UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND ANALYSIS OF PROTON MPV BUMPER ROBOT JIG

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Robotic and Automation) with Honours.

by

MUHAMMAD SHAHRUL HAFIZAN BIN AHMAD FADZIL

FACULTY OF MANUFACTURING ENGINEERING
2010

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS TESIS*

JUDUL: "Design and Analysis of Proton MPV Bumper Robot Jig"

SESI PENGAJIAN: 2009-2010

Saya _____MUHAMMAD SHAHRUL HAFIZAN BIN AHMAD FADZIL_____

mengaku membenarkan tesis (PSM/Sarjana/Doktor Falsafah) ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Tesis adalah hak milik Universiti Teknikal Malaysia Melaka .
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (√)

☐	SULIT	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia yang termaktub di dalam AKTA RAHSIA RASMI 1972)
☐	TERHAD	(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☐	TIDAK TERHAD	

Disahkan oleh:

_____ _____

(MUHAMMAD SHAHRUL HAFIZAN) (EN ISMAIL ABU SHAH)

Alamat Tetap:
NO 10, JLN SP 6/4,
SAUJANA PUCHONG 6,
47100, PUCHONG,
SELANGOR

Cop Rasmi:

Tarikh: 25/5/2010

Tarikh: _____

* Tesis dimaksudkan sebagai tesis bagi Ijazah Doktor Falsafah dan Sarjana secara penyelidikan, atau disertasi bagi pengajian secara kerja kursus dan penyelidikan, atau Laporan Projek Sarjana Muda (PSM).
** Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh tesis ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I hereby, declared this report entitled "Design and Analysis of Proton MPV Bumper Robot Jig" is the results of my own research except as cited in references.

Signature	:	.....
Author's Name	:	MUHAMMAD SHAHRUL HAFIZAN BIN AHMAD FADZIL
Date	:	25/05/2010

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 (Robotic and Automation) with Honours. The member of the supervisory committee is as follow:

……

Supervisor

(En. Ismail Bin Abu Shah)

Faculty of Manufacturing Engineering

(Official Samp and Date)

ABSTRACT

This report is mainly consists of a study, research, and development of jig apparatus for use with industrial robots which name as Design and Analysis of Proton MPV Bumper Robot Jig. Jigs and fixtures are production tools used to accurately manufacture duplicate and interchangeable parts. Jigs and fixtures are specially designed so that the large numbers of components can be machined or assembled identically, and to ensure interchangeability of components. The research starts with a literature review about robot jig from previous researcher, studies from related books and others. The development of this Proton MPV Bumper Robot Jig is done for use in industrial moulding which is to take out a part (Proton MPV Bumper) from mould and put on conveyor for next process. Mainly, this robot jig uses a pneumatic system and it was developed consists of three main parts: mechanical part, electrical and electronic part, and programming part. As for mechanical part is a frame design of the jig while for electrical and electronic part is a circuit design for sensor (limit switch). Programming part is use for the robot jig movement planning. The development for the robot jig is used machining process such as lathe, milling, drilling and also fabrication. The electrical circuit for sensor (limit switch) had been constructed and then attached to the robot jig which acts as the device of controller movement. Programming was set in Pneumatic Traverse Robot Controller which is suitable to use at moulding process for the robot jig movement planning. This robot jig is also design with flexible frame. We can adjust the frame and use not only for Proton MPV front bumper production but also for Proton MPV rear bumper. This is one of the advantage compare to the previous robot jig.

