

# Fault Detection of Mechanical Components Using Image Processing

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**Abstract-** *Fault Detection is very important in mechanical industry to detect objects with manufacturing defects and to isolate them. At present, fault detection is done manually when the mechanical components are transported for assembly and packing in an assembly line. This inspection is done randomly and not all the components are tested. Hence, there is a chance of missing out defected components in the assembly line. Also, this process is time consuming and all the features of the components cannot be verified accurately.*

*This signifies that there is a need for an image processing-based system to detect the defects in the components. In our project, a camera is mounted above the assembly line. The camera captures the images of the mechanical components (nuts and bolts) moving on conveyor belt.*

*The captured images are processed so as to remove the background noise. The image is then enhanced to get the Region of Interest. It is extracted to measure the dimensions of the components. If any defect is found in the attributes of the mechanical components, an electrical signal will be sent to the Solenoid valve and then it actuates deflector plate by the pneumatic cylinder.*

*Defected component is then pushed out of the conveyor and the defect-less products are carried to the packaging. By this way, components with manufacturing defect are identified and isolated way more efficiently.*

**Indexed Terms-** *Image Processing, Camera, Raspberry pi, Computer Vision, LabView*

## I. INTRODUCTION

Customers expect and demand high-quality products. It is important for any manufacturing industry to produce defect-free, quality products. In manufacturing, defect analysis is a process that ensures customers receive products free from defects and meet their needs. When done the wrong way, it can put consumers at risk. Major recalls can be prevented through effective quality control in manufacturing. Nuts and bolts are used everywhere. A defect in nuts and bolts used in home is usually only a minor nuisance. However, a similar failure at a nuclear power plant could be catastrophic, which is why fault analysis of nuts and bolts is so vital. The main objective of automating the fault detection and isolation of the mechanical industry is to reduce human efforts and error. Automating the process of fault detection will more precisely detect the defected components, which would have been missed out by the human inspection. Then, a decision for rejecting or accepting the components is taken by measuring quality parameters.

To develop an image processing-based solution which identifies the faulty components moving in conveyor belt and isolate to a secondary conveyor belt.

To measure quality parameters such as dimensions and features of the product is feasible by use of image processing techniques. Image processing techniques can be used to extract different properties of the objects such as their dimensions, areas, etc.

## II. CONSTRUCTION

The Basic principle of operation starts with the object detection when the conveyor starts to transport the object. And the Camera is positioned in such a way to capture the image and sends to the computer for the dimension extraction and the computer checks for the limits. If it is found that the component doesn't satisfy, then the computer sends the signal to the Solenoid valve and then it actuates deflector plate by the pneumatic cylinder and the defected component is then carried by the secondary conveyor to the re-machining and the quality product are then carried to the packaging.

Image processing-based fault detection and isolation is proposed to detect the defects in the nuts/bolts sent in the conveyor belt. In this work, camera is mounted above the conveyor module and captures the images of nuts and bolts which moving on conveyor belt. Captured images are pre-processed to remove background noise, then image is enhanced to get the appropriate features and Region of Interest (diameter of nut) is extracted to measure the diameter. If any anomaly is found in the attributes (diameter) of the mechanical components, an electrical signal will be sent to the DC gun and then it actuates deflector plate by the pneumatic cylinder. Defected component is then carried by the secondary conveyor to the re-machining and the quality product are then carried to the packaging will passed to the separator through micro controller. In this way, components with manufacturing defect are identified and isolated from assembly line.

## III. METHODOLOGY

Camera mounted above the conveyor belt captures the images of the components which is on moving conveyor belt. Using Mathematical morphology algorithm, the object in the captured image is detected and the feature (diameter) is extracted. It derives the values from the image using LabVIEW and compare with stored area of the object. If any fault detected, through micro controller the electric signals would be passed to the separator and separator will redirect the object to the secondary conveyor belt. In this way, faulty objects are identified and isolated from the conveyor belt.

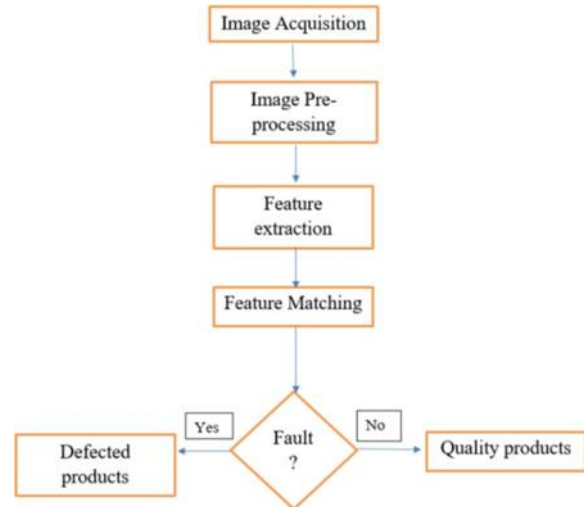


Figure 1. Overall Block diagram

## IV. OBJECTIVES

- To reduce time consumption for the detection of damage.
- To provide good product.
- To reduce the manual workload.
- To check the measurements of the material.

## RESULTS

The image of the mechanical components moving in the assembly line is captured and processed. (As shown in Fig 2)

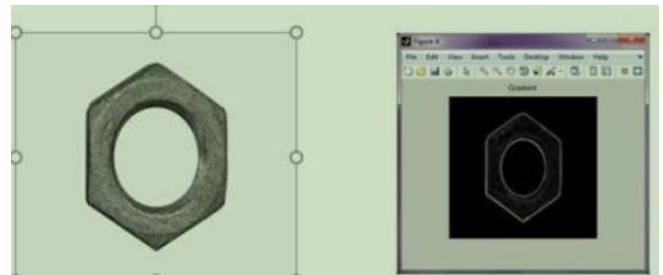


Figure 2. Reference Diagram for image processing

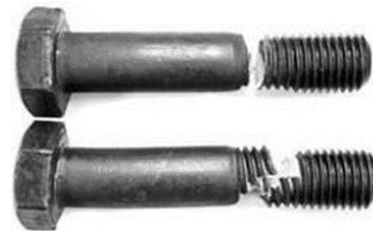




Figure 3. Defective Components

Whenever defective components (As shown in Fig 3) pass through the assembly line, it is detected and pushed out of the assembly line.

If the dimensions are correct the components pass through the assembly line and reach the packing section.

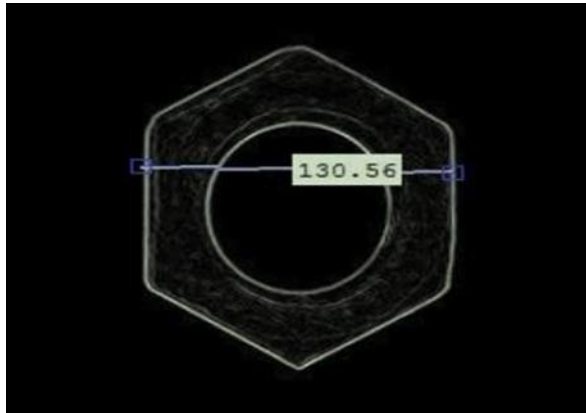


Figure 4. Dimension Analysis Result

### CONCLUSION

In this automated fault detection and identification system, image processing-based solution was proposed and implemented to identify defected/faulty components passing through the conveyor belt. Diameter of the nuts are considered as ROI and extracted for experiment to identify the defected components. Proposed system is experimented for collection of components and we have obtained 85% of accuracy. Contour based feature extraction can be used to enhance the accuracy and it would be considered for future work.

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