



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DESIGN AND DEVELOPMENT
OF
IOT BASED REAL-TIME RESIDENTIAL ENERGY METER
MONITORING SYSTEM**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours

by

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ABSTRAK

Sebagai pengguna elektrik dalam kehidupan seharian, pengguna dapat memantau berapa banyak elektrik yang mereka gunakan dalam satu hari dan tidak menyedari betapa pentingnya penggunaan tenaga. Selain itu, kebanyakan kWh meter hanya memaparkan jumlah penggunaan kuasa dalam kWh sebulan melalui bil utiliti. Terdapat keperluan kolosal untuk mengurangkan penggunaan tenaga yang paling penting ialah elektrik. Walaupun banyak teknologi, pembaziran penggunaan elektrik boleh dielakkan melalui internet. Projek ini mencadangkan satu sistem yang boleh memantau penggunaan semasa, kuasa, kuasa dalam sejam dan nilai RM mengikut tarif TNB di pelayan LCD dan awan menggunakan Arduino Uno R3 dan sensor arus ACS712. Dengan sistem ini, pengguna boleh memantau penggunaan dalam masa nyata melalui internet boleh menguruskan penggunaan kuasa mereka berdasarkan tarif yang ditetapkan oleh TNB. Selain itu, beban boleh dikawal jika terdapat beban yang berlaku melalui sistem yang akan memotong beban menghantar pemberitahuan dari aplikasi Blynk kepada pengguna melalui e-mel.

ABSTRACT

As a user of electric in daily life, consumer enable to monitor how much electric they are using in one day and didn't aware the importance of the energy consumption. Moreover, most commonly kWh meter just display the total power consumption in kWh per month through utility bill. There is a colossal need to decrease energy utilization most importantly the electricity. Despite numerous technologies, the wastage of electricity consumption can be avoided through internet of things. This project proposes a system which can monitor the current, power, power usage in per hour and RM value according to TNB tariff in the LCD and cloud server using Arduino Uno R3 and ACS712 current sensor. With this system, users can monitor the usage in real-time through internet can manage their power consumption based on tariff set by TNB. Moreover, the load can be controlled if there is overload occur through the system which will cut-off the load send a notification from Blynk apps to consumer through email.

DEDICATION

To my beloved parents Mr Padmanathan and Mrs Sarasu, thank you very much for your
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To my supervisor, Prof. Madya Mohd Ariff Bin Mat Hanafiah

To my friends who always helps me carry out this project

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LIST OF ABBREVIATION

IOT	-	Internet of Things
kWh	-	Kilo Watt Hour
TNB	-	Tenaga Nasional Berhad
AC	-	Alternating Current
DC	-	Direct Current
RM	-	Ringgit Malaysia
AMR	-	Automated Meter Reading
ADC	-	Analog Digital Converter
LDR	-	Light Dependent Resistor
PLC	-	Programming Ladder Controller
LCD	-	Liquid Crystal Display
GSM	-	Global System for Mobile Communications
USB	-	Universal Serial Bus
PSM	-	Projek Sarjana Muda

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

The major blessing science that humanity has is electricity. Electricity becomes a section of our daily routine that cannot be predicted without it in the globe. This shows that, energy is the answer part for current innovation. Hence, the vast majority works utilize regular basically couldn't work, and could never have been made. No confirmation of our lives by electricity is improved and it is extremely clear that the living standards of most people would be essentially diminished. Some group of people didn't know the importance of electricity (Waseem Khan, 2018). We regularly squander things that come simple to us. Like it's all the more simple to luxuriously burn through cash when given as pocket-cash than the pay which we get at the most anticipated month-end. The individuals who get a 24x7 supply of power don't have the foggiest idea about the significance of it until they visit a spot where even labor happens in the darkest of night because of absence of power (Rajni Sah 2017). There is a colossal need to decrease general power utilization. The electricity should be observed and controlled according to the need since power consumption is expanding day by day.

In spite of the fact that numerous technological advancements are occurring in this world, the wastage of electricity consumption can be avoided through internet of things, IoT. In 21st century Internet of things viewpoint as buyers is related based on site page

and build in correspondence among purchaser with also provider through input and output. Internet of Things half breed model will creating through zone of Powertrain of wireless channel (Milanpreet Kaur 2018). IoT has brought a new future to the computing and communication world for the technological transformation. This project focuses on designing and building an energy meter monitoring system based on Internet of Things interfacing with Arduino.

1.2 PROBLEM STATEMENT

Absence of assets set up in the present world is starting everybody towards vitality proficient innovations. However, the most commonly energy meter just display the total power consumption in kWh in month through utility bill. The Tenaga Nasional Berhad (TNB) have become familiar with the manual process and support it, although there are many concerns associated with it. Besides that, as a consumer of electricity in daily life, consumer unable to share how much energy they are using in one day and didn't aware the importance of the energy consumption. In order to help people to realize the importance of reducing the energy used, a system can be create to monitor the energy usage. Therefore, consumers can track their monthly electricity usage to get a clear view of how much electricity they consumed. Moreover, consumer also can control their certain load in household.

1.3 OBJECTIVE

The objective of this project is:

- a. To design a real-time residential energy meter monitoring system mechanism via Arduino based microcontroller.
- b. To develop an Internet of Things based real-time residential energy meter monitoring system.
- c. To analyse the performance of the developed system based on tariff set by TNB.

