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MATLAB based Industrial Gear Inspection and Rejection

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Abstract: Manufacturing of gears are performed through net shape molding which incorporates both powder metallurgy and plastic. Many gears are done once they go away the mold, however powdered metallic gears require sintering or funding castings require tools reducing or different machining to complete them. The maximum not unusual place shape of tools reducing is hobbling, however tools shaping, milling, and broaching additionally exist. It is essential to test every and each tool in order that the size of tools produced is below tolerance restrict or not. And we can`t guarantee approximately the fine checking of gears performed through human pressure in any small industries.

In this global of speedy paced computation wherein assets with time and money/capital are very essential the sports in production and processing industries are each day being executed via way of means of computers, algorithms and computing marketers changing human or semi-human intervention. Here withinside the industries that require gears the filtering and type of gears could be very essential and is performed via way of means of human labor, exactly human labor is restrained to its manner of running and the time, value required.

Keywords: Industrial Gear, Matlab, Algorithm, Inspection, Rejection

INTRODUCTION:

A gear is a rotating mechanical part which has cut teeth, or cogs, which mesh with another toothed element to transmit torque. Geared devices can alternate the speed, torque, and path of an energy source. Gears almost always produce an alternate in torque, creating a mechanical advantage, via their tool's ratio, and for that reason can also additionally be considered an easy mechanical part.

Gear drives or gearboxes are utilized in numerous types of machines in particular contributing to machines in automobiles, steel reducing tools, rolling mills, marine strength flora etc. The friction and other losses on this kind of strength transmission device is relatively very low. Manufacturing of gears are done by net shape molding which incorporates powder metallurgy or plastic. Many gears are finished after they leave the mold, however powdered metallic gears require sintering or castings or different machining to finalize them. It is essential to test each gear so that the dimensions produced is within tolerance restrict or not. To achieve this, we have made an experimental setup that

allows you to ease out the fine checking of gears finished with the aid of using human pressure in any small industries.

In this work we are using a software called MATLAB to determine gear parameters. MATLAB is extensively used for scientific as well as research purposes. It is accurate and having several built-in functions which makes it versatile. The programming done here is user friendly, when executed it asks for the inputs and performs the necessary design calculations, giving necessary outputs.

Computer image processing technology allows to do research and develop more advanced computer technologies, such as DSP (digital signal processing) technology, and DIP (digital image processing) technology. We will evaluate the gear image object features easily by using these technologies.

Literature Survey:

An extensive literature search is performed in connection with this task and is presented as follows:

1. Haque Nawaz and Himat Ali [1] conducted research on gear measurements using MATLAB. Image object. I calculated the area of the gear, calculated, and counted the teeth using the image processing of the MATLAB tool. This paper contains five gear image objects processed from the developed MATLAB code. All detected gear image objects have different area values and different teeth. These were measured using the same developed MATLAB code. In this task, you will use a MATLAB tool with image processing to measure each experimental work graph for various gear objects. Measurement is an important task to limit the equipment to a specific size. Basic work has been done using image processing to measure the two most important characteristics. a. To measure the area of a gear image object b. Counts the number of teeth in the image object of the gear.

2. MATLAB research by Cheng Pengfei and Feng Changyong Henan [2] is a kind of high-end computer language with powerful data processing performance and a wide range of applications for digital image processing. This document uses MATLAB image processing to detect gear failures. Gears indicate different types of errors during the usage process. Corrosive pitching and wear are the main types. Different shapes of defects have different image characteristics. This inspection can effectively identify and determine the nature of the defect based on the characteristics of these images.

3. A study of Zhang Jing's method [3] took pictures of tooth profiles and contact points with a digital camera and used computer graphics technology to reconstruct the contact points of radial hypoid gears to make contact with Reconstructed point, tooth surface and dirt. It evaluates the size, position, orientation of edges, and the points of contact between them, forming the basis for in-line inspection of gears.

IMPLEMENTATION:

Proposed Work:

a) Methodology:

In this project, the image of the original gear is read by the MATLAB tool, converted to grayscale, and then thresholded. Next, the area of the image of the gear is calculated. Then highlight the area to be inspected (that is, tooth count, crack check, color consistency (if needed), and gear dimensions).

