

**GRAPHICAL USER INTERFACE (GUI) DEVELOPMENT FOR ENERGY
SAVING CONTROL SYSTEM**

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“I hereby acknowledge that the scope and quality of this thesis is qualified for the
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Date : 17 OCTOBER 2008



To My Beloved Father and Mother,

Mr Mohd Din bin Mat Dris

Mrs Rodah binti Mustafa

My dear siblings,

Mohd Farham Mohd Din

Nur Zahirah Aisyah Mohd Din

And To All My BFF,

Nia

Ida

Munajah

All of u means a lot to me...

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In the name of Allah S.W.T. the Most Gracious, the Most Merciful. Praise is to Allah, Lord of the Universe and Peace and Prayers be upon His final Prophet and Messenger, Muhammad S.A.W.

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ABSTRACT

Graphical User Interface development for energy saving air-conditioning control system means we can control the air-conditioning system by using software to reduce electricity cost. This system will assured us to reduce energy wasting in the lecture halls before and after the lecture time. During the lectures time, most of user forget or in rushing to switch off/on the lighting system and air-conditioner and at the same time we already wasting the energy. So this programme will develop to help us to conduct the switch of lighting system and air-conditioner by clicking just from the computer/PC. User can control the air-conditioning by using their laptop or personal computer (PC). This software is very user friendly. The software is connected to the lighting and air-conditioning system by a circuit consist PIC 18F4620, relay interface circuit and RS232 communication module. The circuit connected to the PC using serial communication port (comm1).

ABSTRAK

Pembangunan antara muka pengguna grafik untuk penjimatan tenaga sistem penyaman udara cara sistem kawalan kita boleh mengawal sistem penyaman udara sistem dengan menggunakan perisian untuk mengurangkan kos elektrik. Sistem ini akan terjamin kita orang untuk mengurangkan pembaziran tenaga dalam dewan kuliah di hadapan dan selepas waktu kuliah. Sepanjang masa ceramah-ceramah, kebanyakan tentang pengguna lupa atau dalam tergesa-gesa untuk menutup / di sistem lampu dan penyaman udara dan pada masa yang sama kita telah membazir tenaga. Supaya program ini akan berkembang untuk membantu kita mengendalikan suis sistem lampu dan penyaman udara oleh berklik adil dari komputer / PC. Pengguna boleh mengawal sistem penyaman udara dengan menggunakan mereka komputer riba atau komputer peribadi (PC). Perisian ini adalah amat mesra pengguna. Perisian ada bertalian lampu dan sistem penyaman udara sistem oleh risian ada bertalian lampu dan sistem penyaman udara sistem oleh sebuah litar mengandungi PIC 18F4620, lari berganti-ganti litar antara muka dan modul perhubungan RS232. Litar bertalian PC menggunakan bersiri pelabuhan komunikasi (comm1).

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	TITLE	i
	DECLARATION	ii
	DEDICATION	iv
	ACKNOWLEDGMENT	v
	ABSTRACT	vi
	ABSTRAK	vii
	TABLE OF CONTENTS	viii
	LIST OF TABLES	xi
	LIST OF FIGURES	xii
	LIST OF ABBREVIATIONS	xiv
	LIST OF APPENDICES	xv
1	INTRODUCTION	1
	1.1 Introduction	1
	1.2 Project objectives	2
	1.3 Scopes of the Project	2
	1.4 Thesis Outline	3
2	LITERATURE REVIEW	4
	2.1 Introduction	4
	2.2 FKEE Approaches in Solving Energy Wasting Occurrences in UMP's lecture hall	4
	2.21 Case Study at DK13, UMP Lecture Hall	5
	2.22 Analysis from the case study in DK13	10

