DEVELOPMENT OF POWER MONITORING SYSTEM FOR HOSPITAL BUILDINGS BY USING IOT

NUR FATIN NABILA BINTI NORIZAN

B071710947

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ABSTRACT

The energy crisis has always been an critical issues for the world. To control the massive use of electricity in commercial, public, hospital, industrial, and household use on a daily basis, good power management is needed. As energy has been a major contributor to the rapid growth of the Malaysian economy, utility management. However, it is difficult to control high electricity consumption because there are no indicators to show the amount of energy used and the cost of consumption charges. It is also hard to recognize the use of excessive usage that causes the short circuit to take place. This thesis describes the development of electrical monitoring system to monitor the use of hospital building energy according to TNB tariff rate. Each floor for a hospital building has a different DB box and different power consumption. The system has a voltage rating of 230V and produces a current (A) rating of up to 100A. The PMS system will send notifications through the blynk application if there is any increase in current (A) that exceeds the proper limit on an area. PMS can display the total power (kWh) and current (A) consumption on the LCD so that users can also monitor their power and current consumption while the system is in online mode or offline mode.

ABSTRAK

Krisis tenaga selalu menjadi isu kritikal bagi dunia. Untuk mengawal penggunaan elektrik secara besar-besaran dalam penggunaan komersial, awam, hospital, perindustrian, dan isi rumah setiap hari, diperlukan pengurusan tenaga yang baik. Oleh kerana tenaga telah menjadi penyumbang utama pertumbuhan pesat ekonomi Malaysia, pengurusan utiliti. Walau bagaimanapun, sukar untuk mengawal penggunaan elektrik yang tinggi kerana tidak ada petunjuk untuk menunjukkan jumlah tenaga yang digunakan dan kos caj penggunaan. Juga sukar untuk mengenali penggunaan yang berlebihan yang akan menyebabkan litar pintas berlaku. Tesis ini menerangkan pengembangan sistem pemantauan elektrik untuk memantau penggunaan tenaga bangunan hospital mengikut kadar tarif TNB. Setiap tingkat untuk bangunan hospital mempunyai kotak DB yang berbeza dan penggunaan kuasa yang berbeza. Sistem ini mempunyai voltan 230V dan menghasilkan arus (A) hingga 100A. Sistem PMS akan menghantar pemberitahuan melalui aplikasi blynk jika ada kenaikan arus (A) yang melebihi had yang sepatutnya di suatu kawasan. PMS dapat memaparkan jumlah penggunaan daya (kWh) dan arus (A) pada LCD sehingga pengguna juga dapat memantau penggunaan daya dan arus mereka semasa sistem dalam mod dalam talian atau mod luar talian.

DEDICATION

To my beloved parents.

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LIST OF SYMBOLS AND ABBREVIATIONS

kWh	-	Kilowatt/per hour
GND	-	Ground
PMS	-	Power Monitoring System
V	-	Voltage
A	-	Ampere
W	-	Watt

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter presents the background and motivation behind this project. There are three objectives listed and described to ensure that the project is realized. This chapter also outlines the scope of work of the project. Lastly, a summary of this chapter in the conclusion section.

1.2 Background

Various energy efficiency strategies in hospital buildings must be Hospital buildings operate 24 hours a day and 365 days a year, resulting in high energy consumption. Therefore, a method to reduce energy consumption and yet keeping the hospital up and running, as usual, would more desirable. The energy consumption in the building is related to factors linked to the design and operation of the building. It has found that 30 per cent of the energy can be saved if the design of the buildings connected to energy performance targets and guidelines (L.D.Danny 2010).

However, the energy crisis has always been a critical issue for the world. Practising proper Power management is essential for controlling the massive use of electricity in industrial application and public sectors. Energy also became the primary contributor

to the rapid development, utility management, of the Malaysian economy (A.Rahim 2019)

The awareness of efficiently managing power consumption gives rise to the idea of a device that could help monitor the use of electricity for the Hospital buildings and avoid future breakdown. The type of distribution in large buildings depends on the kind of building, dimension, length of supply cables, and loads. The vertical supply system (rising mains) and the horizontal supply system can be separated into a distribution system (distribution at each floor level) (Dr Hussain 2018). The configuration of the rising mains depends on the design and shape of the building, and the appropriate size shafts for cable and bus duct installation must be provided with the building architect in collaboration (L.L.Win 2016).

