Faculty of Electrical and Electronic Engineering Technology

REAL TIME ELECTRICAL LOAD MONITORING THROUGH PHONE

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Bachelor of Electrical Engineering Technology (Industrial Power) with Honours

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A project report submitted
in partial fulfillment of the requirements for the degree of
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I declare that this project report entitled “Real Time Electrical Load Monitoring Through Phone” 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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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 : Ts. Dr. Mohd Firdaus Bin Mohd Ab Halim

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DEDICATION

I express my sincere dedication, honor and gratitude to my parents, my father Shamsudin Bin Ismail and my mother Norusmida Bt Nordin for the love, encouragement, support and sacrifice of throughout my life. I can't reach this level without them. I would also like to thank all my brothers and sisters for their constant support and advice in everything i do in life. Beside, all this wonderful work would not be success without my supervisor, Dr. Mohd Firdaus Bin Mohd Ab Halim who always support my works and give a good comment to make my works better Thank you to all the lecturers who have taught and guided through my research, and let's not forget all the friends who have always accompanied me on this fun journey of. I have no words to express my sincere gratitude to all.

ABSTRACT

The cost of utility bill has increased every year especially electricty bill. The consumption of the electricity in domestic house can only be monitored through the meter or TNB apps. However, the details of each load that connects to the house is not known. The purpose of this project is to evaluate the consumption of a single appliances in a house. This projects can be divided into two phase. In the first phase, the load needs to be determine using Arduino Uno. In this phase, the electrical parameters gathered from arduino will be used to determine the power consumed by the load. In the second phase, the power information from arduino will be send to the phone. In this phase, the communication between arduino and the phone is accomplished by GSM module. The result shows that when the electric consumption can be monitored real time with this project. The delay for the message to get through to the phone will take 5 seconds. The accuracy of this monitoring device is 78%. This project will help the user to save monitor and take neccesary action to manage their electric consumption.

ABSTRAK

Kos bil utiliti telah meningkat setiap tahun terutamanya bil elektrik. Penggunaan elektrik di rumah domestik hanya boleh dipantau melalui meter atau aplikasi TNB. Bagaimanapun, butiran setiap muatan yang bersambung dengan rumah itu tidak diketahui. Tujuan projek ini adalah untuk menilai penggunaan peralatan tunggal di dalam rumah. Projek ini boleh dibahagikan kepada dua fasa. Dalam fasa pertama, beban perlu ditentukan menggunakan rduino. Dalam fasa ini, parameter elektrik yang dikumpulkan daripada arduino akan digunakan untuk menentukan kuasa yang digunakan oleh beban. Dalam fasa kedua, maklumat kuasa daripada arduino akan dihantar ke telefon. Dalam fasa ini, komunikasi antara arduino dan telefon dicapai oleh modul GSM. Hasilnya menunjukkan bahawa apabila penggunaan elektrik boleh dipantau masa nyata dengan projek ini. Kelewatan untuk mesej dihantar ke telefon akan mengambil masa 5 saat. Ketepatan peranti pemantauan ini adalah 78%. Projek ini akan membantu pengguna untuk menjimatkan monitor dan mengambil tindakan yang perlu untuk menguruskan penggunaan elektrik mereka.

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V	-	Voltage
LCD	-	Liquid-crystal display
GSM	-	Global system for mobile
PWM	-	Pulse-width modulation
USB	-	Universal serial bus
CT	-	Current transformer
KB	-	Kilo byte
SRAM	-	Static random access memory
EEPROM	-	Electrically eraseable programmable read-only memory
g	-	Grams

CHAPTER 1

INTRODUCTION

1.1 Background

Recently, utility bills, especially electricity bills, are increasing year by year. Excessive power consumption can lead to wasted electricity, and users cannot monitor all electronic devices used in their homes [1]. Each device already has information, but this does not guarantee that electronic device usage can be accurately evaluated. As a result, electricity consumers pay a large and ever-increasing amount for their use.

1.2 Problem Statement

Power consumption refers to the electrical energy supplied per unit of time to operate things such as household appliances. Power consumption is usually expressed in watts (W) or kilowatts (kW). Consumer only can monitor their usage once in a month when they got the electricity bill or only the house that have smart metre can monitor their usage using TNB app. The energy consumed by the device will always be higher than the actual energy required because no device has 100% efficiency.

1.3 Project Objective

The purpose of this project is to propose a method to estimate electric consumption for a single appliance. To achieve this purpose, three objectives needs to be fullfill.