2.3	Visual Basic 6.0 (VB 6.0)	10
2.4	Graphical User Interface (GUI)	12
2.5	Energy-Saving Light Control System	13
2.6	Lighting energy savings in offices using different control systems and real consumption	14
2.7	Energy-efficient of lighting	17
2.8	Conclusion	18
3	METHODOLOGY	19
3.1	Introduction	19
3.2	System Design	21
3.2.1	Hardware Development	21
3.2.1	Block Diagram for Hardware	21
3.2.1.1	Flow Chart for Hardware	21
3.2.2	Pins and Names for Serial Port (Comm1)	22
3.2.3	Circuit For RS-232 Communication module	23
3.2.4	Circuit For PIC18F4620	24
3.2.5	Circuit For Relay Interface	26
3.2.6	Regulator voltage	27
3.3	Software Development	28
3.3.1	Microsoft Window XP	28
3.3.2	Microsoft Visual Basic 6.0	29
3.3.2.1	The Basic Coding For Visual Basic to Use COMM 1	29
3.3.3	MPASM v4.01	29
3.3.4	Melabs Programmer Beta	30
3.3.5	Flow Chart for The GUI	31
3.3.5.1	Flow Chart for Main Form Of The GUI (Page 1)	31
3.3.6	Analysis for constructing the GUI using Visual basic	34
3.4	Conclusion	34

4	RESULT AND DISCUSSION	35
4.1	Introduction	35
4.2	Software	35
4.2.1	Main window for GUI (page 1)	35
4.2.2	Discussion	38
4.3	Hardware (PIC 18F4620)	39
4.3.1	Relay Interface Circuit	39
4.3.2	PIC main circuit	40
4.3.3	Hardware interfacing with software	41
4.3.4	Circuit Analysis	42
4.3.5	Discussion	43
4.2	Conclusion	43
5	CONCLUSION	79
5.1	Conclusion	
5.2	Recommendation for Future Development	
5.2.1	Costing and Commercialization	

REFERENCES

APPENDICES

APPENDIX A

APPENDIX B

APPENDIX C

APPENDIX D

APPENDIX E

LIST OF TABLES

TABLE NO.	TITLE	PAGE
3.1	Specification of Relay for this System	23
5.1	Cost for the Controller Board	46
5.2	Cost for Hardware Connection	46
5.3	Overall Cost of the Project	46

LIST OF FIGURES

FIGURE	TITLE	PAGE
2.1	Graph for Power Consumption	5
2.2	Graph of no of "ON" air-conditioning	6
2.3	Graph for Power Consumption	7
2.4	Graph of no of : "ON" air-conditioning	8
2.5	Graph of no of : "ON" lighting	9
3.1	Flow of Development	20
3.2	Block Diagram for Hardware	21
3.3	Flowchart for program in PIC	22
3.4	Pin Connections	23
3.5	The Circuit for RS-232 Communication Module	24
3.6	The Circuit for PIC18F4620	25
3.7	The PIC with Relay Interface Circuit	26
3.8	The Relay Interface Circuit	27
3.9	Regulator voltage Circuit	28
3.10	MSCOMM Toolbar	29
3.11	MPASM V4.01 window	30
3.12	Main Window	31
3.13	Configuration Window	31

3.14	Flowchart for “ON” and “OFF” button setup	32
3.15	Flowchart for “lighting/air-conditioning” button setup	33
3.16	Flowchart for “EXIT” button setup	33
4.1	View of Main window for GUI (page 1)	36
4.2	View of Log In Form for GUI (page 2)	36
4.3	ON button was pressed	37
4.4	All ON button was pressed	37
4.5	All OFF button was pressed	38
4.6	Combination of Full Circuit	39
4.7	Relay Interface Circuit Testing	39
4.8	Test PIC Circuit with LED	40
4.9	Test PIC Circuit with LED	40
4.10	Indicate Green was shown	41
4.11	Indicate Green was shown	41
4.12	Integrate Hardware and Software	42

