

# **AN EFFECTIVE QUALITY INSPECTION SYSTEM USING IMAGE PROCESSING TECHNIQUES**

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## **Abstract**

Now-a-days human visual logic and decision abilities can be replaced by Machine Vision (MV) System. This system also plays a vital role in the development of intelligent inspection systems. In this paper an efficient quality inspection system has developed by implementing a vision based techniques. The entire process of operation includes the simulation of a captured image through Lab-view centered Vision Builder window. The outcome reveals the effectiveness and quality of a bottle image in terms of its shape, size, height, neck or cap dimensions etc. Through this technique a large numbers of bottle samples to be inspected within an optimal duration.

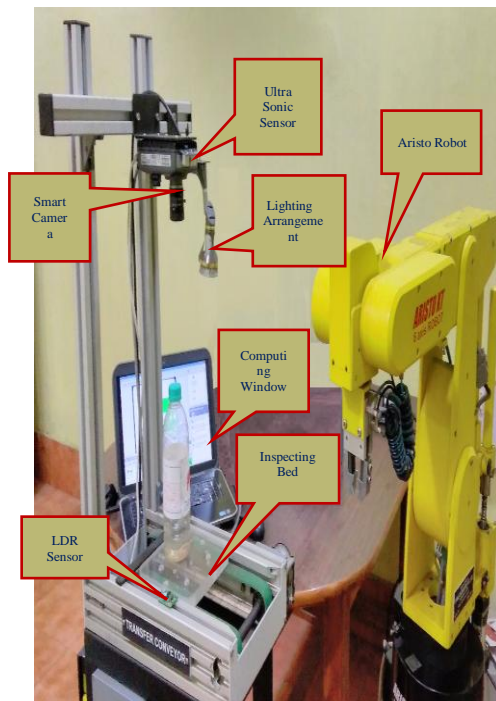
**Key words:** Lab-View, Vision Builder, Machine Vision System

## **Introduction**

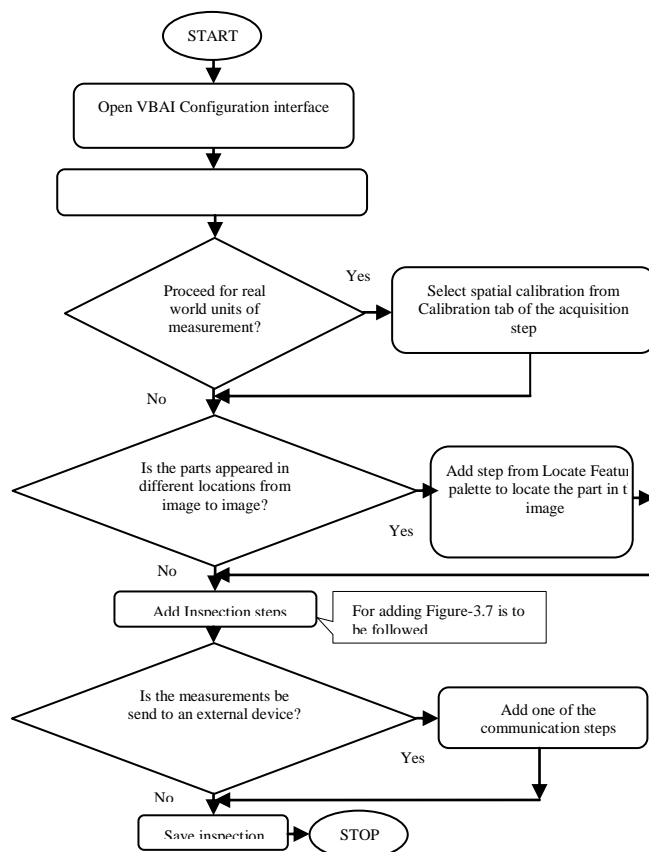
Vision centered scrutiny arrangement has a pair of innovative skills for contact-less measurement and inspection. These apparatus incorporate multitude methodologies including digital imaging, integrated circuit technology, embedded systems and software. MV system includes a smart camera and computer to complete an assessment job. Programmed acquirement and investigation of images can be obtained for monitoring or assessing a precise portion or action. Therefore a factory automation utilizing the said system can execute repetitious assignment more rapidly and perfectly with better stability over time than humans. Hence machine vision plays a significant role in the improvement of a smart inspection structure. By considering the above factors Wildes et al. [1] explained a machine-vision system for iris recognition with a prototype system for personnel verification based on automated iris recognition. Lhajnar et al [2] described a machine Vision system for inspecting electric plates of electric cockers with the goal to reduce labour cost and ensure consistent product quality. Derganc et al. [3] modelled a machine vision system for inspecting bearings, which are an important part of electro-mechanical kWh meters. Tadhg Brosnan et al. [4] described about the food product's accuracy, fast and objective quality, inspected by using machine vision system. White et al. [5] implemented a mobile Climbing Robot for High Precision Manufacture and Inspection of Aero-structures. In this paper they described the design, development, and experimental trials of a climbing robot for manufacturing and inspection applications within the aerospace industry. Roh et al.[6] implemented a differential-drive in-pipe robot for moving inside urban gas pipelines . Treptow et al. [7] Implemented a vision-based approach for tracking people on a mobile robot using thermal images. Marko Heikkila et al. [8] described a novel and efficient texture-based method for modelling the background and detecting moving objects from a video sequence. Now the photographic view of proposed machine vision inspection System is shown in Figure-1.