ABSTRAK

Laporan ini meliputi kajian dan pembangunan perkakasan jig untuk digunakan di dalam bahagian industri robot yang mana dikenali sebagai Rekabentuk dan Analisis Proton MPV Bumper Robot Jig. Jig adalag merupakan peralatan bantuan untuk proses pengeluaran produk .Kajian dimulakan dengan melihat rujukan daripada penyelidik robot jig terdahulu melalui jurnal, pembelajaran daripada buku berkaitan dan juga sumber ilmiah lain. Pembangunan Proton MPV Bumper Robot Jig adalah untuk digunakan di dalam industri moulding yang mana untuk mengambil part (Bumper Proton MPV) daripada mould dan di letakkan di atas conveyor untuk proses seterusnya. Robot jig ini menggunakan sistem pneumatic dan secara umumnya ia dibangunkan atas tiga bahagian utama iaitu: bahagian mekanikal, bahagian elektrik dan elektronik dan juga bahagian pengaturcaraan. Untuk bahagian mekanikal ianya meliputi rekabentuk rangka jig manakala untuk bahagian elektrik dan elektronik meliputi rekabentuk litar untuk sensor (limit switch) Pengaturcaraan pula adalah untuk merancang pergerakan robot jig. Pembinaan robot jig ini menggunakan proses mesin seperti ”lathe”, ”milling”, ”drilling”, dan ”fabrikasi”.Litar elektrik untuk sensor (limit switch) dibina dan digabungkan bersama dengan robot jig yang mana bertindak sebagai salah satu alat untuk mengawal pergerakan. Program pergerakan rrobot jig telah di tetapkan di dalam Pneumatic Traverse Robot Controller yang mana bersesuaian di dalam proses moulding. Robot jig ini juga dibangunkan dengan rangka yang mudah alih. Kita boleh mengubah rangka robot jig bukan sahaja untuk pengeluaran Bumper Hadapan Proton MPV malah boleh digunakan untuk pengeluaran Bumper Belakang Proton MPV. Ini adalah merupakan salah satu kelebihan robot jig ini berbanding robot jig yang lama.

DEDICATION

Specially dedicated to
my beloved parents who have encouraged, guided and inspired me
throughout my journey of education

ACKNOWLEDGEMENTS

I would like to take this opportunity to express my deepest gratitude to my project supervisor; Mr. Ismail bin Abu Shah who has persistently and determinedly assisted me during the whole course of this project. It would have been very difficult to complete this project without the enthusiastic support, insight and advice given by him. My outmost thanks also go to my family who has given me support throughout my academic years. Without them, I might not be the person I am today. I also want to give this appreciation to Mr. Manivanan from Teck See Plastic Sdn Bhd Company for the advice and guidance regarding development of the robot jig and robot system. It is to my advantage that I have received help and support from friends. My appreciation also to all my friends. It is my greatest thanks and joy that I have met these people. Thank you so much.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS, SYMBOLS, NOMENCLATURES

PC	-	Personal Computer
PLC	-	Programmable Logical Controller
TSPSA	-	Teck See Plastics Shah Alam
MPV	-	Multi-purpose vehicle
DAC	-	Double Acting Cylinder
SW	-	SolidWorks

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

Nowadays, in the field of plastic molding, robots were used to load and unload the parts from one place to another. These robots actually need to attach with the jig to make it function well. The use of a jig or fixture makes a fairly simple operation out of one which would otherwise require a lot of skill and time. Both jigs and fixtures position components accurately; and hold components rigid and prevent movement during working in order to impart greater productivity and part accuracy.

Many different types of tools exist for use in operations carried out by robots. Common among robot tools are grippers, clamps, jaws, and more specialized tools. Such tools may be mounted on the last axis of the manipulator or robot. In this robot jig, the grippers were used as a tool to grip a part before unload from a mould machine.The gripper assembly of the robot is that portion utilized to grasp the workpiece. It must have sufficient gripping force to hold the workpiece during movement of the workpiece from one place to another by the robot. The gripper assembly must also have sufficient accuracy in its holding of the workpiece so that positioning of the workpiece after movement may be accurately and repeatedly performed.

1.2 PROBLEM STATEMENT

At Teck See Plastic Sdn Bhd Company, all the part which produces from mold machine will be unloaded by using a robot. Now they have around 15 robots (X-Y-Z Robot) which is still function to load and unload from machine. This kind of robot is very helpful in production planning. It also a friendly user and more safe when use the robot to take a part compare to use operator.

