UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF SMART CLASSROOM USING NODEMCU ESP8266

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

by

ARIFUDIN BIN MOHAMD WAHID
B071610765
950701-14-5173

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY

2019

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: DEVELOPMENT OF SMART CLASSROOM USING NODEMCU ESP8266

Sesi Pengajian: 2019

Saya **ARIFUDIN BIN MOHAMAD WAHID** mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (X)

☐ SULIT*	Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972.

☐ TERHAD* Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.

☒ TIDAK TERHAD

Yang benar,

.....

ARIFUDIN BIN MOHAMAD WAHID

Alamat Tetap:

No 30, Jalan Kenanga,

Taman Sri Raya, Batu 9,

43200, Cheras,

Selangor Darul Ehsan

Tarikh: 15/12/2019

Disahkan oleh penyelia:

.....

RAEIHAH BINTI MOHD ZAIN

Cop Rasmi Penyelia

Tarikh:

*Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I hereby, declared this report entitled DEVELOPMENT OF SMART CLASSROOM USING NODEMCU ESP8266 is the results of my own research except as cited in references.

Signature: ……

Author : ARIFUDIN BIN MOHAMAD WAHID

Date: 15/12/2019

APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Industrial Electronic) with Honours. The member of the supervisory is as follow:

Signature: …….

Supervisor : RAEIHAH BINTI MOHD ZAIN

ABSTRAK

Elektrik telah menjadi salah satu keperluan penting didalam bilik kuliah. Ia memberi tenaga kepada peralatan yang berada didalam bilik kuliah sebagai contoh lampu, kipas dan projektor. Semua peralatan tersebut membantu dalam meningkatkan suasana pembelajaran dimana lampu menerangi bilik kuliah, kipas menyejukkan bilik kuliah dan projektor membantu dalam proses pengajaran. Selain itu, sesetengah orang mungkin sengaja atau tidak sengaja tidak mematikan peralatan tersebut setelah digunakan. Ini membuatkan elektrik sentiasa berjalan walaupun peralatan tidak digunakan maka ia mengakibatkan berlakunya pembaziran elektrik. Tambahan pula, ia juga membazir jangka hayat setiap peralatan tersebut. Bagi mengatasi masalah tersebut, projek ini dibangunkan dan ia diberi tajuk *Development of Smart Classroom Using NodeMCU ESP8266.* Secara umumnya, mircropengawal yang digunakan bagi projek ini adalah NodeMCU beserta dengan cip wifi ESP8266. Seterusnya, peranti masukkan yang digunakan adalah 3 sensor infrare pasif (PIR) dan suis sementara itu peranti keluaran adalah buzzer, pemancar Inframerah (IR), pengesan suhu LM35 dan 2 geganti. Lampu dan kipas bakal disambungkan kepada geganti supaya micropengawal dapat mengawal keluaran peralatan tersebut berdasarakan isyarat yang diberi oleh micropengawal. Lampu, kipas dan projektor boleh dihidupkan secara suis manual atau menggunakan perisian applikasi. Bagi projektor pula, ia akan dikawal oleh isyarat dari pemancar IR dan LM35 akan mengenal pasti status projector. Pengguna perlu menyambungkan diantara perisian applikasi dan ESP8266 melalui internet jika ingin menghidupkan peralatan. Selain itu, jika tidak ada pergerakan/ manusia dikesan oleh sensor PIR dalam masa 5 minit maka buzzer akan berbunyi sekali. Seterusnya, sistem ini akan tunggu selama 1 minit lagi sebelom ia mematikan peralatan didalam bilik kuliah secara sendirinya. Apabila terdapat pergerakan/ manusia yang dikesan dalam selang masa yang ditetapkan, ia akan menetapkan semula pemasa dalam mircopengawal dan mengulangi semula sistem ini sehinggalah ia dimatikan.