1.4 SCOPE OF PROJECT

In order to achieve the objective the scope are prepared has shown below:

1. The main basis for the project's implementation is energy meter monitoring system through Arduino Uno R3 and Internet of Things (IoT).
2. The system will help measure can calculate the energy consumption of a house and send data to the internet. Consumer can monitor the energy consumption through their smart phone with internet availability in anytime.
3. To create a system that can analyse energy consumption which make the world smarter place and make better decision using Internet of Things (IoT).
4. The system will display the current, power, kWh now, Total kWh usage in RM of load consumed in a house in real-time and the load power consumption is controlled.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Consumers have an imperative part in the power management system and their activities represent an important step to play down environmental impacts of power production. Real-time electric vitality data includes an extraordinary affect in consumer's behaviour's and propensities. Due to progresses in hardware and computing, numerous technological arrangements are presently accessible. These arrangements are a really imperative instrument to an economical future (João Gil Josué, 2018). This chapter essentially centres on the background information, data, summary and past inquire about and relationship between strategies utilized by the researcher. Besides, this chapter will show the study about work that relative with this expect by journals, articles, research papers and diverse source. The scope of the literature review will be significant to the essentials of electrical framework for energy saving purposes and all the data that has been accumulated will be in this way concluded. The literature review is examining of the works of other researchers before to procure significant information and comparable control system done by others. The sources are taken from past proposal, journal, conference paper, books conjointly the Web. All the related points were collected and is talked about in this chapter.

2.2 The History of Electricity

Since electricity may be a normal constrain that exists in our world, it ought not to be invented. It did, in any case, have to be discovered and understood. Most people provide credit to Benjamin Franklin for finding electricity. Many believe that, with its famous test in 1752, Ben franklin discovered electricity. Electricity has not at once been "identified". At to begin with, electricity is light connected. Mankind needed a low and secure Way to glow up their house and researchers believe power might be a way to do that. After that, a researcher realize that an electric charge can be generated through a copper wire by passing a magnet.

Then in 1879, a scientist Thomas Edison has concentrated on the design of an efficient light bulb, which will end long before it is burned. The question was to find a solid filament material, the small wire inside the bulb that carries power. The preceding obstacle was to create an electrical environment that would allow people to control these new lights viable sources of energy. Edison wanted a practical and inexpensive way to create electricity. The primary power plant, which could create and transmit electrical power to people's homes, was designed and built. On September 4, 1882, in Unused York City, Edison's Pearl Road Control Station began its generator. In the lower Manhattan, about 85 customers had adequate control to light five thousand lights. Some years later, with the development of alternating current (AC) power systems, the turning point of the electric age occurred. Nikola Tesla came to work with Thomas Edison, a Croatian scientist. Tesla found the revolving magnetic field and created the rotating electric current

framework which is nowadays widely used. Tesla united with George Westinghouse who reveal the AC framework and provide control to the country that appears to be traveling along the long distances—directly in competition with the DC framework of Thomas Edison. Subsequently, Tesla was founded by Tesla Electric Company, who has designed and developed the Tesla Coil, which continues to be used for science laboratories and in radio innovations today. Power plants could transport electricity a lot more than before, currently using AC.

In Malaysia, Power at first showed up in this nation at 20th century, and the most trustworthy record of the energy age can be found back in Rawang, Selangor, and small mining town. Here in 1894 two striking people Loke Yew and Thamboosamy Pillai showed an electrical power generator to operate their mines, were the main user of electric siphons for mining in Malaya. Around a period of time, private supply was associated with Rawang Town for road lighting and in 1895 its first power was supplied to the railway stations in Kuala Lumpur. In 1900, the Raub Australia Gold Mining Company worked at the Sempam Hydroelectric Control Station in Raub to become the main control station in Malaysia. Power remains today a progressive industry, although the range, state and government are infringed politically.

2.3 Electrical Energy

2.3.1 Energy Consumption and Demand

The demand for electricity is measured by kilowatts (kW) and refers to the power consumption rate. On the other hand, electricity consumption is measured in kilowatt hours (KWh) and refers to the total power consumed over a certain length of time (Amy Havens, 2017).

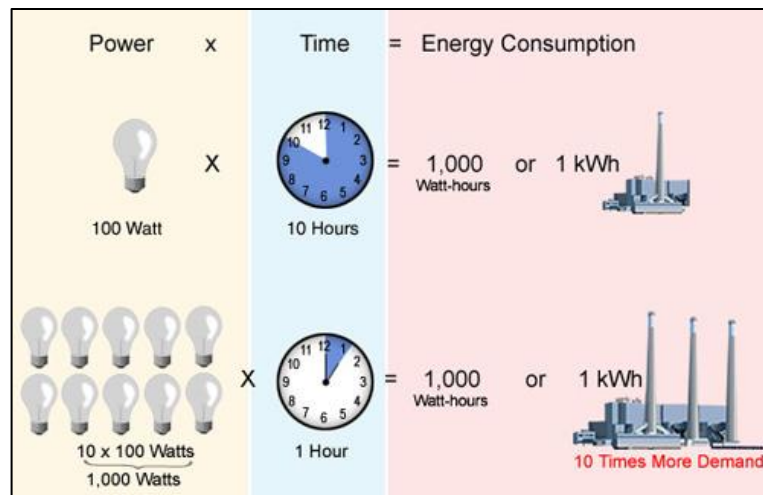


Figure 2-1: Energy Consumption versus Demand (Apogee, 2013).

Based on the figure 2-1, one 100W bulb burning till 10 hours of time expends 1 kWh (1000W per hours). As soon as it is done, 100 watts or 0.1 kW from the power supply are required or "requests." Whenever the customer switches the light on, the power supply must have 0,1kW prepared. Likewise, ten light bulbs that Consume 1,000 watt hours or 1 kWh for 1 hour.