The prime objective of this investigation on smart system is to promote machines that have the capacity to observe, acquire and analyse the imperfections on a bottle image. Generally an Inspection refers to a formal

evaluation or an organized examination of a structure or model. In engineering activities, inspection involves the process of measurement, test and gauges applied to certain characteristics in regard to an object or activity. In this process the results are usually compared to specified requirements and standards for proper determination of the assigned goal or target. Therefore in the proposed research work inspection includes the proper grouping of faulty and defect free bottle by considering the specified standards.



**Figure-1: Photographic view of sensor employed vision builder machine vision inspection system**



**Figure-2: Detailed structure of inspection System**

### Methodology

The inspection of defective bottle in the proposed system includes various stages. The methodology used for formulations of different stages of inspection system is presented in this section. The damaged bottle of different size and shape used here for checking purpose and the image of the collected bottles captured by NI smart camera 1722. The main aim of this research is to categorize the damaged bottle and non-damaged bottles through vision builder simulation window. The detailed structure of inspection is shown in Figure-2.

Following the procedure the different features of a bottle image has tested through Vision Builder (VB) simulation window. A sample simulation window is shown in Figure-3. In this research 95 bottle samples including defective and defect free are considered for investigation purposes.

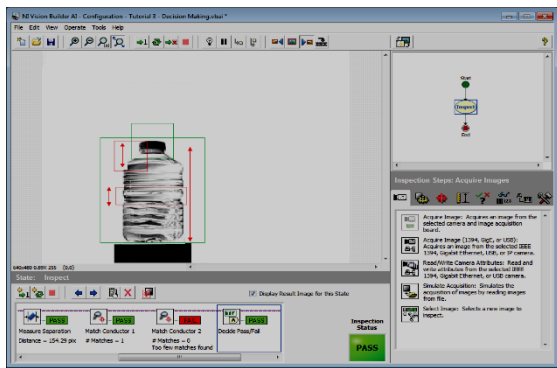


Figure-3: Sample VB simulation window performing bottle height inspection.

