UNIVERSITI TEKNIKAL MALAYSIA MELAKA

E-MAIL NOTIFIER FOR ENERGY SAVING

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

by

MUHAMAD LUQMANULHAKIM BIN SUHAIMI
B071210343
891019-06-5675

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **E-MAIL NOTIFIER FOR ENERGY SAVING**

SESI PENGAJIAN: **2014/15 Semester 2**

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I hereby, declared this report entitled “E-mail Notifier for Energy Saving” is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the Bachelor of Electronics Engineering Technology (Telecommunication) with Honours. The member of the supervisory is as follow:

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(Abdul Halim Bin Dahalan)

ABSTRACT

With the expanding of the wireless technology applications that have no limits, one of the branch viable application that still going on research and development is wireless sensor network technology. In this project, the wireless sensor technology that had been developed is using Wi-Fi transmission technology for sending an E-mail as notify for energy saving system and with using of open-source hardware platforms that is Raspberry Pi as a 'head' to controlling the process flow of this project. The sensor circuit that consists of light and temperature sensor for determine the environment of the places both the air-conditioner and lamp already shut off or not and will send the current situation to user via E-mail. This system need access an internet connection for sending an E-mail and the Raspberry Pi can connect to an internet via wire or wireless. By implement this system, it have a significant to help saving the energy because the building management or user can be notified the situation of the electrical equipment after working hour. Besides that, the system is low-cost and able to add another future application for further improvement for wide variety applications that related to this project environmental. In overall, the system architecture and the design of hardware and software of this project is discussed detail in this paper.

ABSTRAK

Dengan berkembangnya aplikasi teknologi tanpa wayar yang tiada sempadan, teknologi sensor tanpa wayar adalah merupakan salah satu cabang aplikasi yang berdaya maju. Di dalam projek ini, teknologi sensor tanpa wayar telah dibangunkan degan mengunakan kaedah penghantaran melalui *Wi-Fi* untuk menghantar *E-mail* sebagai notifikasi untuk penjimatan tenaga dan ia menggunakan perkakasan sumber terbuka *Raspberry Pi* sebagai 'kepala' untuk mengawal proses aliran projek ini. Litar pengesan suhu dan cahaya adalah untuk mengenalpasti keadaan tempat itu untuk kedua-dua alat elektrik iaitu lampu dan penghawa dingin sama ada sudah ditutup atau belum tutup dan menghantar maklumat itu melalu *E-mail*. Sistem ini juga memerlukan sambungan kepada internet kerana untuk menghantar *E-mail* dan *Rasppbery Pi* juga boleh mendapatkan sambungan internet melalu tanpa wayar atau pun wayar. Dengan pelaksanaan sistem ini, ia percaya bahawa terdapat kesan yang besar dalam menggurangkan penggunaan tenaga. Selain itu, system ini adalah perpatutan dan dapat menambahkan pelbagai lagi applikasi pada masa akan datang untung meningkatkan lagi kepelbagaian projek ini. Pada keseluruhanya, sistem seni bina dan reka bentuk perkakasan dan prisian projek ini akan dibincangkan dengan lebih terperinci dalam kertas kerja ini.

DEDICATIONS

I dedicate this work especially to my mother and father, who always supporting me from the beginning until now and for my beloved wife, who very understanding and my source for inspirations.

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LIST OF SYMBOLS AND ABBREVIATIONS

E-mail	=	Electronic Mail
FTK	=	Fakulti Teknologi Kejuteraan
Wi-Fi	=	Wireless Fidelity
AM	=	Amplitude Modulation
FM	=	Frequency Modulation
USB	=	Universal Serial Bus
HDMI	=	High Definition Multimedia Interface
ADC	=	Analog Digital Converter

CHAPTER 1
INTRODUCTION

1.0 Introduction

In this section, the project background such as problem statement, objectives and the scope of project will be discussed in detail before the project proceed to the development and implementation part.

