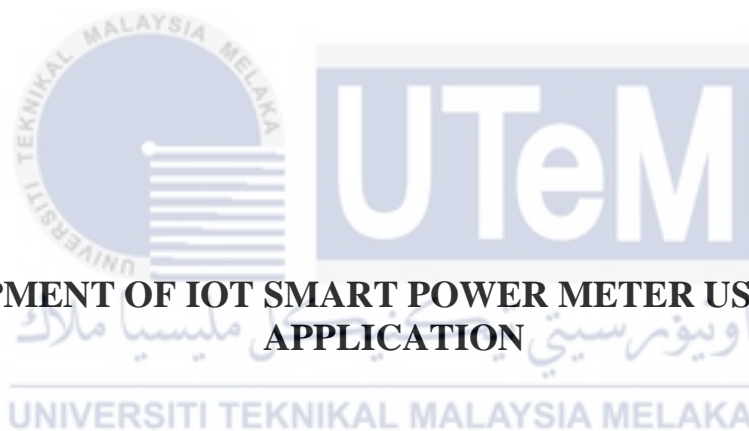**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF IOT SMART POWER METER USING BLYNK APPLICATION

ARUNAGHIRY A/L NARENTHIRAN

Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

2021

DEVELOPMENT OF IOT SMART POWER METER USING BLYNK APPLICATION

ARUNAGHIRY A/L NARENTHIRAN

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN

PROJEK SARJANA MUDA II

Tajuk Projek: Development of IoT Smart Power Meter Using Blynk Application

Sesi Pengajian: SEM1 2021/2022

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I declare that this project report entitled "DEVELOPMENT OF IOT SMART POWER METER USING BLYNK APPLICATION" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Student Name   :   ARUNAGHIRY A/L NARENTHIRAN

Date   :   4 JANUARY 2022

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours.

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Supervisor Name   :

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Date   :

    06/02/2022

Signature   :

Co-Supervisor   :

Name (if any)

    PUAN KAMILAH BINTI JAAFAR

Date   :

    06/02/2022

DEDICATION

To my mentor and friend, it would not have been possible for me to accomplish this without you.

Thank you so much for your help and encouragement along the process.

ABSTRACT

Today, with the increasing consumption of electricity in different fields, there is a need to even monitor the consumption of electricity in order to arrange it into correct data and analyse it. Moreover, human error problems could have occurred if a person received the data from the conventional energy metre. Digital smart metres, by contrast, are a good solution to monitor energy and consumption in real time. This project therefore aims to develop an Internet of Things (IoTs) concepts for a Smart Power Meter. In this project, the IoT concept is implemented. The project uses an Arduino controller, Wi-Fi Module ESP8266, Current Sensor ACS712, Blynk Application, an open source IoT platform. For users to view the data, the Blynk platform was selected. The ESP 8266WiFi transfers data from the Smart Power Meter into the cloud and is the main control system for Arduino's project. This enables the user everywhere and anytime to see the power consumption in clouds. The project focuses on the monitoring and measurement of energy consumption by various devices in our daily lives, the calculation of other parameters and the creation of a database of the information collected. Users are able to easily view their power usage using the cloud system with this project. Finally, users can plan their actions and save money by using the data obtained in real time

ABSTRAK

Pada masa kini penggunaan tenaga elektrik semakin meningkat dalam pelbagai bidang. Penggunaan tenaga elektrik ini hendaklah dipantau supaya boleh menyusun dan menganalisis data dengan tepat. Di samping itu, manusia selalu melakukan kesilapan semasa membaca dan mengira data melalui Meter Tenaga Konvensional. Justeru, Digital Smart Meter merupakan satu penyelesaian yang baik untuk memantau tenaga dan penggunaan elektrik dalam keadaan sebenar. Tujuan projek ini dijalankan untuk mereka cipta sebuah Smart Power Meter melalui konsep Internert of Things (loTs). Konsep loTs digunakan dalam projek ini. Projek ini menggunakan sebuah Arduino Controller dengan ESP8266 wifi modul, ACS712 Current Sensor, sebuah platform sumber loTs terbuka dan aplikasi Blynk. Aplikasi Blynk dipilih bagi memudahkan pengguna untuk mengenal pasti data. Arduino memainkan peranan sebagai pengawal utama dalam projek ini manakala ESP8266 wifi akan memindahkan data dari Meter Smart Power dan muat naik ke Cloud. Ini membenarkan pengguna untuk melihat penggunaan tenaga melalui Clouds di mana sahaja dan pada bila-bila masa. Fokus utama projek ialah memantau dan mengukur penggunaan tenaga elektrik daripada alatan elektrik yang digunakan dalam kehidupan harian, seterusnya mengira parameter yang lain dan mencipta satu database daripada data yang dikumpul serta data database ini dapat dilihat melalui aplikasi Blynk. Melalui projek ini, pengguna dapat melihat penggunaan tenaga elektrik dengan mudah dengan menggunakan Sistem Clouds. Pemerolehan data penggunaan tenaga elektrik dalam keadaan yang sebenar ini membolehkan pengguna merancang penggunaan alat elektrik dan menjimatkan kos.'