Therefore, a robot not completes and cannot run in production without a jig. The jig will create by user as what design they want. It will help a robot to grip a part and take out from machine. The current problem is a dedicated fixture capable to perform only on specified product shape. So, The TSPSA production department request to create a new suitable and flexible robot jig for new product PROTON MPV FRONT AND REAR BUMPER which is also can cater various kind of product shape.

1.3 OBJECTIVES

The objectives of the project are:

1. To design and develop a flexible fixture that could cater various kinds of product shape.
2. To develop a control system this could shorten the lead time.

1.4 SCOPE OF PROJECT

This project will be focusing on developing a robot jig which suitable and functioning to load and unload a product from mold machines without damages a product. Basically, the idea uses a Pneumatic system to function. This jig will assemble with X-Y-Z Robot and set by operator at robot controller.

This project is developed using cylinder iron, solenoid valve, tube, and a kind of machining part. Machining part will refer to a design create future.

This robot jig must suitable and functioning to unload a product from mold machines without damages a product. This jig also must light weight for make sure it easy to carry and install at the robot arm. However, the cost to build this robot jig also very important criteria which is must low cost to build the robot jig. This will help the company to reduce their production cost.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

In this technology world, many factory jobs are now performed by robots. This has led to cheaper mass-produced goods, including automobiles and electronics. All the process done in industries actually more on robot help which is can increase a production quality, shorten the lead time, and also cut down a labor cost. This robot actually must assemble with the jig and fixture to done the process in the industries.

Nowadays, the economical production of engineering components is greatly facilitated by the provision of jigs and fixtures. A jig or fixture is designed and built to hold, support and locate every component (part) to ensure that each process within the specified limits. The correct relationship and alignment between the tool and the work piece is maintained. Jigs and fixtures may be large (air plane fuselages are built on picture frame fixtures) or very small (as in watch making). Their use is limited only by job requirements and the imagination of the designer (Seiji,1985).

2.2 ROBOT AND AUTOMATION

Robot is a machine designed to execute one or more tasks repeatedly, with speed and precision. There are as many different types of robots as there are tasks for them to perform. The term robot comes from a Czech word, robota, meaning "forced labor." The word robot first appeared in a 1920 play by Czech writer Karel Capek, R.U.R.: Rossum's Universal Robots (Craig, J.J, 2005).

A robot can be controlled by a human operator, sometimes from a great distance. But most robots are controlled by computer. Robots are sometimes grouped according to the time frame in which they were first widely used. First-generation robots date from the 1970s and consist of stationary, nonprogrammable, electromechanical devices without sensors. Second-generation robots were developed in the 1980s and can contain sensors and programmable controllers. Third-generation robots were developed between approximately 1990 and the present. These machines can be stationary or mobile, autonomous or insect type, with sophisticated programming, speech recognition and or synthesis, and other advanced features. Fourth-generation robots are in the research-and-development phase, and include features such as artificial intelligence, self-replication, self assembly, and nanoscale size (physical dimensions on the order of nanometers, or units of 10^{-9} meter).

Today, commercial and industrial robots are in widespread use performing jobs more cheaply or with greater accuracy and reliability than humans. They are also employed for jobs which are too dirty, dangerous or dull to be suitable for humans. Robots are widely used in manufacturing, assembly and packing, transport, earth and space exploration, surgery, weaponry, laboratory research, and mass production of consumer and industrial goods.