ABSTRACT

Electricity has become one of the important needs in a lecture classroom. It supplied to equipment in the classroom such as lamp, fan and projector. All these equipment help to improve studies enviroment where lamp brightening the classroom, fan cool down the classroom and projector help in teaching process. Besides that, some people might intentionally or unintentionally not turned off these equipment after used. This will keep the electricity running even though it is not used hence created electricity waste. Furthermore, it also waste lifespan of each of these equipment. In order to overcome these problem, this project is develop and entitled as *Development of Smart Classroom Using NodeMCU ESP8266*. Generally, microcontroller used for this project is NodeMCU with a built in wifi chip ESP8266. Next, input device used were 3 Passive Infrared (PIR) sensor, temperature sensor LM35 and switch. On the other hand output device used is buzzer, Infrared (IR) transmiter and 2 relay. Fan and lamp will be connected to relay so that microcontroller can control output of these equipment based on the signal given from microcontroller. As for projector it will be controlled by signal from IR transmitter and status checked using LM35. Fan, lamp and projector can be turn on using manual switch or using application software. User need to connect between application software and ESP8266 through internet in order to turn on these equipments. Besides that, if there are no movement/ people detected by PIR sensor within 5 minutes then buzzer will beep once. Then, the system will wait for 1 more minutes before it eventually turn off the equipment in the classroom. When there are movement/ people detected within these time interval, it will reset timer in mircocontroller and repeat the system again until it turned off.

ACKNOWLEDGEMENTS

First of all, thanks to Allah S.W.T. for the blessing and an opportunity for me to finish and completing this bachelor degree project II. Project I is an essential research in order to have smoother process and gain enough knowledge in completing project II.

I want to take this chance to give special thanks to my supervisor, Madam Raeihah binti Mohd Zain, for giving a good guideline for the project throughout numerous consultations and always gave advice regarding this project. Her advice and support completely help me to finish this project. Without her support, it might became harder to solved problem outside my knowledge and I will have trouble in finishing this project.

Special thanks to my parents, who support me to complete this project. They have support me financially and encourage me throughout my studies in UTeM. Thanks to that, I am able to focus on completing this project. Words cannot describe my gratitude for them.

Many thanks to my housemates, classmates and friends, which have made great comment suggestions about my project which has gave an inspiration to improvise and completing the project. I would like to thank all the people for their help directly and indirectly to complete the project.

Thanks.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

PIR	-	passive infrared
IOT	-	Internet of Thing
RF	-	Radio frequency
GSM	-	System for Mobile
SMS	-	Short Message Services
IP	-	Internet protocol
SoC	-	System-on-a-Chip
USB	-	Universal Serial Bus
IR	-	Infrared
DC	-	Direct current
AC	-	Alternating current
NO	-	Normally open
NC	-	normally closed
COM	-	Common
SPST	-	Single Pole Single Transition
SPDT	-	Single Pole Double Transition
DPDT	-	Double Pole Double Transition
IC	-	Integrated Chip
M	-	Mega
Hz	-	Hertz
CPU	-	Central Processing Unit
LDR	-	Light Dependent Resistor
k	-	Kilo
G	-	Giga
TNB	-	Tenaga Nasional Berhad
ARL	-	Average Rate Life

CHAPTER 1
INTRODUCTION

1.0 Introduction

This chapter described preparation in completing this report. The content consist of background of project, problem statement, objective, scope and expected outcome of the project. Each of these content described further in this chapter.

1.1 Project Background

Today, classroom lecture have equipped with fan, lamp and projector. Classroom is a room where people or students come to learn something. Having a projector is not compulsory, but higher education such as university tends to use a projector in the classroom that helps lecturers spend time in teaching efficiently.

Even though they have to prepare the material ahead of time, it has improved time management for sure. This is because they able to spend most of the time explaining rather than writing every single details on the whiteboard which is time consuming. These equipment also help students to have a better learning environment, such as cooling down the classroom temperature and lighting the classroom.

