



**COMPARISON OF MEASUREMENT ERROR BETWEEN SD
AND HD WEBCAM IN A VISION SYSTEM**



**BACHELOR OF ELECTRONIC ENGINEERING TECHNOLOGY
(TELECOMMUNICATIONS) WITH HONOURS**

2021



Faculty of Electrical and Electronic Engineering Technology



**COMPARISON OF MEASUREMENT ERROR BETWEEN SD AND
HD WEBCAM IN A VISION SYSTEM**

Nurusolihah binti Zamri

Bachelor of Electronic Engineering Technology (Telecommunications) with Honours

2021

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WEBCAM IN A VISION SYSTEM**

NURUSOLIHAN BINTI ZAMRI

**A project report submitted
in fulfillment of the requirements for the degree of
Bachelor of Electronic Engineering Technology (Telecommunications)**



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA
Faculty of Electrical and Electronic Engineering Technology**

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

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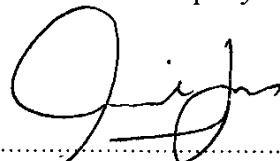


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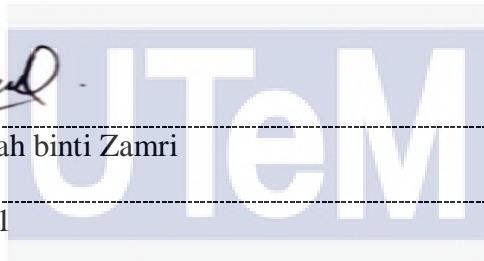
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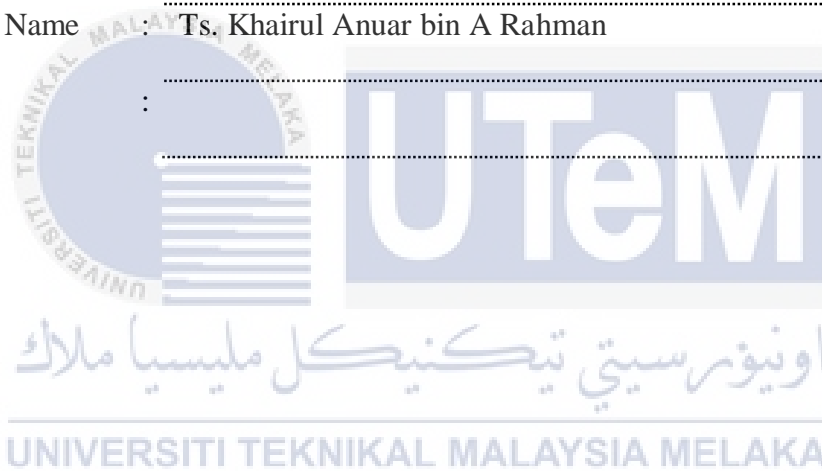
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Signature :



Supervisor Name : Ts. Khairul Anuar bin A Rahman

Date :



DEDICATION

To my beloved parents and family for their love and encouragement.

To my kind lecturers for the past four years of guidance.

Finally, to all my friends their backing and friendship over the years.



ABSTRACT

Webcam has been used widely throughout these days especially in healthcare, video monitoring and security and more. In the industry sector, uses of the webcam are significant especially for the inspection system in measuring objects. It is important to ensure that the quality of product releases in good specification before reach the market. There are few features that must be have in the webcam in defecting the measurement error of the object. In this study, the comparison of SD and HD webcam will be made to determine which webcam is suitable to be used for measurement of object in a vision system. In order to identify the accuracy of the measurement error between SD and HD webcam, the focal length will be change from 8 cm to 10 cm with 0.5 mm increment. The coding will be tested first using the MATLAB software before running the simulation. These webcams then will capturing the object in getting the dimension of height and width. At the end of the experiment, the result of measurement error for both webcams will be compared so that the best webcam can be determined to be used in measurement error in a vision system.



