

ENTERTAINMENT DISPLAY ROBOT  
(ROBODANCE)

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This report is submitted in partial fulfillment of the requirements for the award of  
Bachelor of Electronic Engineering (Industrial Electronic) With Honours

Faculty of Electronic and Computer Engineering  
Universiti Teknikal Malaysia Melaka

April 2009



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**  
**FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER**

**BORANG PENGESAHAN STATUS LAPORAN**  
**PROJEK SARJANA MUDA II**

**Tajuk Projek** : ENTERTAINMENT DISPLAY ROBOT (ROBODANCE)  
**Sesi Pengajian** : 2008/2009

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To my beloved mother, father, brothers and sisters for their never ending care and support. To all my friends, thank you for everything.

## ACKNOWLEDGEMENT

In the name of Allah, Most Gracious, Most Merciful. I am grateful to Allah for His guidance, and only by His strength I have successfully completed my final year project and the write up on this thesis.

I would like to show my respect and thank to my parents for being supportive and understanding. I really appreciate the advices and their concern which guide me to be stronger and motivated.

Secondly, thanks to my UTeM supervisor Pn Norihan Binti Abdul hamid. Without their guidance and advices, it would be impossible for me to finish this final year project.

Last but not least, for those I do not mention their name, thanks for lending me your helping hand and guiding me throughout these one year period times. Your full corporation and guides in order for me to collect all necessary information as needed and for giving me new experiences especially on theoretical and teaching me some technical skills are really appreciated.

A very thank you to all the parties above, without their helps I can never done project without all this people effort. Thank you again.

## ABSTRACT

Entertainment Display Robot (ROBODANCE) is one of the applications of humanoid robot. Although entertainment have a large meanings which is include of music and visual but for this project, entertainment that will be discuss is about dancing entertainment. Introducing the dancing in robot is very interesting and sophisticated. It involves on studying the motion of human and tries to replicate the movement by using the humanoid robot. Through this project, the movement of robot and how to control the movement will be study and analyze. Replicating the human motion needs the robot to have more joint and several motors. Controlling the motor will be used by the microcontroller since it has a huge advantage. Developing the algorithm of the robot and dance sequence needs to understand the direction of forward and reverse motor. Computer software and programming will be used starting from designing the program code, dance sequence until simulating the project. All the result, findings, observation and analysis about this project will be shown at the next chapter.

## ABSTRAK

*Entertainment Display Robot* ialah salah satu aplikasi dalam bidang humanoid robot. Walaupun hiburan mempunyai maksud yang luas, tetapi di dalam Projek Sarjana Muda (PSM) ini, hiburan yang akan dibincangkan ialah hiburan tarian. Mengaplikasikan tarian pada sesebuah robot amatlah menarik dan juga mencabar. Ia melibatkan pergerakan manusia yang akan ditiru oleh sesebuah robot humanoid. Melalui projek ini, pergerakan sesebuah robot dan bagaimana untuk mengawalnya dipelajari secara mendalam. Menghasilkan semula pergerakan manusia memerlukan banyak paksi-paksi cantuman dan juga memerlukan banyak motor untuk menghasilkan pergerakan tersebut. Pergerakan motor tersebut akan dikawal oleh sebuah mikro pengawal dimana ia mempunyai banyak kelebihan. Menghasilkan algorithm dan pergerakan tarian untuk pergerakan robot ini memerlukan pengetahuan berkenaan dengan pergerakan ke depan dan juga ke belakang sesebuah motor. Perisian komputer digunakan untuk projek PSM ini bermula dari penghasilan program kod sehingga ke peringkat simulasi. Kesemua maklumat berhubung dengan hasil dan keputusan, analisis dan perbincangan dimuatkan didalam laporan ini di bab yang seterusnya.



## TABLE OF CONTENTS

CONTENTS	PAGE
<b>TITLE OF PROJECT.....</b>	<b>i</b>
<b>REPORT STATUS VERIFICATION FORM.....</b>	<b>ii</b>
<b>STUDENT’S DECLARATION.....</b>	<b>iii</b>
<b>SUPERVISOR’S DECLARATION.....</b>	<b>iv</b>
<b>DEDICATION.....</b>	<b>v</b>
<b>ACKNOWLEDGEMENT.....</b>	<b>vi</b>
<b>ABSTRACT.....</b>	<b>vii</b>
<b>ABSTRAK.....</b>	<b>viii</b>
<b>TABLE OF CONTENTS.....</b>	<b>ix</b>
<b>LIST OF TABLE.....</b>	<b>xii</b>
<b>LIST OF FIGURE.....</b>	<b>xiii</b>
<b>LIST OF ABBREVIATION.....</b>	<b>xv</b>

### 1. INTRODUCTION

1.1	Project Introduction	1
1.2	Project Objectives	3
1.3	Problem Statement	4
1.4	Scope Of Work	5
1.5	Research Methodology	6
1.6	Report Structure	7

