Robot Auto Insert Ver.1

Sorawit Sirimaleewattana

College of Data Storage Innovation, King Mongkut's Institute of Technology Ladkrabang
No.1 Chalongkrung Rd., Ladkrabang Bangkok – 10520 Thailand.
sorawit.vsalab@gmail.com

***Abstract*— In this paper, We are demonstrate that automation system applied to electronics industry during the manufacturing process leads to reduce production costs and increase efficiency. We focus on the vision system integrated into the robot. To make the robot can adaptive to work in various situations. The use of our proposed scheme can reduce production costs and reduce manufacturing system errors in the industry by using image processing techniques to template matching and edge detection. The results of practical use to show that the proposed scheme yield rate and performance of manufacturing system better manual system.**

I. Introduction

Currently, the electronics industry are considered one of the important to in Thailand's economy. The exports are the most over the years. The industry need skilled labor. But in the current have skilled labor limited. Thus, the electronic industry need to automation system. To make the reduce production costs and increase efficiency in manufacturing system.

Fig. 1. Currently, the production line in Cal-Comp Electronics (Thailand).

II. Image Processing

In imaging science, image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, a series of images, or a video, 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. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. In this project, has algorithm based on edge detection and template matching for inspection. Frist algorithm is edge detection, the name for a set of mathematical methods which aim at identifying 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. A number of researchers have used a Gaussian smoothed step edge as the simplest extension of the ideal step edge model for modeling the effects of edge blur in practical applications. Thus, a one-dimensional image f which has exactly one edge placed at x = 0 may be modeled as:

$$f(x) = \frac{I_r - I_l}{2}\left(erf\left(\frac{x}{\sqrt{2}\sigma}\right) + 1\right) + I_t \qquad (1)$$

The scale parameter σ is called the blur scale of the edge. Ideally this scale parameter should be adjusted based on the quality of image to avoid destroying true edges of the image

Second algorithm is template matching, the technique in digital image processing for finding small parts of an image which match a template image. It can be used in manufacturing as a part of quality control, a way to navigate a mobile robot, or as a way to detect edges in images.

A pixel in the search image with coordinates (x_s, y_s) has intensity $I_s(x_s, y_s)$ and a pixel in the template with coordinates (x_t, y_t) has intensity $I_t(x_t, y_t)$. Thus the absolute difference in the pixel intensities is defined as

$$Diff(x_s, x_t, y_s, y_t) = |I_s(x_s, y_s) - I_t(x_t, y_t)| \qquad (2)$$

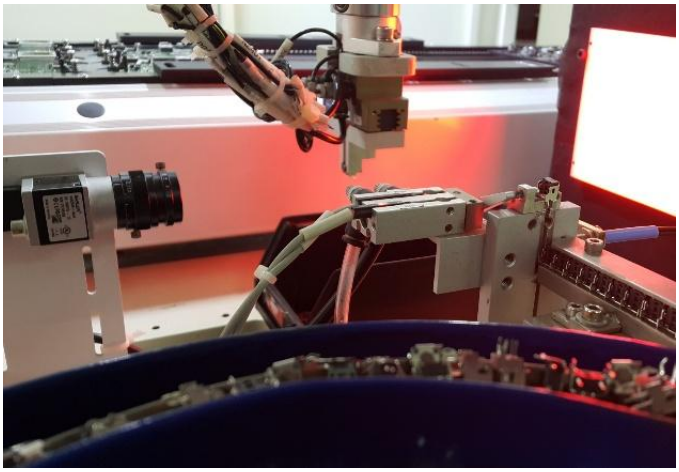

Fig. 2. Image processing performance of the proposed automation scheme compared with the manual system.

III. Method

We design the automation system, have three steps. Step one, machine feed component to make the robotic pick up easy. After the robotic pick up complete next step. Step two, robotic moved to camera for inspection of component electronics. Used canny edge detection algorithm as illustrated in Fig. 3. For inspect the corner size of the component electronics.

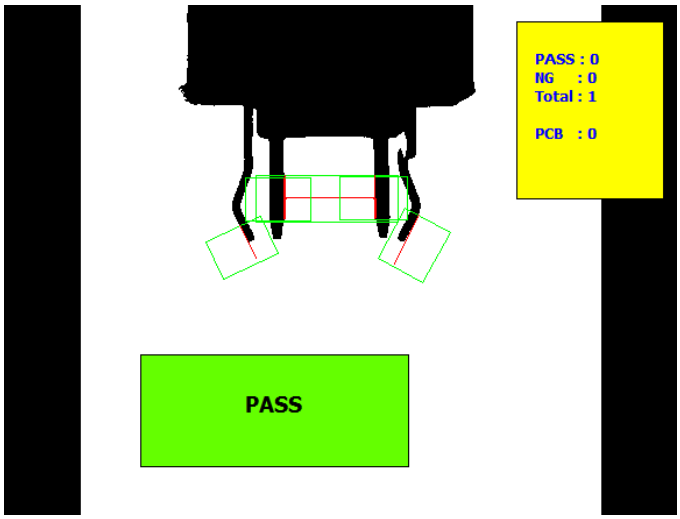

Fig. 3. Development algorithm, we are programming the edge detection.

Step three, vision system find location of target for insert precisely component electronics on printed circuit board (PCB). Using template matching as illustrated in Fig. 4.

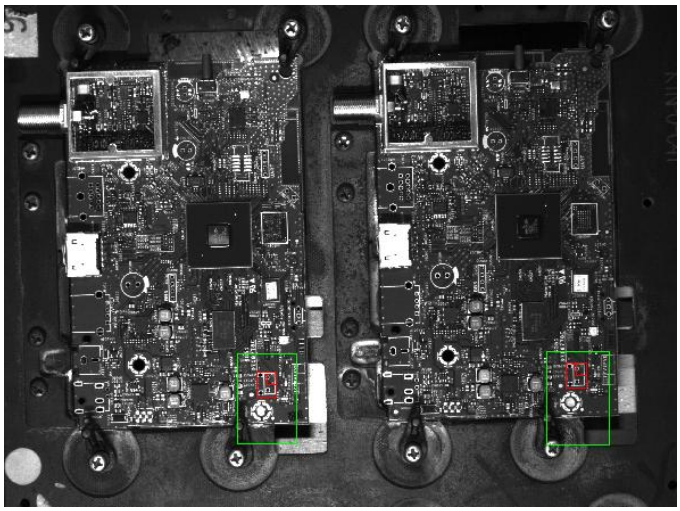

Fig. 4. Development algorithm, we are programming the template matching.

Consequently, we propose to use the feedback data from vision tracking target for robot moving adaptive. To make the increase efficiency in manufacturing system.

IV. Experiments

This paper, we have problem about manufacturing system in electronics industry. The problem is cost and volume of manufacturing. Therefore, Robot auto insert project can improve problem. From experiments, this project be stable when robot can run continuously. Experiments run the project amount 1000 sample. Result from measured yield rate 99.5 percent.

Fig. 5. Machinery industry and Software of robot auto insert project. When feeding printed circuit board in machine.

V. Conclusion

The robot auto insert project can reduce problem about manufacturing system in electronics industry. First problem is reduce cost and volume of manufacturing. Second problem, Industry want to increase reliability of company. Thus leads to automation system the best solution and improve long-term. This project, Reduce cycle time from 8.0 to 5.5 sec and reduce cost 172,800 Bath / Year.

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