraction algorithm, for the template PCB image and PCB image which is to be

inspected, found defects in the PCB. To get the details about the defects, extraction of the structural features based on the regional properties such as perimeter, regional areas, orientation etc has been made. The acquired image is processed in MATLAB.

Advancement of image processing includes the usage of many different algorithms and intelligent techniques such as fuzzy, neuro and other hybrid technologies.

## II. IMAGE PROCESSING IN LabVIEW

Intelligent techniques of image processing could be used as a tool for recognition of objects which deviate from the perfect standards of reference. One such intelligent technique is the use of user friendly graphical interface software Laboratory Virtual Interface Engineering Workbench (LabVIEW). It has controls and indicators in the front panel and functions in the block diagram window. LabVIEW supports image processing technique with the aid of special functional blocks in two categories split as Low Level VI and High Level VI. The IMAQ VISION ASSISTANT module comes under the high level VI. IMAQ VISION ASSISTANT is a prototype of the vision application in LabVIEW. It helps to perform the vision conceptual functions more specifically and precisely.

IMAQ VISION ASSISTANT can be installed in a personal computer. The images could be acquired for processing using external hardware modules such as a USB camera. To support the facility of acquiring images from real time LabVIEW must be aided by National Instruments Image Acquisition (IMAQ) hardware.

Prototyping algorithm could be easily built in a new script in the VISION ASSISTANT window. These custom algorithms help to perform several image processing functions. After testing the custom algorithm built inside the scripting window of the VISION ASSISTANT could be integrated to the main VI using the vision assistant functional block.

The major parts of VISION ASSISTANT are script window which contains the algorithm to be prototyped, image browser which is the repository of the current image browsed into the vision assistant, processing window which updates the changes in the image instantaneously as the user modifies the image parameters, Function window or parameter window which contains all the functions to build the desired algorithm to accomplish the image processing techniques.

The VISION ASSISTANT has special features and facilities which are broadly classified under five domains namely Image processing functions, colour processing functions, grayscale processing functions, Binary processing functions, Machine vision processing functions and Identification Processing functions.

Each of these processing functions has several other functions under them the common of which includes histograms, pattern matching, colour matching, colour pattern matching, geometric pattern matching, edge detection, object tracking, contour analysis, shape detection, golden template comparison, circle detection, particle analysis, Filters, detect texture defects, Colour plane extractor, colour segmentation, colour classification, 3D view and set co-ordinate system.

## III. DEFECT ANALYSIS SYSTEM

External fault analysis is well achieved using the proposed system. The defective product should be moved either manually or by using any automated system. Products ready to be dispatched are alone to be tested using this methodology. The major uniqueness of this project is its cost efficiency and reliable accuracy. NI-IMAQ is used to acquire the real time image using a USB camera and the vision acquisition function in the block diagram. NI Vision Acquisition Express is opened when vision assistant is placed. NI-IMAQ shows the USB camera connected with the system. Acquiring continuous images is chosen for this system.

NI Vision assistant in this system is used for three main processes - Tracking the presence of object, pattern matching and geometric pattern matching. Object tracking is a function which identifies the presence of any object in the given search space. Search space is a space set by the user into which object tracking function searches for the object. Output of object tracking will clearly indicate the user regarding the presence of the object being searched. The next stages of analyses could be proceeded only if object tracking yields positive results.

Pattern matching is a process of checking whether the image of the product captured is same as the reference image given by the user. Pattern matching excludes the boundary of the image during matching operation. The product is searched in all 360 degrees. Each and every part of the image is compared and checked with the template. The type of image used for this matching process is 8-bit binary grayscale image and not RGB type. This conversion is done using colour extractor. Colour extractor is a process of extracting the image's colour and gives a binary 8-bit grayscale image.

Apart from these visual defects it is necessary to ensure that the size, shape, edge sharpness is exactly the same as the reference using Geometric pattern matching. Except for inclusion of boundary of the image for comparison its functions are exactly the same as pattern matching. The template image for this geometric pattern matching is given by marking the boundaries of the image. This entire process of finding out the defect in any product is explained in pictorial format in Fig 1.

