UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF HOME ELECTRIC USAGE NOTIFICATION & MONITORING SYSTEM USING IOT

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

by

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ABSTRAK

Penggunaan elektrik di Malaysia meningkat secara mendadak setiap tahun kerana penggunaan elektrik dalam peralatan rumah lebih tinggi. Tujuan kertas ini adalah untuk membangunkan prototaip sistem pemberitahuan dan pemantauan penggunaan elektrik rumah menggunakan IoT. Sistem yang dicadangkan boleh memaklumkan dan memantau pemakaian penggunaan tenaga elektrik pengguna dari segi arus, kuasa, kilowatt jam dan penukaran Riggit Malaysia mengikut Tarif TNB. Bill elektrik yang sedia ada dengan semua maklumat akan dipaparkan melalui LCD pada peranti prototaip itu sendiri dan juga ciri pemantauan dalam talian melalui telefon pintar. Sistem ini terdiri daripada Arduino Mega yang dipasangkan dengan sensor di mana sensor mengesan arus beban yang melalui kabel hayat. Bahagian pengatucaraan dicipta untuk penukaran maklumat dari sensor kepada ampere. Tarif TNB digunakan sebagai rujukan untuk menghasilkan bil elektrik dan kuasa yang akan ditambah dalam struktur pengaturcaraan. Untuk memudahkan pengguna memantau penggunaan tenaga, modul Wi-Fi ESP8266 digunakan untuk membuat peranti IoT. Di samping itu, Aplikasi Bynk di dalam telefon bimbit menghantar notifikasi kepada pengguna apabila pengguna melebihi had penggunaan tenaga elektrik mereka. Relay juga ditambah ke sistem di mana pengguna dapat mengawal peralatan apabila penggunaan kuasa tinggi untuk peralatan rumah. Sistem ini membantu pengguna menyedarkan jumlah peralatan rumah tertentu dan menguruskan penggunaannya untuk menjimatkan elektrik. Selain itu, ia dapat membantu pengguna untuk merancang belanjawan mereka pada bulan yang akan datang kerana tanpa mengetahui jumlah tenaga elektrik yang digunakan, sukar bagi pengguna tertentu merancang belanjawan mereka.

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ABSTRACT

The consumption of electricity in Malaysia rapidly rises up every year because of higher utilization of electricity in home appliances. The aim of this paper is to develop a prototype of a Home Electric Usage Notification and Monitoring System using IoT. The proposed system able to notify and remotely monitor the energy usage consumption of the consumer in current, power, kilowatt hour and conversion of RM according to TNB Tariff. The existing electricity bill with all the information will be display through LCD on a prototype device itself and also online monitoring features through smartphone. The system consists of Arduino Mega which interface with the current sensor where the sensor will detect the load current that went through the life cable. A programming part was created for the conversion from the sensor to the ampere. TNB tariff was used as a reference to produce an electric bill and power which will be added in programming structure. In order to make an efficient way for the consumer to monitor their energy consumption, ESP8266 Wi-Fi module was used to make IoT device. Additionally, Blynk application at the phone notify the consumer when the consumer exceed the limit of their electric energy usage. A relay was added to the system where consumer able to control the appliances whenever the power usage is high for home appliances. This system helps the consumer to realize the amount of certain household appliances and manage the usage of it to save electricity. Furthermore, it would help users to plan their budget on coming month because without knowing the amount of electricity been used it will be hard for certain consumers to plan their budget.

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DEDICATIONS

I dedicate this project report to my parents and friends. A special thanks to my mother Mrs. Magaswari a/p Suppiah and my sister Mrs. Puvaneswari a/p Suppiah who both taught me that even when the task seems impossible at first it can be accomplished if it is done one step at a time. I also devote this work to my friends and people in the societies who have supported me throughout to finish the project. I will always appreciate the help and knowledge shared especially by Mr. Thenarasu, Mr. Naren Kumar, Mr. Vimaa and Mr. Lugaresan.

