

**DESIGN AND DEVELOPMENT OF ARTICULATED ROBOTIC  
ARM USING PIC MICROCONTROLLER: GRIPPER DESIGN**

**MOHD AMAN B ABD MAJID**

**(2005607097)**

A thesis submitted in partial fulfillment of the requirements for the award  
of Bachelor of Engineering (Hons.) Mechanical

**Faculty of Mechanical Engineering  
Universiti Teknologi MARA (UiTM)**

**MAY 2009**

## **ACKNOWLEDGEMENT**

With the name of Allah, the most Gracious and the most Merciful. The highest gratitude to Allah for blessing me with this opportunity to complete this project and can contribute in further research.

Owing to this, I would like to express my gratitude to my supervisor, Mr Zulikifli b. Mohamed, for his advices, guidance and inspiring me in completing this research. No proper words can express how grateful I am to be blessed by having him as my supervisor.

I also like to send my deepest thanks and appreciation to all lecturers in Mechanical Engineering Faculty that have given guidance and assistance in completing my research.

To my families and friends, thanks for supporting me with all your ideas and also for being understanding. You all have truly made this project so meaningful. As the token of gratitude for the entire acknowledged individual, I would like to present to you this project report.

I hope that this project will benefit to all of us, especially to those who are involved in engineering industry.

Thank you.

## ABSTRACT

Nowadays, robots are used to help humans to make their lives easier. Technology can change the priority of humans in the working field. Lots of engineers have designed a robot that can do whatever humans can do and continuous invention can make robots think like humans, run and also dance. In this study, designing and developing a gripper that can move things from one place to another. It is a reverse engineering of research and finally develops it. The gripper is one of the end-effectors for a robotic arm. It can be autonomous or manually controlled. In this project, the robotic gripper has a 3 degree of freedom such as yaw, pitch and roll. It can move to 3 axes and can pick up an object. But in this case, it can pick a cube item (in this case an eraser) from a place to another place. By designing and developing the robotic gripper, the fundamental concept of making a robot gripper can be learned. In the future the knowledge of this project can be applied in industry and increase their productivity. Besides, it can make human life easier.

## TABLE OF CONTENTS

| CHAPTER  | CONTENTS                    | PAGE     |
|----------|-----------------------------|----------|
|          | PAGE TITLE                  | i        |
|          | ACKNOWLEDGEMENT             | ii       |
|          | ABSTRACT                    | Hi       |
|          | TABLE OF CONTENTS           | vi       |
|          | LIST OF TABLES              | viii     |
|          | LIST OF FIGURES             | ix       |
| <b>1</b> | <b>INTRODUCTION</b>         | <b>1</b> |
|          | 1.1 Introduction            | 1        |
|          | 1.2 Research Objective      | 3        |
|          | 1.3 Problem Statement       | 3        |
|          | 1.4 Research Scopes         | 4        |
| <b>2</b> | <b>LITERATURE REVIEW</b>    | <b>5</b> |
|          | 2.1 Introduction            | 5        |
|          | 2.2 Gripper Finger Geometry | 5        |

|     |  |   |
|-----|--|---|
| 2.3 | Grip Matrix and Internal Forces            | 7 |
|     | 2.3.1 Three Finger Tips of a Point Contact | 7 |
| 2.4 | Efficiency                                 | 8 |
| 2.5 | Robot Control                              | 9 |

## **METHODOLOGY** **10**

|     |  |    |
|-----|--|----|
| 3.1 | Introduction                                 | 10 |
| 3.2 | Chosen a Robotic Gripper and mechanism       | 10 |
| 3.3 | Actual Gripper Size                          | 11 |
| 3.4 | Calculation of Forces                        | 11 |
|     | 3.4.1 Kinematics of Rigid Body in 3-D Motion | 12 |
|     | 3.4.2 Gripping Force                         | 13 |
|     | 3.4.3 Torque                                 | 14 |
| 3.5 | Drawing using CATIA                          | 16 |
| 3.6 | Simulation by CATIA                          | 16 |
| 3.7 | Fabrication                                  | 17 |

## **DESIGN AND DEVELOPMENT OF GRIPPER** **18**

|     |   |    |
|-----|---|----|
| 4.1 | Introduction                            | 18 |
| 4.2 | Main Components                         | 18 |
|     | 4.2.1 Gripper Body Design               | 19 |
|     | 4.2.2 FA-130 DC Motor                   | 21 |
|     | 4.2.3 C36S RC Servo Motor               | 22 |
|     | 4.2.4 Servo Bracket and U-Joint Design  | 23 |
|     | 4.2.5 Fingers and Servo Horn            | 24 |
|     | 4.2.6 Parts in Gripper                  | 25 |
|     | 4.2.7 Assembled Gripper in 3-D View     | 27 |
|     | 4.2.8 Real Fabricated Assembled Gripper | 29 |