Faculty of Engineering

ENERGY EFFICIENT ELECTRONIC BLIND SYSTEM FOR HOME WINDOWS

Liew Hon Choi

Bachelor of Engineering with Honors
(Electronics & Telecommunications Engineering)
2009/2010

UNIVERSITI MALAYSIA SARAWAK

R13a

BORANG PENGESAHAN STATUS TESIS

ENERGY EFFICIENT ELECTRONIC BLIND SYSTEM FOR HOME WINDOW

Judul:

SESI PENGAJIAN: 2009/2010

LIEW HON CHOI

Saya

(HURUF BESAR)

mengaku membenarkan tesis * ini disimpan di Pusat Khidmat Maklumat Akademik, Universiti Malaysia Sarawak dengan syarat-syarat kegunaan seperti berikut:

1. Tesis adalah hakmilik Universiti Malaysia Sarawak.
2. Pusat Khidmat Maklumat Akademik, Universiti Malaysia Sarawak dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Membuat pendigitan untuk membangunkan Pangkalan Data Kandungan Tempatan.
4. Pusat Khidmat Maklumat Akademik, Universiti Malaysia Sarawak dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
5. ** Sila tandakan (✔) di kotak yang berkenaan

☐ SULIT (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti 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

_____
(TANDATANGAN PENULIS)

Alamat tetap: SELALANG TONDONG,

94000 BAU, KUCHING.

_____
(TANDATANGAN PENYELIA)

DR. WAN AZLAN WAN ZAINAL ABIDIN

Nama Penyelia

Tarikh: _____

Tarikh: _____

APPROVAL SHEET

Final Year Project below:

Title   : Energy Efficient Electronic Blind System for Home Windows

Author   : Liew Hon Choi

Matric No.   : 16534

Has been read and certified by:

_____   _____

Dr. Wan Azlan Wan Zainal Abidin   Date

        (Supervisor)

ENERGY EFFICIENT ELECTRONIC BLIND SYSTEM FOR HOME WINDOW

LIEW HON CHOI

Thesis is submitted to
Faculty of Engineering, Universiti Malaysia Sarawak
in partial fulfilment of the requirements
for the degree of Bachelor of Engineering
with Honours (Electronics and Telecommunications Engineering) 2010

Dedicated to My Beloved Family and Friends

ACKNOWLEDGEMENT

During the time of doing this project, I have received the assistance and opinions from many people to whom I am very grateful.

First and foremost, I would like to thank my FYP supervisor, Dr. Wan Azlan Wan Zainal Abidin, for giving me his support, advice and opinions throughout this project. His patience and guidance throughout my thesis is greatly appreciated. I am greatly thankful with him and this thesis is an acknowledgement of his tenacity and confidence in me. Thank you very much.

On the other hand, a word of thanks to my beloved family for their love, care and supports during my four years study in UNIMAS. Thank also to my entire lovely course mate for their supports, helps, and care in everything, especially my FYP.

In addition, I would also like to thanks lecturers of the Faculty of Engineering who have offered their advice during the course of my project and also helped me directly or indirectly in my thesis project. Their advice and help was very helpful in improving my thesis.

Last but not least, I would like to thanks all technicians and staffs from the Faculty of Engineering who have given me technical advice and support. Finally, gratefulness also dedicated to anyone who directly or indirectly helps in making this project success.

Abstract

Energy efficient electronic blind system (EEEBS) for home windows is the version for home suitable for today's needs. The basic idea of this blind system is to equip the home window with an automatic function of this system by depending on energy efficiency factor such as heat and light intensity in order to ensure suitable room temperature and thermal comfort.

Although EEEBS is not yet been used but it will be very useful in terms of improving our quality of living. Therefore, an innovative EEEBS for home window has been implemented based on thermal comfort management and occupant satisfaction. The thermal comfort level has been kept at a high level and the visual comfort has even been improved by the EEEBS.