1.1 Problem Statement

One of the major thing that contribute for increasing in electrical bill is due to electrical equipments such as lamps and air-conditioners not turn off after end of the working hour. In addition, there are no systematic system to monitor lamp and air-conditioners whether it already turn off or not and need a staff to go check that area to make sure it already turn off after working hour.

1.2 Objectives

The main objectives of this project are:

1. To study about the combination of the hardware and software that need to use for develop the system for alerting building management when lamps or air-conditioners not turn off after working hour on specific time.
2. To implement a system that use a Wi-Fi as a connection for internet and able to send a notify E-mail in this project automatically.

3. To facilitate and reduce time for in charge person to monitoring the condition lamps and air-conditioners.

1.3 Scope of Project

This system will implement on the office or building such as FTK building. For starting, the prototype will cover small area before can expand to more building section area. The building that needs to implement this project must have a internet connection that able to connect via wireless or wire for this system to functional. For the temperature sensor, there will be only one unit because the temperature surrounding area is exactly same. The problems that need to consider is light sensor because it needs many sensors for detecting the light for each room or partition of the building. Because of that, this project will start with one temperature sensor and one light sensor. After that, this project requires two different E-mail address for sender and receiver e-mail that who required to get notification on status of light and air-conditioners. This system will operate automatically from Monday to Friday at 7.30p.m.

1.4 Contributions of Research

The contribution regarding on this project are concern about the benefit of minimize as possible electrical usage and can decrease the electrical bill that need to pay. Indirectly, this system able to minimize time of building management staff to monitor the light and air-conditioners whether already turn off or no. The result from implement this system is the schedule notification of everyday is in systematic.

1.5 Project Summary

The study of this project is to create an innovative system that able to help in reducing electrical bill and reducing for the building management to monitoring the status of lamps and air-conditioners. In general, the development and implementation

of this project will consists of hardware and software, in term of hardware it need a microcontroller for control all the system, sensor that consists of two types condition and microcontroller that function as an analog to digital converter. All the explanation of this project will be explained detail in each chapter until chapter five.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

The research on literature review provides a well theory and various methods for start on a new project. It also contributes a new idea for implementing on the projects or it known as a scope of the project. The source for this literature review project is collect from article, journal, book and internet.

2.1 Wireless Fidelity, Wi-Fi

2.1.1 What is Wi-Fi

The very short version is that Wi-Fi is a way for wireless devices to communicate and it come from word wireless fidelity. Wi-Fi is the Wi-Fi Alliance's name for a wireless standard, or protocol, used for wireless communication. The Wi-Fi Alliance is a not-for-profit organization that certifies the interoperability of wireless devices built around the 802.00 standard. The goals of the Wi-Fi Alliance are to promote interoperability of devices based on 802.11, and presumably to promote and enhance the standard. For better or worse, this is no neutral organization. The members of the Wi-Fi Alliance are manufactures that build 802.11 devices. As of this writing, there are 205 companies that belong to the Wi-Fi Alliance and more than 900 products that have been certified as Wi-Fi interoperable. (Davis, 2004)

2.1.2 Wireless Spectrums

Unlike many other wireless standards, 802.11 run on "free" portions of the radio spectrum. This means that (unlike cell phone communications) no license is required to broadcast or communicate using 802.11 or Wi-Fi. The free portions of the radio spectrum used by Wi-Fi are the 2.4GHz band, and, more recently, the 5GHz band. Many house appliances such as microwave ovens and most significantly wireless telephone handsets also use these free spectrums. The Wi-Fi standard includes what is called a physical layer. This physical layer uses something known as Direct Sequence Spread Spectrum technology (DSSS) to prevent collisions and avoid interference between devices operating on the same spectrum. The idea is it do not want the signal coming out from microwave unit to interfere with email (or vice versa).

