Piston connecting rod code detection and matching system using image processing and OCR

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Abstract: *In piston manufacturing company piston connecting rod divided into two parts and both parts have same batch number printed on it, now matching of this batch number performing manually so this is very tedious job and time consuming. So there is need for developing one system, "Piston connecting Code Matching and Detection System" to simplify this job and increase the productivity. Image Processing [IP] And Optical Character Recognition [OCR] is closely related term to each other. Image processing is any form of signal processing for which the input is an image file, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image and the Optical character recognition is the mechanical or electronic conversion of scanned or photographed images of typewritten or printed text into machine-encoded computer-readable text.*

Keywords: Piston connecting rod batch Identification Number; Optical Character Recognition (OCR); Artificial Neural Network (ANN).

1. Introduction

Piston connecting rod is use for connecting piston to the crank shaft. For assembling of piston to the crank shaft piston connecting rod is divided into two parts that is also called as connecting cap. On both cap of piston connecting rod same number printed on it that is called as batch number. Before assembling of piston to the crank shaft there is need to check both cap having same number. These checking are perform using manually. To do it automatically we develop system piston connecting rod batch code detection and matching system using image processing and optical character recognition.

The system is expected to identify the correct pairs of caps of piston connecting rod using their batch number. It is expected to read the characters lying on the connecting rod and recognize them. This system should cater for all conditions for example low resolution captured images, noisy image etc. and after the recognition process took place then this could be very helpful in solving the mentioned problems above. This should be able to solve problems like identifying mismatched piston connection rod cap.
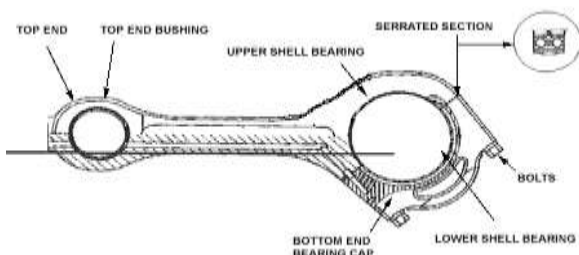

Figure 1: Block Diagram of Piston Connecting rod Code
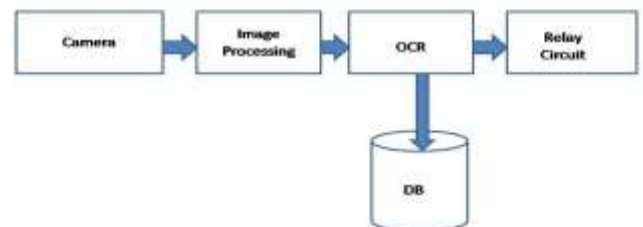
2. System Block Diagram

Figure 2: Block Diagram of Piston Connecting rod Code Detection and Matching System

In this system piston connecting rod is place in front of camera. Camera captures the image then performs OCR If image has less defect or noise it will give more accurate result. OCR is an optical character recognition method used to convert image into editable text format. when both caps of piston connecting rod having same number then its record is maintain in database and also a signal passed to relay circuit.

There are various method of optical character recognition like structural algorithms, Pattern matching, Feature extraction, neural network.

Structural algorithms [5] are very sensitive to the image defects. If image is nosily or distorted it give poor result.

Pattern algorithms are stable to small defects of the image and have sufficiently high recognition velocity. However even minor distortions of the image, which lead to the characters distortion, may influence negatively on the result of recognition

[5]

Feature extraction systems loose important information while calculating the character features and as a consequence make errors on objects classification referring them to the wrong classes [5].

Neuronal networks are able to recognise different fonts taking into consideration their defects and distortions, nevertheless they require complicated multi-layer structure and need a long training using sets of samples [3][5].
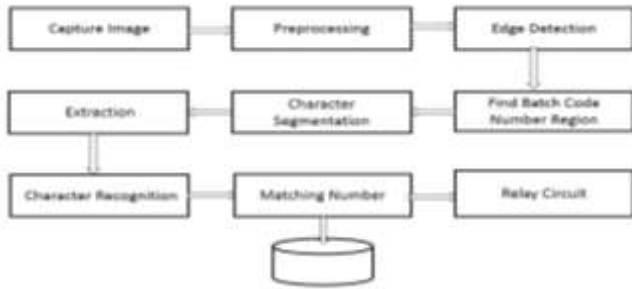
3. Proposed Methodology

Figure 3: Methodology.

3.1 **Capture Image**

Here the digital camera is been used for capture the image. The image taken by the digital camera is then passed to the processes for identification or recognition purposes.