ABSTRAK

Kamera web telah digunakan secara meluas selama ini terutamanya dalam bidang kesihatan, pemantauan dan keselamatan video dan banyak lagi. Dalam sektor industri, penggunaan kamera web sangat penting terutama untuk sistem pemeriksaan dalam mengukur objek. Ini adalah penting untuk memastikan bahawa kualiti produk yang dihasilkan dengan spesifikasi yang baik sebelum ke luar pasaran. Terdapat beberapa ciri yang mesti ada dalam kamera web bagi mencatatkan kesalahan pengukuran objek. Dalam kajian ini, perbandingan antara kamera web SD dan HD akan dibuat untuk menentukan kamera web yang sesuai digunakan untuk kesalahan pengukuran dalam sistem penglihatan. Untuk mengenal pasti ketepatan ralat pengukuran antara kamera web SD dan HD, panjang fokus akan berubah dari 8 cm menjadi 10 cm dengan kenaikan 0.5 mm. Pengekodan akan diuji terlebih dahulu dengan menggunakan perisian MATLAB sebelum menjalankan simulasi. Kamera web ini kemudian akan mengambil gambar objek yang mahu diukur. Kamera web ini kemudian akan menangkap objek dalam mendapatkan dimensi tinggi dan lebar. Pada akhir eksperimen ini, hasil ralat pengukuran untuk kedua-dua kamera web akan dibandingkan untuk menentukan kamera web terbaik untuk digunakan dalam menentukan kesalahan pengukuran



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CHAPTER 1

INTRODUCTION

1.1 Overview

This chapter provides an overview of using SD and HD webcam in determining the measurement error. The problem background and problem statement are described next. This is followed by the objective and the focuses of this research which involves the study of the comparison measurement error using SD and HD webcam in a vision system. Problem Statement

1.2 Background

Before the presence of the webcam, many different measuring for collecting measurements of objects were done by using direct manual measurement in which the correct measurements are obtained with tapes, calipers and protectors. Although these methods are simple and inexpensive, the measurement duration is long and a high level of subject-matter cooperation is required in order to obtain accurate measurements. Some measurements, such as those around the eyes are difficult to obtain due to the risk or irritation or injury to the subject, particularly when the subject is unaware of the need to remain. The recent developments in multi-processing hardware and webcam in a vision system have sparked the webcam imaging technology in designing and creating innovative webcam for a wide variety of applications especially to overcome the problems that faced in measuring the object. However, different type of webcams have their own special capabilities in imaging quality. The webcam that has best performance will produce better image quality that can be used in getting the measurement of the object.

1.3 Problem Statement

There are difficulties that we had to face especially when going to measure the dimension of the object by using the direct manual measurement. This is because it is not too accurate and will give the greater measurement error of the object when compared to the actual dimension object. SD and HD webcams had been used in this project in order to get the more accurate measurement error of object. These webcams will be connected with the MATLAB software in order to measure the dimension width and height of the object. The accuracy of the measurement error between these webcam also will be determined by changing the focal length. The standard percentage error that have to be achieved must be less than 5%. As the analysis had been made and the result obtained, the percentage error of object that measured by both webcams will be compared and determined which webcam has the most accurate to the actual dimension of the object.

1.4 Objectives

The objective of this project is:

- To analyze the measurement error between SD and HD webcam by using the MATLAB software.
- To identify the accuracy of measurement error between SD and HD webcam by changing the focal length.

1.5 Project Scope

The scope of this project is to study the comparison of measurement error between SD and HD webcam in a vision system. Both SD and HD webcam will be connected to MATLAB software in order to get the value for dimension of width and height of the objects. In determining the accuracy of the webcam in measuring the object, the measurement data

for each object has been collected repeatedly 5 times at different focal length which is from 8cm to 10cm with 0.5mm increment. The measurement data will be compared and analyzed based on the calculation average of the percentage error. All the significant measurement will be observed and compared towards the actual measurements as a reference.

1.6 Project Outline

There are five chapters that have been divided in this report. Chapter 1 is introduction is introduction element which explains the context of the project, research goals, problem statement in getting idea in this research and the scope of the project. Chapter 2 briefly explained about the literature review related to the measurement error between SD and HD webcam in a vision system. This literature review as the source to achieve project understanding from different sources, such as articles, journals and books. Chapter 3 described the method, project flow chart and the summary of project software that are used in this project. In chapter 4, it consists of the result and analysis of experiments performed. The last chapter concludes the project did and recommends improvement for the upcoming project.

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CHAPTER 2

LITERATURE REVIEW

2.1 Overview

This chapter will describe about the prior works related to the research about the SD and HD webcam camera in the vision system. In this chapter, it will able to help in understanding more about SD and HD webcam camera by analyses the research that have been done from the previous researcher.

2.2 Introduction of Inspection System

Inspection is most commonly an activity of coordinated analysis or structured evaluation to ensure it complies with specific standards. It is a method of testing component parts during production line inspection. During inspection and testing, if the product does not fall within the acceptability region, it will be rejected and the production management will have to take corrective steps in order to ensure that the product produced complies further with specified requirements and specifications. Inspection and testing play important tools for manufacturing processes as they help to monitor quality, reduce production costs, reduce failure losses and assign reasons for manufacturing defective products. Both inspection and testing processes are conducted before, during and after the production of the product to make sure the product's quality level complies with the specifications. This important aspect of the manufacturing system is also labour-intensive and time-consuming, not to mention the unavoidable risks of human error and resulting tiredness.

