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VISION ALGORITHM FOR CAPSULE INSPECTION SYSTEM

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ABSTRACT

Inspection is a quality evaluation technique which is most widely used in industries to obtain best quality products with specified requirements. Traditionally manual inspection may lead to loss of material, labour, time for production and inaccuracy in measurement. Thus automated inspection technique can be effectively implemented to overcome the above discussed aspects. This paper presents the brief explanation about implementing automated inspection technique in quality control process of capsule tablets in pharmaceutical industry using machine vision. The capsules might have defects like different colour and broken cover. Thus each capsule is checked for perfectness in colour and dimension using machine vision. Machine vision technique includes capturing of image of the capsule, colour image processing, determination of area of capsule and actuation of ejector mechanism. Capsule will be eliminated either if it has different colour or different dimension. By machine vision technique defective capsule can be eliminated accurately and comparatively lesser time for inspection.

Keywords:Automatic inspection, Capsule, Image processing, Pharmaceutical industry, Timing belt

1. Introduction:

The main objective of every business enterprise is to maintain its product quality at its maximum by attaining zero defects [1]. Quality control helps in increasing the productivity and reducing the waste by eliminating the defective. Quality inspection may be manual or automatic. In case of large scale production it is very tedious to inspect [2] through human eyes and so it should be automated using computer vision. All the drawbacks of manual inspection can be overcome by automatic inspection in terms of time, efficiency, human effort and flexibility. Computer vision includes the method of acquiring the image followed by processing and analysing it in order to produce numerical data to make decision [3].Automatic inspection finds vast application in medical field [4]. It is a must to install this kind of methods in pharmaceutical industries as it directly deals with human health. Pharmaceutical industries are one of the largest developing industries in terms of production and consumption. An image based inspection technique (MACHINE VISION) is used to control the quality of capsule produced in pharmaceutical industries. The capsules should be perfect in shape, size, colour and fillings but due to some inconsistent manufacturing process the capsules are subjected to many flaws [5].Defects in capsules like any absence or misalignment of gelatine shell or colour variation between cap and body is detected and rejected. There are standard sizes for a two piece capsules, those deviating from it are also get rejected by this technique. Capsules with hole or small cracks should be prevented from packing. This kind of problems

may lead to spilling out of capsule filling and entry of dust particles in to the hole causing some unsafe chemical reaction affecting the end user by means of health issues.

The method of inspection discussed in this paper integrates the application of camera, image processing software, controller and blower. The orientation position of capsules coming in the conveyor should be good enough to detect the defects.So timing belts are used for carrying the capsules. The image of the capsule is acquired, processed, compared with standards and the defect is classified. The defective capsules are rejected and avoided from packing. Detection of defects in capsules by this vision based inspection system not only helps the industries by raising their standards but also prevents the consumers from health hazards.

II PROPOSED DESIGN

Design of inspection of capsule depends on the concept of colour image processing using MATLAB (Image processing software). The image of the capsule moving over the conveyor is captured by the camera positioned above the moving conveyor. The captured image is processed by the image processing hardware (computer) sing image processing software (MATLAB). The processed image is subjected to sequence of operations which includes in determining the centroid, cropping the required area around the centroid and determining the hue value. The hue value is determined to differentiate between the colours. The determined hue value is passed to the controller where the value is compared with the standard hue value. If any defective capsule is identified then the controller triggers the pneumatic blower and eliminates it from the conveyor. The intensity of the blower must be controlled in such a way that the forth coming capsule remains undisturbed.

