Automated Gear Fault Detection using Image Processing through 2D Filtering and YOLO Algorithm

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Abstract: The accurate measurement of the gears plays an important role in measuring and checking the gears. The tools currently in use are either time consuming or expensive. In addition, some measurement methods can not be used and this allows accurate measurements of all gear ratios, but significantly reduces the time. The purpose of this methodology is to use computer vision technology to develop a non-contact and rapid metering system that allows measurement and control of most gear parameters and accuracy. The proposed system is created and used to measure or control gear wheels.
The built-in vision device is calibrated with metrics, then verified by measuring two sample strokes and calculating the comparison of parameters with the actual values of the fishing parameters. For small gears, greater outputs and small problems can be achieved.
Keywords: Gear; gear parameters;

I.   INTRODUCTION

Gears are one of the most commonly used movements and movements. For most modern industrial and transport applications, fishing gear is important and often used as a key factor. Injuries in the production of gears cause two major problems, increased acoustic noise and increased wear, which is both cumbersome to cause worry.

In sequence to better hold the accuracy of fishing gear, it is important to accurately check gear ratios. Spur gears are mainly used for all types of gear used; therefore, the gear measurement process automatically collaborates with a permanent target. The real dental deviation design profile, profile error, can be calculated in several ways. The easiest way is to calculate gear rails in many places using a custom caliber. Another method is to measure with a moving probe, with a biasing signal transmitted to imitate the design profile. There are many mechanical tire testing systems available, but these systems are not suitable for smaller gears. Some result has been designed to measure smaller mechanical substances for suitable problems. The other use a coordinate measurement machine to calculate the actual profile or roller discs in a stationary sample. The current gear measurement techniques are either time consuming or expensive. In addition, no measurement techniques can be used and allow accurate measurement of all gear entity, but significantly reduces the time of the measurement. Therefore, many authors have emphasized the measurement and control of spiral substances.

Recently, systems have been widely used in many applications. For quality control, computer systems have been developed that are being used as objective measurement and evaluation systems. Robinson et al. The development of the synchronized gearbox control framework described in which measurements were made using a video camera and image processing software. They were investigating the accuracy and possible parameters of errors. They concluded that the measurement accuracy was comparable to the methods used to control the current gear's tolerance. In addition, an inexpensive and easy-to-use image analysis system is an attractive alternative. Sung et al use wavelengths to pinpoint the position of the teeth in the ratchet system with high precision. They reported that the use of such an approach could improve the detection capability of the transmission system, especially if the defective device rotates with other gears at an angle. The purpose of this document is to use a multi-contact viewer to develop metering systems on a computer that allows you to measure most of the rhythm parameter with reasonable accuracy. This can combine and accelerate the process of catch measurement and control system.

A.   Problem Statement

Nowdays in the gear manufacturing industries, final gears are going under the quality checking process.In a small scale industry, the process of quality checking is done manually. As it checks manually there are lots of human errors, like no much accuracy, precession, and other factors like fatigue concentration & another problem in such an industry is for mass production more workers are required to check all the final gears & it needs more labour cost. This methodology will be able to inspect all the gear one by one.

Therefore it is required to automized the existing method of quality checking with the mechatronics system. This system will be able to resolve problems.

B. Objectives

The objectives of this system are to ensure

1) The purpose of the project is to collect the objects desired using a webcam and use unwanted items using a rejection mechanism.
2) The conveyor is transported by genetically transferring components from one place to another.
3) Minimizing the accompanying staff is necessary.
4) Design a conveyor belt that benefits the industry.
5) The sample size is determined by dimension.

II. LITERATURE SURVEY

A. "Transmission Error ON SPUR Gear" Dr.Raghu, Kumar, Niraj Tiwari, Devendra Kunwar R., R Vara Lakshmi, Mohan Chhetri,

The problem of widely measure gears in an electric mass transfer framework is usually characterized by one or more high-power acoustic signals. In order to evaluate the error of the real transmission system due to the geometry of the tool due to the irregular shape of the tool, the two steps are alternately inadequate and so on. Here, the teeth deflection is calculated using flexural pressure, shear stress and fundamental stresses. In this survey, the teeth relief classification is calculated by changing the profile using the FEM

B. "Involute Gear Profile Error Detector" Hariprakash SR

The purpose of the project is to verify the implementation of the inclusive principle of detecting the error. Usually, if the gears have defects, it will cause more vibration. In order to increase the vibration, we plan to developed and fabricate a defective sensor for the specification of the set of gears. The main scenario of the tractor error profiles fault is the base curtain in which the gear is mounted. The gear is locked with a locking system that has a shaft and is connected to the bearings

C. "Outlier Detection and Correction for the Deviations of Tooth Profiles of Gears" Han Lianfu, Fu Changfeng, Wang Jun, Tang Wenyan

This paper provides a method for initial processing of modeling data with varying value and creates a model for detecting and correcting external dentures for abnormal values of dental profiles. The simulation results showed that one and one heterogeneous variable, a separate gray model processed by the pre-treatment method proposed in this document, is more accurate than the one (1.1) sequence (one sequence and one variable other than the homogeneous separate gray model) and OndGam (1.1) is more convenient than non-binding (1.1) rack features.

