



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**A WEB BASED SYSTEM FOR CONTROLLING
HOME EQUIPMENTS**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Computer Engineering Technology (Computer Systems) (Hons.)

by

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This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor's Degree in Computer Engineering Technology (Computer Systems) (Hons.). The member of the supervisory is as follow:

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ABSTRAK

Trend semasa dalam bidang pengkomputeran telah membawa kita kepada dunia yang mempunyai pelbagai peranti komputer yang mudah diakses, dihubungkan antara satu sama lain dan turut jua kepada infrastruktur rangkaian yang semakin meningkat yang telah mewujudkan peluang-peluang baru dalam bidang Teknologi Maklumat. Trend ini juga membuktikan telah menjadi penyelesaian kepada kenaikan kos elektrik yang telah mengalami peningkatan geometrik di beberapa buah negara. Meninggalkan peralatan elektronik dan elektrik dirumah ketika kita keluar bekerja atau memulakan perjalanan yang jauh akan mengundang bahaya disamping meningkatkan jumlah penggunaan tenaga akibat pembaziran ini. Tujuan mengendalikan peralatan rumah melalui sistem berasaskan web ini adalah untuk mengawal peralatan rumah daripada titik kawalan pusat. Dalam penulisan ini, reka bentuk dan pelaksanaannya dalam kos yang rendah tetapi fleksibel kerana berasaskan web sistem automatik dimana boleh mengawal peralatan rumah seperti kipas dan lampu. Komunikasi diantara peralatan ini menggunakan medium komunikasi tanpa wayar. Peralatan ini dihubungkan kepada mesin server dan boleh dikawal melalui internet menggunakan pelayar web pada PC Dekstop atau komputer riba, dan pelayar web pada telefon mudah alih atau tablet. Antara muka aplikasi web ini dibangunkan bagi membolehkan pengguna untuk mengawal peralatan rumah secara langsung dan menghidupkan atau mematikan peralatan mengikut arahan yang diberi. Dalam erti kata lain, sistem ini membaca data daripada aplikasi web dan bertindak balas kepada peralatan mengikut data yang diterima. Sistem ini akan dilaksanakan dengan menggunakan mikroproses Arduino dan Perisai Arduino yang membentuk sisi pelayar sistem. Prototaip sistem juga turut dilaksana bagi projek ini.

ABSTRACT

The current trend in computing has launched us into a world of numerous, easily accessible computing devices connected to each other and to an increasingly ubiquitous network infrastructure which has created new opportunities in Information Technology. This trend has proven to be a solution to electricity costs which has experienced geometric increase in some countries. Leaving electronic devices on at home while away for work or when you embark on a trip has its inherent dangers, as well as rising energy consumption which amounts to waste. The aim of this home controlling equipment through web based systems is to control home from a central control point. In this paper, its design and implementation a low cost but yet flexible web based automation system which can control home equipments such as light and fan. The communication between this device is wireless. The appliances are connected to the server machine and can be controlled over the Internet using a web browser on a desktop PC, Laptop, and web browser on mobile phone or tablet. The developed web user interface allows the user to control home appliances directly and also they can check their status of appliances or directly switch ON and OFF the devices according to the user order. In other word, it reads the data from the web system and response to control the devices according to the data send by the user. The system will implemented using Arduino Uno microprocessor and Arduino Ethernet a which forms the server side of the system. A prototype of this system will be develop at the end of this project.

DEDICATION

Dedicated to my beloved,

Muhamad Zin bin Abdul Mutalib

Sarina binti Mohamad

Muhammad Hamizan bin Muhamad Zin

Nur Hazwani binti Muhamad Zin

Muhammad Haziq bin Muhamad Zin

Ahmad Nu'aim bin Zulkifli

For your infinite and unfading love, sacrifice, patience and encouragement besides
the understanding and cooperation.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

AC	-	Alternate Current
APIs	-	Programming Interfaces
CSMA/CD	-	Carrier Sense Multiple Access/Collision Detect
DTMF	-	Dual Tone Multi Frequency
FTDI	-	Future Technology Devices International
GSM	-	Global System for Mobile Communications
GUI	-	Graphical User Interface
GPRS	-	General Packet Radio Service
HTTP	-	Hypertext Transfer Protocol
EHS	-	European Home Systems (EHS)
HVAC	-	Heating, Ventilation and Air Conditioning
IBM	-	International Business Machines
IEEE	-	Institute of Electrical and Electronics Engineers
IC	-	Integrated Circuit
ICSP	-	In Circuit Serial Programming
JDS	-	Justice Digital Solutions
LAN	-	Local Area Network
POE	-	Power Over Ethernet
PC	-	Personal Computer
PCS	-	Powerline Carrier Systems
PLC	-	Power Line Communication
PWM	-	Pulse width Modulation
RF	-	Radio Frequency
UPB	-	Universal Powerline Bus
URL	-	Uniform Resource Locator
USB	-	Universal Serial Bus
WIFI	-	Wireless Fidelity
WWW	-	World Wide We

CHAPTER 1

INTRODUCTION

This chapter will discuss briefly the project flow from introduction, objectives and problems statement of project. Hence, followed by the scope of work and the description of the methodology. Each sub-topic relates each other in order to make the readers understand about the flow of the project.

