



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF SMART BABY CRADLE BY USING
PIC16PF877A CONTROLLER**

This report is submitted in accordance with the requirement of the Universiti Teknikal
Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology
(Industrial Power) with Honours.

by

AMIR SYAHIR BIN MOHAMED

B071410194

930909115653

FACULTY OF ENGINEERING TECHNOLOGY

2017

DECLARATION

I hereby, declared this report entitled “PSM Title” is the results of my own research
except as cited in references.

Signature :

Author's Name : Amir Syahir Bin Mohamed

Date :

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

.....

(Project Supervisor)

ABSTRAK

Projek ini bertujuan membina dan mengkaji buaian bayi pintar dengan menggunakan pengawal PIC16PF877A. Fungsi utama adalah untuk mereka bentuk buaian bayi pintar secara hayunan automatik dengan anggaran kos yang rendah. Buaian bayi yang sedia ada terdapat di pasaran begitu mahal. Buaian ini dibina bertujuan lebih mudah pada para ibu bapa untuk menjaga bayi mereka. Selain itu, buaian ini menggunakan pengesan untuk mengawal buaian automatik dengan menggunakan sensor. Ini berlaku apabila pengesan mengesan pergerakan bayi. Untuk bekalan elektrik, ia mempunyai sandaran sumber bekalan apabila tiada bekalan elektrik di rumah. Bekalan elektrik kembali dengan menggunakan solar dan menyimpan tenaga itu kepada bateri. Buaian bayi pintar boleh dibawa atau dipindahkan kemana sahaja kerana buaian ini adalah mudah alih. Dengan pembinaan buaian bayi pintar, rutin harian senang untuk para ibu bapa untuk menjaga bayi.

ABSTRACT

This project is presented a development of smart baby cradle by using PIC16PF877A controller. The main function is to design the smart baby cradle automatically swing with the low cost budget. The existing baby cradle available in market is expensive and do not have more advantage. This cradle builds for parent to take care their baby. Another that, this cradle using a sensor to drive the cradle automatically by using motor. This happen when the sensor detects the motion of baby. For the source, it has a backup supply source when no electricity at house. The supply back up by using a solar and store the energy to battery. The smart baby cradle can bring or move everywhere because this cradle is portable. With the development of smart baby cradle, daily routine has been easier for the parents along with the baby care.

DEDICATION

To my beloved parents Mr. Mohamed Bin Taib and Mrs. Aminah Binti Ibrahim for their support and pray. A fully appreciation to my supervisor Mrs. Rozilawati Binti Mohd Nor for advising and helping through this project. Lastly, thank you to all my friend and appreciate to my house mate.

ACKNOWLEDGEMENT

Firstly, most thanks to Allah S.W.T for giving me the opportunity to complete this report “Projek Sarjana Muda 1” with a success after I went through a lot of obstacles with patience. This report would not be completed without the kindness and generosity of my supervisor, Madam Rozilawati Binti Mohd Nor. She was very patient with me and willing to guide me in order to accomplish this final year project. Besides that, she gave valuable knowledge and a lot of information in completing this project. Her willingness to help me contributed tremendously to my progress, and she had inspired me greatly with her encouragement and motivation to carry on with my project. Not to forget, I would like to thank others lectures and staffs of Faculty Engineering Technology that willing spends their time to help me to solve the problem. A lot of thank for the cooperation and great commitment during complete the project. Moreover, special thank go out to my family and friends, especially my parents. They have shown me the virtue of endurance in the face of extreme adversity. On the other hand, their wonderful support and understanding throughout completing this project. Last but not least, I would like to thank to authority of Universiti Teknikal Malaysia Melaka (UTeM) for providing me with a good and more convenient environment and facilities to complete this project.

