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Machine Vision Based Height Measuring System

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Abstract- This paper presents a machine vision based height measuring system. The system will measure the height of a product based on the input from a webcam. The input image from the webcam will then be processed using image processing and then calculated to give the height of the product. In the market, there are many products that need to be measured whether the length or the height. These products also have different size and shape. There are several problems when using manual method for measuring such as man power will be needed at the station, longer time needed for measuring the product and the measurement may not be so accurate. This system aims to reduce these problems by developing a measuring system based on vision system.

Index Terms – Machine Vision, Measuring System, Product Height, Image Processing

1. INTRODUCTION

The aim of this project is to develop a system that can measure the height of a product by using machine vision system. The system will detect and acquire the image of a product and then display the height on the screen of a computer. In this project a webcam was used to detect or capture the image. Then the image will be processed using image processing. The purpose of this project is to simplify the measurement process of products and it can also be applied in measuring station as well as in factory. Fig 1.0 shows the block diagram for the measuring process.

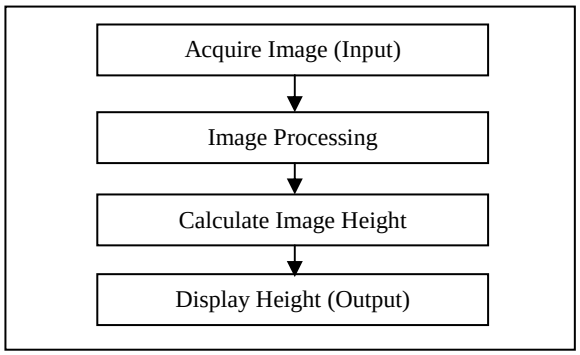

Fig 1: Block Diagram For Product Measurement

2. MACHINE VISION AND IMAGE PROCESSING

Machine vision systems are a distinctive part of daily operations in many industries. The chief purposes of machine vision systems are automated inspection and measurement of items in a production environment. Machine vision system designers generate products that emulate human vision and make decisions based on the data they collect. As a non-contact visual measuring system, the rapid and accurate measurement of objects is possible. The machine vision systems themselves can vary greatly as far as components but generally consist of an integrated camera, image capture, processing, storage, analysis and control scheme. Top machine vision system designers are able to craft equipment that works 24 hours a day and seven days a week, with very little need for service or other downtime [11].

The image that was acquired by the webcam will be in the RGB (Red Green Blue) format. It will then be converted into grayscale format as shown in Fig 2. Thresholding is used to convert the image from grayscale to binary format. An edge enhancement that uses sobel edge detection will increase the contrast between the edges and the background in such a way that edges become more visible. Fig 3 shows the result of using thresholding and sobel edge detection.

After the filtering process, the image is complimented in order to get white background. Finally the desired image will be cropped from the background and the pixel will be used to calculate the height.

