DANCING ROBOT

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Tajuk Projek : DANCING ROBOT

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For my beloved Mama and Abah

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Thank you.

ABSTRACT

This project was conducted between two tasks, which are hardware and software preparation. This report represents the hardware task fulfilment. Dancing Robot was design to be a mobile robot which it has wheels at its leg as movement method. This Dancing Robot was designed to dance according to the programmed music within a specific time frame. The methods used in developing this project including research on previous project and studying PIC. This robot was designed in hardware and software interfacing which will allow it to dance using motors as the driver and PIC programming as the controller. This robot will be control with a start button and will be moved according to the program in the PIC which will initialize the movement of the hands and legs. The program will be burn in PIC16F877 microprocessor which will move the servo motors as the driver of the arms. Beside servo motor, DC motor with gears was used to move the legs of the robot. With the interface of the circuit and microprocessor, Dancing Robot will move as if it dances according the music played.

ABSTRAK

Projek ini telah dijalankan dalam dua bahagian, iaitu dalam penyediaan perisian (*software*) dan perkakasan (*hardware*). Laporan ini membentangkan penyediaan perkakasan dalam menyiapkan *Dancing Robot*. *Dancing Robot* telah direka sebagai sebuah robot bergerak dimana ia mempunyai roda di bahagian kakinya sebagai alat pergerakan. Robot ini telah direka untuk menari mengikut musik saperti yg diprogramkan dalam sela masa yang tertentu. Kaedah-kaedah yang digunakan untuk membangunkan projek termasukalah melakukan kajian terhadap projek seumpamanya dan juga mempelajari PIC. Robot ini direkabentuk di dalam bentuk perisian dan perkakasan yang mana akan menghasilkan pergerakan tarian yang menggunakan motor sebagai penggerak dan program PIC sebagai kawalan. Robot ini akan dikawal oleh satu butang pemula dimana kemudiannya akan bergerak berdasarkan arahan program di dalam PIC yang akan menyatakan pergerakan pada tangan dan kaki robot. Program ini akan di programkan di dalam mikropemproses PIC16F877A yang mana akan menggerakkan motor *servo* pada lengan robot. Di samping motor *servo*, motor DC juga akan digunakan untuk menggerakkan kaki robot. Dengan adanya perantaraan diantara litar dan mikropemproses, *Dancing Robot* akan bergerak seperti menari mengikut lagu yang dimainkan.

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CHAPTER I

1.1 INTRODUCTION

Lately, the field of cooperative mobile robotics has received a lot of attention from various research institutes and industries. A focus of these research and development activities is that of distributed motion coordination, since it allows the robots to form certain patterns and move in formation towards cooperating for the achievement of certain tasks. Motion planning algorithms for robotic systems made up from robots that change their position in order to form a given pattern is very important and may become challenging in the case of severe limitations, such as in communication between the robots, hardware constraints, obstacles etc.

In the beginning, robots only used on a singular function or purpose that is as an aid to human. Nowadays, the robot not also assigned to do work but also entertain. As part of it, dancing robots were created. Dancing robots grab people's attention with heir ability to dance on the floor especially on their own feet. Sony QRIO surely one of the lead example of world's robotic technologies. Its smooth movement when dancing captures everyone's heart. These inventions increase people's interest on robotic world. Many robot kits were design to let the public having them as a part of hobby. As for this project, the robot will have two legs instead of moving platform, previously done by UTM's student, to let the robot have more humanoid looking. But still we cannot afford to have it dance according any music played. But it still fun to have it moving while the music played.

1.2 PROJECT OBJECTIVE

The main objective of this project is to design a new Dancing Robot. This dancing robot can be characterized by mobile robot where wheels will be used for its leg's movement. This dancing robot will dance according to the programmed movement along with the chosen music within a specific time frame. This robot will design in hardware and going to operate by interfacing the software to control all robot's movements due to the dancing steps that have been programmed. To fulfil this need, PIC16F877A microprocessor was used to apply the software programming on the circuit. As for the show, one start button will be use to start the performance.

1.3 PROBLEM STATEMENT

There are several casualties to be faced in terms to work out this project:

1.3.1 Software that is going to be used must be learned and understand first before it can be write and run according requested specification. In this project, Programmable Integrated Circuit (PIC) Assembly Language is chosen as the software device to fulfill the programming terms of the project.