At this point, convert the original gear image object to grayscale. The grayscale of the original gear image then begins with the procedure of counting the teeth of the gear and checking for cracks, color consistency (if needed), and gear dimensions. This means using programming code to inspect the device through image processing.

b) Experimental Setup:

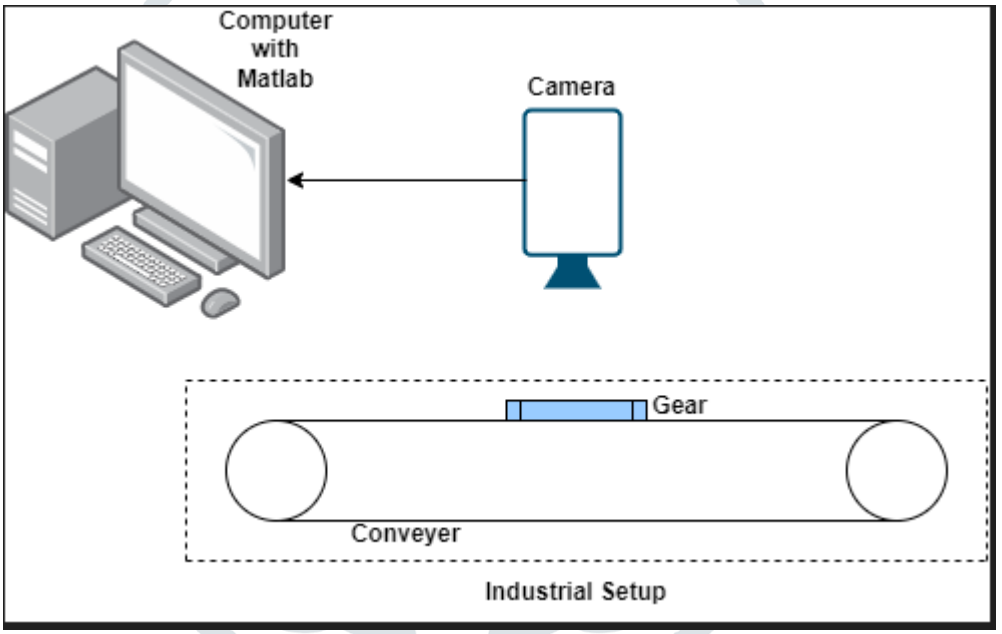
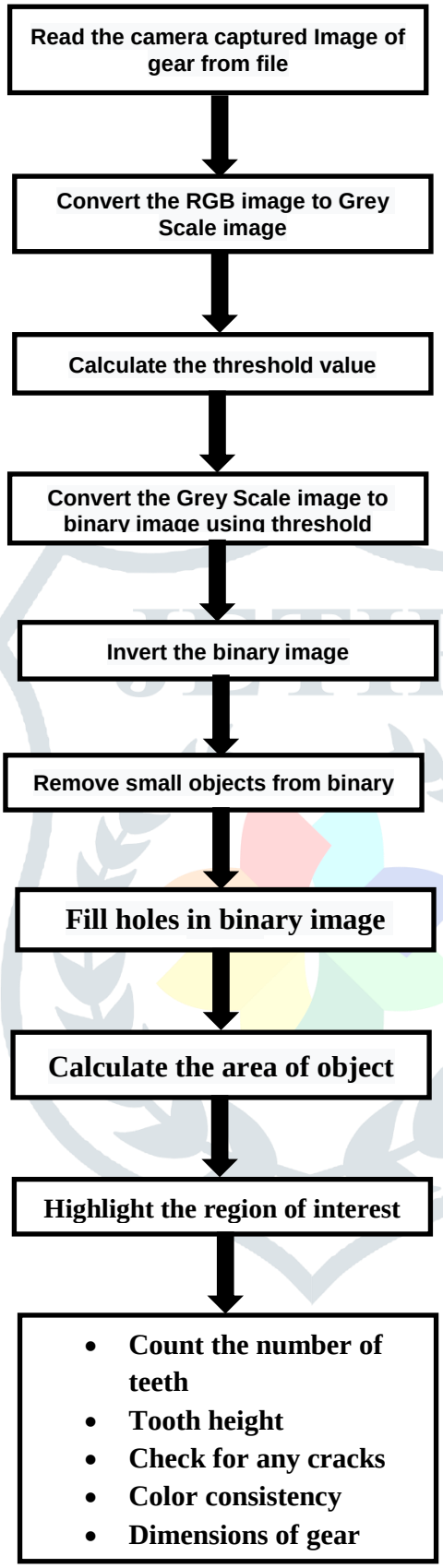