There are lots of classrooms in university and most of them equipped with fan, lamp and projector. Furthermore, wattage for a projector lamps is range from 150 to 300 watts (Vinod Kakumanu, 2017). Recommended projector is around 200 watts where lamp and fan have lower wattage than that. If these equipment are not managed properly it can affect the electricity bills considering total classroom in the university.

1.2 Problem Statement

There are no denying on the benefit of having these equipment but due to human attitude or carelessness it may become a problem. For example, they may intentionally or unintentionally leave these equipment turning on after being used that create a waste of electricity. Plus, the projector consumes a lot of power when compared to the ceiling fan and pendaflour lamp. Everything has a specific lifespan, but it is not a good idea to aimlessly waste this lifespan.

In order to overcome these problem, automatic shutdown system need to be implemented on these equipment. This system shutdown the equipment when there are no human present in classroom. There are various sensor that can detect object or living things. One of the suitable sensor for this system is passive infrared (PIR) sensor with characteristic of small physical size, low noise and high sensitivity. Microcontroller used in this system is NodeMCU ESP8266.

1.3 Objective

a) To integrate between NodeMCU ESP8266, PIR sensor, LM35 and Buzzer.
b) To reduce electrical wastage from a projector, lamp and fan as much as possible.
c) To increase efficiency on usage of lifespan for projector, lamp and fan.

1.4 Scope

This project emphasize about projector, lamp and fan in a classroom. It will automatically shut down when PIR does not detect human presence in the classroom after a while. Furthermore, NodeMCU have built in Wi-Fi module of ESP8266 and it can interact via a website or applications. Plus, NodeMCU act as brain for this system which interact between input and output device.

1.5 Expected Result

Projector, lamp, and fan should be able to turn off after a while when there is no human presence in the classroom. Electricity bills may be reduce from reducing electricity wastage. Besides that, lifespan of these equipment may be prolong.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter contains some articles, technical paper, conferences and journal. Those paper were taken based on related topic with this project and it have been briefly summarized. Besides that, focus in this studies related to automatic shutdown system either power outlet, equipment, appliances and the method used to this project.

2.1 Past Related Project Research

2.1.1 Smart Automated Home Application using IoT with Blynk App

Nowadays world is tend toward digitalization where everything is become easier and comfortable for people. Smart Automated House Application using Internet of Thing (IOT) is a system which simple house facilities can be controlled from anywhere by device (Durani, 2018). It does contain functionality of Node ESP8266 which are linked to house application with assistance of coding and hosting online. As shown in figure 2.1, it is handled by the internet-based Mobile Application software that controls the house application.

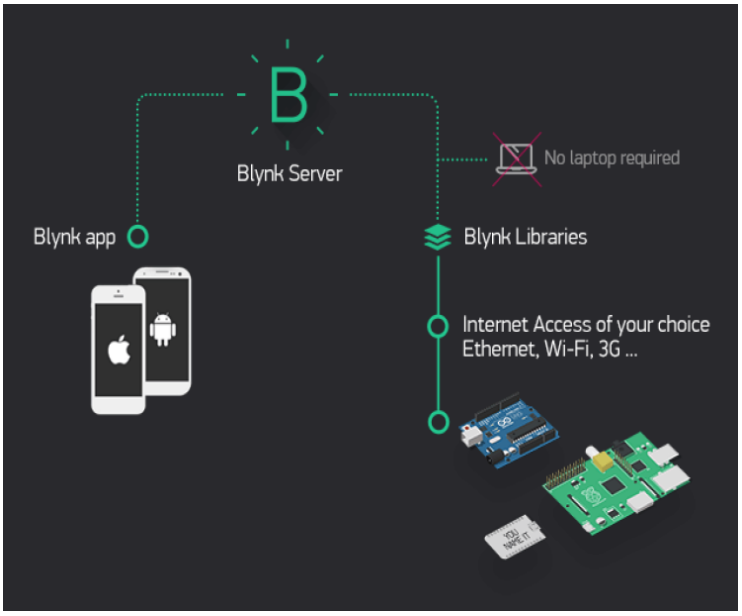

Figure 2.1: Blynk application working diagram

2.1.2 433 MHz (Wireless RF) Communication between Two Arduino UNO

Radio frequency (RF) is one part of electromagnetic wave frequencies that ranged approximately from 3 kHz to 300 GHz, which includes those frequencies used for communications or radar signals. A radio tuner is required to adjust to a specific frequency. A circuit with a condenser and an inductor forms a tuned circuit in its simplest form. Within a specific frequency band, the resonator amplifies oscillations while reducing oscillations at other frequencies outside the band. Figure 2.2 shown RF433MHz module.