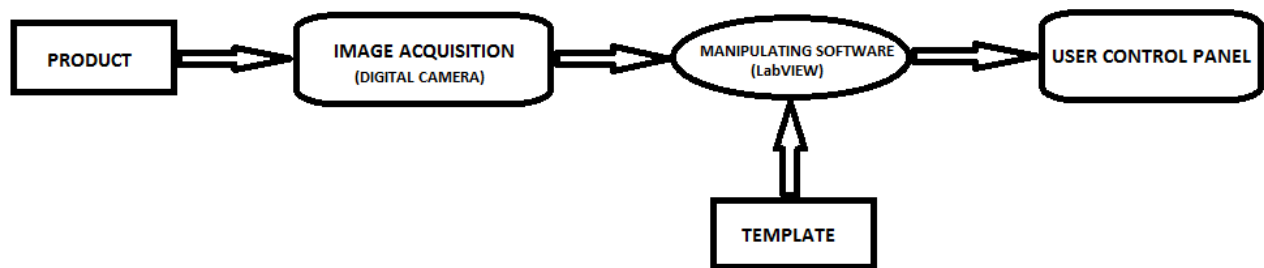


Fig 1: Block diagram of the system

If the image in either one of the analysis doesn't match with the reference, then that product is indicated as a defective one. It can be removed away with the help of the orientation data un-bundled from the matching results of the object tracking function.

#### IV. TESTED RESULTS

The product taken for external defect analysis using the proposed system is a Battery. External defects in battery includes any scratches, holes, bends or cracks. All these defects have been identified and the observed results are as follows:

*Scenario 1:* When the product is found in the given search space, the position, angle and status will be obtained from the NI VISION ASSISTANT. Then the product is subjected to the further analysis. Geometric pattern matching and Pattern matching are preceded with the product image. When the product is matched perfectly in both the matching functions as shown in fig 2, the product is termed to be non-defective.

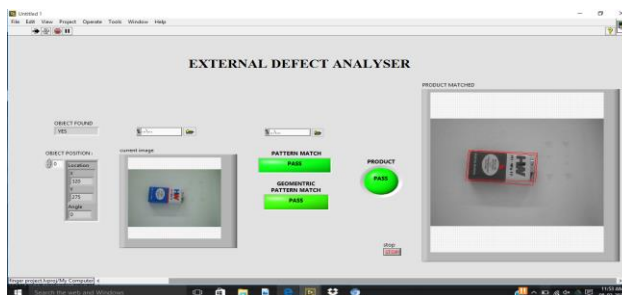


Fig 2: Non-Defective Object

*Scenario 2:* When the product is not matched perfectly in Geometric pattern matching i.e. when there is a mismatch in shape and size, the product is defective. This is indicated as shown in Fig 3 and has to be removed.

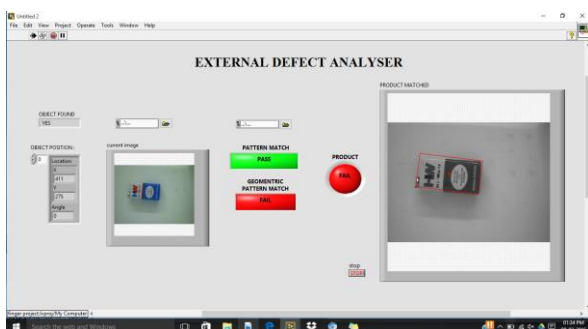


Fig 3: Geometric Pattern Matching defect

*Scenario 3:* When error occurs in pattern matching i.e. when there is a mismatch such as external pinhole, cracks or edge missing, as in Fig 4, again the product is defective and has to be removed.

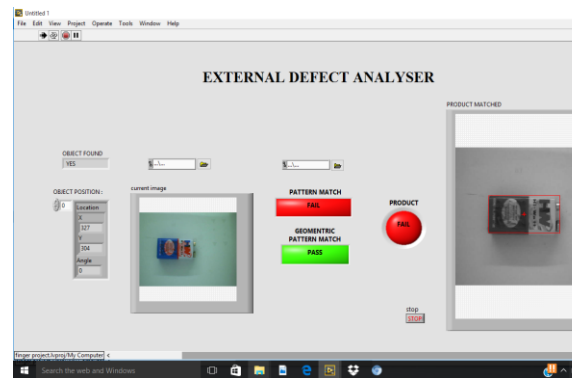


Fig 4: Pattern Matching Defect

*Scenario 4:* The product becomes wholly defective when there occurs error in matching in both the analysis of pattern matching as well as geometric pattern matching as shown in Fig 5.