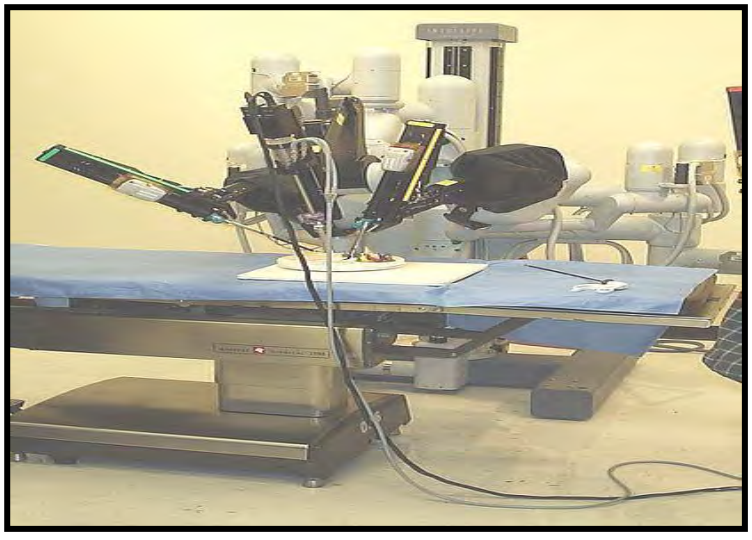

Figure 2.1: Surgery Robot (Paul,2008)

Automation is the use of control systems (such as numerical control, programmable logic control, and other industrial control systems), in concert with other applications of information technology (such as computer-aided technologies [CAD, CAM, CAx]), to control industrial machinery and processes, reducing the need for human intervention (Jeremy,1995). In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provided human operators with machinery to assist them with the muscular requirements of work, automation greatly reduces the need for human sensory and mental requirements as well. Processes and systems can also be automated.

Automation plays an increasingly important role in the global economy and in daily experience. Engineers strive to combine automated devices with mathematical and organizational tools to create complex systems for a rapidly expanding range of applications and human activities.

Many roles for humans in industrial processes presently lie beyond the scope of automation. Human-level pattern recognition, language recognition, and language production ability are well beyond the capabilities of modern mechanical and computer systems. Tasks requiring subjective assessment or synthesis of complex sensory data, such as scents and sounds, as well as high-level tasks such as strategic planning, currently require human expertise. In many cases, the use of humans is more cost-effective than mechanical approaches even where automation of industrial tasks is possible.

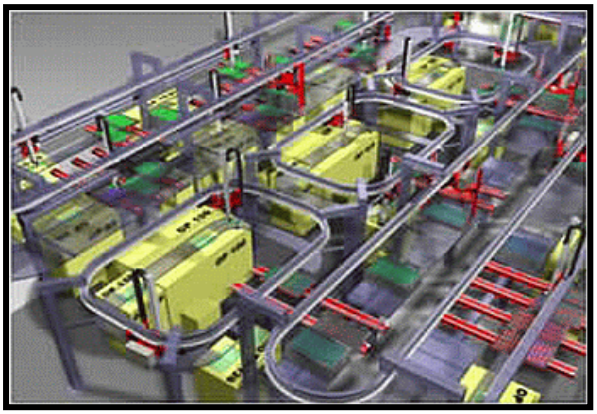

Figure 2.2: Industrial Automation (Maveric,2007)

2.3 INDUSTRIAL ROBOTIC

A conventional industrial robot is provided, at the extremity of the arm or the wrist thereof, with a robot hand which is controlled by a robot control device and is widely used in various industries as a laborsaving device, Particularly, conventional industrial robots are being utilized more and more in combination with a machine tool for carrying a work piece, for loading and unloading a work piece, for carrying a work piece after machining, and for assembling various parts. Recently, there has been provided an interchangeable robot hand type of industrial robot, namely, an industrial robot capable of sequentially executing desired robot task by alternately holding a robot hand, selected from among a plurality of robot hands previously prepared for a specific purpose, at the extremity of the arm and the wrist thereof. Such an interchangeable robot hand type of industrial robot is provided with a hand-holding device at the extremity of the arm or the wrist thereof and is adapted to execute desired robot task by alternately and detachably holding various robot hands by means of the hand-holding device (Hajimu,1986).

As an example, when an exclusive welding robot suitable for processing certain particular work is introduced to perform few-kind and large-quantity production, a welding jig apparatus must be used to carry in and out work with respect to the robot fixedly installed on the workshop floor and in this case the employment of such a jig apparatus of special construction and function adapted for exclusive use applicable to few kinds of work will suffice for the purpose, whereby operating efficiency can be increased; even if said jig apparatus is custom-made and hence rather expensive, it will pay because of mass production (Seiji Hirai,1985).