LIST OF ABBREVIATIONS

GUI	Graphical User Interface
PIC	Programmable Interface Controller
MHz	Mega Hertz
IC	Integrated Circuit
IDE	Integrate Development Environment
RAD	Rapid Application Development
CFL	Compact Fluorescent Light
VDC	Volt Direct Current
AC	Alternate Current
VB	Visual Basic
kWh	Kilo Watts per Hour
LED	Light Emitting Diode
SPDT	Single Pole Double Throw

LIST OF APPENDICES

APPENDIX NO.	TITLE	PAGE
A	PIC18F4620 datasheet	48
B	Datasheet of PIC Microcontroller(18F4620)	49
C	Source Code for Visual Basic	57
D	Source code for PIC 18F4620	65
E	Data of Power Utilization in DK13 2006	72

CHAPTER 1

INTRODUCTION

1.1 Introduction

The projects are basically developing the system that using VB (visual basic) GUI and programmable intelligent controller that can reduce energy wasting in control system. The problem occurred when the lecturer and students forget to switch off the lighting and air-conditioner when finishing the class. It will cause the energy wasting and increased the cost of electricity.

This system will assured us to reduce energy wasting in the lecture halls before and after the lecture time. During the lectures time, most of user forget or in rushing to switch off/on the lighting system and air-conditioner and at the same time we already wasting the energy. So this programme will develop to help us to conduct the switch of lighting system and air-conditioner by clicking just from the computer/PC.

Furthermore, the lecturers can switch on/off the system separately due to which lighting system or air-conditioning that will use. Also, we can turn off the overall of system for the easiest one. This system was also protected and safe to use.

In this system, PIC microcontroller will be used to control the hardware and the GUIs development will be designed using visual basic (VB 6.0) programming.

1.2 Project Objectives

The objectives of this project are to:

- i. To design, built and test energy saving control system interface with VB (visual basic) GUI.
- ii. To build a working prototype of lighting and air-conditioning control system using GUI in order to reduce energy wasting in lecture hall.

1.3 Scope of Project

This project aims to develop an energy saving system by using **Graphical User Interface** to control lighting and air-conditioning. This system is consists of two part which is PIC microcontroller will be used to control the hardware and the GUIs development will be designed using visual basic programming to built software. The hardware will be interface with software by using RS-232 communication module. The main purpose of this project is to improve the lighting and air-conditioning control system. The scopes of the project are:

- i. Software development on microcontroller and GUI using Visual Basic (VB).
- ii. Hardware design for the complete control system circuit.
- iii. Integrate hardware and software by using the RS-232 communication module.

1.4 Thesis Outline

I. Chapter 1 (Introduction):

This chapter discussed about why this project has been developed. The problem statement discussed about the problem been faced by user that cause this project has to be develop. The project objective and the project scope are discussed to achieve the project target at the end of the developing.

II. Chapter 2 (Literature Review)

In the literature review part discussed about prove of energy wasting in lighting and air-conditioning system, Visual Basic 6.0, Graphical User Interface (GUI) and circuit example.

III Chapter 3 (Methodology)

This chapter will review all the method that is used while developing this project. This chapter include flowchart, block diagram, and circuit diagram and software descriptions.

IV Chapter 4 (Result and Discussions)

This chapter will review all the project result and analysis of this project.

V Chapter 5 (Conclusion and Recommendation)

This chapter will conclude all about this project with future recommendation. This chapter also offers the cost and potential commercialization of this project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will explain the information about the article that related to the project design. Besides that, it will be important references when do the project. It also includes the journal and the important information when do the research about the project. The information got from several sources such as websites, journals, books, magazines, handout and others.

2.2 FKEE Approaches in Solving Energy Wasting Occurrences in UMP's lecture hall.

Approximately half of the energy consumption in a building is due to the air-conditioning in trying to achieve a comfortable and conducive work environment. Clearly, a major energy saving can be obtained if the air conditioning systems can be made more energy efficient through better control. This has been proven to be true as in the case of Malaysia's Security Commission Building, Sultan Zanariah Library U.T.M, Takeuchi MDF Sdn. Bhd. and Universiti Kebangsaan Malaysia [1].

