



Faculty of Computer Science and Information Technology

***SMART POWER MANAGEMENT SYSTEM BASED ON I.O.T***

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Bachelor of Computer Science with Honours  
(Information Systems)  
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**SMART POWER MANAGEMENT SYSTEM BASED ON I.O.T**

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## **ABSTRACT**

*Smart Power Management System Based on IoT is a power consumption monitoring for the individual room offices by the users. This system is to help the user to monitor and control the consumptions of electricity in the offices. This system is proposed in order to create awareness on the consumption of electricity. Meanwhile, the traditional way is to look up on the current meter that is installed by the Sarawak Energy company to review. Another problem faced is the insufficient evidence to file a report regarding power outlet consumptions. By proposing this Smart Power Management System, the user can monitor the overflowing electricity consumption remotely. The methodology that used to develop this proposed system is RAD Methodology.*

### **ABSTRAK**

*Sistem Pengurusan Kuasa Pintar Berdasarkan IoT adalah pemantauan penggunaan kuasa untuk pejabat bilik masing-masing oleh pengguna. Sistem ini adalah untuk membantu pengguna untuk memantau dan mengawal penggunaan elektrik di pejabat. Sistem ini dicadangkan agar dapat memberi kesedaran mengenai penggunaan elektrik. Sementara itu, cara tradisional ialah mencari meter semasa yang dipasang oleh syarikat Sarawak Energy untuk mengkaji semula. Satu lagi masalah yang dihadapi adalah bukti yang tidak mencukupi untuk memfailkan laporan mengenai penggunaan sumber kuasa. Dengan mencadangkan Sistem Pengurusan Kuasa Smart ini, kakitangan yang ditugaskan dapat memantau penggunaan elektrik yang melimpah dari jauh. Metodologi yang digunakan untuk membangunkan sistem yang dicadangkan ini adalah Metodologi RAD.*

# CHAPTER 1 INTRODUCTION

## 1.0 Introduction

With the evolution in the era of technology, electrical energy is one of the main power source as the technology evolves energy requirement rises day by day, and these demands applied in the domestic and industrial sector. Moreover, as the demands of the electricity rises and the natural fuels is dropping due to high-energy use. With the unparalleled differences between request and equipping, reduction of automation and control equipment will produce significant interruption worldwide (Joshi & khan, 2017).

Therefore, people and companies are looking for the best methods to decrease their rising on the electricity bills. Nevertheless, a real-time monitoring system is one of the best methods to help people especially companies, a system that gives out a figure about the power consumptions and allow them to adjust their habits to reduce cost (Chobot et. al., 2013).

Traditionally, electrical technician or administrations keep tracks on the power consumption is through regular computerize or metered power consumption monitoring system that have been implemented currently. To control quality consumption of electricity, the electrical technician or administration must observe the meter thoroughly from time to time. However, it is impossible for them to monitor from time to time because of human limitation and time consuming. For this reason, IoT (Internet of Things) technology offers an innovative way to monitor electrical current consumption remotely, as the IoT approach offers a communication between current sensors and a microcontroller through wireless sensor network.



Moreover, utilizing this approach in this matter, one must have good knowledge of IoT technology and formulae of electrical calculation. In addition, developers must consider some empirical research about human behavior and electrical elements in order to make the system more efficient and effective.

Smart Power Management System generally is a proposed system that control and monitors the current consumption in the offices with the Arduino through using IoT Technology. In addition, this system has only one part, Sensing node, whereas it integrates with ESP8266 Wi-Fi module to establish communication between the cloud and the sensing node on any available network. The sensing node is where it receive all data and upload it to the cloud, from the cloud; the data will be pushed to user.

The sensing node is to sense the current in Watt per Hour consumptions and able to sense human presence in the office as the sensing node is integrated with RCWL-0516 Sensor. In addition, RCWL-0516 Sensor is a microwave proximity sensor also known as human radar sensor. Moreover, this sensor applies Doppler Effect, which measures the velocity of distant object as the sensor transmit will transmit a signal and receive the bounce signal from an object so by implementing the sensor into Smart Power Management System can work with the controlling current flow more efficient and conservative. In general, RCWL-0516 Sensor detects human presence in its surroundings and commonly used in security systems and automatic lighting applications. Moreover, the sensing node sends the data to Blynk cloud. With this application in the system, user can access it from anywhere and control it as long as the user has the internet connection in their devices. Nevertheless, the user are able generate statistical information and plotting graph to help user to act and avoid the wastage in electrical power.