TABLE OF CONTENT

Abstrak	i
Abstract	ii
Dedication	iii
Acknowledgement	iv
Table of Content	vi
List of Tables	viii
List of Figures	ix
List Abbreviations, Symbols and Nomenclatures	x
CHAPTER 1: INTRODUCTION	1
1.0 Introduction	1
1.1 Project Overview	2
1.2 Problem Statement	2
1.3 Objective	3
1.4 Scope	3
1.5 Expected Result	4
CHAPTER 2: LITERATURE REVIEW	5
2.0 Introduction	5
2.1 Embedded Baby Monitor	5
2.1.1 Block Diagram Description	6
2.1.1.1 Embedded Baby Monitor Cradle Module	6
2.1.1.2 Angle Care Handy Receiver	7
2.1.2 Proposed Implementation	8
2.2 Detecting Motion Using PIR Sensor	10

2.2.1	The PIR Sensor Working	10
2.3	Charging Battery with Solar	12
2.3.1	Voltage and current from source a solar cell	13
2.3.2	Series Connection Battery	15
2.3.3	Parallel Connection Battery	16
2.4	DC Gear Motor	17
2.4.1	Pulse Width Modulation (PWM)	18

CHAPTER 3: METHODOLOGY **20**

3.0	Introduction	20
3.1	Flow Chart	21
3.2	Smart Baby Cradle Development	22
3.3	General Solar Energy System Block Diagram	24
3.4	Smart Baby Cradle System Operation	24
3.5	The Component Used In System	25
3.5.1	PIR Sensor	25
3.5.2	Power Window motor	26
3.5.3	Battery	27
3.5.4	Solar panel	27
3.5.5	Material Baby Cradle	28

CHAPTER 4: RESULT AND DISCUSSION **30**

4.0	Introduction	30
4.1	Analysis of Output Solar	30
4.2	Analysis of swing of cradle	32
4.3	Analysis of battery charging	34
4.4	Analysis of distance detection of PIR sensor	36
4.5	Discussion	37

CHAPTER 5: CONCLUSION & FUTURE WORK	38
5.0 CONCLUSION	38
5.1 Suggestion of Future Work	39
REFERENCES	40
APPENDICES	

LIST OF TABLES

3.1	Type of Pipe Selected	29
4.1	Result data solar output from 8am to 7pm	31
4.2	Result data power when applied load	32
4.3	Result data using solar percentage % battery vs day	34
4.4	Result data using direct charger percentage % battery vs day	35
4.5	Result data detection with distance	36

LIST OF FIGURES

2.1	Block Diagram of Embedded Baby Monitor Cradle Module	6
2.2	Block Diagram of Angel Care Handy Receiver	7
2.3	Prototype of Cradle Module	8
2.4	Angel Care Handy Receiver	9
2.5	PIR sensor detection area	11
2.6	The progression of the solar cell IV curve as the incident light increases.	13
2.7	Series connection of four cells (4S)	15
2.8	Parallel connection of four cells (4S)	16
2.9	Pulse Width Modulation	18
3.1	The flow chart of the project	21
3.2	Design of smart baby cradle	22
3.3	The Solar Energy System Block Diagram	24
3.4	PIR Sensor Module	26
3.5	Power Windows motor	26
3.6	Battery Lithium-ion	27
3.7	Solar Panel 12V	28
3.8	GI Conduit Pipe Bander	28
3.9	Smart baby cradle	29
4.1	Graph data solar output from 8am to 7pm	31
4.2	Graph data power vs load	33
4.3	Dumbbell as load	33
4.4	Bar chart data day vs percentage battery	34

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

V	-	Voltage
W	-	Watt
A	-	Ampere/current
sq	-	square
ft	-	feet
PIR Sensor	-	Passive Infrared Sensor
LED	-	Light Emitting Diode
PV	-	Photovoltaic
P&O	-	Perturb and Observe
MPPT	-	Maximum Power Point Tracking
PSM	-	Projek Sarjana Muda
PCV pipe	-	Polyvinyl chloride pipe
GI pipe	-	Galvanized Iron pipe
%	-	Percentage

CHAPTER 1

INTRODUCTION

1.0 Introduction

In this chapter will explain the introduction of the project consist of project overview, problem statement, objective and scope of the project. This project more to development about how to build the smart baby cradle. This project start with a little research about how to make smart baby cradle by reviewing past projects and improvement of existing projects. This project used the motor for swinging the cradle and sensor to detect the movement of the baby. This signal send to motor for swing movement by using PIC16PF877A controller. The project use solar energy to beck up if the absence of the main source.