ACKNOWLEDGEMENTS

First and foremost, I would like to express my immeasurable appreciation and deepest gratitude to Universiti Teknikal Malaysia Melaka (UTeM) for providing me an opportunity to undertake my Final Year Project in partial fulfilment for Bachelor of Electrical Engineering.

Firstly, I'd like to express my heartfelt thanks and appreciation to my supervisor, Encik Adam Bin Samsudin who has guided and encouraged me along this semester. His prompt encouragements, timely assistance, erudite advice, and warm kindness have motivated me to perform better and widen my research boundaries in the completion of my Final Year Project.

Next, I would like to extend my deepest thanks to Puan Kamilah Binti Jaafar for her continuous guidance in giving advice for the completion of my project. Her willingness to teach me and offers me vast knowledge regarding my project deserve immense appreciation.

The utmost appreciation also goes to my family. With their love and encouragement, I am able to persevere through the obstacles that come to me. Finally, I'd like to thank my friend especially who has assisted me in every possible way to complete this report.

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LIST OF ABBREVIATIONS

V	-	Voltage
A	-	Ampere
KWH	-	Kilowatt Hour
RM	-	Ringgit Malaysia
IOT	-	Internet Of Things
WSN	-	Wireless Sensor Network
GSM	-	Global System Mobile Communication
AMI	-	Advance Metering Infrastructure
SMS	-	Short Messaging Service

LIST OF APPENDICES

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 1

INTRODUCTION

1.1 Background

From an economic and environmental standpoint, pursuing energy efficiency as a lifestyle goal may be a required goal. Our standard of living is based on the use of electricity, a finite and expensive resource whose use has increased dramatically in recent decades. One of the most important issues affecting any economy's power sector is energy management. Many people are unaware of how much power their devices consume and, as a result, use them indiscriminately. The best solution to the energy management problem would be a system that could show people how much energy they use at any given time and also allow them to set limits on their power consumption by turning their devices on and off remotely.

The aim of this project was to examine and explore the patterns of electricity consumption in household appliances. The Internet of Things (IoT) Smart Power Meter will be designed with the ability to read energy consumption and display an electrical bill. The purpose of creating this Internet of Things (IoT) Smart Power Meter is to motivate consumers to manage their energy consumption more effectively. The increased and wasteful use of energy has had a negative impact on the world. The Arduino microcontroller board based on ATmega328P can be used to create an Internet of things Smart Power Meter.

The load current that passed through the live cable is detected using a 20A current sensor where it is connected to the Arduino controller.

The controller will be able to sense current, power, kilowatt per hour usage, and the current electricity bill, all of which will be displayed on an LCD on the prototype device itself, as well as online monitoring features via an Android phone. The ESP8266 WIFI module will be used to create the IoT device in order to provide an effective on how to monitor the consumer's power consumption. These modules will be used by the main controller to send all of the data readings to the cloud server. Consumers will be able to monitor their power meter through online using an Android phone application thanks to the IoT Smart Power Meter's architecture. The service provider should monitor the pattern of energy use with such detailed records of electrical usage, allowing for better and more efficient management. The billing system on the other hand will become more transparent.

1.2   Problem Statement

The residential sector is one of our country's largest power generations. There is currently a substantial disparity in energy consumption between urban and rural households. However, they do not apply to energy efficiency standards. The market penetration rates of electrical appliances such as refrigerators, washing machines, radiator, dryer, dish washer, air conditioners, and ovens are the second factor. Thus, IoT Smart Power Meter can potentially design energy-efficient replacement appliances for traditional ones. It will motivate users to make long-term behavioral changes that will decrease their electrical power consumption. Furthermore, the Smart Power Meter may motivate users to improve their ability to track, monitor, and manage their power consumption. This will help raise energy awareness and keep everyone informed about the consequences of their energy

consumption habits. Reduce the use of the air conditioner, for example. Furthermore, there are tools (both software and hardware) available worldwide that people can use to efficiently manage their power consumption.

Short message service (SMS) and other traditional techniques which are still in use today, are expensive. Because IoT is less expensive than short message service (SMS), it is possible to monitor energy usage at a lower cost. Furthermore, user can access through an Android application or a web portal to check the daily consumption reports. The system is more dependable and reading values extracted from energy using devices are more precise. The Android application will display live device readings. The readings are also available to view online. Human intervention is avoided, and all values are stored on a central server. The communication medium is safe and tampering with energy meters or electricity theft can be easily detected. The value in the central server will not be corrected if the system encounters an error. The reports are available from anywhere in the world because the values are stored in a central database. In addition, the server is available 24 hours a day, seven days a week.

The Electricity Board has become accustomed to working by hand, and they continue to use it despite numerous concerns. After receiving a defective bill as a result of human error, the user must contact the energy supply board to have it corrected. In that situation, the customer must go to the office, wait in line, and get the problem fixed. The issue arises solely because of human intervention. The IoT Smart Power meter system was used in this new production to prevent human interference in the billing process.