1.1 Background

There has been an explosive growth in Internet for the last few years. Millions of computers are connected together and can exchange information, picture, data and other through World Wide Web (www) or global networking. The availability of connection through the web has introduced many new things, such as E-banking, Internet telephone, telemedicine, online conferences and virtual library reference. Nowadays web based control system is one of the popular control systems. Web based control means using web pages to control external devices or automation processes.

While home automation means the use of control systems and information technology to control equipment, industrial machinery and process or in other words, reducing the need for human intervention. Automation plays an increasingly important role in daily experience and global economy. Engineers strive to combine automated devices with mathematical and organizational tools to create complex systems for a rapidly expanding range of applications and human activities.

Many roles for humans in industrial processes presently lie beyond the scope of automation. Human-level pattern recognition, language recognition, and language production ability are well beyond the capabilities of modern mechanical and computer systems.

Sometimes, when going out or travel far away from home and suddenly remember that forget to switch OFF our television, air conditioner or when there are able to switch on our air conditioning system twenty minute before get to home on a hot afternoon. This is what home automation is about and there is no end to its application. Besides in fact, sophisticated home automation system are now being developed that can maintain an inventory of household items.

1.2 Problem Statement

The main problem bring up to develop such a project of smart home system because of our human being bad attitude itself. Lazy to turn ON or OFF home appliances are common problem among us besides forget to do it while in rushing situation or even while asleep. Percentage of wastage of high electricity is increasing year by year. A better smart home system is able to overcome or to be a solution for this serious problem. Next, older people are incapable to control home appliances by moving all over house especially if a double story house. Definitely they will suffer to control their home appliances if the house designed control the appliances by switches. This kind of problem can be solved by developing a system which the home appliances controlling by a web based application either through Personal Computer (PC) or web browser from the smart phone because smart phone is becoming a product where necessary and necessity nowadays to our daily life style due to the modern era. In future smart phone will use by everyone, not only for communication purpose but also for other important purpose thing.

1.3 Project Objective

The objective of this project are:

- a) To design and implement a system that will enable users to remotely control their home appliances or check their status, through the medium called Internet.
- b) To develop a web interface which user will be able to communicate with their home appliance such as fan, lamp, or television.
- c) To implement a low cost, reliable and scalable prototype of home automation system that can be used to remotely switch ON or OFF household appliance.

1.4 Project Scope

In order to achieve this objective of the project, several scopes has been outlined.

This project consist of hardware and software. The hardware will give an output to control the home equipment. The hardware consist of:

- a) The Arduino Ethernet Shield
- b) Arduino Uno
- c) Home controlling equipment box
- d) GSM Module

This project work is complete on its own in remotely and automatically switching ON and OFF of electrical appliance and only limited to household appliances. It sends a feedback message indicating the new present state of the appliance. It does not implement control of multiple appliances or automatic detection of faults in the controlled appliance.

1.5 Project Requirement

The requirement of this project are:

- a) The system cannot be operate if no WIFI or internet connection either inside or outside from home.
- b) Number of electrical appliances that can be controlled by this system is limited
- c) If appliances are disconnected from the main supply, they can no longer be controlled by the user and that part of the system would be rendered non-functional.

1.6 Project Constraints Consideration

The following is a list of constraint considerations:

- a) The controlled appliances will need an electrical control interface. This system is only capable of controlling electrical devices.
- b) The control module will need to be shielded against electrostatic discharges. This will increase the reliability of the system.
- c) Battery backup for controlling unit can be implemented in case of power disruption.

1.7 Thesis Outline

Web based system for controlling home equipment using Arduino technology's final thesis is a combination of 5 chapters overall that contains and elaborates specific topics such as the Introduction, Literature Review, Methodology, Result and Analysis, Conclusion.

- Chapter 1:** Introduction of the project. The explanation for the project will be given in a general term. The objectives of the project will be elaborated. It is followed by the explanation in the scope of project, objective doing this project and also the problem statements. Besides the project requirement.
- Chapter 2:** Literature review for the development of web based system for controlling home equipment. This chapter describes the literature review of the project elaborately. Explanation will be focused on web based system for controlling home equipment related researched and based on theory and conceptual ideas. Some literature reviews of current existing projects based on web based system for controlling home equipment are also be discussed here.
- Chapter 3:** Methodology of the project. This chapter discusses the full methodology of the overall project. Hardware architecture and software implementation of the project. This chapter discusses about the architecture of the project that consists the hardware design and the software implementation. Also the organization of the project.
- Chapter 4:** Result and Analysis. This chapter explains the result obtained regarding the performance of the system in general term and overall systems operation.
- Chapter 5:** Conclusion. Conclusion and further development or future recommendation that can be applied in this project are being discussed in this last chapter.