1.1 Project Overview

Nowadays, the existing baby cradle is used for baby to make their sleep. However, conventional cradle does not electronically equipment such like battery or supply to automate the cradle automatically. In addition to that, these kind of conventional cradle is used in villages areas or non-developed cities due to its low cost. However, the problem of this kind of designated cradle is that you need main power supply for automatically swing by motor to take care your baby

Besides, there are extra function is provided by using motion sensor for detecting motion of baby and can drive automatically swing. This is because in the present world people are busy in their professional life, so they do not get enough time to take care their baby. It will be very difficult control the babies and if someone is hiring professional to take care of their baby. It may increase your expenses from monthly expenditure. This development of smart baby cradle can easily the parent care their baby and can do another work at home on the same time.

1.2 Problem Statement

Nowadays, the automatic baby swing had been improved and developed with deferent kind of feature. These features have increased the product cost and this cost does not included with the installation cost. Many people especially with low budget to purchase the electronic baby swing because the product available in market is expensive. About the design, the existing baby cradle are heavier and hard to move because the design so large.

The design can be altered to achieve a more simplified mechanism for the same function. The mechanism should be redesigning to find out the alternative mechanism that can be reduce the cost and more functional and friendly user. The smart baby cradle must be portable and easy to carry because this can bring any ware to place. The smart baby cradle should have more safety than existing cradle because it so important when locate the baby in safe situation.

1.3 Objective

Objectives for this project refer to the purpose or standard that can be reasonable achieved within the expected timeframe and with the available resources. The purpose of this project is:

1. To design the development of baby cradle automatically swing with the low-cost budget.
2. To drive the motor by using PIR sensor.
3. To using solar for back up energy source.

1.4 Project Scope

The project scopes refer for study how to design the controller by using PIC16PF877A to control the motor automatically. Choosing the type of motor also important because it will relate to build the smart baby cradle. About the motor, it will relate with force when locate the baby on cradle. This project also studies about how to detect a motion of baby when the baby move or wake up. It can use a PIR sensor to detect the motion of the baby and give a signal to controller.

Study about several types of automatic baby swing and they to understand the working principle in term of movement. Those mechanism include swing baby type mechanism, direction of swing and how the automatic control the swing. Try to figure out few type of design and sketch from the other design that suitable in market. Roughs sketch several types of automatic baby swing and compare between those designs and choose the best. The design should consider about the portability compare with the previous design in market. Order and purchase the new part based on the design. Build the design based on the finished drawing in full dimension.

Lastly, this project will study how the solar can back up the power supply and how the solar save the energy to storage. It also will test the output of solar can generate the energy.

1.5 Expected Result

Designed smart baby cradle it should be reliable, easy to maintain, safe to operate and less in cost compare to other types of automatic baby swing. The smart baby cradle can control the speed by using PIC16PF877A controller and can detect the motion of baby using PIR sensor. The swing of baby cradle is suitable and comfort for the baby. Lastly, the supply can back up the supply by using solar.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter will provide the detail description literature review done according to title of design of smart baby cradle. Automatic cradle swing act as movement right and left to make the parents life easier. The circuit board receives a signal from an access control (like a keypad or a control) and tells the smart baby cradle to swing more speed or more period to swing.

2.1 Embedded Baby Monitor

During the early stages, infants need proper rest and sleep for growth and development. Hence, it is the responsibility of the parents/guardian to provide the necessary care and attention to the infant. But with the modern lifestyle, parents are busy and have a lot of work with little time to provide for their little ones. This finally results in giving their child to nanny who is assumed to take care of the baby but at times things don't turn out as expected. Some of the families cannot even afford a nanny because of their high demands. Women especially have to take care of their professional as well as the household work. There are existing baby care systems in the market which are either very costly or manually operated. Hence, we have developed a system which would help the parents in child care. (John, Kundukooli, Neema, & Jose, 2015)