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LIST OF SYMBOL

A	- Ampere
GND	- Ground
I	- Current
I/O	- Input & Output
J	- Joule
KTOE	- Kilotonne of Oil Equivalent
V	- Voltage
VCC	- Input for Arduino
W	- Watt

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LIST OF ABBREVIATIONS

AC	**Alternating current**
ADC	**Analog to Digital Conversion**
APP	**Application**
DAQ	**Data acquisition board**
DC	**Direct Current**
EEPROM	**Electrically Erasable Programmable Read-Only Memory**
GPRS	**General Packet Radio Services**
GSM	**Global System for Mobile**
IHD	**In home display**
IoT	**Internet of things**
KWh	**Kilowatt-hour**
LCD	**Liquid Crystal Display**
OS	**Operating System**
PC	**Personal Computer**
RAM	**Random access memory**
RM	**Ringgit Malaysia**
ROM	**Read only memory**
RTC	**Real time clock**
RX/TX	**Receiver Transmitter**
SMS	**Short message service**
TNB	**Tenaga Nasional Berhad**
TOU	**Time of use**
USB	**Universal Serial Bus**
Wi-Fi	**Wireless Fidelity**

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CHAPTER 1

INTRODUCTION

1.1 Background

Efficient power consumption and savings became a major issue recently and the need for power is increasing day by day in Malaysia (Electricity demand, economic growth, and sustainable energy resources in Malaysia, 2011). A domestic user such as residential customers is not aware of their consumption of energy usage and sometimes power stealing could happen because of this. Generally, bills are often prepared by assuming and if it is a digital energy meter users are unlikely to know the amount of usage because of the lack in tariff calculation. Therefore, to overcome the problem a home electric usage notification & monitoring system is designed to monitor and notify the energy usage consumption in household's appliances. The home electric usage notification & monitoring system which has an ability to notify and alert the consumer regarding usage energy consumption and at the same time the consumer able to monitor the electric bill via LCD and cloud server.

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The purpose behind developing this system is to empower the customer on the most proficient method, which effectively reduce energy utilization. Expanding and squandering of energy utilization has given the negative impact on the earth. Arduino Mega integrated with Atmega chip was used for designing purpose. Additionally, Arduino is use as an interface with current sensor where the sensor will detect the load current that went through the life cable. A programming part was developed for the conversion from the sensor to the ampere unit. Moreover, an equation to pick up the power and calculation to get the power bill with the reference by TNB tariff will also added in a programming structure.

The ACS712 Current sensor will have the capability to detect the usage current, power, kilowatt per hour usage and existing electricity bill with all the information can be display through LCD on a prototype device itself and online monitoring features through the smartphone. In order to make an efficient way for the consumer to monitor their energy consumption, the ESP8266 Wi-Fi module will be used to make IoT device. The main controller will use these modules in order to send all the information to the cloud storage server. The architecture of the system will give access to the consumer to monitor their energy meter online through the smartphone application. Additionally, blynk application sends a notification to the consumer when the consumer exceeds the limit of their energy usage and it operates in offline mode

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too. Meanwhile, a buzzer sound will be heard when the limit was reached and the consumer needs to turn off the home appliances for temporary action.

A relay will be added to the system where consumer able to control the appliances whenever the power usage is high for home appliances. With all the function, squandering of energy utilization and household appliances electric bill can be minimize and control. It helps the user to realize the amount of certain household appliances and manage the usage of it to save electricity. This system would able to help users to plan their budget on coming month because without knowing the amount of electricity been used it will be hard for certain users to plan their budget. Other than that, this system could prevent power thief by other user. It will be a revelation to everyone on how to use, conserve and preserve electricity.

1.2 Problem Statement

Energy meter has been introduced for the residential and industrial section when the usage of energy became wide. The energy meter main function is to detect energy usage, display it in Kilowatt/Hour, and calculate the overall monthly electric bill which consumer needs to pay at the end of the month. The energy meter is widely used in the world when it is widely used proportionally along with the growth of energy many problems occur (Clenitiaa and Ilakya, 2017). Because this project implements in Malaysia, consumer difficult to figure out the electrical bills and amount

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of usage sends by Tenaga Nasional Berhad (TNB). As a consumer, we always use electricity without knowing the limit, moreover when it comes to festive season electricity usage will rise up and along with all expenses, high electricity bill would be a big burden for consumer.

The fast contribution of advancements and the continuous increment of the human needs have put on our condition numerous with new electrical and electronic gadgets. There is no proper alerting system to the consumer and monitoring device that helps the consumer to track the energy consumption in daily life. These contribute to the key problems of the current world that are excessive energy consumption. Daily production of vast amounts of energy underwrites to the pollution that primes to the ozone hole, which has a great deal with the greenhouse effect, that prompts the liquefying of ice and accordingly to the ascent of ocean levels and the eradication of uncommon types of fauna on the planet. Therefore, the consumer needs to make a move with the end goal to diminish these impacts. The consumer would prefer not to quit utilizing energy sources that make our lives more comfortable, or facilitate the replacement of older appliances with new, higher-efficiency (Ardakani and Ardehali, 2014), yet, what consumer can do is moving towards greener decisions utilizing the innovation. This can be achieved by seeking to reduce energy consumption.

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