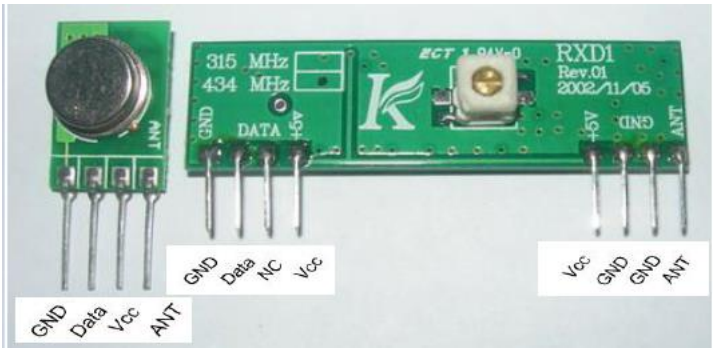

Figure 2.2: Pin diagram of RF module

2.1.3 Device for the Automatic Shut-Off of Equipment's Stand-by Power

The current invention relates to a device for the automatic shut-off of equipment's stand-by power which can switch on or off the power for a set of electronic and electric appliances and can reduce the power consumption in a state of waiting for use. As shown in figure 2.3, it mainly includes a power switching controller, a first relay for switching contacts of the first line and second relay for switching contacts of the second line.

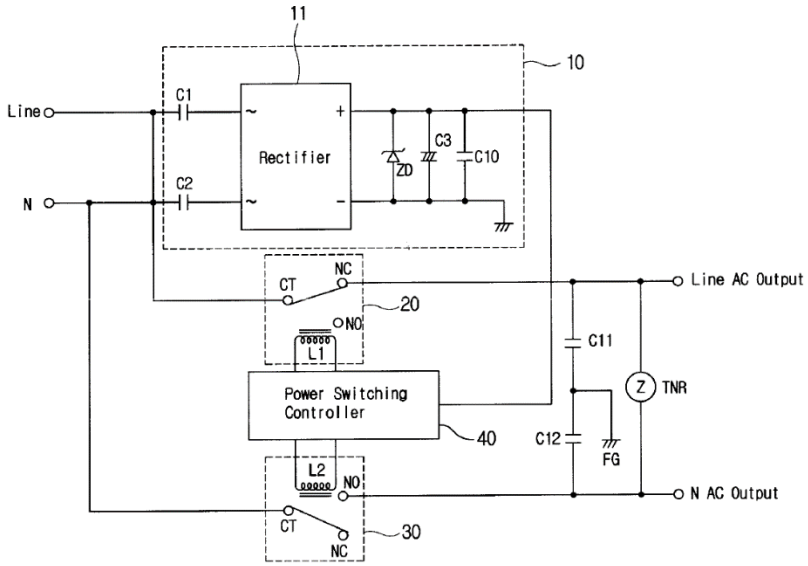

Figure 2.3: Circuit diagram for automatic shut-off of equipment's

2.1.4 Creating Smart Room Using an IOT approach

The objective is to change a typical meeting room into "smart meeting room" (Sfikas, 2016). Figure 2.4 shows the architecture of this smart room. The SYNAISTHISI platform is used to offer the essential infrastructure to communicate heterogeneous devices and services across heterogeneous networks. The state of the room is continuously monitored and decisions are made to control the room facilities including the projector either manually, remotely, or even through automatic processes.

