



Faculty of Electrical and Electronic Engineering Technology



DEVELOPMENT OF GSM BASED SMART ENERGY METER

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Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

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DEVELOPMENT OF GSM BASED SMART ENERGY METER

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**A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electrical Engineering Technology (Industrial Power) with Honours**



Faculty of Electrical and Electronic Engineering Technology

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I declare that this project report entitled “DEVELOPMENT OF GSM BASED SMART ENERGY METER” 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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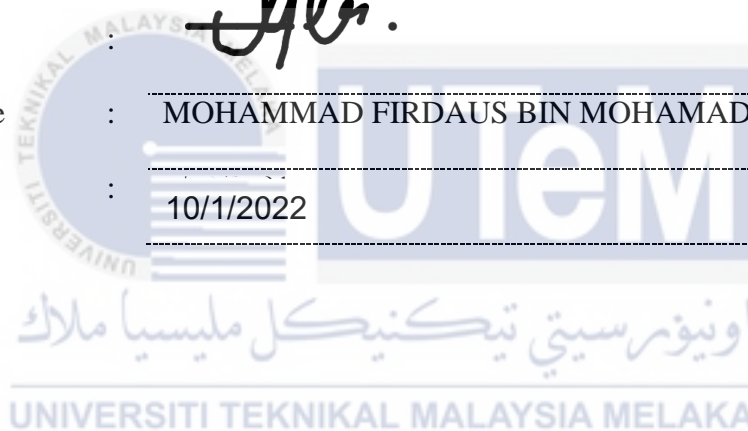
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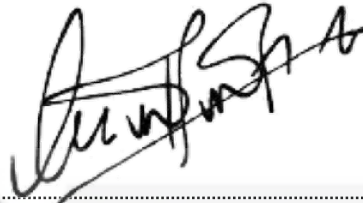
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APPROVAL

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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DEDICATION

To my beloved mother, Zainab binti Ahmad and all housemate whose support it would not have been possible.



ABSTRACT

Smart Energy Meter that allows customers to view their current power use (bill) at any time and from any location using smartphone by Short Message Services (SMS). A GSM module on Arduino is used to implement the proposed methodology. The energy consumption is determined using voltage and current measurements. Arduino programming does the power and energy calculations, and a message is sent to the relevant consumer with the unit consumption and bill amount. Proteus was used to create a simulation model for this project. We can measure the power consumed by each load and send the data to a mobile phone using the GSM module. After the taking alert for consumer , they can set the limit of price.



ABSTRAK

Meter tenaga pintar yang membolehkan pelanggan melihat penggunaan kuasa semasa (bil) pada bila-bila masa dan dari mana-mana lokasi menggunakan telefon bimbit mereka melalui Perkhidmatan Pesanan Ringkas (SMS). Modul GSM pada Arduino digunakan untuk melaksanakan metodologi yang dicadangkan. Penggunaan tenaga ditentukan menggunakan pengukuran voltan dan arus. Pengaturcaraan Arduino melakukan pengiraan kuasa dan tenaga, dan mesej dihantar kepada pengguna yang berkenaan dengan penggunaan unit dan jumlah bil. Proteus digunakan untuk membuat model simulasi untuk projek ini. Kami dapat mengukur daya yang digunakan oleh setiap muatan dan mengirim data ke telefon bimbit menggunakan modul GSM. Setelah berjaga-jaga untuk pengguna, mereka boleh menetapkan had harga.



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LIST OF SYMBOLS

δ	-	Voltage angle
	-	
	-	
	-	
	-	
	-	
	-	
	-	



LIST OF ABBREVIATIONS

V	-	Voltage
	-	
	-	
	-	
	-	
	-	
	-	
	-	
	-	



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CHAPTER 1

INTRODUCTION

1.1 Background

An electricity meter is a tool used to measure the rate of electricity consumption by domestic residential consumers, business premises, government buildings, and so on. Electricity meters are calibrated according to the billing units has been take and being calculate in kilowatt hours. The electricity meter is read periodically according to the electricity bill cycle once a month. therefore, the electricity bill records the electricity consumption on that billing cycle. Some countries have different electricity tariff systems according to the time of day and night. Therefore, electricity meters in the country will record energy consumption at peak times where electricity tariffs are more expensive. In addition, the electric meter also has a relay that is able to turn off electrical equipment that is not needed. according to technology the meter is also improved from time to time according to need. For example, previously TNB used electromechanical meters and then improved to digital meters to get more accurate readings.