D. "A brief experience on journey through hardware developments for image processing and it's applications on Cryptography", Sangeet Saha, Chandrajit pal, Rourab paul, Satyabrata Maity , Suman Sau:

Improvement of image processing for the perceived human perception of image, such as image removal, movement of memory cards in various space, such as satellite imagery, medical imaging, etc. Application Specific Integrated Circuits (ASICs) and / or digital signal processors (DSPs) have so far successfully implemented their applications, but the development of VLTS technology is a very powerful hardware, namely, Field Programmable Gates (FPGA), which combines ASICs and DSPs. The core of the program is reprogrammable. , which makes them very attractive for creating a best prototype.
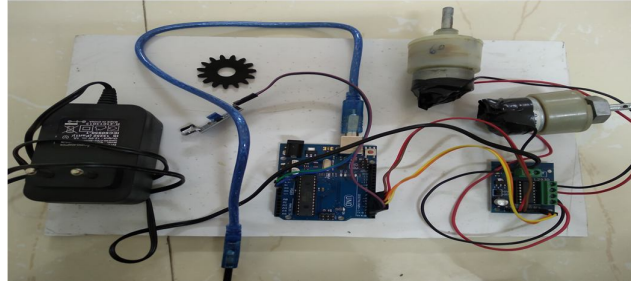
III. COMPONENTS OF OUR SYSTEM

1) Conveyor belt, Pulley
2) Shaft
3) DC Motor
4) Shooting gun
5) Base
6) Camera
7) Proximity sensor
8) Control unit.

IV. WORKING PRINCIPLE

We have to develop 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 red and yellow 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 thetool, the five different gear objects measured by changing the name of the gear object in same developed code.

We designed first module which will detect gear through IR sensor and the L293D motor driver is used to rotate the motors of the conveyor belt. The Arduino board is used to connect the IR sensor and motors.

V. PARAMETERS RELATED TO QUALITY CONTROL

1) The Diametral pitch Having the outer diameter and the number of teeth, the diametral pitch (P) can be calculated as follows:
$$P = (N+2)/D_o$$

2) The Pitch Circle Diameter Having the diametral pitch and the number of teeth, the pitch circle diameter (D) can be calculated as follows:
$$D = N/P$$

3) The Module Having the pitch circle diameter (D) and the number of teeth, the module (m) can be calculated as follows:
$$m = D/N$$

4) The Circular Pitch The circular pitch (p) can be calculated as follows:
$$p = \pi D/N.$$

5) The Addendum Having the outer diameter (Do) and the pitch circle diameter (D), the addendum (a) can be calculated as follows:
$$a = (D_o - D)/2$$

6) The Dedendum Having the root diameter (DR) and the pitch circle diameter (D), the dedendum (b) can be calculated as follows:
$$b = (D - DR)/2$$

7) The Clearance Having the addendum (a) and the dedendum (b), the clearance (c) can be calculated as follows:
$$c = (b - a)$$

8) The Whole Depth The whole depth (ht) can be calculated as follows:
$$Ht = (a + b)$$

9) The Circular Tooth Thickness The circular tooth thickness (TCirc) is calculated as follows:
$$TCirc = \pi m/2.$$

10) The Chordal Tooth Thickness The chordal tooth thickness (TChor) is calculated as follows:
$$TChor = mN\sin(90/N)$$

11) The Base Circular Diameter The base circular diameter (DB) is calculated as follows:
$$DB = D\cos\phi$$

12) The Base Pitch The base pitch (PB) is calculated as follows:
$$PB = \pi m \cos\phi.$$

VI. CONCLUSION

To overcome manually testing due to sampling process we need to check gear parameter like pitch, addendum(inner diameter), dedendum(Outer diameter), pitch circle diameter of each and every gear. Thus this process is difficult manually so we need to design a mechanism containing a flat belt conveyor, camera which detects whether there is error or no error.

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