2.2.1 Case Study: Power Utilization in Dewan Kuliah 13 UMP

Human factors play an important role in energy wastage. Lecture halls are left with air-conditioning and lights ON when they should be OFF and it will contribute to energy wasting and high energy consumption. Energy consumption and energy wasting can be reduced by periodically reviewing schedules to make sure the equipments are run only when needed also maximizing the use of energy saving control system to operate the equipments [1].

The graph on figure 2.1 below showed the analysis of energy consumption and energy wasting at DK13 for 1 month without installation of timer. The data was taken from 8th august 2006 till 30th august 2006.

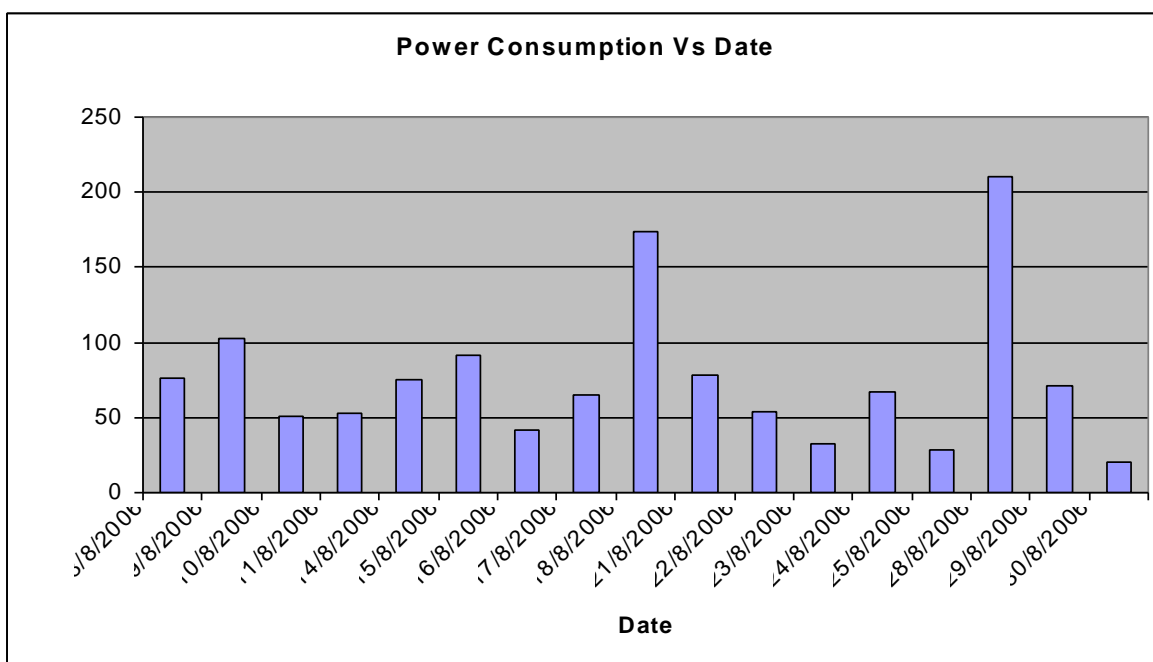


Figure 2.1 Graph for Power Consumption per Day

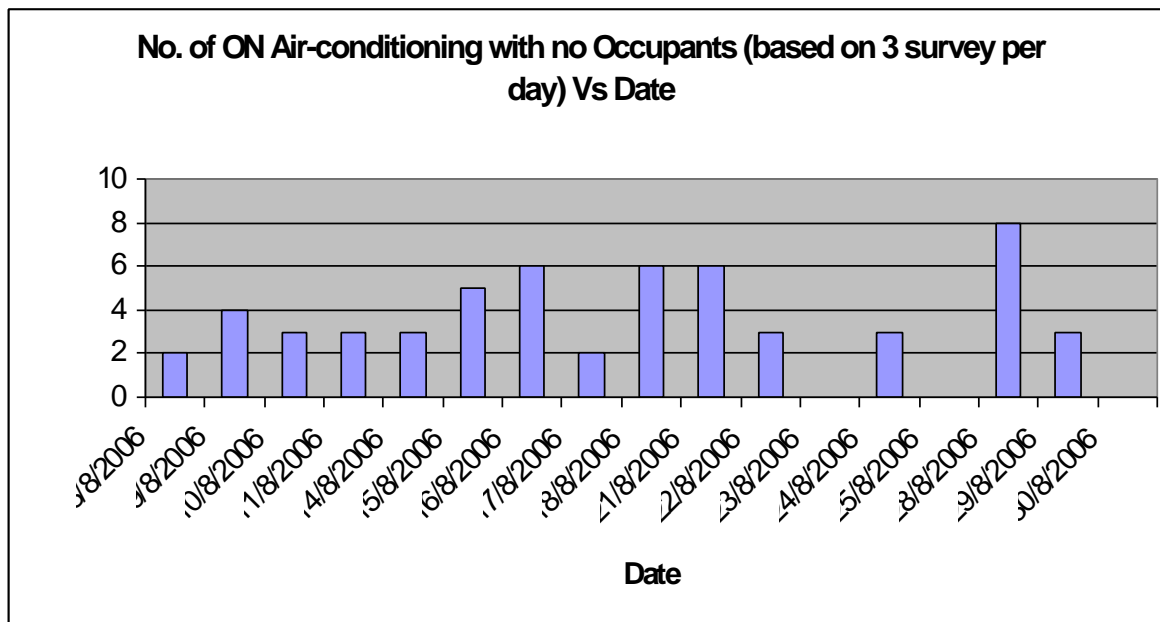


Figure 2.2 Graph No of ON Air-conditioning with No Occupants

The survey is done in August 2006 at DK13 and the data taken without the timer installation. The data were collected three times daily, taken when the hall is unoccupied. From the figure 2.1 we can see that the highest energy consumption is 210 kWh on 28th August 2006 and the lowest energy consumption is 22kWh on 30th August 2006. Figure 2.2 showed that 8 units air-conditioning is ON when the hall was unoccupied on 28th August contribute to high energy consumption. The trend of graph for power consumption and energy wasting due to air-conditioning are almost same [1].

The graph on figure 2.3 below showed the analysis of energy consumption and energy wasting at DK13 for 1 month with installation of timer. The data was taken from 3rd March 2008 till 31st March 2008.

