UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN OF THE INTEGRATION OF WEBCAM AND MATLAB IN AUTOMATIZING A VISION SYSTEM

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Telecommunications) with Honours.

by

AINA MUSFIRAH BINTI NORAZIZI

B071710768

961230-59-5066

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY

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No 195, Taman Desa Melang, Fasa 2
72000 Kuala Pilah,
Negeri Sembilan

Tarikh:

Disahkan oleh penyelia:

.....
KHAIRUL ANUAR BIN A RAHMAN
Cop Rasmi Penyelia
TS. KHAIRUL ANUAR BIN A RAHMAN
Quality Control Manager, Teaching Factory
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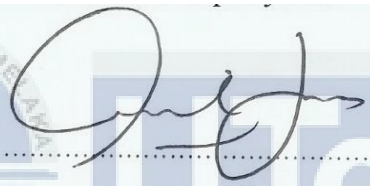
APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

Signature: 

Supervisor : KHAIRUL ANUAR BIN A RAHMAN

ABSTRACT

The MATLAB has been used in many applications to measure an object, but it required a several steps to obtain the measurements. This project aims to develop an automated non-contact measurement by using MATLAB software with connecting a webcam for its vision system. Next This study will begin with an overview of the title, problem statement, objective and project scope of the project includes with the outline project. For the literature review section, the software tools, techniques, parameters that are applied in this project and other factors that will affect the outcome of measurement is considered. The methodology approach in this project such as tools that are used in the software for measuring the dimensions is also presented. The result of the measurement obtained by the coding are shown and discussed in this paper. The approach towards future recommendations is also discussed.

ABSTRAK

Perisian seperti MATLAB telah banyak digunakan di dalam aplikasi untuk mengukur objek tetapi ia memerlukan beberapa langkah untuk mendapat jumlah ukuran tersebut. Projek ini mengfokuskan tentang perkembangan automasi pengukuran tanpa sebarang sentuhan dengan menggunakan pengisian program pengekodan MATLAB dan menyambungkan ia dengan sebuah peranti video, 'webcam' untuk sistem penglihatan. Untuk bahagian tinjauan literatur, terdapat beberapa aspek yang dikaji seperti, alat perisian MATLAB, teknik-teknik yang akan digunakan, parameter yang diterapkan di dalam projek serta faktor-faktor lain yang akan mempengaruhi pengukuran akan disertakan di dalam laporan ini. Pendekatan metodologi dalam projek ini seperti alat yang digunakan di dalam perisian untuk mengukur dimensi juga dikemukakan. Hasil pengukuran yang telah diperoleh dari pengekodan perisian MATLAB juga dibincang didalam kajian ini. Cadangan untuk penambahbaikan projek juga telah disertakan.

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Alhamdulillah, Praise to the Almighty Allah S.W.T

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My parents,

My beloved Family,

My supervisors,

My lecturers

and my friends.

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CHAPTER 1

INTRODUCTION

1.0 Overview

Today, the industrial field, factories such as semiconductor manufacturing, produce their own product with its own size and shape in an appropriate measurement. To determine the exact size, the company will do quality inspections where the products will be checked to make sure that the products will meet the customer's requirements. This process will accentuate the size, measurement, functionality of the product to avoid having defects' products to be sent towards the customer. According to Jaim (2016), the computer of the inspection system will act as a controller to connect with the integrated inspection tools where it includes computer coding to calibrated the inspection object.

The most common measurement that is commonly used in the measuring system is by using rulers, Vernier calipers, measuring tapes, micrometers and etc. The tools that are being used depends on the complexity and geometry of the product. There are also non-contact tools measurement that can be used such as microscopes, profile projectors, vision measuring machines and many more. The reason why the non-contact measuring system is needed because the smaller parts of a product have the tendencies to damage or deformation even at the slightest touch. Therefore, it can use to preserve the shape from getting defects.

1.1 Problem Statement

The non-automated measurement in MATLAB software will only take more time and steps for the users to get the data dimensions. The users are required to take the pictures of the object and include all the image object that will be measured in one folder. After that they need to renamed the image that want to be measured and simulates the coding. In order to solve this problem, this project will upgrade to automatizing measurement where it captures real-time by using webcam camera. One pin point of measuring the object in image is to have a low noise and sharp image to get capture a better shape of an object so that the value measurement of an object will be more accurate compared the actual length. The accuracy of the measured object will be emphasis in this project.

