Identify defects in Plastic (gears) using Digital image processing -A Review

Amandeep Mavi
Student of Dept.of Computer Science,
SVIET-Banur,India.

Mandeep Kaur
Lecturer of Dept.of Computer Science,
SVIET-Banur,India

***Abstract*-Detection of bad quality plastic gears is critical for any manufacturing unit trying to make a mark in the market in terms of quality standard and cost. Here we explore the possibility of using image segmentation and algorithms like non-smooth surface detection algorithms to automate the process of defect detection. In these plastics we have picked industrial strength plastic gears used typically in applications like robotic arms where quality in paramount for the functioning of the device. In this paper review of various gear defects and the possible automated solutions using image processing techniques for defect detection is given.**

Keywords-defect detection; image processing; computer vision.

I. INTRODUCTION

Computer vision systems are being extensively used to provide industrial solutions, especially in developing automated inspection systems, which help plastic product manufacturer s in attaining a high order of accuracy and convenience, as it gives freedom from the human issues related to labor and takes us to total quality management implementation. Since the concept of total quality management is based on continuous monitoring and improvement of system, there is an urgent need to develop an ecosystem within a manufacturing organization which can be implemented on the principles of continuous monitoring and improvement, To achieve this, image processing can be a great tool to detect the defects of plastic products (plastic gears) on the principle of total quality management.

Total quality management: - Total Quality Management (TQM) [1] is a comprehensive and structured approach to organizational management that seeks to improve the quality of products and services through ongoing refinements in response to continuous feedback. Total quality management aims to hold all parties involved in the production process as accountable for the overall quality of the final product or service.

The review paper is organized into Section I includes Introduction, Section II Types of defects in plastic gears, Section III Related work, Section IV Conclusion and future work.

II. TYPES OF DEFECTS IN PLASTIC GEARS

Before we go further to explain the techniques involved in image processing for improving quality in plastic manufacturing unit, let us first consider and overview the types of defects of plastic products like gears.

The various types of defects [2] that can be present in the plastic gears which can be detected by using image processing are:-

A. Flash

This defect refers to the excess molding material that penetrates into mold gaps like slide push-out faces, and inserts, etc. in a molten state.

B. Warping

This defect describes the deformation which occurs when there are differences in the degree of shrinkage at different locations within the molded component.

C. Bubbles

It is an air bubble like material trapped inside plastic gear as a defect during its production.

D. Unfilled sections

This defect occurs when injection molding does not reach certain portions of the inner side of the die before solidifying.

E .Sink marks

These are the marks or irregular patches on the surface that occur on the outer surfaces of molded components.

E. Ejector marks

Flow marks in which a pattern of the flow tracks of the molten plastic remains on the surface of the molded product.

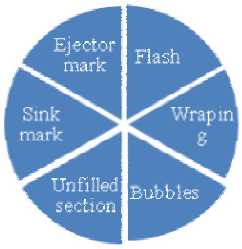

Figure1.Defects that can be identify by using image processing

Figure2 .Defective plastic gears

Figure3. Non-Defective plastic gears

III. RELATED WORK

Tomislav Petkovi´cy *et. al.* [3]made an attempt to classify various defects encountered in production of molded plastic products by taking advantages of image processing .This paper basically discusses the relevance of doing shape analysis for identifying surface defects in plastic products and further classifying these defects using nearest neighborhood classifiers. Defect detection starts with image acquisition. . The image of the product is obtained by using background illumination which provides excellent contrast nontransparent black object against the illuminated background. Such images are then segmented by using thresholding. All existing boundaries are traced and for each boundary the pattern vector is calculated. Finally, the pattern vectors are compared against the prototype vectors. The results of the algorithms are position of the defects and some of their characteristics, and these are compared with the product prototype. The various stages of development describing algorithms are successfully tested with the limited number of instances and require further testing with greater number of instances. In surface inspection subsystem several algorithms are used which are designed for line detection, spot and blemish detection. The shape inspection subsystem is to detect and classify possible shape defects.

