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Sorting of Assembly Parts Using Automation

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Abstract—In Lock and Key manufacturing industries the quality check of keys and lock parts is done manually using various gauges, callipers and visual check. This manual checking is very slow & also erroneous and human-dependent. In this paper, the aim is to check misalignment of visual features i.e. logo and hole/rectangle of a key from an image. The paper intends to implement Real-Time key inspection using Image Processing which uses Computer Vision methodology with the combination of matlab software for sorting out faulty keys. The defects are identified within economical cost and produce less error prone inspection in real time. Primarily the system captures digital key images by image acquisition device i.e. external webcam and converts the RGB images into grey images. Later, the features of the keys are calculated and are compared with the values from the database. The database contains the values for ideal dimensions of the keys. Thus, the key may be declared as defective or non-defective.

Keywords—Edge Detection, MATLAB, Template Matching.

I. INTRODUCTION

A defect in the keys is an major reason for poor quality and of embarrassment for lock/key manufacturers. Quality Check Process is an integral part of any manufacturing company. Quality check ensures that the manufactured product is produced with the proper standards that have been established. A poor product quality can greatly degrade the company's image and affect the customer preferences.

A Logo on a key will be checked for its alignment on the key according to the company standards. Company Logo on a key plays a significant role in Building a company identity. Logo is an extremely important part of having a successful business. There are several reasons why having a logo and company identity is so important: it gives your business a sense of legitimacy, it makes your product recognizable and memorable. They encourage product identification and bring in business.

The existing quality (misalignment) check process is manual. The human dependency of the quality check introduces a lot of disadvantages like higher error rate, slow speed etc. Thus there is a need to automate this process to improve the processing speed, efficiency and accuracy. Same is the case for the key manufacturing process in industries.

Automation of the process will reduce the possibility of human error and also reduce the overall processing time. This can be achieved by using Digital Image Processing techniques.

The objective of our research is to propose a Real Time Quality check technique for keys which will sort keys as non-defective or defective depend upon standards set.

II. SCOPE AND MOTIVATION

Automation of the quality check process of keys will reduce the manpower required in the industry. This would increase profit margins. The quality check of keys also influences the quality check process of locks. Presently, three keys are manufactured per lock and the lock is tested against all three keys. The total cycle time for this process is 24 seconds per lock. However if this automated technique is used the cycle time will hence reduce i.e. rise in production rate. Also, the implementation of this technique can be used to check the serial number on keys and thus making numbering process more efficient. Only those keys will be numbered whose quality is found satisfactory.

III. PROPOSED APPROACH

Logo alignment checking will be done by using two methods merged together , edge detection and template matching method .The logo will be extracted using a template matching method in which an image of the stored logo will be matched with the logo on the key. The coordinates of which will be noted. Using this same coordinates a rectangle will be drawn on the Edge detected profile of the key by precisely varying the thresholds .The distance between the logo and the borders of the key will be noted. The position of the logo will be checked for deviations from the borders of their predefined position in the standard drawings.

Logo alignment checking will be done by using two methods merged together, edge detection and template matching method.

A. Edge Detection

Edge detection is done with the canny edge detector .It identifies points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed *edges*. The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images. It works with various steps, first it does Noise reduction for the image, then Finds the intensity gradient of the image and then traces images by hysteresis thresholding.

IV. TEMPLATE MATCHING

Template matching is a technique used for finding areas of an image that match (are similar) to a template image (patch). We need two primary components:

Source image (I): **The image in which we expect to find a match to the template image.**

Template image (T): The patch image which will be compared to the template image.

To identify the matching area, we have to COMPARE the template image against the source image by sliding it. By '**sliding**', we mean moving the patch one pixel at a time (left to right, up to down). At each location, a metric is calculated so it represents how "good" or "bad" the match at that location is (or how similar the patch is to that particular area of the source image).template matching is done by using correlation method.

A. Image Acquisition

The image of the key whose dimensions are to be found is acquired using a camera. The image obtained is a RGB 3 channel image.