1.3   Project Objective

The following are the project's objectives:

- To developed the Internet of Things (IoT) based android application smart power meter monitoring.

- To design the smart meter monitoring system using Arduino controller with Blynk application.

- To analyze the energy consumption and load current usage that can help consumer to control their monthly electric bills.

1.4   Scope of Project

The scope of this IoT Smart Power Meter project are shown to have the following features:

- The information is collected in an internet-based data management system that provides users with information on energy use.

- The app can view the load analysis curve along with current load data connected to the power meter on a day-to-day basis. This allows for power optimization.

- 20A current sensor is used in this Smart Power Meter where the Smart Power Meter is limitless to a test load current of not more than 20A.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

Nowadays, the demand of energy in the form of electricity is increasing around the world due to global population increment. Electricity consumption is one of the major cost contributors in the commercial, industrial, or household property. In fact, many people are concerned about reducing the intensity and cost of consuming electricity but are yet to find a suitable solution to it.

Therefore, this project helps to develop a monitoring system for the electricity consumption in the household. This system will help users to have deeper understanding on the relation of the appliances they use in the household and the power consumption needed to fuel their daily routines. The smart energy management system faces several obstacles, including the massive amount of data that must be collected and submitted to the cloud. There may be loss of data at certain period of time where server failure happens. Therefore, the design of energy monitoring system should be able to compensate the loss of data by allowing alternative ways for data storage

2.2   Internet of Things (IoT)

The Internet of Things (IoT) refers to a group of technologies which make it possible to connect and to communicate different appliances, devices and objects (or simply "things") via networking technology. The vast majority of content and knowledge on the Internet is

generated by humans, while on the Internet of Things, small devices are often the active factor that provides information [1].

The Internet is more than just a computer network. Automobiles, smartphones, home appliances, toys, cameras, medical equipment, and industrial systems are among the devices that have grown into a vast network. As shown in Figure 2.1, the IoT connects everything, allowing it to always communicate and share information with one another. Furthermore, IoT based applications have become a popular solution for real-time issues. The IoT allows a city to collect all the data required to become a smart city by integrating intelligent measuring devices throughout the city [2] [3].

Figure 2.1 Internet of Things

2.3 Smart Meter Concept

A smart meter is an ecological energy meter which measures electricity in kilowatt-hours (kWh). It is simply a device that provides consumers with a positive benefit when they want to reduce their electricity bills. They belong to the Advanced Meter Infrastructure division and are responsible for sending meter readings automatically to the energy supplier. Figure 2.2 is a simple Smart Meter illustration.
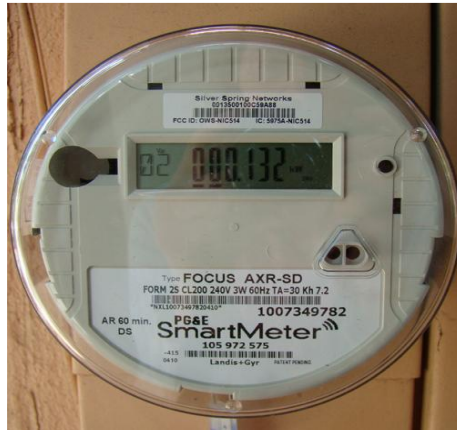
Figure 2.2 Smart Meter [4]

Energy consumption can be managed and monitored in real-time with smart meters. Nowadays, the market can purchase a variety of smart metres, and the IoT is the means by which they can communicate with one another. Figure 2.3 shows existing market smart meters [5] [6].

Figure 2.3 Siemens Meter, Schneider Meter And Micro Meter

Mostly with the inclusion of firm benefits from the Smart Meter, accurate metre readings will be provided. A Smart Meter has nonvolatile data storage, the ability to connect or disconnect remotely, tamper detection, and two-way communication. They send the collected data to the central metre via remote reporting. The functionality of the Smart Meter is monitored by this central metre. Smart Metering improves the operational managementand

control of the power grid [7]. The following are some of the advantages of smart power meters:

- Operating costs are low

- Consumers and utility companies will save time when reporting meter readings to energy providers.

- It is ready to request your electricity bill online.

- With an intimation policy during high peaks, power consumption can be greatly reduced

The smart meter detects all the consumption generated by residents. Meter readings provide a better understanding of energy utilities, allowing residents' overall energy usage habits to be changed. Finally, all the data generated by Smart Meter will contribute to noble generation.

2.4   Energy Monitoring

The device that displays the total amount of energy consumed by a domestic, industrial, or agricultural device is known as an energy monitoring system. Various real-time parameters such as current, voltage, power, and energy can be obtained based on electricity consumption. Sensing elements such as voltage transformers and current transformers are used to detect the voltage and current consumed by the load.

2.5   Power Consumption

Energy consumption refers to the total amount of electricity consumed by a single household. The consumption of electricity is a crucial aspect of the supply of electricity. The