(i) To determine the value of power consumption in kW of a single load.

(ii) To transmit the power consumption information to the user's phone.

(iii) To evaluate the reliability of the proposed project.

1.4 Scope of Project

The scope of this project are as follows:

(i) Using simulation during design phase for the circuit.

(ii) Measure a single appliance.

(iii) Load that use in this project is predetermined.

(iv) Using GSM module.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter consists of overview about the power reading using current transformer sensor to get the actual reading of a single appliance. In general, the past case studies are related to this project are presented in article to be discussed as well.

2.2 Electrical consumption study

2.2.1 Programmable Energy Meter for Electrical Load Survey

The proposed system uses 8051 family of microcontrollers and a rectified power supply. Four pushbutton switches are connected to a microcontroller to provide electricity price information. A 16x2 LCD display is connected to the microcontroller to display information.

The system is connected to the load through a comparator IC with an energy meter. A microcontroller reads the pulses from the energy meter and determines the energy consumption of the power consumer. When the user enters the unit price and charging time into the microcomputer through the push button switch, it will be calculated according to the program and the relevant energy consumption and cost information will be displayed on the LCD display [2].

Figure 2.1 Project circuit

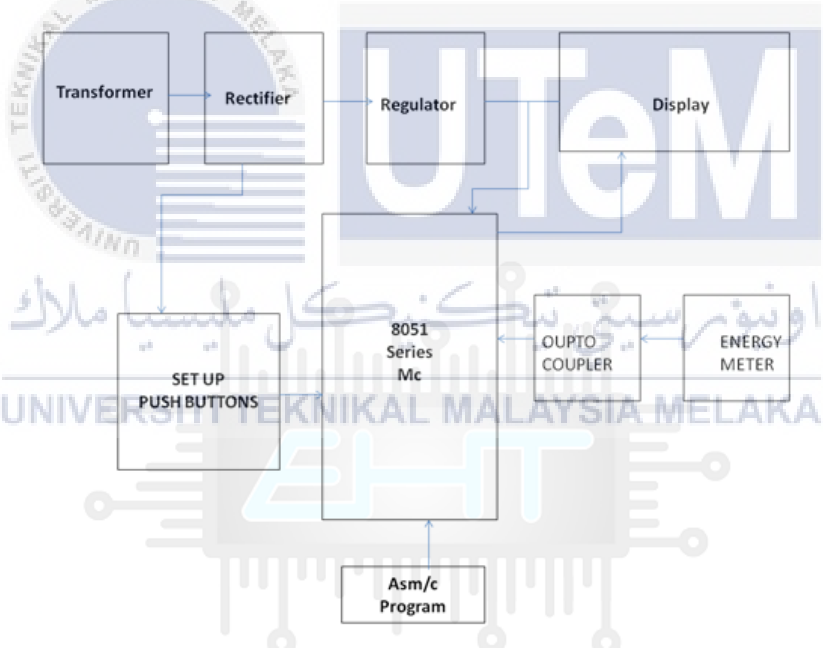

Figure 2.2 Block diagram of this project

2.2.2 Analysis of the Effectiveness of the Utilization of Power Monitoring Devices in Reducing Electric Energy Consumption

This study focuses on the analysis of uses of energy consumption control devices in combination with Wireless Fidelity (Wi-Fi) and mobile telephone technology. These devices combine monitoring, signaling and control functions. Any electrical appliances are connected that utilize electrical energy from a power plant to this energy consumption monitoring system.

According to the test results after installing these devices, savings measures showed a 15.88% reduction in daily energy consumption. Meanwhile, weekly consumption shows a decrease of 6.43%. Within 3 months of observation, energy expenditure decreased by 33.77% [3].

2.2.3 A Smart Voltage and Current Monitoring System for Three Phase Inverters Using an Android Smartphone Application

This researcher introduces a new intelligent voltage and current monitoring system "SVCMS". Use the Arduino platform as a microcontroller to monitor a three-phase electrical system, read voltage and current from sensors, wirelessly transmit the measured data, and monitor the results with a new Android application. The on-board SVCMS design uses Arduino Nano V3.0 as a microcontroller to measure the results from 3 voltage sensors and his 3 current sensors, after calculation, end this data via Bluetooth HC-05 Send to his user's android smartphone device. The Arduino Nano V3.0 Controller and Bluetooth HC-05 are inexpensive microcontrollers and wireless devices respectively. A new Android smartphone application that monitors voltage and current measurements uses the open-source MIT App Inventor 2 software and can monitor some basic power quality characteristics. These systems allow technicians, administrators, and managers to monitor and control the performance of devices from a safe distance [4].