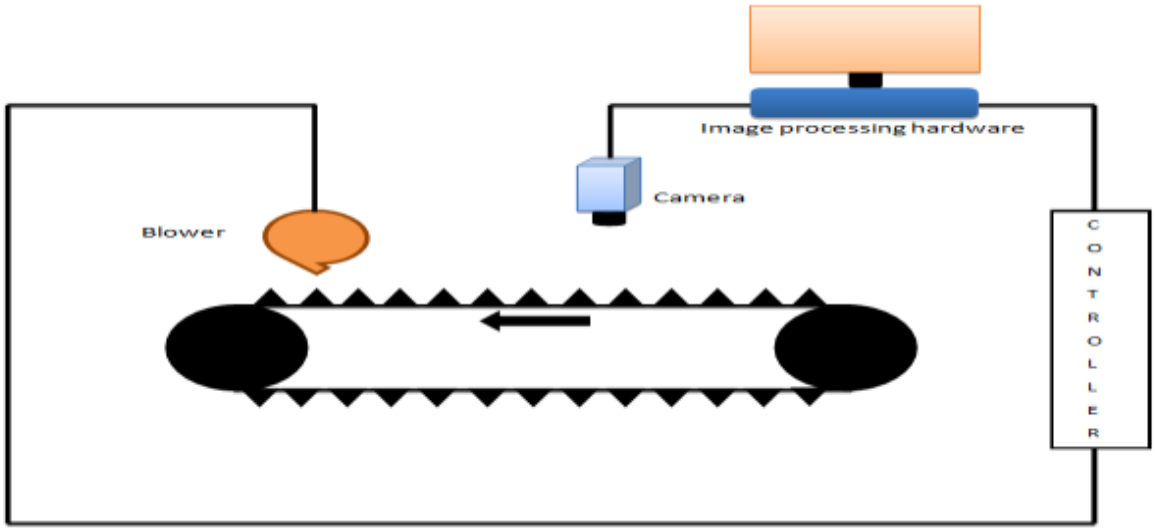

Fig.1: Design of capsule inspection

2.1 Components of the system

- Camera
- Conveyor
- Image processing hardware

- Controller
- Pneumatic Blower

2.1.1 Camera

Camera is the most important and primary component of inspection technique which is used to capture the image of the capsules moving over the conveyor and transmits it to the image processing hardware. Camera is positioned at the top of the conveyor such that the lens faces downwards as shown in Fig.1. The shutter speed of the camera depends on the speed of conveyor motor and the distance between twoconsecutive capsules. Focal length of the camera should be less (10 to 30mm). Wide and fixed lens camera is used for high accuracy image.

2.1.2 Conveyor

Conveyors are used to move object from one place to another in production line. The conveyor used in this process can be specified as timing belt. The capsules are made to move between the two corresponding teeth of the timing belt. The speed of the conveyor motor should be optimum so that there is a little time gap between the consecutive inspection and rejection.

2.1.3 Image Processing Hardware

Image processing hardware is the personal computer in which has image processing software. The software used here is MATLAB. This software enables the comparison of image of the part to be inspected with the standard part image in terms of pixel areas. Data thus obtained after comparison is fed to the controller.

2.1.4 Controller

Controller forms the heart of this automatic inspection technique. They are used to control the action of entire system by means of program that is already stored in ROM (read only memory). By the nature of data obtained from the computer it controls the actuation of blower.

2.1.5 Pneumatic Blower

A blower used here is centrifugal fan to provide flow of air which is driven by a motor or turbine. It is connected to the output terminal of the controller. Blower motor is driven or actuated only if the inspected part is defective. Moreover the flow rate of these fans must be of very less cubic feet per minute so that only the defected part is blown off from the conveyor.

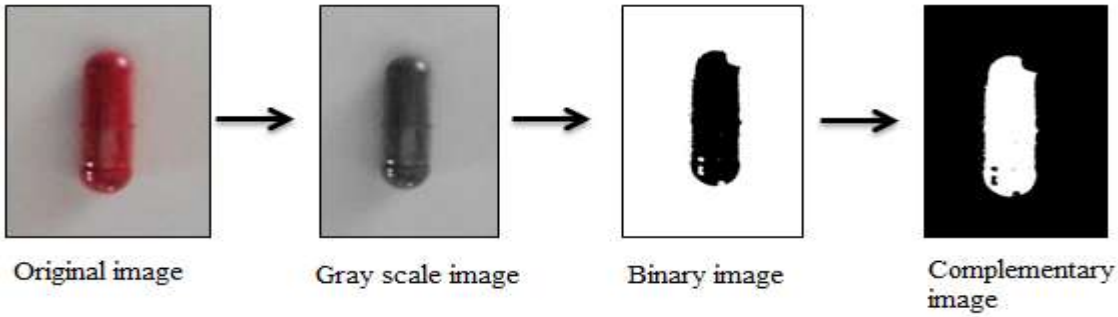

Fig.2: Images obtained during processing

III WORKING ALGORITHM

The capsule after being manufactured is subjected to the proposed inspection mechanism. The camera that has been placed over the conveyor is controlled to capture the image of the specimen under it. Now the obtained

image is processed using the programmed algorithm. If the specimen under inspection doesn't bound to the required criteria, the rejection mechanism is activated and elimination process is carried out.

The specimen under investigation is verified by a suitable colour image processing software. The various defects that have to be checked in a capsule are colour, size, structure and cracks. Rejection of the defective capsules is done once the evaluation process is done. The capsules are first checked for their size wherein they are compared with standard values. If the specimen size matchesthe standard value then it is checked for the colour. If the results are found to be positive the capsule is sent for outsourcing. Any aberrations in the parameters may result in rejection of the capsule. Series of processing is carried out over the capsule. If the result is positive the capsule is subjected to the next evaluation in sequence. Here the colour of the capsule is verified. The hue value of the capsule colour is generated. For every colour there is a measured and established hue andsaturation value. So the algorithm should be coded in such a way that it checks for the hue value of the capsule. So the hue and saturation value of the specimen should be checked .If the values doesn't coincide the standard value, the specimen is rejected. If the capsule doesn't pass the first test it is not further processed for the second condition. By this way standardization of the capsule is executed through this method.

IV CONCLUSION

The presence of undesirable defects in the pharmaceutical capsules is harmful to the end users causing unsafe impact on those consumers. Quality inspection is a must in this kind of industries. The vision based automatic inspection technique to detect the flaws in capsules manufactured in pharmaceutical industries made the inspection process more easy, flexible and fast. This inspection paves the way to the quality control. Image processing tools and techniques are used to find the capsule defects. The 2D algorithm used here to classify the defect is simpler and easily understandable. All kind of major possible defects are easily detected by this algorithm and methodology. The proposed method is a highly cost effective and quality guarantee to the consumers in this competitive market.

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