In this thesis, the development of an EEEBS that able to perform monitoring and controlling applications is described. The systems and technologies of EEEBS has been carried out and investigated for a better understanding. A suitable solution for real time monitoring is proposed. By the development of the proposed EEEBS, any changing on the current room temperature and light intensity should be able to be controlled instantly by the system and also monitor by occupants.

EEEBS for home windows is a system that requires the combination of both hardware and software. It is a system that provides very useful and suitable functions for every home window in order to improving quality of life.

Abstrak

Energy Efficient Electronic Blind System (EEEBS) untuk tingkap rumah adalah versi rumah sesuai untuk keperluan hari ini. Dasar sistem ini adalah untuk melengkapkan tingkap rumah dengan fungsi automatik, justeru sistem ini akan bergantung kepada faktor seperti kepanasan dan keamatan cahaya untuk memastikan suhu bilik yang sesuai dan keselesaan terma.

Walaupun EEEBS belum digunakan lagi, tetapi ia akan sangat berguna dalam meningkatkan kualiti kehidupan kita. Oleh itu, EEEBS yang inovatif telah dicipta mengikut keselesaan terma. Keselesaan terma telah dipastikan pada tahap yang tinggi dan keselesaan keamatan cahaya juga telah ditingkatkan oleh EEEBS.

Dalam tesis ini, penciptaan EEEBS yang mampu melakukan pengawalan telah dijelaskan. Sistem dan teknologi EEEBS telah dilakukan dan diselidiki untuk pemahaman yang lebih mendalam. Satu perancangan yang terbaik telah dicadangkan. Dengan penciptaan yang dicadangkan, EEEBS boleh mengawal secara langsung sebarang perubahan suhu bilik dan keamatan cahaya.

EEEBS untuk rumah tetingkap adalah sebuah sistem kombinasi 'hardware' and perisian komputer. Ini adalah sistem yang menyediakan fungsi-fungsi berguna dan sesuai untuk setiap tetingkap ruamh bagi meningkatkan quality kehidupan.

TABLE OF CONTENTS

Contents	Pages Number

Chapter 1 Introduction

Chapter 2 Literature Review

LIST OF TABLES

LIST OF FIGURES

ABBREVIATION

A

ADO   ActiveX Data Objects

AH   Affordable Housing

ANFIS   Adaptive Neuro-Fuzzy Inference System

ANN   Artificial Neural Network

ASHRAE   American Society of Heating Refrigerating and Air

             Conditioning Engineers

AW   All Weather

B

BACnet   Building Automation Systems and Control Networks

BIEMS   Building Intelligent Energy Management System

C

CI   Computational Intelligence

CO_2 Carbon Dioxide

D

DAO   Data Access Objects

DDE   Dynamic Data Exchange

Df   Defuzzy Value

DIL   Dual-in-Line

DGI   Daylight Glare Index

E

EDIFICIO   Efficient Design Incorporating Fundamental Improvements for
              Control and Integrated

EEEBS   Energy Efficient Electronic Blind System

EPBD   Energy Performance of Buildings

EU   European Union

F

FFES   Fossil Free Energy Scenario

FLCs   Fuzzy Logic Controllers

FYP   Final Year Project

G

GUI   Graphical User Interface

H

HVAC   Heating Ventilation and Air Controlling

I

IAQ   Indoor Air Quality

IDE   Integrated Development Environment

IEEE   Institute of Electrical and Electronics Engineers

IEEE-USA   Institute of Electrical and Electronics Engineers of United
              State

ILL   Illuminance

ISO   International Organization for Standardization

L

LA   Large

LED   Light Emitting Diode

LESO-PB	Solar Energy and Building Physics Laboratory	
LUX	SI Unit for Illuminance	

M

ME	Medium	
MISO	Multi-Input and Single-Output	

O

OT	Outdoor Temperature	

P

PCM	Pulse Coded Modulation	
PIC	Programmable Integrated Circuit	
PLC	Project Life Cycle	
PMV	Predictive Mean Vote	
PVC 3.4.5	Polyvinyl Chloride	