1.2 Objectives

The objectives of this project is:

- To develop an automated non-contact measurement by using MATLAB software.
- To construct a real time measurement of an object that are captured from the webcam as a vision system.
- To obtain the possible lowest measurement error percentage between the simulation from MATLAB and actual parameters of an object with a suitable focal length

1.3 Project Scope

The scope of this project is to study the comparison of measurement error between SD and HD webcam in a vision system. The image of the object that captured by these webcams will be compared based on the measurement of image in order to determine which webcam is the better in measurement accuracy. These webcams will be connected with the MATLAB software in order to get the measurement of the object.

1.4 Project Outlines

This report is divided into five chapters. The first chapter is an introduction of the project where it covers the theory about automatizing a vision system. This chapter will explain the problem statement of the study, objectives, project scope and project outlines.

The second chapter is about the study of the literature from the previous research that is related to the measurement in a vision system by using MATLAB. This literature review is based on articles, journals, and international research sources.

The third chapter will illustrate the methods that are used in the projects. It contains details on how the project is built accordingly. The implementation of the hardware the illustrated designs are included in this chapter.

Followed by chapter four will show the expected results of the project. This will show where the objective of the project is achieved. It will also include the observation and analyses from the output data.

The last chapter is about the conclusion of this project. It consists of the implementation and recommendation for the upcoming project.

CHAPTER 2

LITERATURE REVIEW

2.0 Overview

This section will be covered on the journal, article, books, report and internet sources that are related with this project. All these references are chosen on the basis of their importance to the field of study and are also used for methods, interpretation and assessment of the findings.

2.1 Introduction to Vision System

Vision system is a machine controlled applications system where software executes functions that are normally intended for industrial quality assurance, component collection, fault identification, etc. This system can operate in complex task and high efficiency. In industry has been used machine vision system because it does an excellent job in measuring a structured scene quantitatively due to its rapidity, precision and repeatability.

In placing more emphasis, Sergio, Won Suk Lee2, Nuria, Et al. (2016) has review a research on Automated Systems Based on Machine Vision for Inspecting Citrus Fruits from The Field to Postharvest. The research starts with an automated external inspection and a high-speed classification of fruits into commercial categories. It also can detect some of the disease by viewing the wavelength that leads to development of multispectral imaging system. The example of the early detection of the disease is citrus tanker, black spot, decay or citrus

Huanglongbing. This essay discusses recent research using colour and non-standard machine vision system technologies for automatic citrus inspection. It describes different methods for collecting images and the use they make use to analyse the internal and external features of these fruits non-destructively.

According to Donald, Stuart, Neil Et al (2015) has make a research on Visual Turing Test for Computer Vision Systems. Visual Turing test is aim to give a new direction to the computer vision that will create a system that will give the machine understand the images as well as humans. This is more likely to a vision system test. After learning from a trained set, the machine will answer the questions. After that, given the history and correct answers to questions, it is almost as likely that they are positive or negative.

Kumar and Ratnam (2015) has proposed a project called Machine Vision Method for Non-Contact Measurement of Surface Roughness of a Rotating Work Piece at a speed at 4000 rpm. The rotating work piece profile will be captured by capturing a silhouette of a rotating work piece by using single lens reflex camera that has higher shutter speed. The profile of the captured images will be extracted with sub- pixel accuracy by using the method edge detection. From there, there are few parameters that will be taken in such as the average, root mean square and peak valley from the ten different specimens with a speed of 4000 rpm. Based on the results, it highlighted that the parameters results are determined by using a vision system for each of the work piece. It proves that the vision system method has the ability to measure the roughness parameters even at the maximum speed of 4000rpm.

2.1.1 Lighting for Machine Vision System

Lighting aspect in machine vision system is very important so that the camera will be captured every detail of the object so that the measurements taken is accurate. The output of a good image is influenced by an appropriate focus, lighting and its source. Below is the type of light source that can be considered in using machine vision system: -

i. Fluorescent – it produces visible light that are made of mercury vapor gas. It is used because it is inexpensive operating cost and it produces heats; thoroughly equals the spectral response of vision cameras. The disadvantages of this type of lamp is that it flickers and of overall intensity.

ii. Quartz Halogen – it is a combination of inert gas, iodine and bromine. It contained tungsten filament where it can work at higher temperature and produces higher efficacy and color temperature. The quartz halogen bulb is very fragile and have to handle it with care. It will be not working effectively if it has stain on the surface; the stain probably is coming from the direct skin contact which will leave oils. The results of this contact will produce bubbles or cracks and the gas will leak.

iii. Light Emitting Diode (LED)- the LED will produce an image with more distinguished colors. LED can provide the users with application constancy, output stability and longevity.

iv. Incandescent Bulb- the benefit of this bulb are cost effective and its availability.