2.1.3 The Free Spectrums

Any signal that are sent wothout wires is called a radio transmission. A common example is that the radio in car receives transmissions or standard cell phone works by receiving and transmitting radio signals. Every device that broadcasts a radio transmission does, so at a particular frequency, which is the oscillations or movement from peak to through of the electromagnetic wave created by transmission. The entire set of radio frequencies is known as the radio spectrum. Contiguous portions of the radio spectrum are called bands, as in "the FM band". There are various frequencies in the radio spectrum that can be used for transmissions. This has inevitability lead to the potential for conflicts about usage, as well as attempts to dominate particular frequencies. The government has regulated the usage of most of these frequencies. In the United States, government regulation of radio frequencies is controlled by the Federal Communications Commissions (FCC). Some frequencies are reserved for particular usages, such as the military. Others, such as the AM and FM bands, are licensed. This means that only the licenses can use the frequency for the purpose it was licensed.

2.1.4 The Future of Wi-Fi

Wi-Fi is a disruptive technology that came unexpectedly and has been growing by leaps and bounds, mainly because it is inexpensive and fills a need. Originally, Wi-Fi was just a hack so that people could connect a notebook to a network via wireless using a spectrum that did not have to pay. No one expected it to grow so fast and widely used. The fact that it has spread like wildfire has caused many kinds of technology companies, from wireless cell phone providers to network hardware manufacturers to rethink their businesses. The growth of Wi-Fi has triggered all kinds of fun and useful developments and gizmos. As Wi-Fi grows up, it is getting better, more secure and faster. Clearly, vendors and the Wi-Fi Alliance have listened to users need for security and interoperability.

2.2 Others Application of Wi-Fi

2.2.1 Wi-Fi for Measuring

There are researches using Wi-Fi for measuring bus passenger load by monitoring Wi-Fi transmissions from mobile devices. The uneven loading of busses degrades passengers travel experience for a variety of reasons. Load balancing for busses requires information about the load, both the potential passenger load at the bus stop and the actual load currently aboard travelling busses. It measuring bus passenger loads by detecting the periodic network probing activity from Wi-Fi devices built into smart phones. Even though capturing and analysing the Wi-Fi packets might not be enough to extract the number of passengers, and may require enhancement of this method of detecting passengers. Combination with other wireless technologies, including GSM, Bluetooth, etc., may be required to augment in this method. (Oransirikul, Nishide, Piumarta, & Takada, 2014)

2.2.2 A Wi-Fi Coverage Based Location Verification System in LBS

With the growth of mobile devices, location-based services (LS) have penetrated into daily life in recent years. In an LBS system, the users check in at different venues to acquire reqrds such as virtual points or real-world coupons/discounts, and easily share with their friends the recent activities. While these rewards benefit benign users a lot, they are incentives for malicious users to cheat on their locations. Recent researches have revealed that location cheating can be launched automatically on a large scale at ease. In current practice, the defense against location cheating relies on the server side solution, which has been proven to be insufficient. Novel verification systems named WiLoVe were proposed. It maps the physical area of a venue to local Wi-Fi coverage and involves the venue owner as the verifier to verify the user's presence at the venue. It implements the verifier as an independent application, which can be easily installed on the venue owner's existing devices that able to connect to Wi-Fi. Hence, no additional hardware is needed. An adaptive algorithm is designed to defend against proxy attacks based on the check-in delay. Extensive experiments show that WiLoVe achieves low false rate, as well as consistent user experience, acceptable power consumption, and good applicability to different Wi-Fi environments. (Lin & He, 2014)

2.2.3 Wi-Fi Wireless Digital Sensor Matrix for Environmental Gas monitoring

It demonstrated an open access Wi-Fi wireless system for environmental gas monitoring based on different types of gas sensors with SPI digital output. Digital sensors matrix consists of four sensors with especially developed data exchange protocol for digital intellectual sensors (DIS) giving possibility to work with any type of sensors. System architecture has also an advantage "hot swap" of sensors. Visualization of gas concentrations received from the matrix is possible through any web application available on any mobile device (laptop, smart phone, etc.). (Samotaev, Ivanova, Oblov, Soloviev, & Vasiliev, 2014)

2.3 Raspberry Pi

The Raspberry Pi is a computer or minicomputer because it size very small than computer but it capable to do what a normal computer can do but with some limitation. In addition, Raspberry Pi offers an opportunity to do a lot more task than the others do (in term of microcontroller module). (Richardson & Wallace, 2012) Figure 2.1 shown the descriptions of the board.