3.2 Pre Processing

1) Gray Scale Conversion

The color image contains a 24bit color so it is difficult to apply image manipulation to the image, to solve this problem we apply gray scale to the image where we basically reduce the 24bit color to 8bit that is more manageable to work with and as well we reduce the pixel values to 0-255 with 0 representing black and 255 to more lighter color or white. By applying this method the values Red, Green and Blue will be represented by the gray value and this method gray scaling helps a lot when comes to image manipulation since does not contain of so many pixel values to work with.

    a)   Purpose of use gray scale for image processing

gray scale image used to identify important edges and other features from the image that lately can be very useful when coming to finding the batch code on the image, extraction and recognition of characters from the image, all of the mentioned it is very difficult to perform with the color image.

    b)   How to convert the image to gray scale

$$Gray\_Conversion = 0.299R + 0.587G + 0.114B$$

Figure 4: Gray Scale Image.

2) Histogram equalization

Histogram equalization is a technique for adjusting image intensities to enhance contrast. This method is helpful in improving the image quality by increasing the contrast on an image.

Figure 5: Equalized image.

3.3 Edge Detection

This is the process of identifying the change occurrence between colors. This process is done by scanning the whole image and running through the array width and height. An edge is detected by checking the pixel with its neighbor and if determined that they differ then we have an edge but if the comparison is the same then we do not have an edge. The edge detection method would be applied to the binary images in this algorithm. Edge detection [6] is simply a set of mathematical methods that aims only at determining the color change occurrences that happens in the image. Again can say is a set of connected pixels that lie on the boundary between two regions. Sharp edges are thinner than blurred and vice versa. The use of detecting sharp changes on bright images is to gather or capture important events that occurred. Edge detection it's very helpful since it can help filter out information that may be regarded as less relevant.

There are four operators [6] for edge detection that is Robert, Prewitt, and Sobel, canny. Out of that Sobel is better due to Sobel kernels are designed to respond maximally to edges running vertically and horizontally relative to the pixel grid, one kernel for each of the two perpendicular orientations. The mask is applied separately to the input image, to produce separate measurements of the gradient component in each orientation (Gx and Gy). The gradient magnitude is given by:
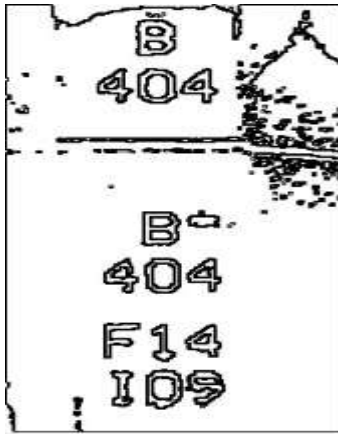
$$\text{Mod G} = \sqrt{G_x + G_y}$$

Figure 6: Sobel

3.3.1 Algorithms for edge detection contain three steps:

• Filtering (removing): Filtering reduces noise.

• Enhancement: it highlights pixels where there is a significant change in local intensity values and is usually performed by computing the gradient magnitude.

• Detection: Many points in an image have a nonzero value for the gradient, but not all these points can be considered to be edges. Therefore, some method should be used to determine which points are edge points. Frequently, thresholding provides the criterion for detection.

3.4 Rectangular box Detection

After the corner detection we can be able to detect the piston connecting rod code region on an image.

3.4.1 Corner detection

Here the batch code regions are located according to geometric features like shapes (box). The first thing that happens in this method is to scan through the whole image and detect were a shape lies in the image, box like structure.

3.4.2 Piston Connecting rod Rectangular box Extraction

In this process the Rectangular box image will be extracted out of the original image. The processes helping in doing so is the morphological operators. Here Corner detection will be applied to the image as well as to detect the corners on the identified Piston Connecting rod region on the image given.

3.5 Character Segmentation

Firstly Thinning will be applied to the Box region in order to get the single pixels of each character that lies in the Box region image before slicing takes place. Character segmentation [4] is basically slicing the extracted image according to individual characters that lie on the Box region image. Character segmentation is based on projection method vertical and horizontal projection. These are used to perform the vertical and horizontal segmentation. Horizontal segmentation removes the unnecessary top and bottom parts of the license Box region image. Vertical segmentation helps in dividing each character on the Piston Connecting rod image.

3.6 Character Extraction

It helps faster the recognition process. Which uses the projection analysis method that is used to find the features that have been analyzed from the image segmentation? This also involves obtaining the characters from the segmented images and these characters are our features the main features that we want to extract character [1] out of the Piston Connecting rod in the first place. From this method focusing on single character images that will be easily used for the recognition process.

3.7 Character Recognition

Artificial Neural Network [2][3] gives better accuracy for character recognition. Character recognition algorithm using neural network, and it can be trained by using back propagation algorithm .This is also called as block training. The process character matrices are comparing with the store neural network character matrices and closest match display as recognized character.

CONCLUSION

Developing system give more accurate result if image has less distortion or noise. If image is noisy then try to remove noise by using filtering technique. With the help of ANN if give more accurate result. After OCR if both cap have same batch number then that number is stored in Database and also signal is pass to the Relay Circuit for further Processing.

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