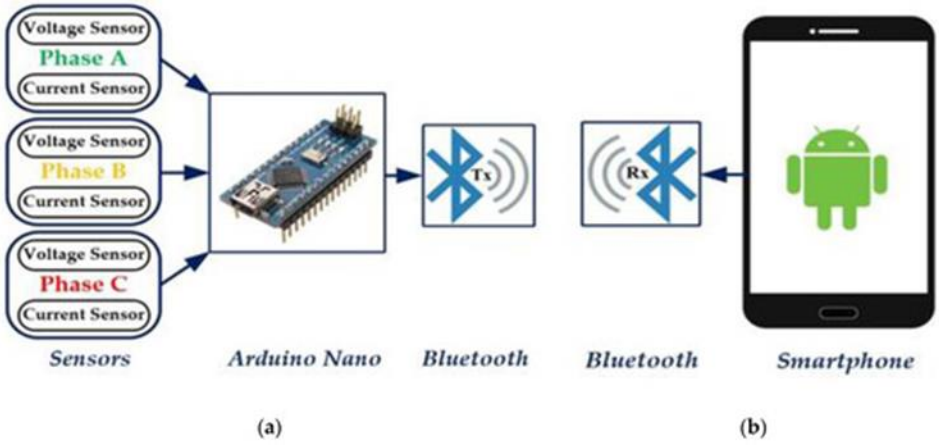

Figure 2.3 SVCMS project

An image on a smartphone is a inspection system or inspection application installed on a tablet or smartphone device. This application monitors data (three-phase voltage and current) received from a microcontroller. This document uses a new application developed using MIT App Inventor 2. This is Google's open source platform that can be used to design different types of applications that can be implemented on Android smartphones or tablets [5].

2.2.4 Measure Current Using Arduino And ACS712 Current Sensor

This researcher measure a DC current using an Acs712 Hall effect-based linear current sensor and an Arduino Uno. The Acs712 can exactly and accurately measure current if properly maintained. Researchers looked at various blogs on the internet about interfacing acs712 current sensors with arduino and other microcontrollers. The Acs712 current sensor can measure both direct current and alternating current.

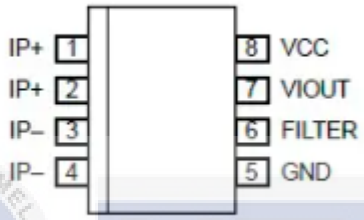

Figure 2.4 Pin-out Diagram

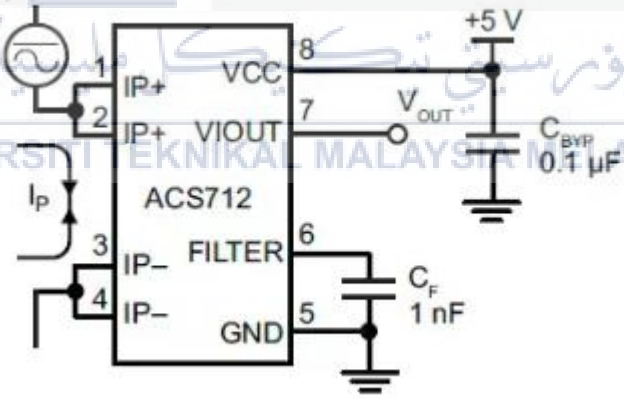

Figure 2.5 Typical Application

Connect the sensor in series with the system that measures the current. Cut the circuit wire and connect one end of the wire to IP+ and the other end to IP-.

Viout is the voltage output pin. The ACS712 outputs analog signals corresponding to changes on the IP+ and IP- pins. That is, it outputs an analog voltage on the VIOUT pin as the current changes [6].