## **2. LITERATURE REVIEW**

2.1	Introduction	8
2.2	Controller	8
2.2.1	PIC	9
2.3	Motor	12
2.3.1	The Stepper Motor	12
2.3.2	The Servo Motor	15
2.3.3	The Difference between Stepper Motor and Servo Motor	19
2.4	PWM Servo Controller	20
2.5	Servo Motor Brackets	23
2.6	Programming PIC	24
2.6.1	Example code for PROTON IDE	25
2.7	Circuit board	32
2.7.1	Printed Circuit Board	32
2.7.2	Strip Board	32
2.7.3	Advantages of PCB	33

## **3. METHODOLOGY**

3.1	Methodology of the project	35
3.2	Project Implementation	38
3.2.1	Circuit Design And Drawing	38
3.2.2	Programming the PIC	39
3.2.3	PCB Construction	41

<b>4.</b>	<b>RESULT AND DISCUSSION</b>	
4.1	Result	47
4.2	Circuit	48
4.3	Simulation	49
4.4	Programming	50
4.5	Anatomy of Entertainment Display Robot	53
4.6	Problem and Troubleshooting	58
<b>5.</b>	<b>CONCLUSION AND RECOMMENDATION</b>	
5.1	Conclusion	62
5.2	Recommendation	63
<b>6.</b>	<b>REFERENCE</b>	64
<b>7.</b>	<b>APPENDIX</b>	65

## LIST OF TABLE

NO	TITLE	PAGE
2.1	List of microcontroller manufacturer	9
2.2	Advantages and disadvantages of stepper motor and servo motor	17
2.2	Comparison of Stepper motor and Servo motor	18

## LIST OF FIGURE

NO	TITLE	PAGE
2.1	Pin Out PIC 16F877A	11
2.2	Peripheral of PIC16F877A	11
2.3	Stepper Motor and Wiring	12
2.4	Clockwise control of Stepper Motor	13
2.5	Counterclockwise control of Stepper Motor	13
2.6	Servo Motor and its internal component	15
2.7	Block diagram of servo motor	16
2.8	Open Loop stepper motor	19
2.9	Close loop servo motor	19
2.10	Pulse Width Modulation signal	20
2.11	PWM of Servo motor	21
2.12	Servo Bracket and U-joint	23
2.13	Proton IDE software	24
2.14	Example PCB layout	32
3.1	Flowchart of Methodology	36
3.2	Flowchart of Programming method	40
3.3	UV exposed	42
3.4	Developer Machine	43
3.5	Etching machine	44
NO	TITLE	PAGE
3.6	Drill machine	45
3.7	Soldering Equipment	45
3.8	Multimeter	46
3.9	Completed PCB and its component	46
4.1	Circuit of Entertainment Display Robot	48
4.2	Simulation of the circuit	49

4.3	Layout of Entertainment display robot	53
4.4	Head, left and right arm	54
4.5	Rotating arm of robot	55
4.6	Arm	55
4.7	ROBODANCE casing construction	56
4.8	Movement of robot	57
4.9	Increasing track, via width and holes	58
4.10	Increasing width constraint	59
4.11	Scrap board	59

## LIST OF ABBREVIATION

PIC	Programmable Interface Controller
PWM	Pulse Width Modulation
I/O	Input Output
DC	Direct Current
AC	Alternate Current
PPR	Pulse per Revolution

## CHAPTER 1

### INTRODUCTION

#### 1.1 PROJECT INTRODUCTION

The role of entertainment in our daily life is very important. It offers relaxation and thus contributes to our mental health. Entertainment consists of music, visual, or motion. One of the most important is the existence of two sides: entertainer and audience. Entertainment can be classified into two types. One is a real-time type that includes performers or entertainers performing live in front of an audience. Another is the non-real-time type like watching movies.

One reason why choose dance as an entertainment for robots is because dance is quite sophisticated. Based on the considerations described above, dance robots allow us to become both entertainers and spectators. When watching a robot dance, we are spectators. On the other side, many people will probably want to install dance motions



on their robots and show these actions to others. In this case they are entertainers. For the classification between real-time and non-real-time entertainment, dance robots also have significant characteristics. If we want to show people the robot dance, we have to install the dance actions beforehand, meaning that the robot dance is non-real-time entertainment. At the same time, by developing interactive capabilities, the robot would show improving dancing behaviors. For example, it could change the dance depending on audience requests. A dance robot could provide flexible entertainment that ranges between real-time and non-real-time entertainment.

This project is to design and develop an entertainment display robot known as ROBODANCE that can perform the dancing movement of robot according to the algorithm and music setup. The robot will have many axis depending on the design and creativity of student due to the audience target. In this project, the design of robot was studied to construct and build an attractive display robot (mechanical robot structure). DC motor, parameter and variable to be control will be learned through this project. PIC software will be used as software to interfacing the robot.

