DEVELOPMENT OF ROBOT BASE VISION SYSTEM FOR PART RECOGNITION AND LOCATION

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DECLARATION

I hereby declare that this report entitled **"**Development of Robot Base Vision System for Part Recognition and Location**"** the result of my own research except as cited in the references.

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (*"Robotik dan Automasi*). The members of the supervisory committee are as follow:

Mr Shajahan Bin Maidin
(PSM Supervisor)

5 Mei 2008

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ABSTRACT

This Bachelor Degree Project discusses about the development of robot base vision system for part recognition and location. The study has highlighted the stages of image processing algorithms using the vision camera to visualize, measure and different object and integrated with a robot. The vision camera will inspect the object and present the object into the image-processing algorithm and the robot process the signal from vision system to perform the image analyses. The image can be analyses with different method of image processing algorithms. The key successful of this project is to generate the signal and inspection for object that will captured using vision camera. The image generates the image processing algorithms and analyses for part recognition operation. This project can be implemented at manufacturing industry to improve the productivity minimize the cycle time, and eliminate non-value added activities, and to reduce the cost in manufacturing industry at Malaysia.

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ABSTRAK

Kajian ini membincangkan pembangunan untuk robot menggunakan sistem penderiaan dan kecerdikan dalam menghasilkan sistem yang dapat mengesan barangan . Kajian ini menjurus kepada proses untuk menghasilkan gambaran mengenai alogritma bagaimana sesuatu sistem penderiaan mampu untuk mengesan dan menganalisas barangan dan gambaran yang dihantar oleh sistem penderiaan kepada robot dalam bentuk isyarat. Sistem penderiaan akan memeriksa barangan dalam bentuk prosese gambaran alogritma dan robot akan menghasilkan isyarat untuk menunjukkan terdapat isyarat dalam sistem ini. Kajian ini dapat dijalankan dalam pelbagai cara dan kaedah proses gambaran alogritma untuk memastikan bahawa kajian ini berjaya dalam mengenal barangan yang di deriakan. Adalah diketahui bahawa kajian ini dapat dijalan dalam industri untuk meningkatkan produktiviti , mengurangkan masa produktiviti, mengurangkan kos dalam industri pembuatan di Malaysia .

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DEDICATION

For my beloved parents:

Mohamad Nasir B. Ismail

Azizon Bt.Hasan

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

PSM	-	Projek Sarjana Muda
SCN	-	Scene

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CHAPTER 1
INTRODUCTION

1.1 Background

In manufacturing engineering, there are many problems associated with recognizing and locating the parts especially in assembly process in industry. Engineers have considered these factors and explore various methods to overcome them. One of the main ideas to achieve is by using machine vision system. This technology has become possible due to the combination of new microelectronics, high capacity memory, fast-embedded processors and the migration and availability of "high-end" vision algorithms and technology. All of this forms the basis for the development of "smart cameras" or vision sensors.

This project is about the development of robot base vision system for part recognition and location. This project focuses on the image processing software, part recognition and location algorithms and integration between robotics and machine vision to develop the process. An object recognition and localization system should answer the question whether an expected object is present or absent, example verification and what are the next processes that should be carried out. Such a system would be very useful in an automated production environment for the fulfillment of certain tasks.

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This project is about a machine vision system used to develop parts recognition algorithms in order to identify and recognize three objects with different size and shape on the conveyor belt. The objective of the project is to use a vision camera from OMRON F500 Vision Inspection System and Vision Composer Net Software to program. The system, which recognize and inspects a range of shape parts using vision composer net software. After that, the Rhino robot will integrate with vision system to pick parts from the storage and recognize the parts absent and location the same parts at the conveyor belt.

1.2 Problem Statement

By using an OMRON F500 Vision Inspection System and Vision Composer Net Software, which will be mounted on Rhino robot, an algorithm will be develop to inspect and recognize three different shape of parts. The robot used in the project will move on top of the conveyor so that the vision camera can inspect the presence of these parts on the conveyor and to pick any specific parts that are absent from storage and put the part on the conveyor for next operation. Integrating the two systems provides greater handling flexibility such as positioning and reorienting parts. Thus, it is possible to overcome some of the problems with human labor in manufacturing environment in terms of safety, fatigue and ergonomics, which will results in better and faster work quality. This can also eliminate a tedious and repetitive task, which often leads to an unpleasant working environment.

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1.3 Scope and Objectives

1.3.1 Scope

The scope of this project are two folds. The first scope is the development of algorithms to recognize and inspect arrange of three different shapes of parts using image processing and machine vision. The second scope is to interface the machine vision with six axes Rhino Robot.

1.3.2 Objectives.

The objectives of the project based on gaining knowledge within the fields of robotic and machine vision. The following objectives are specified:

i. To study on machine vision image processing.
ii. To develop a part recognition algorithm.
iii. To program and operate the Rhino Robot.
iv. To integrate communication between vision sensor and robot.

The next chapters begin the report with a description of the general theory on machine vision systems and image processing techniques used in industries that can be integrated with Rhino Robot. Table 1.1 shows the Gantt for period of time Bachelor Degree Project.

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CHAPTER 2
LITERATURE REVIEW

2.1 Background

This project require strong literature review because it deals with fundamental of the vision camera The project involved the explanations about machine vision, types of camera, the application of vision system in industries and the Rhino robot applications and interfaces between vision systems. Literature reviews have conducted for all elements involved in development of this project. It helps a lot in determine the method, equipment and fundamental for the project. Figure 2.1 shows about the workflow project that content the processes required in producing the best project and the way to implement this project.

The main factors need to consider are by understanding the title, scope and objectives of the project by searching the information from all sources by doing the literature review. The sources are journals, articles and books.

The important things that need to focus on were the way to choose the software, vision camera and how to apply it. The main things that need to focus were to operate the designing, programming, testing and solve the problems that occurred when the project was develop.

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2.1.2 Machine Vision Definition

A machine vision is the ability of a computer to –see". A machine vision system employs one or more video cameras analog-to-digital conversion (ADC) and digital signal processing (DSP). The resulting data goes to a computer or robot controller. Machine vision is similar in complexity to voice recognition (Anonymous, 2001). Machine vision is making machines see, and recognize what they see, is a major part of industrial embedded, and often military computing of image-related computing. Machine vision involves image processing, computer vision, and often real-time response (Mark, 2007).

A complete or nearly design for vision system contained in the camera body itself. Lighting and optics may or may not be integrated. At a minimum a Smart Camera combines a camera with image processing and MV-related programs within the same housing. Sometimes smart cameras are called –Intelligent Cameras" and "Vision Sensors"(Kellett, 2006).In some cases Vision Sensors are lower-end Smart Cameras. In other cases they have the same functionality and flexibility as Smart Cameras and thus are merely another term for Smart Camera.

The vision technology matures; its usability and the implementation become more widely accepted. The machine vision industry, with more than 40 years of existence and implementation, is no exception (Anonymous, 2007). The vision sensors can be explaining in several different forms of hardware and software that combination to provide several ways of solving some problem during inspection and measurement applications at industry.

According to Caitlina Fuller, a machine vision camera usually abbreviated by MV. aIt is the type of computer vision made available to the manufacturing industry. Computer vision is different from machine vision in that is focuses on machine-based images however; machine vision focuses on input and output digital devices as well as computer networks to control certain types of equipment like a robotic arm or other similar device (Caitlian, 2007).

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