

# Bottle Cap Inspection Using Image Processing

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## ABSTRACT

The "Bottle cap verification" presents a smart approach for a real time inspection and selection of objects in continuous flow. Image processing in today's world grabs massive attentions as it leads to possibilities of broaden application in many fields of high technology. The real challenge is how to improve existing sorting system in the modular processing system which consists of four integrated stations of identification, processing, selection and sorting with a new image processing feature. Existing sorting method uses a set of inductive, capacitive and optical sensors do differentiate object color. In this project a Mechatronics sorting system solution with the application of image processing. Image processing procedure senses the objects in an image captured in real-time by a webcam and then identifies fault and information out of it. This information is processed by image processing for sorting. This system deals with an automated material handling system. It aims in classifying the faulty objects by shape, size, missing labels, missing parts which are coming on the conveyor by picking sorting the objects in its respective pre-programmed place.

**Keywords :** Micro-Controller, Camera, RS232, Servo Motors, Power Supply

## ARTICLE INFO

### Article History

Received : 6<sup>th</sup> March 2016

Received in revised form :  
9<sup>th</sup> March 2016

Accepted : 13<sup>th</sup> March 2016

### Published online :

16<sup>th</sup> March 2016

## I. INTRODUCTION

Machine vision system is generally referred to the system which extracts desired features from digital images. Captured input images are the main objective of this system. Application of the vision system in industries in order to automate manufacturing process is considered as Automated visual inspection (AVI) when attempts are made to inspect, control products and recognize the defects by using only images of the products. In fact, human as inspectors are slower and their efficiency is affected by their state of illness, exhaustion or other human shortcomings. In some applications they need sometimes special environments which are dangerous and not conducive for human operation.

Inspection is carried out by machine vision system via image processing technique is application in beverage and food industries, milk industries, medicine industries and other chemical product industries. In this area, accurate filling, inspection of cap closure, sorting, recycling plastic

bottle, recognition between glass bottle and pet bottles, inspection for over-fill or under-fill, verification of label quality and detection of defected products are inspected automatically. The first step in a visual inspection system is the image acquisition, which is concerned about capturing a good quality image through a camera. Camera resolution, its position, colour of background and speed of the conveyor belt and light has important effect on image quality.

For four quality inspection in bottle cap: Detection of tamper in side view, Detection of tamper in top view, Detection of without cap condition of bottle on conveyor and different coloured cap of bottle on conveyor. So developing such algorithm where four most important parameters of automation of bottling are combined we get an efficient bottling system. Besides we have presented a detailed explanation of image processing of bottle cap detection and new algorithm combining the four parameters through list of figures. MATLAB, these software will

provide various digital image processing technique used for obtaining required information from an acquired image. Based on the extracted image the processor will take decision i.e. acceptable or not acceptable. The work in the paper is considered as a limited module no given as a final output to sort objects such as apple depending on its attributes such as colour. Thus by using fully automated system the time required for the sorting process is reduced to the great extent, so proposed system is fast, accurate, economical, robust and cost efficient.

## II. LITERATURE SURVEY

Literature Since the introduction of AVI methods in the early 1980s (Jarvis 1980, Chin and Harlow 1982) several systems for quality inspection have been successfully developed using different image processing techniques. The main objective of AVI is to increase productivity. In industrial manufacturing, product inspection is an important step in the production process. Since product reliability is of utmost importance in most mass production facilities, 100 percent product inspection of all parts, subassemblies, and finished product is often being attempted. The most difficult task for inspection is inspecting by visual appearance. Visual inspection seeks to identify both functional and cosmetic defects. The visual inspection in most manufacturing process depends mainly on human operators whose performance is generally inadequate and variable.

In recent years the importance of process automation has been increased as the growth of any industry is directly depends on it. For precise output and accuracy of industrial process robots with sophisticated sensors are used. Advances in technology have resulted in better, cheaper image analysis equipment, which enable the use of affordable automated visual inspection system [1]. The major advantages of automatic operation are speed and diagnostic capabilities. There has been extensive research in the area of visual inspection system. These activities include, among others, delicate electronics component manufacturing, quality textile production, metal product finishing, glass manufacturing, machine parts, printing products and granite quality inspection, integrated circuits (IC) manufacturing and many others [2-9]. Visual inspection technology improves productivity and quality management and provides a competitive advantage to industries that employ this technology.

In recent years the importance of process automation has been increased as the growth of any industry is directly depends on it. For precise output and accuracy of industrial process robots with sophisticated sensors are used. In modern era application of image processing in many industrial processes has proven its prevalence and dominance. This paper present color based object sorting system which uses the machine vision and the operations in image processing. The proposed work is to develop compact, easy and accurate objects sorting machine using real time color image processing method to continuously evaluate and inspect the color deformity using camera based machine vision. After the evaluation of quality the object is sorted into predefined quality groups with the help of pick and place robo arm. If the inspected object fails to follow quality norms it is rejected out by the system. The proposed system

will have broad areas of applications in many fields where continuously evaluation of the quality is required.