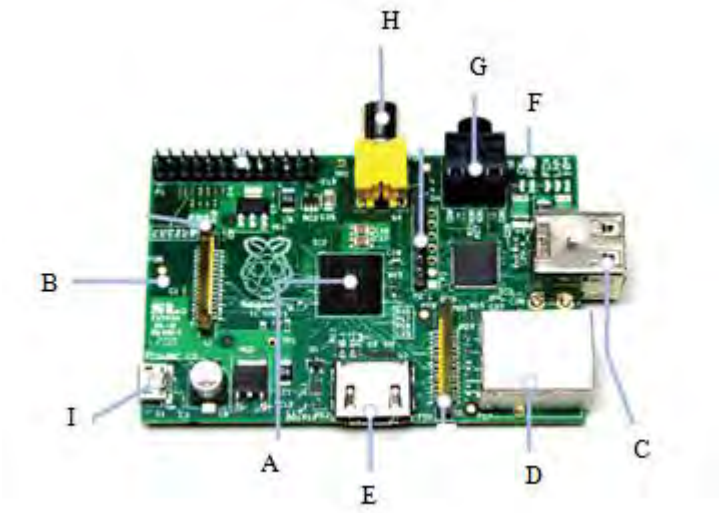

Figure 2.1: A parts of the board Raspberry Pi

a. The processor: This chip is a 32 bit. 700 MHz System on a Chip built on the ARM11 architecture. ARM chips come in a variety of architectures with different cores configured to provide different capabilities at different price points. The model B has 512MB of RAM and Model A has 256 MB.

b. The Secure Digital (SD) Card Slot: There is no hard drive on the Pi, everything is stored on SD Card.

c. The USB port: On the Model B there are two USB 2.0 ports and only one on the Model A. the original Pi board supported 100mA or so, but the revisions are up to the full USB 2.0 spec. One way to check the board is to see if there are two *polyfuses* limiting the current

d. Ethernet port: It has a standard RJ45 Ethernet port. Wi-Fi connectivity via a USB dongle is another option.

e. HDMI connector: The HDMI port provides digital video and audio output. 14 different video resolutions are supported, and the HDMI signal can be converted to DVI (used by many monitors), composite (analog video signal usually carried over a yellow RCA connector), or SCART (a Euro pean standard for connecting audio-visual equipment) with external adapters.

f. Status LEDs: The Pi has five indicator LEDs that provide visual feedback. (refer Table 3.1)

Table 2.1: The five status LEDS

ACT	Green	Lights when the SD card is accessed (marked OK on earlier boards)
PWR	Red	Hooked up to 3.3V power
FDX	Green	On if network adapter is full duplex
LNK	Green	Network activity light
100	Yellow	On if the network connection is 100Mbps (some early boards have a 10M misprint)

g. Analog Audio output: This is a standard 3.5mm mini analog audio jack, intended to drive high impedance loads (like amplified speakers). Headphones or unpowered speakers won't sound very good; in fact, as of this writing the quality of the analog output is much less than the HDMI audio output that get by connecting to a TV over HDMI.

h. Composite video out: This is a standard RCA-type jack that provides composite NTSC or PAL video signals. This video format is extremely low-resolution compared to HDMI

i. Power input: There is no power switch on the Pi. This microUSB connector is used to supply power. MicroUSB was selected because the connecter is cheap USB power suppliers are easy to find.