Various technologies have been developed and used to estimate the electrical consumptions. Among the types of smart meters that have been studied by scientists, students and others. Exmple "IOT BASED ENERGY METER READING"[18], "Smart Energy Meter [19], "Smart Energy Meter Using Android Application And GSM Network"[20]. Base on my observations they

using three main micro-controller as connectors to the GSM first is Arduino Uno, PIC Programmable Intelligent Computer, Raspberry Pi.

1.2 Problem Statement

In a normal metering system in Malaysia, an electricity provider employs to every house with manually record metre readings and sent the amount of bill direct to consumer. This is not only slow but also laborious, as The Company has no control over these metres. There is a stark amount of revenue loss being incurred by our country due to energy theft which is a serious problem, people try to manipulate meter reading by adopting various corrupt practices such as current reversal, partial earth fault condition, bypass meter, magnetic interference etc. [17]. With the help of this project, a comprehensive solution is provided that allows power companies to have complete control over energy metres and real-time information from a remote place with minimal human work and at a lower cost than traditional ways..

1.3 Project Objective

The main aim of this project is to propose a systematic and effective methodology to estimate system wide TL of MV distribution network with reasonable accuracy. Specifically, the objectives are as follows:

- a) To develop system to monitor and control domestic energy meter base on arduino.
- b) To develop a GSM modem to implement monitoring and control in the system.
- c) To remotely disconnect power supply at the house.

1.4 Scope of Project

The scope of this project are as follows:

- Communication between GSM and smartphone and a smart energy meter.
- Measurement of maximum load demand, and current price
- Coding the GSM using Arduino IDE.
- Operate with 230V single phase and 50Hz power sources.



CHAPTER 2

LITERATURE REVIEW

Introduction

An electricity metre is a device that measures amount of electricity at home, company, or other building has been uses electricity. Electricity metres are usually calibrated in billing units, with the kilowatt hour being the most prevalent (kWh). Usually in peninsula Malaysia Electric metres are installed by Tenaga nasional berhad (TNB) that supplies the electricity in order to measure the amount of electricity consumed by each of its customers, a process known as net metering [3]. While in Sarawak it provide by Sarawak energy and Sabah by Sabah electricity (SESB)

2.1 History of Electric Energy Meter

2.1.1 Types of Meter Reading

Electricity meter is a tool to measure the consumption of electricity by domestic consumers, business premises, government buildings, etc. Electricity meters are calibrated according to official billing units, the most common being in kilowatt hours. Electricity metres are read on a regular basis (usually once a month) in accordance with the electricity bill cycle. Base on Suruhanjaya Tenaga ST ELECTRICITY REGULATIONS 1994 under Sub regulation 4 (1) (a) to (h) of the Regulations bills in respect of the amount payable to the licensee shall be provided to the user on a monthly basis and shall be paid within thirty days after delivery [1].

Supply of Licensee 1990 hence, the electricity bill records the electricity usage during that billing cycle (as in the previous month). Different energy tariffs apply

during the day and at night in certain countries. As a result, electricity metres in the country can monitor energy usage during peak hours, when electricity tariffs are higher. Some electric metres have relays that can switch off electrical equipment that isn't in use. An electric metre works by constantly measuring voltage and current and then finding the product of the two to produce a power value, which is then multiplied by time to produce an energy reading in kilowatt hours. They are several types of meter such as electromechanical meters, Electronic meters, Diesel meters, Smart meters and prepaid meters. Here we only focus on two type of domestic meter only analogue meter and digital meter.

2.1.2 Analogue Meter

We can't see the quantity of energy, such as current, voltage, or force, with our five senses. To find out the value of its magnitude, the letter is used as a measuring device that can transform the quantity of electricity through a physical phenomenon that can be observed, and seen with the five human senses. This electrical quantity is converted to a mechanical quantity by a physical phenomenon; the transformation is a cycle around a specific axis. The value of the rotation angle is directly related to the quantity of electricity to be observed. The measuring instruments mentioned above are referred to as conventional measuring instruments (Soedjana & Osamu, 2000) [1].

