UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ENERGY MANAGEMENT, MONITORING USING RASPBERRY PI AND ARDUINO

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

by

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This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Laporan ini menangani pengurusan, pemantauan sistem menggunakan arduino dan raspberry pi. Dalam era ini, perkakas tenaga pintar untuk pengurusan tenaga adalah kemudahan untuk rumah kediaman. Dalam Home Energy Management (HEM) sistem menggabungkan sistem pengawasan dan pengawalan. Pengguna sistem ini dapat melihat penggunaan kuasa penggunaan perkakas di rumah. Untuk meningkatkan perkhidmatan tenaga pengurangan potensi ini adalah lebih baik jika komuniti di Malaysia dapat membuat penelitian untuk memantau dan mengawal penggunaan elektrik di rumah. Sistem utama ini dapat membangunkan Sistem Tenaga Rumah dan membantu pengguna atau pengguna memantau penggunaan perkakas di rumah. Fokus utama adalah di rumah kediaman yang merupakan perkakas rumah dan sistem harus meminta untuk memantau tenaga yang digunakan dalam satu alat perkakas. Asas utama system ini adalah perisian Raspberry Pi dan Arduino yang digunakan sebagai program utama untuk projek ini. Menyediakan peralatan ini ini mempunyai beberapa prosedur untuk diikuti dalam menjayakan projek ini.

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ABSTRACT

This report addresses the management, monitoring system using Arduino and raspberry pi. In this era, the intelligent energy appliance for energy management is a convenience for a residential house. In-Home Energy Management (HEM) the system combined the monitoring and controlling system. This system user able to watch the power consumptions of the appliances used in-house. To increase this energy service of potential reduction it is best if the community in Malaysia can control their home's energy activity from far at their residential home and using gadgets such as device to monitor the electric usage. The main of the system is able to develop a Home Energy System and help the user or consumer monitoring the appliance usage at home. The main focus is in the residential house which is the house appliance and the system should ask to monitor the energy used in one appliance device. The fundamental is Raspberry Pi and Arduino which is used as a main based program for this project. Setting up this equipment this has a few procedures to follow to make this project successful. The current transformer will be used to detect the current flow. The data from current transformer will store in SQL database and will show the result in SQL result also graph. All the result in this paper is taken from the data obtained and analysed throughout the project.

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DEDICATION

This report is dedicated to my respective parents Mazlan bin Muda and Ainun binti Ismail, who always support me to never give up and give me hope for me to complete this project completed successfully. Secondly, this report is dedicated to my project supervisor, Mr. Zulhasrizal bin Bohari, for been the one who play important rule and always give me help for any unresolved problem. Lastly, for my friend Nur Fatin Fatehah Hashim, always give me help in solve the problem. The others friends, who always help me on the hardware and circuit design and implementation part. Without their support this project would not have been made possible.

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LIST OF SYMBOLS

V	-	Volt
I	-	Current
A	-	Ampere
W	-	Watt
R	-	Resistance

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LIST OF ABBREVIATIONS

HEM	Home Energy Management
IED	Intelligent Electronic Device EMS Energy Management System
IoT	Internet of Things
IHD	In Home Display
ICT	Information and Correspondence technology
VI	Virtual Instrument
WSN	Wireless Sensor Network
GSM	Global System for Mobile Communication
GPRS	General Packet Radio Service
MEMS	Micro Electro Mechanical System
LAN	Local Area Network
UI	User Interface
RAM	Random Access Memory
PC	Personal Computer
SPA	Standard Power Analyser
NI	National Instrument
DAQ	Data Acquisition
SoC	System on Chip
API	Application Programming Interface
LEMS	Laboratory for Engineering Man/Machine System

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AWS	Amazon Web Services
EEMS	Energy Efficiency System
MQTT	Message Queuing Telemetry Transport
IEEE	Institute of Electric and Electronic
RTU	Remote Terminal Unit
AVR	Automatic Voltage Regulator
IPC	Information and Privacy Commissioner
SQL	Squelch (Radio Communication)

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CHAPTER 1

INTRODUCTION

1.1 Background

In this century, the growing complement on environment protection and more intelligent energy appliance this day call for better energy management system. For residential units, this ordinarily includes overseeing the power utilization of the entire appliance and controlling their activity states. The home system gives users with not just a more available illustration of their energy consumption practices, yet additionally the possibility to remotely control their home appliances. These abilities will eliminate the energy misuses and the potential dangers presented by the appliances due to running off extra time (Li, Tan, & Tsang, 2015), (Coetzee, Mouton, & Booysen, 2017).

In the studies of Wenjin (Jason) Li, Xiaoqi Tan, Danny H.K. Tsang, structure of smart home energy management system combining both approaches which are monitoring and controlling, so precise power consumption observing and natural communication with the all home appliance are accomplished (Li et al., 2015).

Home Energy Management (HEM), the act of giving input and control over private vitality utilize, has appreciated a lot of consideration starting late. Consideration of energy usage made by the nations over the world stated this justified study that in the United States of America, living arrangements expend 37% of all electrical vitality

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delivered. Dutch private utilization involves 24% of power use. In South Africa, family units make up 28% of aggregate vitality expended. The capability of this under-investigated HEM arrangement space is huge and the application thereof could reshape the vitality scene on both a neighborhood and utility scale. The HEM idea is executed through methods for a Home Energy Management System (HEMS), which is an umbrella term for all system that reduced family vitality utilization (Coetzee et al., 2017),(Son, Pulkkinen, Moon, & Kim, 2010).

In power sector, the deregulation in power sector picked up a huge change in the improvement, which encouraged the industrial and commercial user to deliver power at the less expensive cost furthermore, notwithstanding pitching it to the customers. There are such huge numbers of elements that are related to Deregulation in control division, for example, Privatization, reliable and cheap, privatization, customer focus and innovation (Shenghui & Yong, 2012) ,(Han, Choi, Park, Lee, & Kim, 2014).

Reliability of electric distribution system is in particular fundamental for the two utilities and purchasers. Generally, control blackouts are caused because of environmental hazardous condition what's more, overhead of electrical cables. Modernisation in the smart grid makes utilization of bidirectional savvy meters, remote control switches and Intelligent Electronic Devices (IED's), which accumulates a substantial measure of information and gives adequate data to screen system activity in close continuous (Shenghui & Yong, 2012),(Nguyen, Tran, Leger, & Vuong, 2010).

So as to lessen the power utilization at home residential, HEMS assumes a basic part. Effective Energy management with the home apparatus is a key element of HEMS

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set-up. Setting mindful and client movement data can be additionally used to advance the vitality utilization in HEMS. The fundamental objective of HEMS is to decrease the vitality utilization considering the clients‟ needs, to accomplish this, checking of the vitality utilization is required along with the energy management techniques (Li, Tan, & Tsang, 2015),(Coetzee, Mouton, & Booysen, 2017).

1.2 Statement of the Purpose

The purpose of the project is to investigate the energy usage in residential house.

1.3 Problem Statement

Based on Malaysia- Energy Policy, laws and Regulations Handbook volume one which is Strategic Information and Basic Laws 2015 Edition in Malaysia as much as 97% people connected with electricity in 2000. In fact, at the year 2011, energy services of potential reduction is 998MWh and total cost saving is 0.36(million RM), and in the year 2012 it shows improvement which is three times from 2011 in total cost saving is 1.01(million RM), yet in 2013 energy consumption is 2896MWh and cost saving is 1.54(million RM). Table 1.1 shows the energy Service of Potential Reduction of Energy Consumption.

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