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Automatic Material Handling and Sorting of Defective Gear Using Image Processing

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Abstract:

Gear is a widely used mechanical component whose primary use is to transmit power from one shaft to other. Gears are of many types namely spur gear, helical gears, worm gears etc. Gear drives are used in various kinds of machines like automobiles, metal cutting tools, material handling equipment's, rolling mills, marine power plants etc. MATLAB is extensively used for scientific & research purposes. It is accurate & also has a number of built in functions which makes it versatile. Gear Measurement has been carried out by focusing two features of gear image object. The problems are to measure the gear features of gear image object, in the sense the measurement of the area of the gear image object and as well the teeth of the gear will be counted. MATLAB tool is used to develop a code which overcomes these problems and measures the area as well as teeth of the gear image object counted.

Keywords — **MATLAB tool, CCD, RGB Image, Threshold Value.**

I. INTRODUCTION

In imaging science, image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing maybe either an image or a set of characteristics or parameters related to image.

A Gear can be defined as the mechanical element used for transmitting power and rotary motion from one shaft to another by means of progressive engagement of projections called teeth. Spur Gears use no intermediate link or connector and transmit the motion by direct contact. The two bodies have either a rolling or a sliding motion along the tangent at the point of contact. No motion is possible along the common normal as that will either break the contact or one body will tend to penetrate into the other. Thus, the load application is gradual which results in low impact stresses and reduction in noise. Therefore, the spur gears are used in transmitting power with very less friction losses.

II. LITERATURE REVIEW

Digital image processing is the use of computer algorithms to perform image processing on images. Many of the techniques of digital image processing, or digital picture processing as it often was called, were developed in the 1960s at the Jet Propulsion Laboratory, Massachusetts Institute of Technology, Bell Laboratories, University of Maryland, and a few other research facilities, with application to satellite imagery, wire-photo standards conversion, medical imaging, videophone, character recognition, and photograph enhancement. The cost of processing was fairly high, however, with the computing equipment of that era. That changed in the 1970s, when digital image processing proliferated as cheaper computers and dedicated hardware became available. Images then could be processed in real time, for some dedicated problems such as television standards conversion. As general-purpose computers became faster, they started to take over the role of dedicated hardware for all but the most specialized and computer-intensive operations. With the fast computers and signal processors available in the 2000s, digital image processing has become the most common form of image processing and generally, is used because it is not only the most versatile method.

In 2002 Raanan Fattel introduced Gradient domain image processing, a new way to process images in which the differences between pixels are manipulated rather than the pixel values themselves.

The use of computer vision has attracted much interest and reflects the progress of computer vision technology for fruit inspection. Yang in 1994 used a flooding algorithm to segment patch-like defects on monochrome images. This method could be difficult to apply on bi-color fruits where the defects are darker then the ground color, but lighter than the blush color. This method of feature identification is applicable to other types of produce with uniform skin color. This technique was improved by Yang and Merchant, in 1995, who applied a 'snake' algorithm to closely surround the defects. Molto et al. in 2002 used linear discriminate analysis to segment pixels into three and four classes. A discriminate function sorted the apple as accepted or rejected. The accuracy was good for apples. Leemans et al. in 1998 used a Gaussian model of the color to segment defects on Golden Delicious apples with two enhancement steps. The detection was effective, but revealed some difficulties.

III. PROJECT DETAILS

- **Objective**

The main objective of this research is to find mechanism of automating the process of mechanical component quality assurance.

The objective of this project is to develop setup which can help us test and select spur gear with required dimensions. System also consists of arrangement which can reject spur gear. This whole process is to be made automated, accurate and fast image processing system which could identify defects of gear. A system for identifying surface defects on gear was designed, based on analysing images acquired from top of the gear.

- **Project Statement**

Gears have a wide variety of uses in mechanical and electrical industries and need to be perfect and flawless. Different features such as number of teeth, pitch circle diameter, module, addendum, duodenum, face width define the correctness and application in sense where these gears are to be used. This task of checking and classifying gears are done by humans but have limitations of speed and accuracy .This responsibility of classification of items can be accelerated and made more accurate by the use of imaging technology and computers aided by some mechanical devices.

In this project we are detecting various parameters of spur gear from which we can compare it with standard dimensions to find the errors in gear. This is going to be done with the help of MATLAB.

IV. METHODOLOGY

We have developed MATLAB code by using image processing, read the image original gear object and converted original gear object into gray scale image, and then calculated the threshold value of gray scale image and by using threshold value we have converted the gray scale image into binary image. After this process it has removed small objects from the binary image, to overcome the holes of the object it has filled the holes of binary image object, then calculated the surface of binary image of gear object, showing the area of gear object here it is measured.

The code has sequenced in this way, it has measured the properties of the image object regions, after that we have convex the polygon which are in regions, finally it is converted into regions of interest to the regions mask through which it has been highlighted the region with lines which indicates the teeth region of a gear object. Obviously through this process it has measured the gear object area and counted the teeth by using the MATLAB tool.

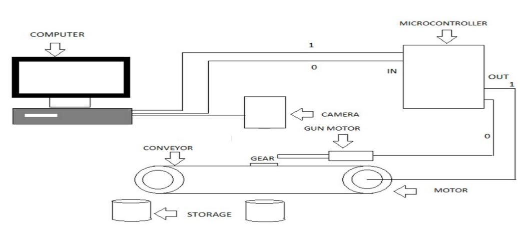

Fig. 1 block diagram of project

V. RESULT

Result

Following are the results of right gear and defective gear.

Right gear result

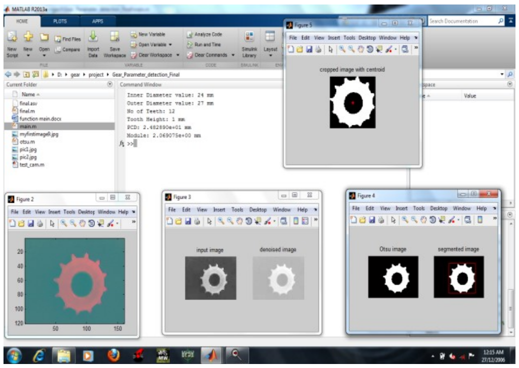

Fig. 2 Result images of defective gear

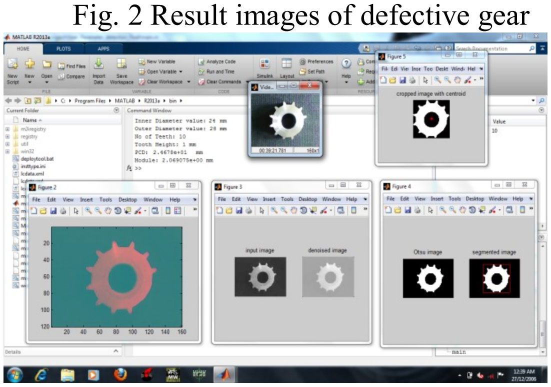

Fig. 3 Result images of non-defective gear

VI. CONCLUSION

The no. of teeth of spur gear obtained during trial is correct. While the values of PCD, module differs with large value. Greater variation is observed in these values as the intensity of light varies place to place. Automation is achieved as controlling circuits are used. Quick results are obtained which helps in bulk checking.

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