1.3.2 The motor control and drives are other tasks that must be settled as the main part of the robot. Since the robot have movable link, the motor characteristics must be considered at any cost to suit the need of the robot, such as weight, torque provided, rotational speed and the control panel need for each motor used. And for this project, two servo motor and a DC motor was chosen to be placed in the robot.

1.3.3 The main problem for the whole project is hardware and software interfacing. If there is any mistakes in preparing either hardware or software, interfacing both of them may lead to a failure. The crucial part is to troubleshoot the project and

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debug the error. In this case, part by part testing will be required in order to locate the error and fixed or reduce it.

1.4 SCOPE OF WORK

The scopes of work include the research on dancing robot before and study about the Programmable Integrated Circuit (PIC) software for robot's programming. In this case, study on this software is needed deeply in order to understand and use the assembler language. Other than that, study on integrated circuit (16F877A) and types of motors and how to control them must be done before designing. At the same time, study about robot's behavior and specification through previous work piece such as their movement, control mode and so on.

1.5 REPORT STRUCTURE

Generally, this report was divided into several main chapters. The first chapter is the introduction chapter. This chapter gives an overview of the project, the objective; problem statement and scope of work that will be carry through the whole project accomplishment. The literature review took place in second chapter, including the information of some previous project or other project. The operation of the circuit and component related can be found in the third chapter, where the project development processes were described. Chapter four will describe the result and findings of the project developed. Any problem will occur in any project developed, so chapter five will do the problems description and steps taken to overcome them. The conclusion in sixth chapter includes all of the idea of improving, the advantages and disadvantages of the project. This report was divided into several chapter as a purpose to make an easy arrangement and easy for those who wants to read it.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

This project is a robot that has legs, considered as the walker robot. Different from the other mobile robot, the movement of the robot uses 2 legs since it representing human movement method in dancing. Essentially, walker robots use legs for locomotion. Locomotion by legs is hundred million of years old. In contrast to this, wheels are relatively a new science, being only 7,000 to 10,000 years old. Wheels are good but they require a relatively smooth surface to ride upon. Just look at aerial photograph of any city or suburb to see the highways and streets crisscrossing the landscape.

2.2 SONY QRIO

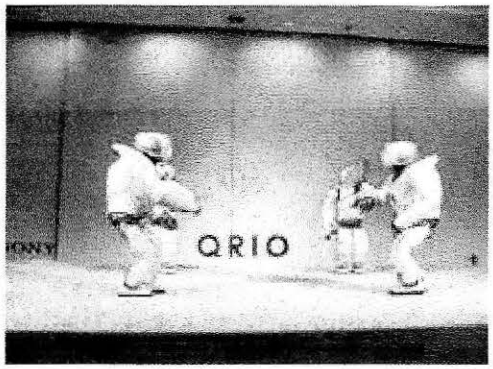

Figure 2.1: Sony QRIO

One of the best creations in robotic world! QRIO was developed in latest 3D navigation system developed by the Information Technologies Laboratories at Sony Corporation to open up new possibilities in robotics, the Sony QRIO robot is one of the world's most sophisticated and intelligent humanoids. Being Sony's Corporate Ambassador, QRIO is taking advantage of various opportunities around the world to communicate Sony's vision of a world of dreams, entertainment and curiosities as well as introducing the technology that makes this vision a reality.

The main point that this robot was picked out as one of this project literature review is THESE ROBOTS CAN DANCE. But despite of its intelligence, these robots are hard to compare with seen at their technology, budget and engineers involve. But as an example they are good to set look at.

2.3 *ROBODANCE* UTM

Figure 2.2: UTM's ROBODANCE

This is a project that the students of UTM produce. It is a good robodance that fulfil all the criteria needed. This robot seem clearly can dance with the music even though that the step of movement a bit faster but still have its own entertainment value. But still it is not a two-leg robot even that the robot has leg movement. The robot was placed on a moving platform as it moves on the dance floor.

This project of Dancing Robot that is going to develop actually builds in terms to enter ROBOFEST competition. But since the competition was terminated, this project will continue as another phase of robotic implementation project in KUTKM. This project will be build as it fulfil the objective (maybe quite same with the UTM's) but will be build on two legs, not platform. That is the main different with the UTM's but still can't afford to achieve the technology as the QRIO's. As long as the robot can dance on its own legs, that's enough to satisfy this project's objective.