Tremaine *et. al* [4] in this paper we were able to understand how mould and die when not working properly, might give rise to the surface defects in plastic product. This paper basically discuss defects develop due to shrinkage, due to overheating and variation in temperature. To identify these kinds of defects, this paper suggests using SEM (Scanning Electron Microscope) technique. This algorithm is running on the surface as well as the cross-sections of the plastic products. Samples of various internal defects (solidification shrinkage porosity, ductile and brittle "burst" fracture surfaces, and hydrogen "flakes") were systematically characterized before and after high temperature processing (i.e. heating to forging temperature in a vacuum) to see how the appearance of each defect evolves or changes due to the high temperature processing were discussed.

Michaeli *et. al.* [5] gives a study of the various algorithms focuses on the inspection of plastic material exhibiting irregular texture. He uses the local binary pattern operator for texture feature extraction. Various typical defects include holes, friction lines, burn marks foreign particles or printing rollers. For classification, supervised and semi-supervised approaches are used. The results obtained out of the proposed technique have been found better compared to the other existing methods. Experiments with images show detection rate with 97% accuracy.

Sivabalan *et. al.*[6] this paper made an attempt to identify defects, by using visual inspection system in fabric. Various techniques of feature extraction and segmentation are used to identify the defects in grey level digital images. In this research work the minimum, maximum and median values are calculated for each row of the image to frame the feature vector. The high frequency components are eliminated using the median value of each row and at last the low frequency component image along with the median value of each row is used to detect the defected points with sudden intensity variation from the former picture element or sudden variation from the median value. The defected area is identified sudden variation from the former pixel or from the median value. The pixel with abrupt changes, from the median value of about 60% or from the pixel of about the same value is considered as a pixel in defected area. The comparison process excludes the pixels which have zero value in order to expedite defect detection algorithm.

IV. CONCLUSION AND FUTURE WORK

As the technological progress is happening the products are now extensively made using plastic material especially in robotics which needs to be ultra light weight and modular in nature plastic components like gears, As per industry statistics we have found that gears are made up of plastic material High-density polyethylene (HDPE) which is prone to various kinds of defects when manufacturing using image processing. Therefore we suggest a fully robust system taking advantage of image processing techniques (Image segmentation, Non smooth corner detection etc)

must be explored to build an economical solution to provide Total Quality Management in manufacturing units which would allow an eco-system of continuous monitoring and improvement there by reducing the cost.

There are number of future possibilities for improving the performance of these detection algorithms like usage of machine algorithms which help to identify the defective parts as these occur over a period of time. They increase their accuracy based on the updated parameter set and scenario machine algorithm like SVM, KNN and neural network can be used.

ACKNOWLEDGMENT

I would like to thanks my parents and my friends for their support and trust.

REFERENCES

[1] http://searchcio.techtarget.com/definition/Total-Quality-Management.

[2] http://www.custompartnet.com/wu/injectionmolding.

[3] Tomislav Petkovi cy, Josip Krapacz, Sven Lon cari cy.and Mladen Sercerz "Automated Visual Inspection of Plastic Products".

[4] Alisha Tremaine (2005), "Characterization of Internal Defects in Open Die Forgings"

[5] FIERF Grant Project for Undergraduate Research November 17, 2005.

[6] Walter Michaeli, Klaus Berdel "Inline-inspection-of-textured-plastics-surfaces" Optical Engineering 50(2), 027205 (February 2011).

[7] K.N.Sivabalan , Dr.D.Ghanadurai (2010) "Detection of defects in digital texture images using segmentation" K.N.Sivabalan et. al. / International Journal of Engineering Science and Technology Vol. 2(10), 2010, 5187-5191.

AUTHORS PROFILE

Miss. Amandeep Mavi was born in the small village of Mohali (Punjab).After finishing high school, she move to Kharar to pursue Bachlor's dergree in Computer Science.After graduating with a bachelor of Technology in computer science from Guru Gobind Singh College of Modern Technology, Kharar. in 2009.Now she is pursuing M.Tech in computer science engineering from Swami Vivekanand Institute of Engineering and Technology,Banur,Punjab.

Mrs. Mandeep Kaur-She is Masters of Technology in Computer Science and Engineering from Punjab Technical University with specialization in Networking and Digital Image Processing. She has given guidance to many student in their thesis work of M.Tech.She has also contributed in the research work on WiMax networks with her papers. She has four years teaching Experience and presently working as Lecturer in Swami Vivekanand Institute of Engineering and Technology. She has done Bachelor's of Engineering from Punjab Technical University in the year 2005 in Computer Science and Engineering with Information Technology.