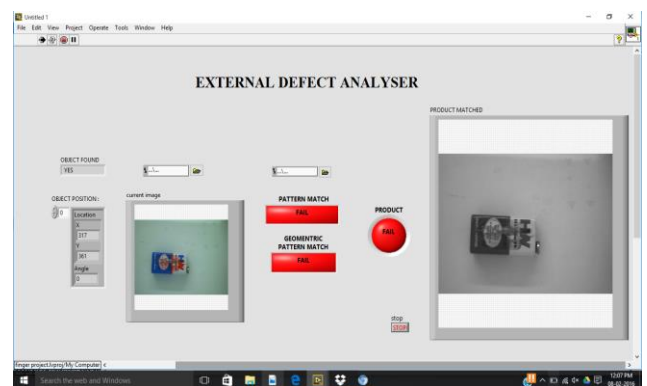


Fig 5: Wholly Defective Product

*Scenario 5:* When there is no object, the VI indicates the use with a pop-up message requesting the user to place the object for analysis. This is indicated in Fig 6.

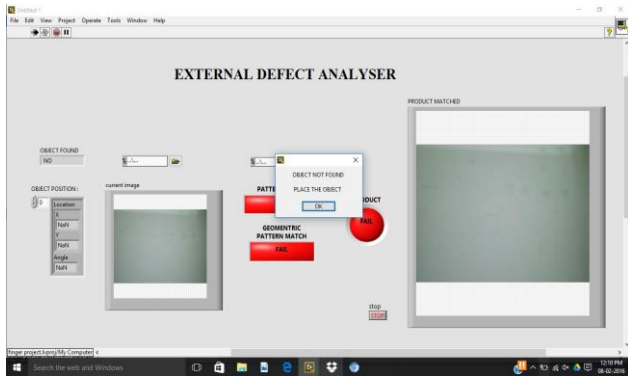


Fig 6: No object placed  
(Pop – up message: OBJECT NOT FOUND  
PLACE THE PRODUCT)

The entire process is aimed to run continuously with specified time interval to acquire the images of the object. This time period corresponds to the speed of movement of objects in the conveyor belt. Provision for manual shut down of the system is also included.

## V. CONCLUSION

Thus owing to the increasing need of defect analysis in industrial sector the above proposed defect analysis system is built wholly as an automatic functioning system. As this system uses an advanced technique of implementing visual image processing in LabVIEW, the results obtained have proven to be more efficient than the traditional methods of employing algorithm based strategies. The

major advantage of the proposed model is that the user can easily set the template image and the score of matching according to the area of application. Though the mere algorithm based methods such as filtering, sampling algorithm of image processing showed more similar results, this proposed method of image processing in LabVIEW using NI vision assistant has a major advantage of user friendly application. Thus the above system of defect analysis can be used to identify any kind of external defects inclusive of shape, size, colour, external cracks, external bends and holes in the given product.

## REFERENCE

- [1] S. Ekwall, D. Kragic and F. Hoffmann "Object recognition and pose estimation using color Co-occurrence histograms and geometric modeling" Image Vision Comput., vol. 23, no. 11
- [2] "Evaluation of yarn defects by image processing technique"
- [3] "A Step towards Automatic Defect Pattern Analysis and Evaluation in Industrial Radiography using Digital Image Processing"
- [4] "PCB inspection system using image processing", International Journal of Science, Engineering and Technology Research (IJSETR) Volume 4, Issue 4, April 2015.
- [5] G. M. Atiqur Rahaman and Md. Mobarak Hossain, "automatic defect detection and classification technique from image: a special case using ceramic tiles", (IJCSIS) International Journal of Computer Science and Information Security, Vol. 1, No. 1, May 2009
- [6] Foram Sanghadiya and Darshana Mistry, "Surface Defect Detection in a Tile using Digital Image Processing, Analysis and Evaluation", International Journal of Computer Applications (0975 – 8887) Volume 116 – No. 10, April 2015.
- [7] NI Vision assistant user manual by National instruments