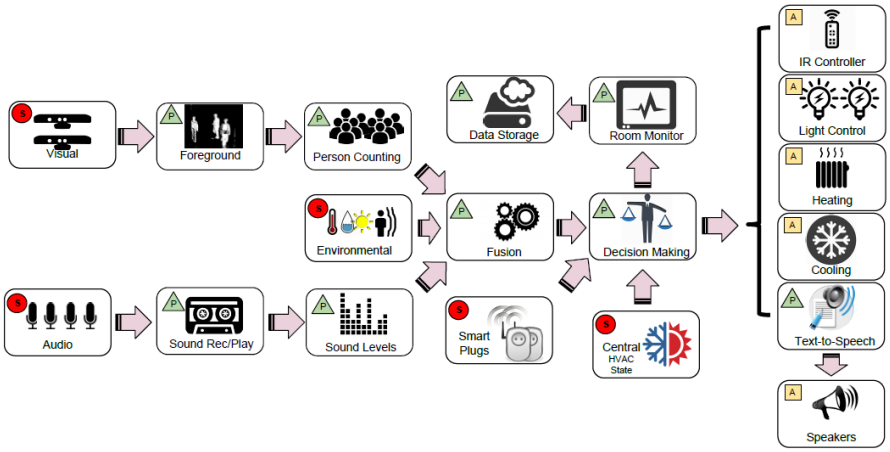

Figure 2.4: High-level architecture of the smart room application

2.1.5 Projector Device Management System

This project structure was illustrated in block diagram as shown in figure 2.5. The system contains a projector manager linked to a computer network where the projector manager is designed to monitor the status of a certain feature of a particular projector device over the network and to change the status of the certain feature when desired. This system also contains a projector manager controller connected to the computer network.

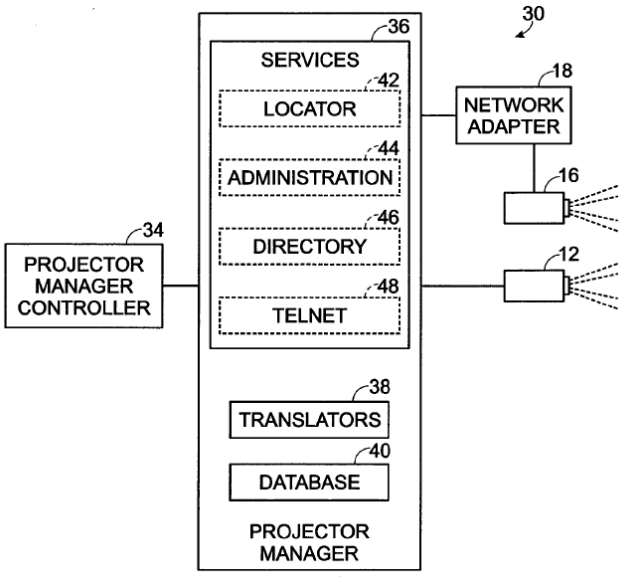

Figure 2.5: Block diagram of the projector device management

2.1.6 Design of Smart and Intelligent Power Saving System for Indian Universities

Manual operation of electrical devices in the university becomes unnoticed in the traditional system, which eventually create maximum power wastage. In order to solve this problem, the authors have designed this system where each classroom is equipped with a PIR that reacts to occupancy and the corresponding devices are switched ON / OFF automatically (Lakra, Kiran, & Chinara, 2016). The central base station monitors and controls the entire system, which is shown in figure 2.6.