This project's development consists of elements of hardware and software. Usage of power in kilowatt-hours(kWh), current in Ampere (A), and total of usage in Ringgit Malaysia (RM) is shown on an LCD and smartphone using Blynk App. Users can also monitor electricity usage remotely. Moreover, the development system measures the amount of current utilized over time. It transforms it into the cost of the amount. Then, the calculation of total energy consumed based on the tariff rates of Tenaga Nasional Berhad (TNB) in Ringgit Malaysia (RM). The system will send notifications through the blynk application if there is any increase in current (A) that exceeds the proper limit on an area that can causes the fires or the short circuit to take place.

1.3 **Problem Statement**

Uncontrolled use of electricity can lead to short circuits, fires, and maintenance costs can be high. In hospital buildings, energy meters can only use energy in kWh. For any disruption, power and current monitoring are necessary, particularly for a building that operates 24 hours such as a hospital. The user or technician may not recognize the use of excessive usage that causes the short circuit to take place. Existing meters indicate the value of total power consumption in RM. However, it is difficult to calculate the use of power and current on each floor in the buildings, since there is no index or metric. Indices and parameters are designed to help understand the amount of energy and current are using and change in cost usage.

1.4 **Objectives**

The objective of this project is as follows:

1) To design a building power meter system to helps the user to monitor daily energy consumption.

2) To develop a system whereby the user can monitor daily energy consumption from anywhere at any time.

3) To implement the system which provides accurate data of the energy consumption to users.

1.5 **Scope of work**

The scope of this work is to develop a monitoring device with a 230V voltage rating and a current rating of up to 100 A with a microcontroller, current transformer, Wi-Fi module, LCD panel, and Blynk App. The device should be capable of calculating the power consumption of the entire building in kWh and converting it to the cost in the RM according to the TNB tariff rates. These values displayed on the LCD, and data is also saved in the cloud using the Blynk App. Also, In online or offline mode, users power consumed can be tracked as well.

The analysis of the working system will be implemented when the data from the Blynk app is showing the graph of daily consumption, and all the system are well operated. Then, ensure that the current transformer is clamped on the right live wire. Then, the data using power from a different level of the building will be collected and observe the energy and current change.

1.6 Thesis Outline

This report consists of three chapters, and the overall summary for each section is as per below.

- Chapter I gives the introduction of the project, which consists of background, problem statement, objective, the scope of work, and thesis outline.
- Chapter II gives an overview of previous projects that includes the concept, theory, and perspective. In this chapter, the hardware and software used to develop the last system explained.
- Chapter III explains the chosen hardware and software and process of design and development of the hardware and software elements of this project.
- Chapter IV is the result and performance analysis of the system. The simulation and the result of the circuit and overall devices are presented in this chapter.
- Chapter V discusses the conclusion for the development of this project and the suggestion of the project for the future.

1.7 Conclusion

This chapter has covered the introduction, background of the project, problem statement, objectives, and scope of the project. The origin of this project is about the notification and control system for the electric use of hospital buildings. This initiative was a plan to enhance the recent monitoring of energy meters, which allows users to save and use electricity wisely. The objectives briefly explained, and the scope discussed the hardware and software used in these particular projects.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter gives the background study about the power monitoring, electricity meter, overview of the previous project on the power meter monitoring system for buildings, the power monitoring system by using IoT and differences between residential meter monitoring system and power monitoring system for hospital buildings. A brief explanation about the perspective, methods, and used and comparison in the previous project were present in this chapter.

2.2 Power monitoring

Energy meter measures the energy consumed by the electrical load in joules(J). While power meter measures the electrical power flows in the circuit in watt(W). Hospitals are the buildings with a high level of energy consumption; they use energy in many different ways. Hospitals operate 24 hours and seven days a week; one of the most critical problems in hospitals is the indoor environment. Hospitals lead to load more air conditioning due to tropical climate and hot. Therefore, integrated energy efficiency in hospitals could minimize the amount of energy consumption and save energy cost. An energy and power control system will also assist users in evaluating the power quality, detecting problems such as voltage drops, swells, and transients. These issues can