## **1.1 Problem Statement**

People often forgets when it comes with remembering simple standard of procedure (SOP) in organizations such as switching everything off when going back home after work, because 'forgetting' is part of human nature or simply just lazy to switch off all the appliances ("Offices waste thousands a year on unused electricity", 2018). In addition, companies and Organizations are often have issues on short of budget due to the overuse of electricity in their own office. Moreover, their staff were unaware of the electricity current flow in their offices seems like they does not care. In fact, that is the main cause of over-budgeting on electricity. Imagine, leaving the offices with running current flow where all the electrical devices in the office are prone to catch fire due to the increasing the probability of system breakdown for example, computers overheated and power sockets short circuit happened in the office's extensions creating sparks from electrical surge (software, n.d.). This can lead to an accident where there are flammable items in the offices such as papers.

Hence, Smart Power Management System with the integration of RCWL-0516 Sensor is to overcome the issues by monitoring current flow in the offices conservatively and collecting data into a database for review. In addition, this is to eliminate the issues or prevent the over-budgeting issues from overtaking it.

## **1.2 Project Scope**

The smart power management system will monitor the current flow in the offices from time to time, as the system is IoT based. In addition, the system will read the electrical current flow from the current sensor and detect human presence by the RCWL-0516 Sensor as it detects motion in the office. Nevertheless, user will be able to monitor the current flow remotely. At

the same time, the system will be able to stop the current flow whether by remote device or automatically by the system if the system detect no human presence in the office when it meets the pre-requisite requirements. Moreover, the system will generate a report and email it to the admin user to review the consumptions.

### **1.3 Aim and Objectives**

#### **1.3.1 Aim**

The aim of this project, to develop a system that help lecturers and admin staffs to monitor the current flow in the individual room offices in the Central UNIMAS Building for Educators (CUBE). In addition, the Central UNIMAS Building for Educators (CUBE)

#### **1.3.2 Objectives**

The main objective of this project is to design and develop an online IoT platform for lecturers to control their electrical appliances in their own offices and admin staff that will ease the workload for them in order to monitor the electrical current using ACS758 50A Allegro current sensor integrate with RCWL-0516 microwave sensor and ESP8266-01 Wi-Fi module. In addition, to stop or lessen on over budgeting the electrical bills.

Other objectives include:

- To design an autonomous system that control the main power switch based on human presence.
- Able to start/stop the electrical power source remotely.

- To ease lecturer/staff to file a report regarding abnormality in electrical current with good evidence because the data of the electrical current flow is collected by the system.

#### 1.4 Brief Methodology

RAD (Rapid Application Development) approach will be used in this project to meet the project requirement, as it consists of four stages, including Requirement Planning, User Design, Construction and Cutover.

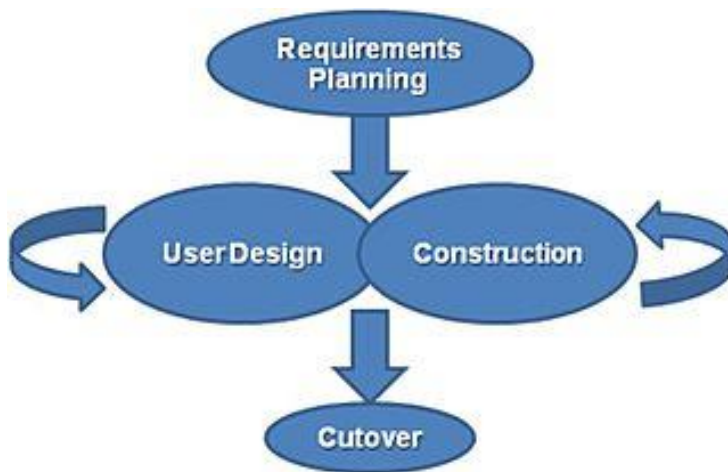


Figure 1.1 RAD Methodology

##### 1.4.1 Requirement Planning

The first phase of this methodology is Requirement Planning, which involves analyzing and finalizing the requirement of the application. Information gathering of the existing system is held in this phase, which will be explained in Chapter 2.

### **1.4.2 User Design**

The second phase of this project development is based on user interaction with the system will be shown by block diagram of proposed system, system Architecture, software design, and hardware design. In this phase, the design will be outlined as the system layout is properly designed and well developed in the stage. In addition, the design will be explained more detail in Chapter 3, which based on methodology and design.

### **1.4.3 Construction**

The construction phase, hardware device integration is involved which will cover in chapter 4.

### **1.4.4 Cutover**

The last phase of RAD process, the prototype will be connected to the wire extensions as the power source of the individual room offices and test whether the system meet its requirements and the objectives of the system which will cover in Chapter 5 and 6.