## III. SYSTEM ARCHITECTURE

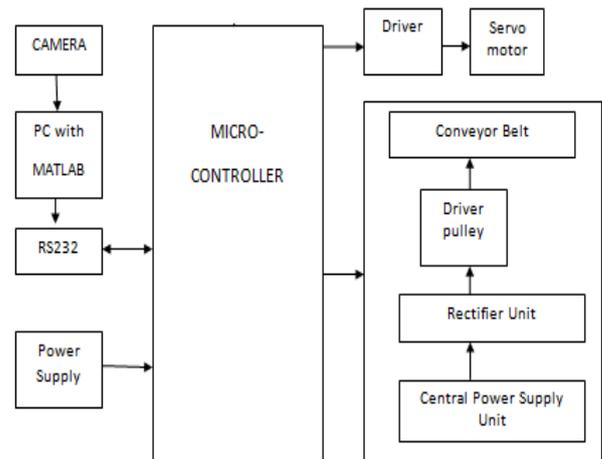


Fig 1. Bottle Cap Inspection Using Image Processing Block Diagram

As shown in above block diagram our system proposes a hi-tech vision system for sorting bottles without cap or labels from conveyor line.

Here we use hi-speed cameras which captures continuous images of bottles and this images are been processed using mat lab real-time. As soon as the bottle without cap or label is detected the controlling signals are send from PC to controller.

It will capture the all the answers feed by users and will do the comparison with standard answers enter by system operator. There various modules are connected to the system are camera two DC motor, five servomotor, conveyor belt, display module, power supply module. Camera is input sensor which is connected to PC using USB cable.

Camera is used to capture real time image of object. There is PC with MATLAB software is connected to ARM processor by using RS232 cable. Display is connected Microcontroller to display object count and message like object is rejected or object is ok. Driver IC is driving servomotor. There are two DC motors which are used to drive conveyor belt. The conveyor motor receives power and signal from the central supply through rectifier and control circuit. The control circuit consisting of a potentiometer will allow the user to manually control the speed of conveyor belt by the regulatory knob. Polyester is used as a belt material. A conveyor belt consists of two or more pulleys, with a continuous loop of material the conveyor belt that rotates about them. Out of these two DC

motors one is used as driver pulley and other is used as idler pulley.

Microcontroller is the heart of the entire system and used for data analysis and storage. There various modules are connected to the system are camera, two DC motor, five servomotor, conveyor belt, display module, power supply module. Camera is input sensor which is connected to PC using USB cable. Camera is used to capture real time image of object. There is PC with MATLAB software is connected to by using RS232 cable. LCD display is connected to Microcontroller to display object count and message like object is rejected or object is ok. Driver IC is driving servomotor. There are two DC motors which are used to drive conveyor belt. The conveyor motor receives power and signal from the central supply through rectifier and control circuit. A conveyor belt consists of two or more pulleys, with a continuous loop of material the conveyor belt that rotates about them. Out of these two DC motors one is used as driver pulley and other is used as idler pulley. Camera is placed at exactly centre of the conveyor belt.

#### IV. ADVANTAGES AND APPLICATION

Advantages:

1. Components can be identified consistently.
2. Easy fault detection.
3. Easy implementation.

Applications:

1. Fruit grading and sorting system
2. Bottle filling industries
3. Packaging industries
4. Automotive sectors
5. Airports
6. The robots find numerous applications in industrial, domestic, medical, pharmaceutical, and hazardous environment where there are threats to human life.

Some major applications given as follow:

- a. Industry: Object sorting robot arm can be used in food processing industries to sort the fruits depending upon their colour, dimensions and weight.
- b. Medical: Robotic arms are used in telesurgery and also helpful in precision surgeries.
- c. Hazardous environments: robot arm can be used in environments such as coal mines, radiation places which is either hazardous or dangerous to access.
- d. Defence: Robot arm can be used to defuse the bombs.

#### V. CONCLUSION

The sorting machine sorts the objects depending upon the colours of the objects successfully with the help of the robo arm and MATLAB program in image processing. The USB webcam serves as an eye of the system which captures the real time image of the objects. The robo arm picks the faulty quality object and places it at predefined place, while good quality object continues its motion on conveyor belt and finally drops into object carrier system. The LCD displays the object count with the status about the quality of the object. The servomotors used in the robo arm plays the vital role as control movement of the robo arm wholly depends control signal given to servo motor. Hence to operate the system accurately the synchronization between dc motors of the conveyor belt and robo arm is very essential.

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