2.1.1 Block Diagram Description

This system is divided into mainly two sections – Cradle module and Angel Care Handy Receiver. The communication between these two sections is carried through RF transmitter-receiver. We have used a low power microcontroller (PIC16F877A) as the embedded processor which is the heart of the system. The wetness and temperature of the baby is detected using LM35 sensor. The baby's cry sound is detected by Sunrom microphone amplifier module. The music is played by a low cost BT66 IC and finally the cradle is swung using a 12V DC motor. The different conditions are checked, and the information is sent via RF transmitter to the Angel care handy receiver. In the Angel care handy receiver, we have used another microcontroller (PIC12F675) which on reception of the signal through the RF receiver drives the corresponding LEDs for the condition along with a buzzer sound.

2.1.1.1 Embedded Baby Monitor Cradle Module

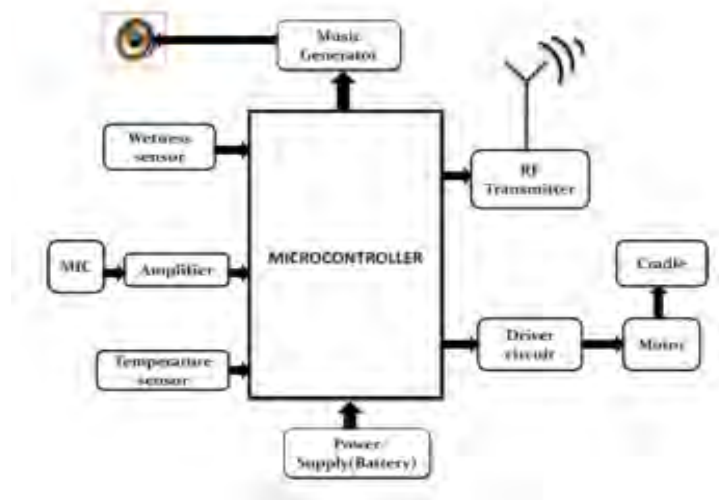


Figure 2.1 Block Diagram of Embedded Baby Monitor Cradle Module

As shown in the above figure 2.1, PIC16F877A is the heart of the embedded baby monitor cradle module. The PIC receives the three inputs- from the wireless sensor, microphone amplifier module and the temperature sensor. The input received through the microphone module is amplified whereas the inputs received from wetness and temperature sensor is given directly to the microcontroller. When the baby cries, the PIC gives output to the music generator circuit which produces a soothing music and to the motor driver circuit which would gently swing the cradle. Simultaneously, a signal is sent through the RF transmitter to the Angel care handy receiver for intimating the parent or guardian.

2.1.1.2 Angel Care Handy Receiver

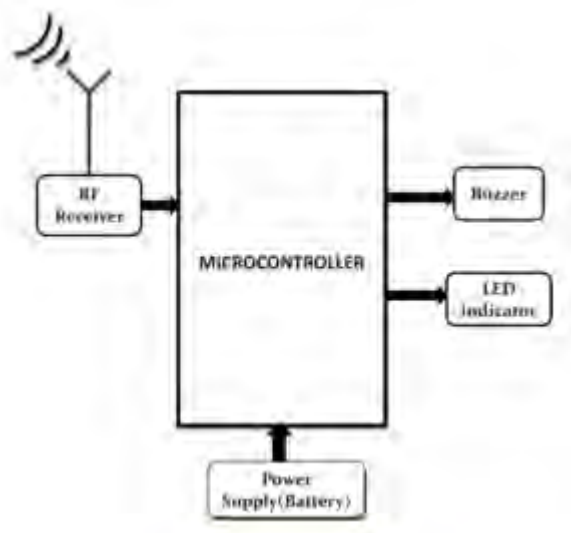


Figure 2.2 Block Diagram of Angel Care Handy Receiver

As shown in the above figure 2.2 PIC12F675 receives the signal through the RF receiver. There are 3 LED on the receiver. The red LED indicates fever, green LED indicates wetness and blue LED indicates that the baby is crying. On receiving the signal, the PIC drives the LED for the corresponding condition along with a buzzer sound. This receiver is light in weight, battery operated and portable.