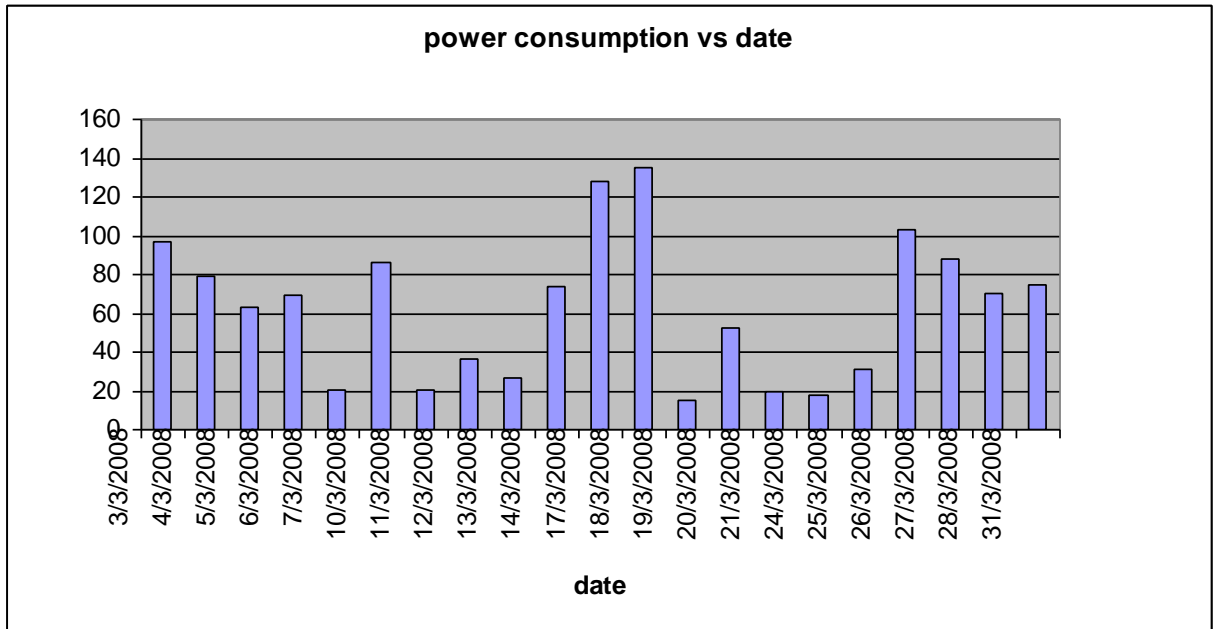


Figure 2.3 Graph for Power Consumption per Day

Figure 2.3 showed the survey that is done in March 2008 at DK13. The data was collected after installed the timer in control room. The data were collected three times daily, taken when the hall is unoccupied. The highest energy consumption is 135.3 kWh on 18th March 2008. The lowest energy consumption is 15.3 kWh on 19th March 2008 [1].