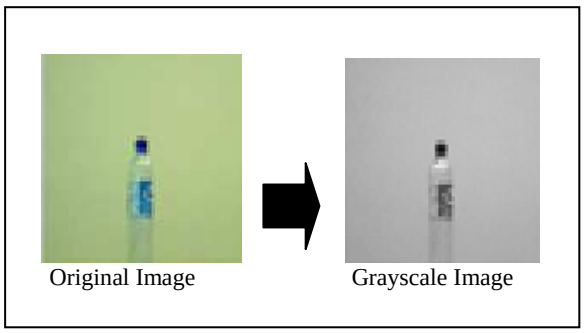

Fig 2: Conversion to Grayscale Image

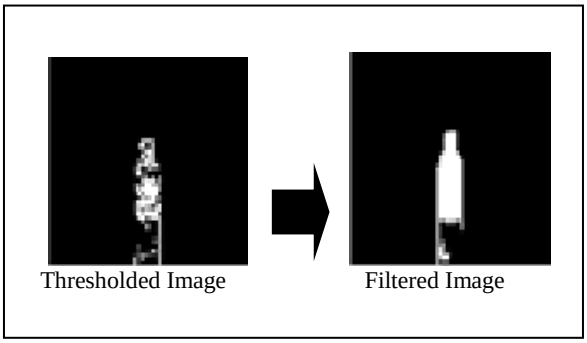

Fig 3: Image Processing

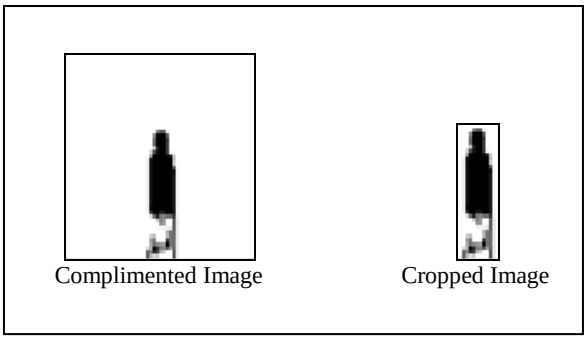

Fig 4: Final Process

3. HEIGHT CALCULATION

The measuring algorithm used in this project is using mathematical ratio concept. The height of the real object will be compared with the pixel value of image on the computer screen. The pixel value will be calculated after the image had been processed and cropped. In order to get the setting ratio that will be used in the program, the distance of the webcam was set at 1 meter from a wall. Then maximum height of the wall that can be seen in the computer screen was labeled and measured. For measuring process as shown in Fig 5, firstly the wall is taken as a reference and the maximum height of the wall that can be seen on the computer screen is 52 centimeter. After that the program will count the pixel value of the current image. The value of the image is equal to 480 pixels. Using these gathered data, we can calculate the ratio between the height of the object and the pixel value. The ratio is 52 centimeter equal to 480 pixels. This ratio will be used for setting the program. To measure the height of an object, the same step as previous was followed.

Measurement the height of product,

The actual size of wall appeared on screen:
52cm (height) × 67.5 cm (width)
The size of wall in pixel value:
480 pixel × 1920 pixel

The ratio is:
480 pixel = 52cm
480 : 52

$$Height = \frac{52}{480} \times \text{Pixel of cropped image}$$

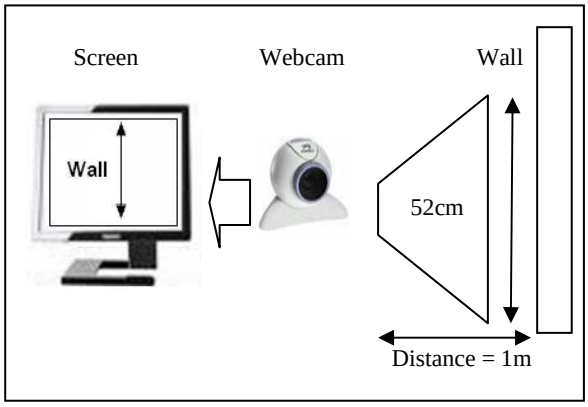

Fig 5: Height Calculation

4. RESULTS

For measuring product A where the actual height is 20.3 cm, the system gives 20.3013 cm. This gives the percentage error equal to 0.0064%. As for product B, the system gives 23.075 cm where the actual height is 23 cm. For this measurement, the percentage of error equal to 0.326%.

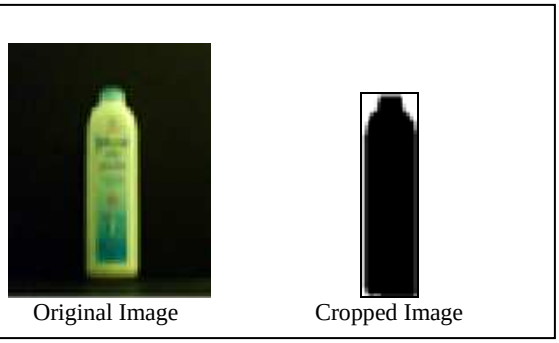

Fig 6: Measuring product A

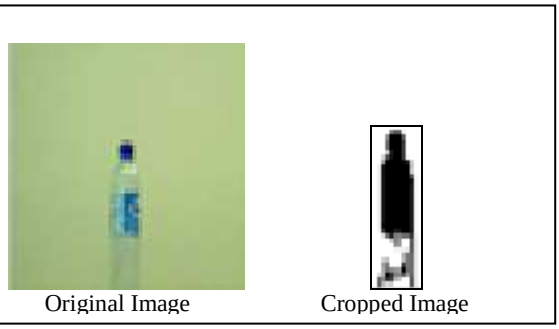

Fig 7: Measuring product B

5. CONCLUSION

From the results, the system manages to measure the height of any products with accuracy about 99% from the real height. The main problem for this system is the surrounding lighting. Different lighting may give noise to the image thus affect the output. Therefore the system can only be used in the same lighting condition.

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