



DEVELOPMENT OF A PICK AND PLACE TABLE TOP SIZED ROBOT CELL

This report is submitted to Faculty of Manufacturing Engineering of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Manufacturing Engineering (Robotics and Automation) with Honours.

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2013

DECLARATION

I hereby, declared this thesis entitle “Development Of A Pick And Place Table Top Size Robot Cell” is the result of my own research except as cited in references.

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APPROVAL

This report is submitted to Faculty of Manufacturing Engineering of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Manufacturing Engineering (Robotics and Automation) with Honours. The member of the supervisory committee is as follow:

(Official Stamp of Supervisor)

ABSTRAK

Projek sarjana muda ini membincangkan pembangunan prototaip sel robot berskala makmal berfungsi untuk mengambil dan meletak objek yang diintegrasikan dengan sistem pengimejan mesin berasaskan komputer untuk melakukan beberapa fungsi seperti mengesan, mengira dan mengesahkan. Secara umumnya, sistem ini merangkumi tiga sistem yang berlainan iaitu sistem konveyor, sistem pengimejan mesin dan robot yang akan diintegrasikan bersama untuk melakukan suatu fungsi yang lengkap. Setiap alatan utama didalam sistem secara umumnya mempunyai sistem kawalan tersendiri bergantung kepada keperluan alatan tersebut. Secara umumnya, 3 sistem kawalan digunakan didalam system ini iaitu PIC microcontroller untuk mengawal konveyor, “sensor” dan pengasing, komputer peribadi untuk mengawal system pengimejan serta “XPC target” komputer industri untuk mengawal pergerakan robot secara masa sebenar. Prototaip sistem yang telah dibina adalah sebuah sistem yang tepat dan boleh berulang dimana ia telah dibukti melalui 30 ujian yang dilakukan secara rawak bagi mengesan warna dan jumlah blok Lego™ didalam sebuah pemasangan. Melalui projek ini, beberapa kebaikan akan dapat diperolehi dimana ia boleh dijadikan sebagai contoh yang bagus untuk diaplikasikan di industri secara skala yang lebih besar dimana ia boleh membantu dalam meningkatkan produktiviti dan kecekapan proses dengan mengautomasikan proses menggunakan teknologi pengimejan mesin. Disamping itu, projek ini juga boleh digunakan sebagai medium pengajaran oleh pensyarah untuk mengajar pelajar berkaitan system pengimejan mesin berasaskan computer.

ABSTRACT

This Bachelor Degree Project discusses about the development of a pick and place table top sized robot cell which are integrated together with computer based vision inspection system for detecting, counting and verification function. Basically the prototype of the system that had been developed consist of three separate components which is the conveyor, computer based vision inspection system and robotic arm which are integrated together to perform one complete function. Each of the main components of the system generally had its own individual controller based on the requirement of the components in order to provide better performance and reduce the computational time of the system. The 3 types of the controller used in the system is the PIC microcontroller which is used to control the conveyor, sensor and sorter, a personal computer (PC) which used to controls the vision system and the XPC target industrial computer for real time processing of the movement of the robotic arm. The prototype of the system developed is an accurate and repeatable system as it had given accurate result within the 30 random tests that had been perform in order to detect the right colour and numbers of the Lego™ blocks inside an assembly. The benefit of this project is that it can a good example for be implemented in the industry in larger scale in order to enhance the productivity and efficiency of the operation by automating the process using machine vision technology. In addition to that, this project can also be used as a teaching medium for lecturers to teach students about computer based vision inspection system.

DEDICATION

To my beloved families, lecturers and friends for their endless support and
motivation

ACKNOWLEDGEMENT

Alhamdulillah...i am grateful to ALLAH S.W.T for letting me successfully complete the project within the time period. My sincere and humble thanks goes to my beloved families for giving me such motivation and support for me until I am able to reach this stage. You are my source of inspiration and without you all, i may not be able to reach this step in my life.

I would also like to express my gratitude and thanks to few people who had contributed much during the project development. Firstly I would like to thanks my supervisor which is Dr. Zamberi bin Jamaludin for his endless support and motivating me in completing the project as well as develop new ideas for improving the system that had been made. My thanks also goes to Mr. Mahasan bin Mat Ali, Mr. Mohd Nazrin bin Muhammad and Mr. Muhamad Asari Bin Abdul Rahim for helping me in solving few technical problems which I had encountered during the project development phase. Not to forget all the BMFA friends who had contribute in giving me ideas for completing the project.

Finally, I would like to thank all that had contributed to this project directly or indirectly. All of you guys support and motivation will be always be appreciated by me throughout my entire life.

Thank you ALLAH S.W.T

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

CCD	-	Charge-Coupled Device (CCD)
CMOS	-	Complementary Metal Oxide Semiconductor
IR	-	Infrared
LED	-	Light Emitting Diode
CAD	-	Computer Aided Design
3D	-	3 Dimensional
DC	-	Direct Current
VR	-	Voltage Regulator
IC	-	Integrated Circuit
PIC	-	Peripheral Interface Controller
PC	-	Personal Computer
NO	-	Normally Open
NC	-	Normally Close
ROI	-	Region Of Interest
DOF	-	Degree Of Freedom
M1	-	Motor 1
TM	-	Trademark
HSV	-	Hue,Saturation,Value
RGB	-	Red,Green,Blue

COM	-	Communication
ASCII	-	American Standard Code For Information Interchange
UART	-	Universal Asynchronous Receiver/Transmitter
LCD	-	Liquid Crystal Display
CPU	-	Central Processing Unit
RAM	-	Random Access Memory

CHAPTER 1

INTRODUCTION

1.0 Introduction

Nowadays as the industry become more competitive than ever, many manufacturers are now strive to increase the level of the productivity of their operation to maximize the volume of output produce in order to gain better profit margin. In addition to that manufacturers are also focusing on producing high quality products with little or zero defect. As this happen, there are needs to develop and introduce better manufacturing process into the production operation of their manufacturing plant. One of the emerging technologies that are rapidly used in the industry today's to deal with this type of problem is the machine vision system. A machine vision system is a technology that deals with an algorithm that processes an image in real time in order to perform several beneficial functions in increasing the productivity and the efficiency level of the production process. Such functions that can be perform using the machine vision system is product inspection, quality assurance, parts sorting, material handling and also process control.

This project is being introduce in order to develop a prototype of a table top size robot cell that are integrate together with a computer based vision inspection system to demonstrate a manufacturing process in packaging operation inside a manufacturing robot cell.

The system develop will include two separate system that are integrated together to perform a beneficial function in material transfer across a packaging process. The first system is a robot cell which includes a robot arm that performs a pick and place operation to pick parts from parts bay and insert it into the incoming box from box conveyor and transfers it to another conveyor for next operation. When the process is completed the second

system which is the computer based vision inspection system will take over the operation. Different from the system 1, the computer based vision inspection system will be used to perform three separate function simultaneously which include part detection, counting and part verification to verify whether the parts inside the box containing the right numbers of quantity such as program by the users. If the system detect that the right quantity of part inside the box, the system will allow the box to travel through the conveyor and enter the finish bay but if the quantity does not met the set quantity, an automatic sorter will be enable to sort the box into reject box. The cycle of the operation will be continuing until the users stop the operation.