## **1.5 Significance of Project**

This project is expected to create awareness on the consumption of electricity in the individual room offices. Moreover, this project will help the administrator to monitor and control the overall usage power consumption of each individual room offices.

## **1.6 Project Schedule**

This project starts with requirements gathering which take 52 days. It is consist of project proposal and requirement gathering. Moreover, user design stage, which is design phase

of the prototype of the system take 15 days. In addition, construction stage which including the development of the system that meets the requirements will take 96 days.

Lastly, cutover stage where system will be tested in working environment will take 37 days including install the system, testing, documentation such as user manual and amendment.

For Gantt chart please refer the figure below.

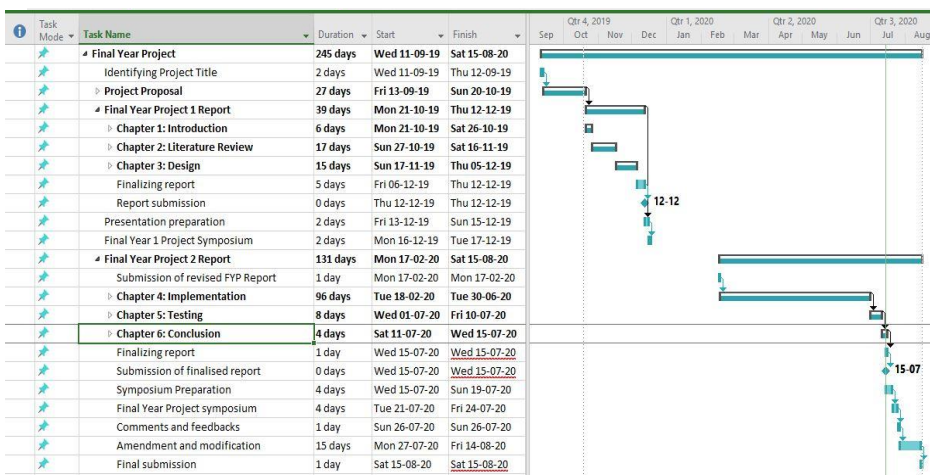


Figure 1.2 Project Schedule

## 1.7 Expected Outcome

The expected outcome of this project is the “Smart Power Management system based on IoT that monitors and controls the usage of power consumption based on time and microwave motion sensor. User will be able to monitor and switch on/off from remote device.

## 1.8 Project Outline

This report consists of six chapters. The rest of report is organize as follow:-

- Chapter 1 introduces the whole idea of the project including the introduction of system importance. Further, this chapter introduces the problem statement with current systems, a proposed system, the scope, the methodology used, and significant of project.
- Chapter 2 includes of literature review of other related system and documentation of the proposed system. These generation of systems is analyze and compare altogether of which to get the best of its user interface design, its interaction with user, its features and its functionality. The pros and the cons of each compared system will be listed and the ideal features bring forwards into Analysis & Design.
- Chapter 3 includes of requirement analysis and design of the proposed system. In the analysis part, user requirements data will be documented for design purposes. The design part includes of the architecture design, Block diagram, and software and hardware design.
- Chapter 4 includes the implementation of Android Based Plant Monitoring System, which is based on the requirements that are analyzed. Moreover, the testing of the system will be covered in this chapter.
- Chapter 5 includes the testing and result of Android Based Plant Monitoring System. This chapter will be divided into several test cases in order to measure the given parameter.
- Chapter 6 is discussing about the conclusion and future work of Android Based Plant Monitoring System. This chapter outlines the potential future works through recommendation and suggestion, which can be applied in the future.

## CHAPTER 2 LITERATURE REVIEW

### 2.0 Introduction

Internet of Things (IoT) technologies is the new trend in the current era that most developer/maker using this approach in order to complete task due to its connectivity, mobility and automations. In this approach, it applies to computing devices, mechanical and digital machines, objects, animals or people that are provided with Unique ID (UID) and the ability to transfer data over a network without requiring human-to-human interaction (Rouse et. al., n.d.).

Internet of Things (IoT) technologies refers to the general concept of the vast number of interconnected devices through a network medium to communicate with each other, whereas the networked devices are able to sense, collect, process and share data amongst themselves for various interesting purposes ( Sharma & Tiwari, 2016).

Internet of Things has many applications but the most famous application are smart home, wearables and smart city (Gour, 2019). Now, Smart power management system will ease people to control and monitor the current consumption in their desire location from anywhere with the help of IoT technology by utilizing smart phones devices.

The literature discusses the review that have done on the existing “smart power management system” that similar to proposed system. The overall study is based on information provided on their published papers and journals of existing system. Limitation of the existing system is analyzed by presenting a side comparison of the system features.