2.1.3 Digital Meter

Digital meter is similar function like analogue meter record daily electricity use but it has been upgrade by each suppliers over wireless digital radio frequency Networks to meet each other's needs. The advantages of energy management in the home energy management system are attainable with appropriate interactive devices connected to an advanced metering facility (AMI). For example, smart meters can one day help clients plan electricity consumption during off-peak hours when power is cheaper.

Literature Review

This Literature Review base on the previous paper review and analysis similar to my project Development of Gsm Based Smart Energy Meter.

Bil	YEAR, PAPER & NAME	DESCRIPTION	HARDWARE/ SOFTWARE
1	(February 2014) - Design and Development of PIC Microcontroller Based 3 Phase Energy Meter- [6]	<p>Develop a 3-phase Energy Meter utilising a dsPIC33F microcontroller and a Microchip MCP3909 ADC IC to perform all of the energy meter's measurements. Using the formula $P = V * I$, the energy metre is meant to measure energy, which is comparable to power consumption over time. As a result, the ADC chip has two input channels, one for voltage and the other for current. The two input channels will detect analogue signals, which will then be transformed into digital signals by ADCs. The dsPIC33F calculates the power consumption using the two digital input signals supplied over SPI protocol to the microcontroller. As a result, energy consumed will be accumulated over a defined length of time.</p>	<p>-PICmicrocontroller - MCP3909 ADC -transformers</p>
2	2014-Design And Construction Of A Gsm Based Energy Meter7]	<p>Design and installation of a GSM-based Remote Energy Meter for Electricity , Consumption Control, and Payment, Data</p>	<p>-Arduino UNO. -GSM Module. -Energy Meter. -Load.</p>

		<p>Logging and Savings in Power Distribution and Management to facilitate the measurement of energy use and the billing mechanism. The materials and technology utilised here are a microcontroller unit that monitors the metre continually and is connected to a GSM MODEM with a dedicated remote operating SIM. Serial communication in collaboration with embedded systems was used to carry out this project. The metre displays the billing information on an LCD screen.</p>	<p>-Liquid Crystal Display (LCD) 20x4</p>
3	<p>(2017) - Gsm Based Smart Energy Meter To Implement Billing System And To Control Electricity Theft [8]</p>	<p>Automatic meter reading (AMR) systems send SMS messages with meter reading, power cut, total load utilized, power disconnect, and tempering information on demand or at regular intervals. This has the goal of measuring and monitoring the electricity utilized by customers in a given area, communicating the consumed power to the station, and automatically sending a bill for the consumed power, with online payment options. It also tries to uncover</p>	<p>-Arduino UNO. -GSM Module. -Energy Meter. -Load. -Liquid Crystal Display (LCD) 20x4</p>

		metering irregularities.	
4	(2018) - GSM-Based Smart Energy Meter with Arduino Uno [9].	<p>Users able to monitor current power consumptions using their mobile phone via Short Message Services. Customers would benefit greatly from being able to see their energy meter's power consumptions (bill) in real time. The main controller, Arduino UNO, served as the link between the energy metre and the GSM module. The GSM module allows the energy metre to communicate with the user's mobile phone. To get the true time, a Real Time Clock (RTC) DS1307 was used to count and store the usage into the EEPROM. In the Arduino IDE, the application was written in C and used Arduino syntax.</p> <p>The demonstration of the proposed system. The suggested system successfully demonstrated its capacity to verify current usage (bill), inform when the limit is reached, and reset the usage (bill) using simply a GSM-based mobile phone.</p>	<ul style="list-style-type: none"> - Arduino Uno - Real Time Clock (RTC) DS1307 -GSM module
5	(2018) - Review Paper on Smart Energy Meter Using	Smart energy metre based on the Internet of lot, which will eliminate billing errors and	<ul style="list-style-type: none"> -Arduino UNO. -GSM Module. -Energy Meter.