CHAPTER 2

LITERATURE REVIEW

In this chapter, there will be some discussion of the research background related to the project. The overall result in the concept literature framework shows that the link between research projects with the theory and concepts in the figure or an appropriate model about this project.

2.1 Home Automation

Home/office automation is the control of any or all electrical devices in our home or office, whether we are there or away. Home/office automation is one of the most exciting developments in technology for the home that has come along in decades. There are hundreds of products available today that allow us control over the devices automatically, either by remote control; or even by voice command. Home automation (also called domotics) is the residential extension of "building automation". It is automation of the home, housework or household activity. Home automation may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, and other systems, to provide improved convenience, comfort, energy efficiency and security. Disabled can provide increased quality of life for persons who might otherwise require caregivers or institutional care (Kaur 2010).

A home automation system integrates electrical devices in a house with each other. The techniques employed in home automation include those in building automation as well as the control of domestic activities, such as home entertainment systems, houseplant and yard watering, pet feeding, changing the ambiance "scenes" for different events (such as dinners or parties), and the use of domestic robots. Devices may be connected through a computer network to allow control by a personal computer, and may allow remote access from the internet.

Typically, a new home is outfitted for home automation during construction, due to the accessibility of the walls outlets, and storage rooms, and the ability to make design changes specifically to accommodate certain technologies. Wireless systems are commonly installed when outfitting a pre-existing house, as they reduce wiring changes. These communicate through the existing power wiring, radio, or infrared signals with a central controller. Network sockets maybe installed in every room like AC power receptacles. Although automated homes of the future have been staple exhibits for World's Fairs and popular backgrounds in science fiction, complexity, competition between vendors, multiple incompatible standards and the resulting expense have limited the penetration of home automation to homes of the wealthy or ambitious hobbyists



Figure 2.1: Example of Smart Home Technology Automation (Mohamaed 2011)

2.2 Home Automation Standard

For home automation systems there are many established industry standards and are implemented over the various carrier modes ranging from powerline standard to wireless standard. The major standards and popular are INSTEON, European Home Systems (EHS), ZigBee, KNX, X10 and Universal Powerline Bus (UPB). For this project, X10 standard is chosen to be implemented in this home controlling equipment.

2.2.1 X10 Standard

X10 is an international and open industry standard for communication among electronic devices used for home automation. It primarily uses power line wiring for signaling and control, where here the signals involve brief radio frequency burst representing digital information.

X10 is an early home automation technology that was developed by Pico electronics of Glenrothes in Scotland back in 1975. X10 is an open protocol for communication among home automation devices that primarily uses mains wiring for signaling and control. It allows compatible products to talk to each other using the existing wiring in the home. Most X10 compatible products are very affordable and the fact that they talk over existing wires in home means that no rewiring is required. It is very simple, a transmitter plugs in at one location in the home and sends its control signal to a receiver which plugs into another location in the home. X10 wired or wireless protocol packets consist of a four bit House code followed by one or more four bit Unit codes and then a four bit Command Different House code often need to be used within the same home to generate enough distinct X10 addresses and so they are usually not available to help distinguish one X10 house installation from a neighbouring one. Smart Home products together with X10 are Leviten, Stanley, IBM, JDS, ACT, Homepro and others. (Shukla and Yadav 2013)

The Home Automation field is expanding rapidly as electronic technologies converge. The home network encompasses communications, entertainment, security, convenience, and information systems. Powerline Carrier Systems (PCS) is a technology which is used to send coded signals along a home's existing electric wiring to programmable switches, or outlets. These signals convey commands that correspond to "addresses" or locations of specific devices, and that control how and when those devices operate. A PCS transmitter, for instance, can send a signal along a home's wiring, and a receiver plugged into any electric outlet in the home could receive that signal and operate the appliance to which it is attached. X10 is a common protocol for PCS, it is a signaling technique for remotely controlling any device plugged into an electrical power line. X10 signals, which involve short radio frequency (RF) bursts that represent digital information, enable communication between transmitters and receivers. In Europe, technology to equip homes with smart devices centers on development of the European Installation Bus, or Instabus. This embedded control protocol for digital communication between smart devices consists of a two-wire bus line that is installed along with normal electrical wiring. The Instabus line links all appliances to a decentralized communication system and functions like a telephone line over which appliances can be controlled. The European Installation Bus Association is part of Konnex, an association that aims to standardize home and building networks in Europe (Robles and Kim 2010).