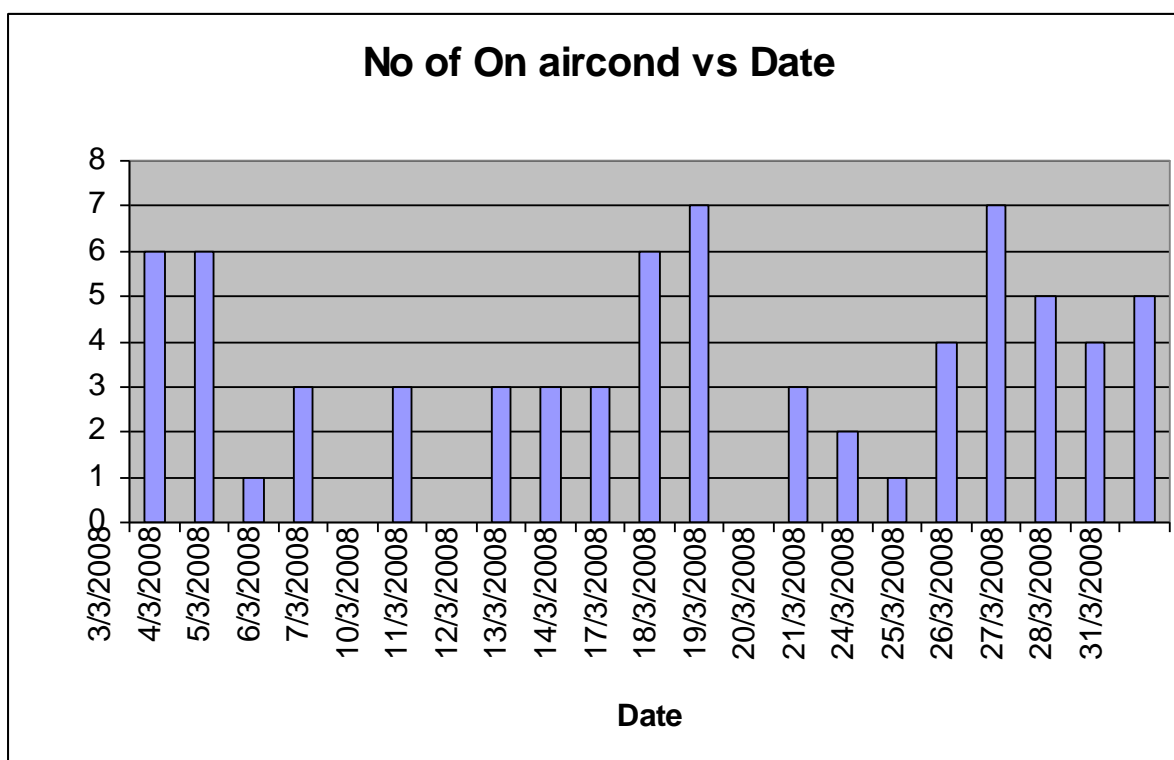


Figure 2.4 Graph No of ON Air-conditioning with No Occupants

From the Figure 2.4 above, the graph of no of ON Air-conditioning with no occupants have shown. 7 units air-conditioning is ON when the hall was unoccupied on 18th March contribute to high energy consumption. The trend of graph for power consumption and energy wasting due to air-conditioning are almost same [1].