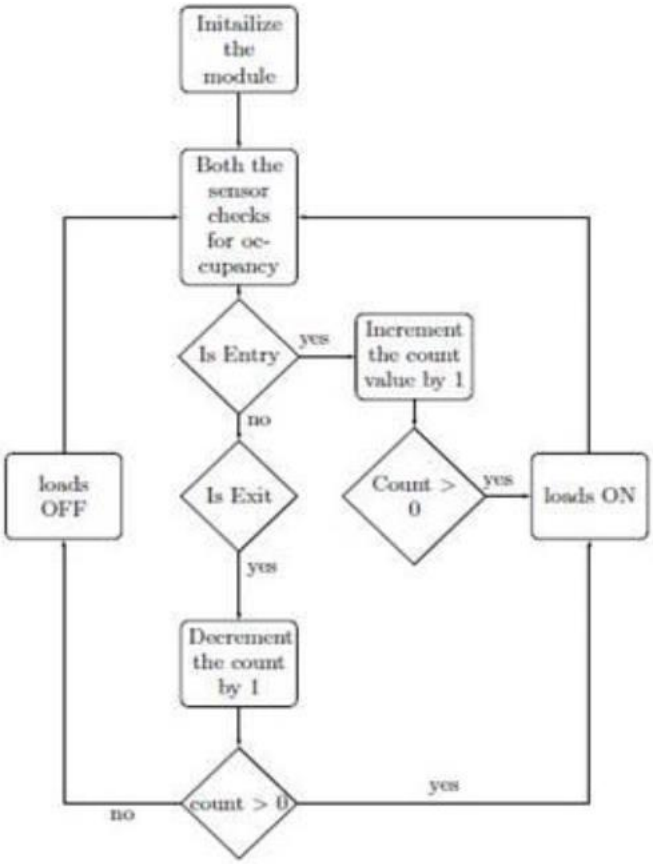

Figure 2.6: Flow chart of smart class room

2.1.7 Smart Surveillance System Using PIR Sensor Network and GSM

Surveillance is most important security systems in home, industrial, office and public places. In this time, the system triggers an alarm that detects a person's presence within a specific time interval and at the same time sends the number of

person or intruder via message to the Short Message Services (SMS) via Global System for Mobile (GSM) communications modem. Figure 2.7 shows this system architecture, which consists of several devices that are easy to obtain quietly.

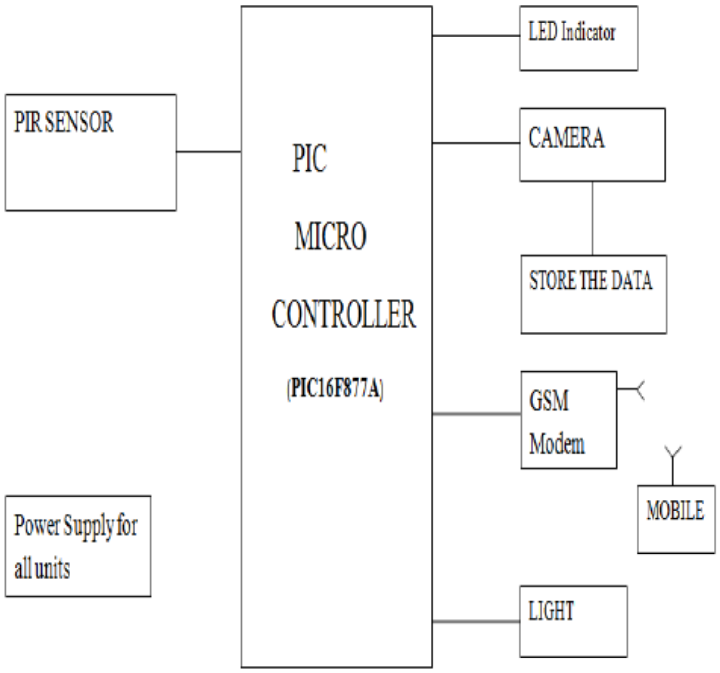

Figure 2.7: System architecture

2.1.8 Smart Office Automation System for Energy Saving

This paper's main motive is to save electricity as people leave the room (Selvaraj, 2017). People sometimes leave the room without turning off facilities such as fan and light. It might resulting power waste and money waste hence this project were created in order to solve this problem. Furthermore, figure 2.8 shown the flowchart for this project where after leaving the room, facilities are turned off automatically within a small time interval. On the basis of sunlight intensity, light is switched on. If the intensity of sunlight is sufficient, light will be switched off.