2.4 COMPONENT THEORY AND ITS USAGE

This dancing robot requires two integrated circuits that are PIC16F877A microprocessor, voltage regulator LM7805 and L293D along with two servo motors and a DC motor. The specific briefing will be described as below.

2.4.1 PIC16F877A

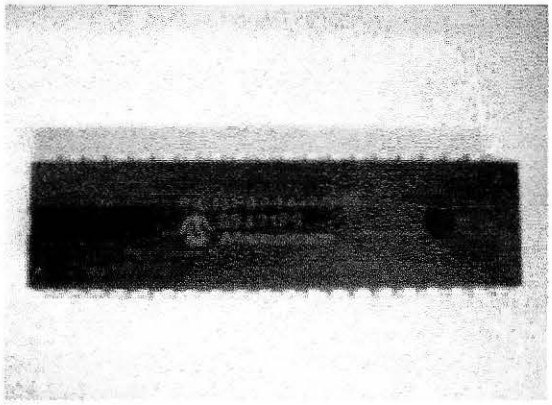

Figure 2.3: PIC16F877A microcontroller

The microcontroller ability is to store and a run unique program makes it extremely versatile. For instance, one can program a microcontroller to make decisions based on predetermine situations and sensor readings. Its ability to perform math and logic function allows it to mimic sophisticated logic and electronic circuits. The operation will be discussed below.

2.4.1.1 Circuit Operation

The output of the microcontroller can control direct current (DC) motor drives (using DC or pulse-width modulation (PWM)), servo motor positioning, stepper motor and etc. to program a microcontroller, all that are needed is a microcontroller (PIC16F84/ PIC16F877 or others) and software relevant to what language we decide to used on the IC. As for this project, we used the C language and the suitable software is MPLab.

PIC16F877A is a powerful (200 nanosecond instruction execution) yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller which packs Microchip's powerful PIC® architecture into a 40 pin package. The PIC16F877A features 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I2C™) bus and a Universal Asynchronous Receiver Transmitter (USART). The code for the microcontroller can be written in either in C language or Basic in microcode studio.

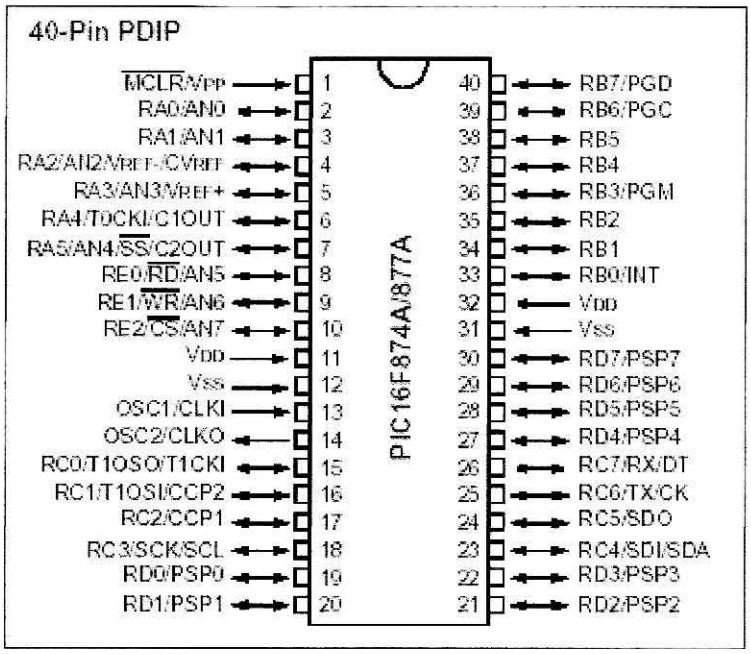

Figure 2.4: PIC16F877A Pin Description

2.4.1.2 The Features

Special Microcontroller Features

- 100,000 erase/write cycle Enhanced Flash program memory typical
- Self-reprogrammable under software control
- Single-supply 5V In-Circuit Serial Programming
- Watchdog Timer (WDT) with its own on-chip RC oscillator
- Programmable Code Protection
- Power-Saving Sleeping mode

Peripheral Features

- Two 8-bit (TMR0, TMR2) timer/counter with Prescalar
- One 16-bit timer/counter
- Brown-out detection circuitry
- Parallel Slave Port (PSP): 40/44 pin-device only