(Shi et al., 2019) proposed the Stainless Steel Precision Blanking Sheet Contour Online Inspection System for the defect measurements. In this research, a new method of

online contour defect inspection is proposed for stainless steel precision blanking sheet to resolve problems in using the current method for detecting information: the recognition system is complex and the defect dimension measurement error is high. The blanking sheet images are obtained via the developed image collection system. The results of the image analysis show that the blanking sheet defect contour has the properties of correspondence and similarity. An improved algorithm for the detection of sequential similarities and the measuring algorithm is being established. The measurement tests show that the online inspection method is stable and accurate, and 0.0362mm is the maximum measurement error. The findings of this analysis will lay the groundwork for online precision machining inspection.

(LI et al., 2019) have suggested a Precision Assessment of High-Speed Railway Slab Intelligent Inspection. There are several problems with conventional railway slab evaluation approach with the rapid development of high-speed railway. The conventional method is slow, and its accuracy is restricted by the accuracy of specified railway slab inspection. Since the accuracy assessment of these systems is based on railway slab testing tools that are complex for operation, this research aim a new method for evaluating the accuracy of an intelligent slab inspection system by using the spatial deviation between the point cloud of a benchmark slab and the corresponding position. The experimental results show that the device can match the slab point cloud with its corresponding digital 3D model based on the actual point cloud processed by an intelligent slab inspection system.

In placing more emphasis, (Ding et al., 2016) studied about A Method of Plastic Gear Inspection Based on Machine Vision. In this study, they founded an easier way to detect the defect of plastic gear which is difficult to measure because of its small size. So, they used a method based on machine vision to inspect plastic gear accurately and quickly. The

researchers had used a CCD camera to capture the digital images of plastic gear and then pre-processed the image to produce a single pixel edge of the gear. The number of the tooth, circular pitch and diameters of the addendum circle and root circle is determined based on this tip, which is the basis for checking whether the gear is fit. The experimental results show this approach meets on-line inspection requirements.

2.3 Introduction of Vision System

A vision system or machine vision system is the image-based inspection automated that can commonly be used for robot guidance, automated inspection which is mostly used in the industrial or manufacturing application. The vision system can be used for measuring and sorting parts at high speed, able to measure and verify parts in the correct position and also to recognize the shape of parts. The machine vision system mainly used for online inspection can perform mundane, complex and consistency at a high speed. The vision system had played a big role, especially in the industrial and manufacturing field because it combines various technologies especially the design of these systems which most of the companies would definitely use this technology in order to implement better quality control and also for security purposes. Any defects and failures in the manufacturing process are detected rapidly and transmitted to the proper personnel so that regulated changes can be made to reduce waste or scrap in the manufacturing process and minimize costly downtime.

(Widiasri et al., 2019) proposed Design and Research on Computer Vision System (CVS) to measure egg volume and mass accurately and precisely without damaging the egg. The disc method had been used in this research in order to calculate the volume of an object with a circular cross-section such as an egg. CVS is designed to measure the volume using the disc method and calculate the egg mass using density and regression models, based on images captured in real-time or images that have been captured previously. Based on the

results, CVS is the best method in measuring the volume and mass of egg quickly, accurate and precisely without damaging the egg.

(Jridi & Alfalou, 2017) had investigated the Multi-CPU/FPGA SoC (System on Chip) design flow and to transfer know-how and skills to rapidly design embedded real-time vision system. They take the facial detection and pre-treatments as a case study to be designed by using the Xilinx Zedboard platform. The last is the core element of the vision system which has been developed. The video acquisition is carried out using either standard webcam connected to the Zedboard via USB interface or several camera IP devices. Visualization of video content and intermediate outcomes are possible with the HDMI interface connected to an HD display.

2.4 Webcam

In this project, there are 2 different webcam that being used which are Standard Definition (SD) webcam and High Definition (HD) webcam.

2.4.1 Standard Definition (SD) Webcam

Standard Definition webcam or SD webcam is a portable digital camera that can be connect directly to the computer or built into the hardware in order to display video images in real time. It can captures light from a small front lens by using a small grid of microscopic light detectors, which is similar to the digital camera. Besides, a webcam's maximum resolution is lower compared to the most handled video cameras. This is because it will minimize the higher resolutions during the transmission occurred. The lower resolution in the webcam enables it to be relatively cheap than the other video cameras.

The webcam does not have a built-in memory chip or flash memory because it does not need to save the images, since it is programmed to record and send them to a device