B. RGB to Gray

The acquired image is a 3-channel RGB (Red Green Blue) Image. To make processing simpler, it is converted to a 1-channel gray scale image. In a gray scale image the intensity varies from 0 (perfect Black) to 255(perfect white).

The gray scale image is then smoothened using a Gaussian blur so as to eliminate noise. In the program a Gaussian matrix of size 7x7 is used. Increasing the size of the Gaussian matrix the image becomes more smoothened.

C. Edge detection

To measure the dimensions of the key the profile of the key has to be traced. This is done using a canny edge detection technique. Using this gray scale image is converted to a simple black and white image wherein the edges have an intensity value of 255 (white).

D. Template matching

Template matching is a technique for finding areas of an image that match (are similar) to a template image (patch). Source image and template image (image of logo only) are matched to find a similar area between them. Then a rectangle on the edge detected image of key profile is drawn with the coordinates of the same.

E. Logo detection

Using template matching technique, the logo on the key is detected. The template matching uses a pre-stored image of the logo. It then gives the location of the points where a match has been found.

F. Measure distances

The Image post edge detection is black and white. The white pixels represent the profile of the key. Also, using template matching the outer rectangle of the logo on the key is detected. To check the alignment of the logo, the distance between the detected rectangle and the outer profile of the key is measured. The measurement is done at four points on the profile for the four sides of the rectangle using scanning techniques similar to the one used in Key Inspection. Again, the distance obtained will be in pixel scale which will be converted to real dimensions using a factor.

G. Decision Making

After the real distances have been calculated they are compared with the distances specified in the key drawing for the logo. If all four distances are within tolerance limits of drawing distances then the logo is said to be properly aligned.

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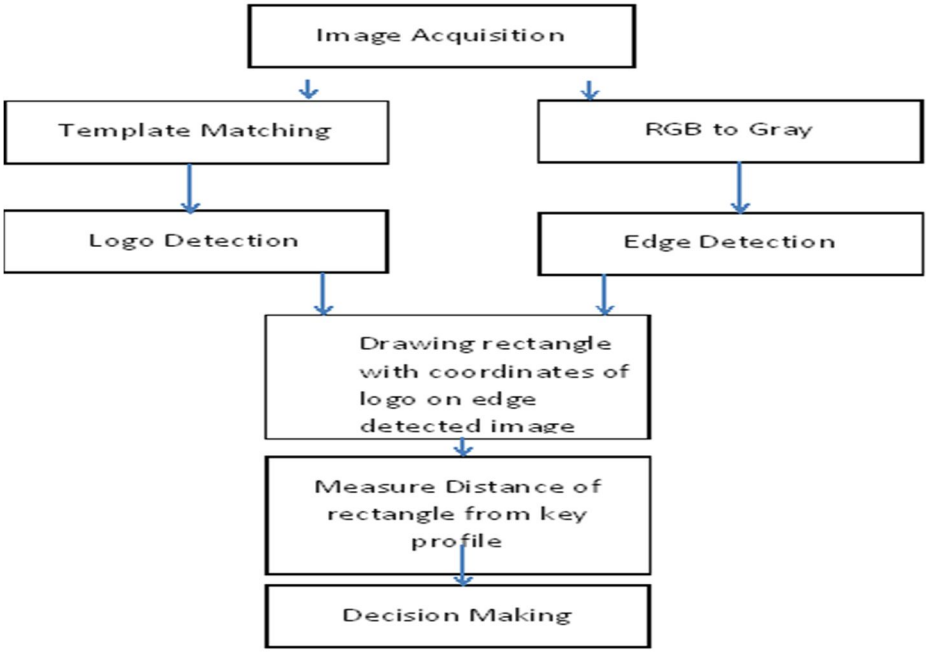


Fig. 1 Algorithm of Program

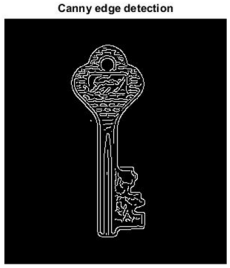
V. RESULTS

Following are some of the results obtained:

A. *RGB image*

B. *Gray scale image*

C. *Canny Edge Detection*



VI. CONCLUSION

Canny edge detection was used since it gave very thin edges and also false edges were eliminated. The logo is matched using template matching.