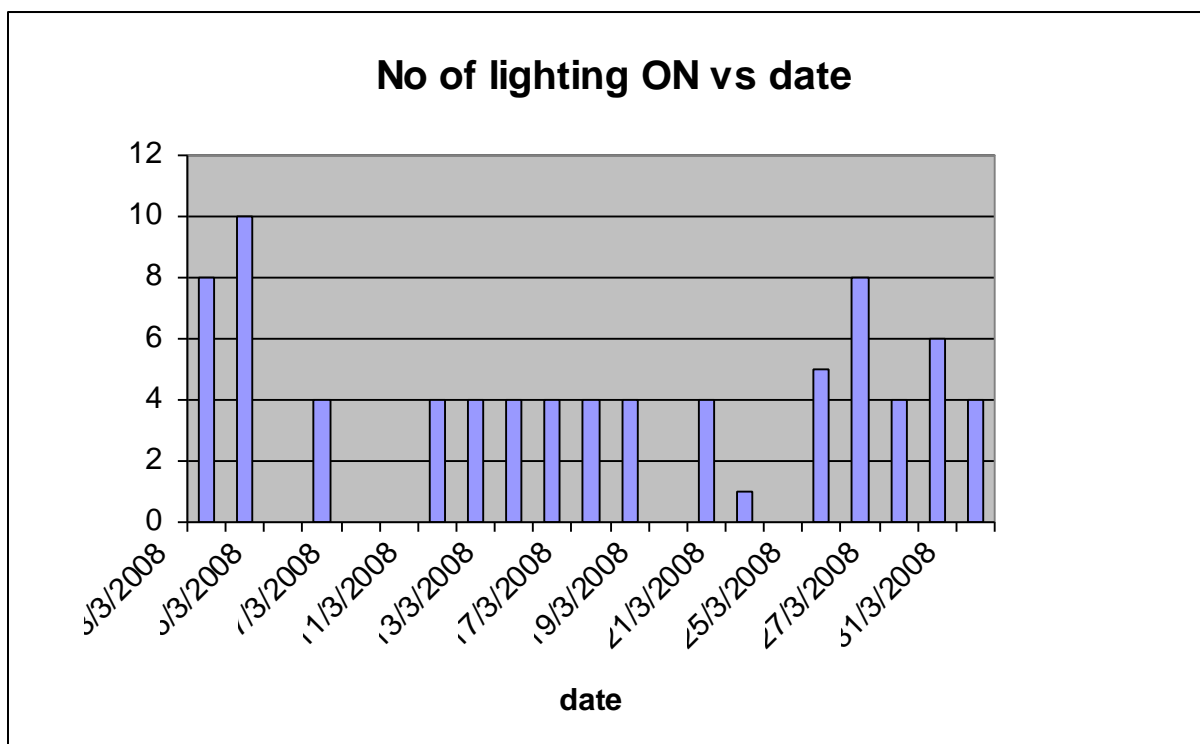


Figure 2.5 Graph of the No of Lighting ON per Day

From the Figure 2.5, it had shown the surveys on the switch ON lighting per day with no occupants or no activities involved in DK13. 10 units air-conditioning is ON when the hall was unoccupied on 5th March contribute to high energy consumption. The trend of graph for power consumption and energy wasting due to air-conditioning are almost same [1].