2.1.2 Proposed Implementation



Figure 2.3 Prototype of Cradle Module

As shown in the figure 2.3, a cradle prototype was built with length, breadth and height as 36 cm, 20 cm and 44 cm respectively. The programming of the PICs was done using MPLAB. The sensors used for detecting wetness and fever were the same as different threshold voltage levels were set according to the specified application. The output from microphone was set as 2.5V such that whenever the baby cried, the cradle would swing for 1 min through the driver circuit which drove the motor at 2.4V supply using the crankshaft mechanism. Simultaneously, the music generator would play the music for 1 min. The cradle module PCB was mounted on the lower side of cradle such that wetness sensor would be placed on the bed and the temperature sensor would touch the baby's skin.



Figure 2.4 Angel Care Handy Receiver

Figure 2.4 shows the Angel care handy receiver which is light weight, battery operated and portable. This device can be easily carried by the parent/guardian and has the dimensions similar to that of a cell phone. There are three LEDs for the indication of the three corresponding conditions. The signal is received through RF receiver which operates at 433 MHz using ASK modulation technique. The cradle module as well as the Angel care handy receiver operates at 5V supply which is given through a battery thereby providing maximum security to the baby.

2.2 Detecting motion using PIR sensor.

A PIR or a Passive Infrared Sensor can be used to detect presence of human beings in its proximity. The output can be used to control the motor. Basically, motion detection use light sensors to detect either the presence of infrared light emitted from a warm object or absence of infrared light when a object interrupts a beam emitted by another part of the device. A PIR sensor detects the infrared light radiated by a warm object. It consists of pyro electric sensors which introduce changes in their temperature (due to incident infrared radiation) into electric signal. When infrared light strikes a crystal, it generates an electrical charge.

So accordingly, we in our research have employed not only pyro electric sensor but also temperature and humidity sensor towards detecting the intruder. PIR sensor detects when line of sight is cut by any entity and there is change in infra- red energy. So along with this, Temperature sensor also employed which measures the surrounding temperature change when someone has entered.(Suresh, 2016)

2.2.1 The PIR sensor working

Whenever, human being (even a warm body or object with some temperature) passes through the field of view of PIR sensor, then it detects the infrared radiation emitted by a hot body motion. Thus, the infrared radiation detected by the sensor generates an electrical signal that can be used to activate an alert system or buzzer or alarm sound. The PIR sensor internally is split into two halves, one half is positive, and the other is considered as negative. Thus, one half generates one signal by detecting the motion of a hot body and other half generates another signal. The difference between these two signals is generated as output signal. Primarily, this sensor consists of Fresnel lens which are bifurcated to detect

the infrared radiation produced by the motion of hot body over a wide range or specific area.

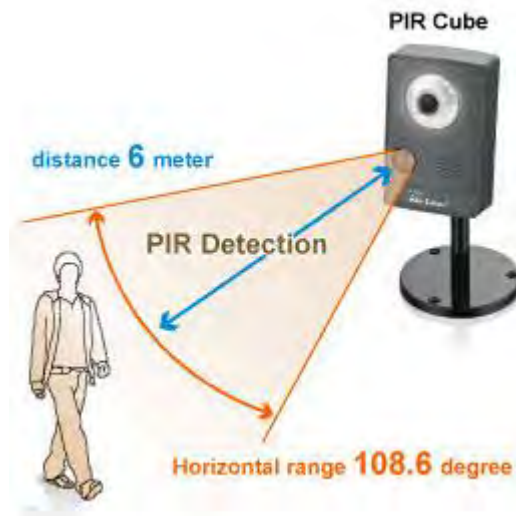


Figure 2.5 PIR sensor detection area

Figure 2.5 show the PIR sensor detection area. If once the sensor gets warmed up, then the output remains low until it detects motion. If once it detects the motion, then the output goes high for a couple of seconds and then returns to a normal state or low. This sensor requires settling time, which is characteristically in the range of 10 to 60 seconds.

The response of sensor detection from microcontroller running every second, the server will immediately sends a request to web server in every second also, and generate a redundancy twitter message received by user.(Sukmana, Farisi, & Khairani, 2016)