R

RAD	Rapid Application Development	
RBF	Radial Basis Function	
RDO	Remote Data Objects	

S

SA	Slat Angle	
SDLC	System Development Life Cycle	
SI	Solar Insolation	
SM	Small	
SOIC	Small Outline IC	

T

T_{amb}	Ambient Temperature	

V

VB   Visual Basic

VL   Very Large

VS   Very Small

CHAPTER 1

INTRODUCTION

1.1 Overview

This chapter will cover the statement of problems for this project. Problems encountered based on the use of home blind system will be briefly discussed. Then, the clear objectives of this project will be stated in order to overcome the problems. The benefits and expected outcomes at the end of this Energy Efficient Electronic Blind System (EEEBS) project will be briefly explained. In addition, the expected outcomes are discussed based on the objectives of this project. The brief explanation of the contents for each chapter for this FYP will be covered in the project report outline.

1.2 Statement of Problems

Energy efficiency becomes a main issue not only for a home but also in this world due to the factor of global warming. A lot of ways are come out by related organizations to overcome this issue but it is not effective enough. The major problems encountered for most of the home are stated as below:

- No systematic monitoring system

Nowadays, most of the homes are equipped with blind system for home windows, air-conditioning and lights. However, almost all of these equipments are lack of energy efficiency due to the fact of no systematic monitoring system because occupants of the home can only control and monitor the equipments manually.

- Uncomfortable home environment

Weather are change everyday, so as a result, sudden extreme change of temperature and intensity of light are frequently occurred especially in our country which is located at the tropical climate. Hence, occupants will feel uncomfortable with the home environment. Beside that, some of the homes are installed with timer to control the blind system and air-conditioning, but it is still insufficient in terms of energy efficiency. The timer monitoring systems are still not effective due to recent environmental factors such as heat and light intensity to ensure suitable room temperature.

1.3 Objectives

The purpose of this project is to design an EEEBS system for home windows that will be able to open and close electronically depending on factors such as heat or light intensity in order to ensure suitable room temperature. To achieve this purpose, several objectives must be reached:

i. To study and investigate the current technology of environmental sensors for monitoring application

ii. To design an energy efficient electronic blind system for home windows

iii. To develop a software Graphical User Interface (GUI) for monitoring and controlling.

1.4 Benefits and Expected Outcomes

The development of EEEBS for home window contributes a lot of benefits. The most important benefit is to save energy in more efficient way by automatic monitoring and controlling system to perform suitable room temperature and light intensity at home. Hence, occupants of the home will feel more comfortable and satisfaction.

The expected outcomes of this project are as follows:

i. An energy efficient electronic blind system for home windows which consists of hardware and software that monitor and control the room temperature.

ii. A software for configuring the hardware and then to monitor as well as to control room temperature.

1.5 Project Report Outline

This project report is divided into 5 chapters. Chapter 1 provides introduction and overview of this project. Besides, this chapter also covers the statement of problems which describes the real time problems faced, objectives of the project, benefits and expected outcomes from this project.

Chapter 2 is the literature review, which discusses and detailing the concept of EEEBS for home windows. The environmental factors will be briefly discussed in terms of monitoring the system. Furthermore, research on the design of this system is discussed by applying the various types of possible monitoring technologies.

Chapter 3 explains the design methodology used to construct the blind system. All the procedures involved in the design and development of hardware and software will be discussed. Some of the electronic components and type of software chosen for GUI will be discussed in this chapter. The basic configuration and operation of the EEEBS will be briefly described.

Chapter 4 explains about the results and discussions for this EEEBS project. Beside that, how to determine the range of light intensity and temperature for each comfort level are also detailing in this chapter. The recorded daily light intensity and temperature at Kuching, Sarawak also will be briefly explained. The hardware and software parts will be explained in specific also.