Cost of electricity in DK13:

Calculation cost of electricity without installation of timer (from 7th August to 30th August 2006):

Tariff = $(1773 - 736 \text{ kWh}) * 29.00 \text{ sen/kWh}$

Tariff = 30073 cent

RM 300.73 (Tariff D - Low voltage industrial Tariff)

Calculation cost of electricity after installation of timer (from 3rd March to 31th March 2006):

$$\begin{aligned}\text{Tariff} &= (14667.3 - 13843.8\text{kWh}) * 29.00\text{sen/kWh} \\ \text{Tariff} &= 23882 \text{ cent} \\ &= \text{RM } 238.82 \text{ (Tariff D - Low voltage industrial Tariff)}\end{aligned}$$

2.2.2 Analysis from the case study in DK13

From the Case study in DK13 that was collected, it shows that human factors play an important role in energy wastage. Hence, a prototype of control systems to reduce energy consumption and energy wasting in lecture halls is partly complete. This control system will be tested in DK 13 lecture hall for analysis. Our target in this project is to achieve at least 10% reduction in the energy consumption of the air-conditioning system in the lecture room. Also, from the data that collected, the cost of electricity before and after installation of timer is different. The cost of electricity was decreased after the timer installation which is reducing cost almost 20.58% by before [1].

2.3 Visual Basic 6.0 (VB 6.0)

Visual Basic (VB) is the third-generation event-driven programming language and integrated development environment (IDE) from Microsoft for its COM programming model. VB is also considered a relatively easy to learn and use programming language, because of its graphical development features and BASIC heritage. Visual Basic was derived from BASIC and enables the rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using Data Access Objects DAO, Remote Data Objects RDO, or ActiveX Data Objects ADO, and creation of ActiveX controls and objects. Scripting languages such as VBA and VBScript are syntactically similar to Visual Basic, but perform differently. A programmer can put together an application using the components provided with

Visual Basic itself. The final release was version 6 in 1998. Microsoft's extended support ended in March 2008 and the designated successor was Visual Basic .NET [2].

Like the BASIC programming language, Visual Basic was designed to be easy to learn and use. The language not only allows programmers to create simple GUI applications, but can also develop complex applications. Programming in VB is a combination of visually arranging components or controls on a form, specifying attributes and actions of those components, and writing additional lines of code for more functionality. Since default attributes and actions are defined for the components, a simple program can be created without the programmer having to write many lines of code. Performance problems were experienced by earlier versions, but with faster computers and native code compilation this has become less of an issue [2].

Visual Basic can create executables (EXE files), ActiveX controls, DLL files, but is primarily used to develop Windows applications and to interface web database systems. Dialog boxes with less functionality can be used to provide pop-up capabilities. Controls provide the basic functionality of the application, while programmers can insert additional logic within the appropriate event handlers. For example, a drop-down combination box will automatically display its list and allow the user to select any element. An event handler is called when an item is selected, which can then execute additional code created by the programmer to perform some action based on which element was selected, such as populating a related list [2].

Alternatively, a Visual Basic component can have no user interface, and instead provide ActiveX objects to other programs via Component Object Model (COM). This allows for server-side processing or an add-in module. Unlike many other programming languages, Visual Basic is generally not case sensitive, although it will transform keywords into a standard case configuration and force the case of variable names to conform to the case of the entry within the symbol table entry. String comparisons are case sensitive by default, but can be made case insensitive if so desired [2].