Fig 1: Block diagram of MATLAB based Industrial Gear Inspection and Rejection

1. The gear parameters will be calculated and inspection of count the teeth of the gear, check for cracks, color consistency (if required) and dimensions of gear will be done by using image processing in the MATLAB programming software.
2. The computer is the body of the project. Connect the I / O device to a parallel port on your computer.
3. Image processing is any form of signal processing where the input is an image such as Photo or video frame. The output of image processing is either an image or a set of properties or parameters related to the image.
4. Most image processing techniques involve treating the image as a two-dimensional signal and applying standard signal processing techniques to it.
5. In industry two rollers are mounted according to the required distance, the belt is mounted on the rollers on which the materials are placed.
6. The rollers shaft is coupled with the Motor drive hence when power is supplied to the motor rollers rotate with a certain time delay according to the Motor drive and the belt moves along the rollers. Therefore, material handling is performed.

7. With the help of motor drive, time delay can be achieved.
8. Motor conveyor is not moving initially. When the gear is kept on conveyor belt and the gear image is captured by the camera which is fixed at the top of the setup.
9. The captured image will be sent to the computer with MATLAB
10. The MATLAB algorithm reads the image, processes it using image processing, and the results are displayed in the MATLAB command window.
11. When the entire lot of gears is inspected, the error and approved percentages are displayed in the report and a report will be generated.

Flow Chart: Gear Inspection and Rejection Algorithm



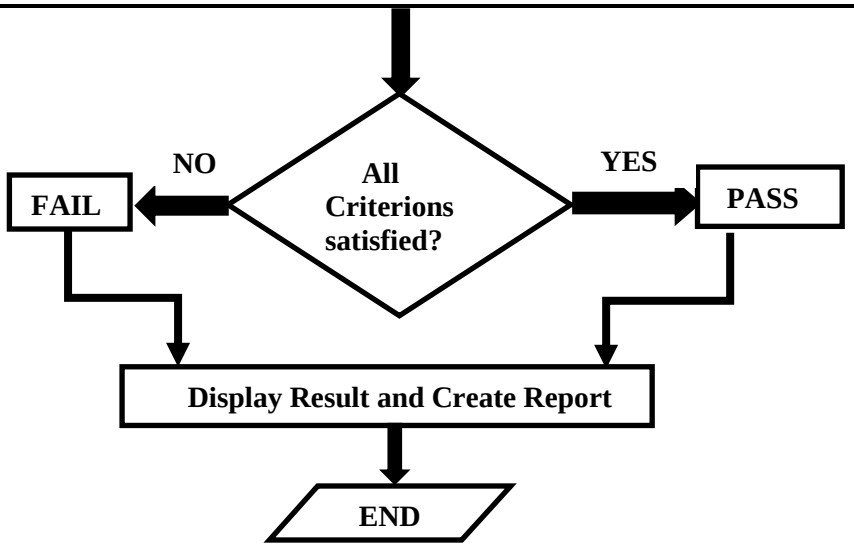


Fig 2: Flow Chart of Industrial Gear Inspection and Rejection Algorithm

Description of Flowchart:

MATLAB code is developed for image processing. The image of original gear object is read, then this image is converted into gray scale image. Then the threshold value of gray scale image is calculated. By using this threshold value this gray scale image is converted into binary image.

After this process small objects from the binary image are removed, the holes of binary image are filled to overcome the holes of the object, then the surface of binary image of gear object is calculated, showing the area of gear object to be measured.

The code is sequenced as follows:

- Measure the properties of the image object regions
- Convex the polygon which are in regions
- Convert these into regions of interest to the regions mask through which it is been
- highlighted the region with red and yellow lines which indicates the teeth region of a gear objects.

Through this process it measures the gear object area, calculates the tooth height, counts the teeth, checks color consistency, and checks for any cracks by using the MATLAB tool.

CONCLUSION:

We analyzed the solutions currently available for the inspection of gears. This system proposes a pre-processing method for the inspection of gears based on various parameters such as number of teeth, tooth height, color consistency and checks for crack to improve the quality of gears.

The system uses computer vision methodology along with the local thresholding to identify possible errors. Recognizers identify gear defects at an economical cost and create error-prone, real-time inspection systems. The recognizer captures digital gear images through an image capture device and converts RGB images to binary images via a reconstruction process and local thresholding techniques. Later, the output of the processed image is the area of the defective part and based on this we will calculate the possible defective and non-defective gears as the output.

The conclusions are as follows.

- The inner (Addendum diameter) and outer diameter (Dedendum diameter) of the gear and tooth problem shall be checked.

- The consistency of color (if applicable) and checks for cracks shall be checked.
- Analysis report of number of gears rejected and approved in a particular lot will be generated.

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