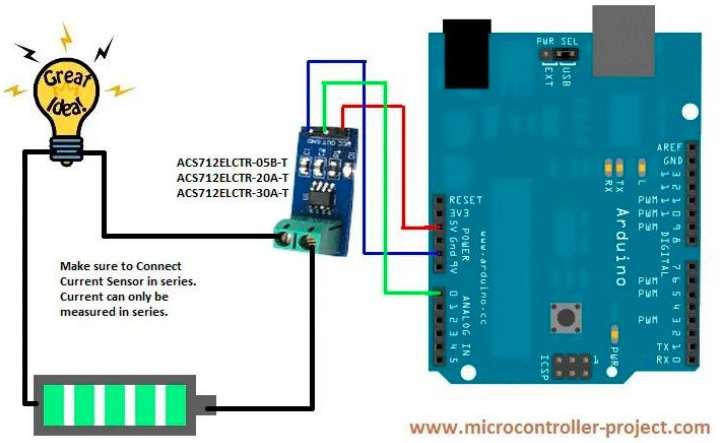

Figure 2.6 Acs712 with Arduino Uno -Circuit Diagram

2.2.5 AC Current Measurement System Using Arduino and CT Sensor

The researcher has built an Arduino-based smart energy monitoring system for AC power measurement. AC current measuring multimeter built by a professional engineer who can measure current very efficiently. However, these meters are expensive and cannot always monitor the current.

Build an Arduino-based system that can constantly sense current and display the results on an LCD display. Efficiently measures current using a CT (Current Transformer) sensor. The circuit also uses a rectifier and amplifier for signal conditioning. The current display uses a 16x2 LCD display [7].

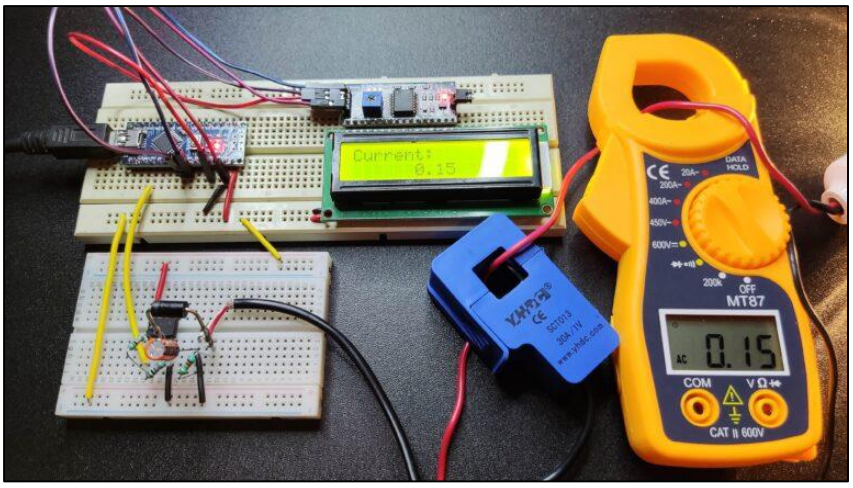

Figure 2.7 Project circuit with clamp meter

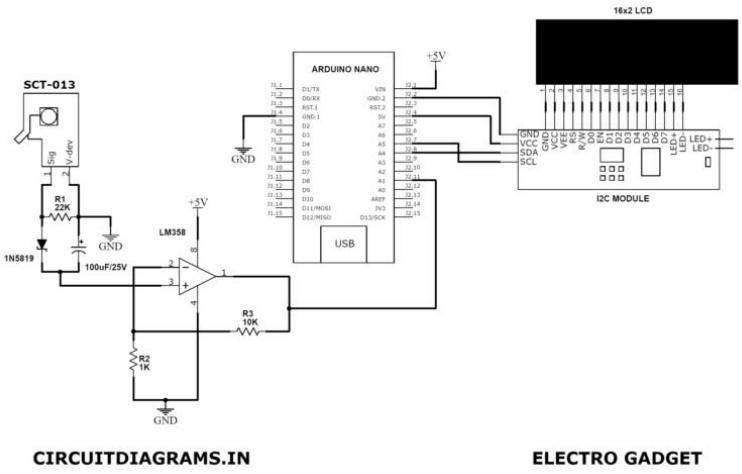

Figure 2.8 Circuit diagram of project

2.2.6 Arduino-based home fire alarm system with GSM module

This project has constructing a home fire alarm development is based on an Arduino board as the main control board interacting with the GSM module working on the communication part. The GSM module runs by sending the user it SMS, so this system works entirely with wireless network communication. The GSM module is responsible for the communication part of the circuit. It receives information from the Arduino about where to send information and what information needs to be sent. It uses a GSM SIM card for communication. It's basically just a modem that uses serial communication to communicate with the Arduino, and requires Hayes-compatible AT commands for communication [8].

The GSM SIM900A operates in dual-band 900-1800 MHz and is designed for use outside Europe and the US only. With proven performance, industrial-grade interface standards, and built-in TCP/IP protocol, it looks great and is suitable for electronics projects [9].