## 1.2 PROJECT OBJECTIVE

The objective of project is to make sure that the project following on the right plan and what the project really want to achieves. Besides than it also to ensure the positive progress of the development system and also to ensure that the main objective will be realized. Below are the objectives of the project:

1. To design and develop the entertainment dance robot that can perform the dance movement of robot according to the algorithm and music setup.
2. To study and write the PIC programming using PIC's software and learn how to interface it to the motor circuit
3. To familiarize the behavior of motor movement depends on the sequence needed.

### 1.3 PROBLEM STATEMENT

The research and development of various kinds of robots is actively being carried out, especially in Japan. One main reason is that robots have physical bodies, and so human-robot interaction extends beyond human-computer interaction [8]. Although in the future these robots are expected to support various aspects of our daily life, so far their capabilities are very limited. At present, installing such a task in robots remains very difficult. To break through such a situation, entertainment might be a good application area for robots. Developing an entertainment display robot would be remarkable from various points of view. It might become a new form of entertainment.

The problem when designing the robot is the difficulties on transforming human motions into the motions of robots due to the limitations of the degree of freedom at each robot joint. Directly transforming the motion captured by the system into robot motion does not work well.

The other problem when design the autonomous display robot based on the previous project is about the unstable of motor speed to control the movement of hand and arm (forward and reverse) and how to control the movement. The arm must joint each other using DC motor that conventional in servo motor [3]. It is quite difficult to develop the algorithm for the robot to entertain the audience around them based on the movement which is controlled by the PIC. Therefore, to control the motor movement on basic reverse and forward using microprocessor is a tough one.

Using microcontroller, it is the best way to control the servo motor at forward and reverse direction. There are so many way to designing the PIC controller depends on the complexity of the circuit. Simulations for this project are needed to achieve the best result and the Proteus software Proteus software and PROTON IDE [7] is used for programming the PIC and simulation the circuit. The size of the robot also is important for me to construct the body of the robot. There will be a problem to fix the circuit inside the robot without causing the failure on the robot's movement.

## 1.4 SCOPE OF WORK

Scope is important to achieve the objective of the project where it will be my reference point to create a success project. The scopes are:

1. To design the entertainment robodance which can move according to music and algorithm set up. The movement is more likely humanoid robot.
2. Selection of the motor for constructing the robot based on the required torque and speed.
3. Construct the mechanical structure with the minimum of size and material used.
4. Construction of software and hardware including troubleshooting.

## 1.5 Research Methodology

The basic operation of this Entertainment Display robot is to control the servo motor using the microcontroller. Each method to control the servo motor will be define clearly starting from the designing the circuit until attach to mechanical structure. To achieve these objectives, the following steps should be determined:

- Research and Development
- Project Planning
- Engineering Design
- Hardware Design
- Software Simulation and Implementation
- Troubleshooting

## 1.6 Report Structure

This report contains of five chapters that explain detail about this project. The first chapter is introduction of the project. This chapter contain of project introduction, project objectives, project scope of work, problem statement and research methodology. It describes the overview of the project basically.

The second chapter is literature review about the project. This includes product, equipment, hardware, software and any sources that will help on producing the project. The project will be explained briefly in this chapter. The advantages and disadvantages on each method. So, it is very important to understand the concepts involve and how this project works

The third chapter is Project Methodology. This chapter will figure out a process, data analysis and data collection method that been executed along producing the project. This includes all details of process in producing the project. Details process for hardware and software from the beginning to the end of the project were properly presented using flowchart.

The fourth chapter is result and discussion of Entertainment Robodance. This chapter consists of an outcome and current progress of this project. It shows results, possible problems and solution for the problems occurred.

The last chapter is about conclusion and suggestion of the project. This chapter contains the conclusion of the project, project achievement and suggestion to improve this project.

## CHAPTER 2

### LITERATURE REVIEW






#### **2.1 Introduction**

This chapter will explain and discuss about the information and theoretical that related to the project. It is consist of researching and analyzing every part of the project. This chapter is also contained the theory of the components, equipments and programming languages that is used in the project.

#### **2.2 CONTROLLER**

In this project, some research was done about the microcontroller to control the project. There are so many microcontrollers that can be use, for example PIC, AVR, ARM, MIPS, POWERPC and AT-MEGA. There are advantages and disadvantages of each microcontroller but to decide what will be used for the entire project, there are some criteria that will be looked for example cost, availability, application and ability to reprogram.

Table 2.1

MANUFACTURER	DESCRIPTION
	Manufacturer of 16 bit and 32 bits with fair development tool support.
	Atmel Corporation 8051, AT91, AVR, AVR32 Microcontroller
	Popular manufacturer of microcontroller
	Popular microcontroller of a wide variety of analog and digital semiconductors ranging 8 bit to 32 bit.
	Microchip Technology PIC 8bit microcontroller, Interface chip. The most popular microcontroller

In this project, PIC microcontroller manufactured by Microchip Technology was chose as a controller to this project.

### 2.2.1 PIC

PIC is a family of Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1640 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Programmable Interface Controller", but shortly thereafter was renamed "Programmable Intelligent Computer". PICs are popular with developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability [2].