VII. ACKNOWLEDGMENT

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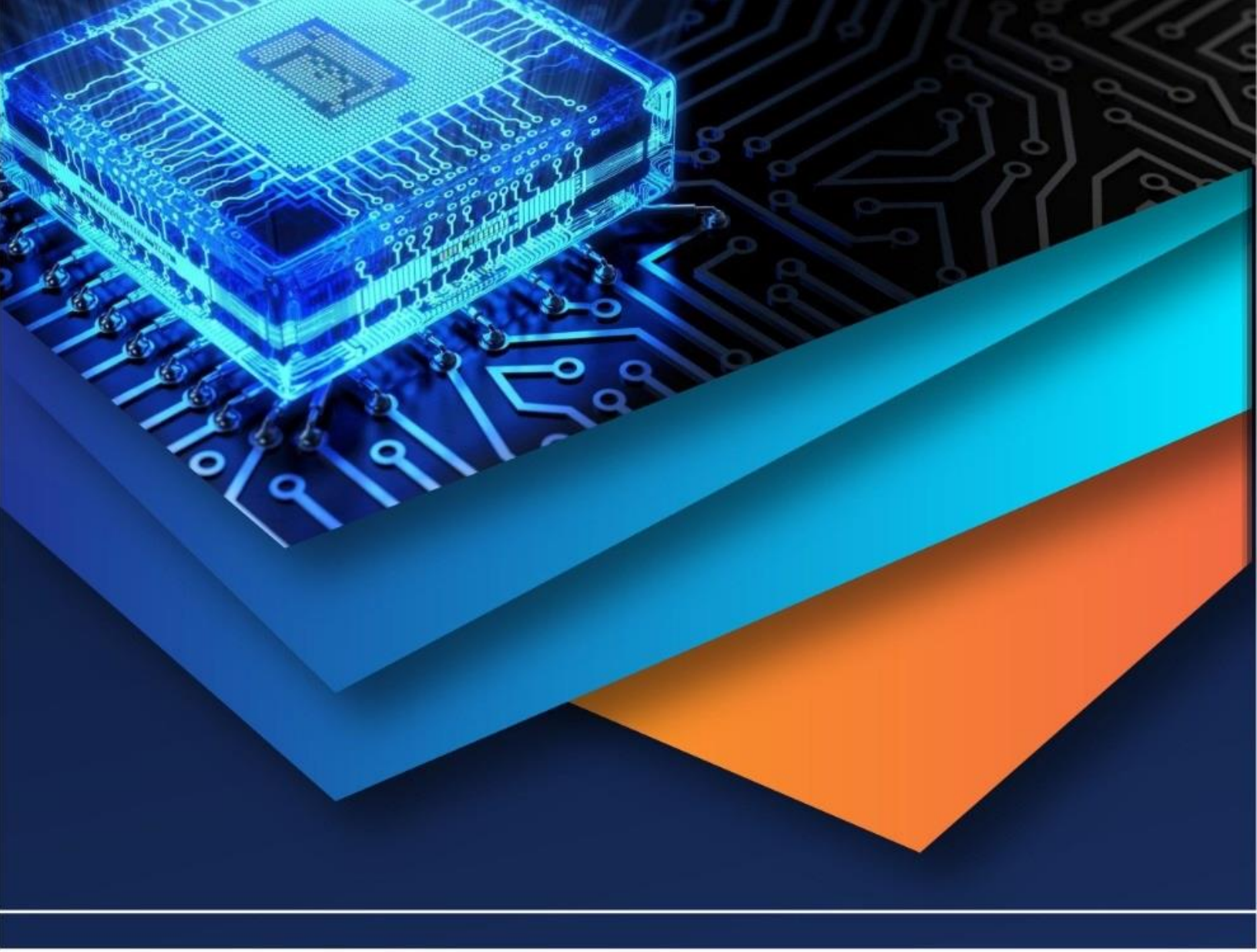

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