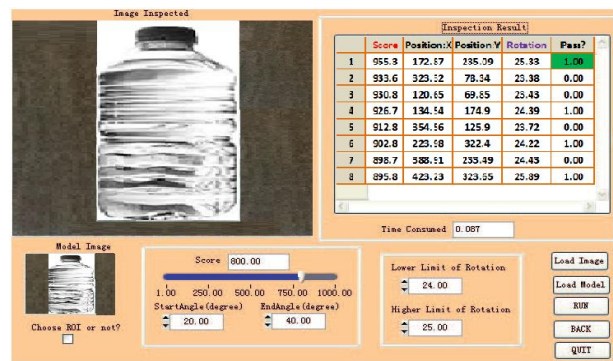


Figure-4: Bottle inspection response of the machine

Figure-3 signifies the proper arrangement of the simulating platform during the course of bottle investigation. Similarly Figure-4 represents a simulated window indicating different parameters like height or distance, bottle positioning etc. Likewise, Figure-5 illustrates the different steps related for bottle neck inspection, through which we are able to investigate the accuracy of a bottles. Therresponse of the same is presented in Figure-6and Table-1. Figure-6 signifies the bottle neck inspection by considering it's edge parameters.

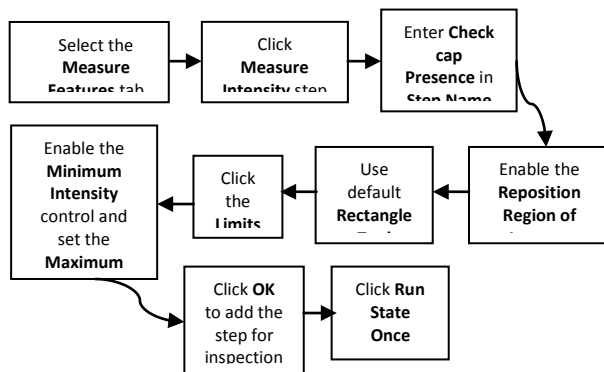


Figure-5: Bottle cap inspection steps followed in VBAI System

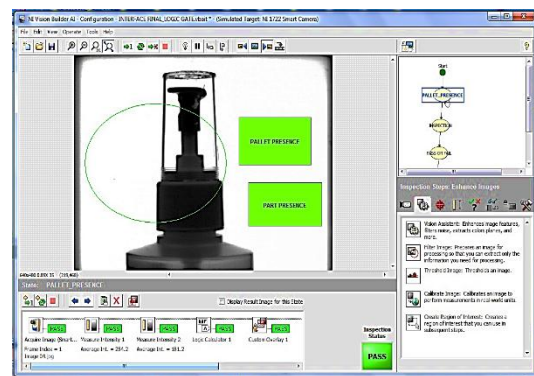


Figure-6: Bottle neck inspection response of the machine vision system

Table-1: Response of the defective and defect free bottles			
Image Name	Height detected	Inspection Status	Explanation
B_01.jpg	25.62 cm	PASS	All Steps Passed
B_05.jpg	25.60 cm	PASS	All Steps Passed
B_10.jpg	22.32 cm	FAIL	Inspection steps fails because dimensions not matched properly
B_15.jpg	24.99 cm	PASS	All Steps Passed
B_20.jpg	25.75 cm	PASS	All Steps Passed
B_25.jpg	25.42 cm	PASS	All Steps Passed
B_30.jpg	26.00 cm	PASS	All Steps Passed
B_35.jpg	26.52 cm	PASS	All Steps Passed
B_40.jpg	29.78 cm	FAIL	Inspection steps fails because improper dimensions found in an image
B_45.jpg	25.78 cm	PASS	All Steps Passed
B_55.jpg	26.32 cm	PASS	All Steps Passed

### Result Discussion

The overall performance of the developed vision systems for with and without sensor module implementation is compared in terms of the three adaptive features. The complete comparison is shown in Table-2

**Table-2: Comparison of overall performance**

SI No	Bottle class	Overall performance of VBIS
1	Defective	95.00%
2	Defect free	96.00%

### Conclusions

This paper reports automatic classification of bottle through different types of captured bottle image. The work has adopted a robust approach for the classification of same using different classifiers and software simulation platform. It is revealed that the proposed Vision Builder based inspection system has better classification rate comparison than the other approaches. In this work the performance validation of the proposed model with the other approach has been discussed. The outcome reveals that the overall performance of the proposed machine vision inspection system including robotic arrangement provides better results than the other approaches. Therefore, the proposed approach is very precise for inspection of different objects other than bottle and also can be implemented in industrial unit for the same

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