WIRELESS HOME ELECTRICAL APPLIANCES MONITORING AND CONTROL USING ANDROID MOBILE APPLICATION

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To both of my paradise companion, mom and dad.

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ABSTRACT

The aim of this project is to design an Android application based on wireless home automation system. The concept of smart home is an emerging issue to the modern technology dependent society. Remote control technologies are widely used to control household electronic appliances without walking up to them. The open-source hardware development Arduino has been growing up in recent years. Arduino platform has good specifications, cheap, easy to use and wide varieties of shields may emerge with many different purposes. This project is divided into two main parts which are the parent and child node. Arduino Uno microcontroller and Ethernet Shield are used to implement the parent node design. In addition, parent node is the home server which establishes the wireless communication between the smartphone with child nodes of the system. Meanwhile the child node is designed based on Arduino Uno connected through Ethernet and prototype LEDs to indicate home appliances. Next, the parent node will send an instruction to establish wireless communication between android phone and the parent node. This android application is designed to offer a user friendly graphical user interface (GUI) for remotely controlling home appliances through web server via Android anywhere or everywhere around the world. An application that automatically enable the controller to take any further action such as to switch ON and OFF the home appliances such as light, air-conditioner, and fan are one of the most desirable nowadays. MIT App Inventor 2 software was utilized to accomplish the integration of android application and Arduino IDE is used to widely integrate the whole system including home server using Local Internet Protocol written in HTML language. Upon controlling appliances, notification status which indicates the received instruction are automatically acknowledge user upon current status of the devices. The prototype has been successfully developed and it could provide an effective mechanism in utilizing controllable wireless home appliances onto everyone's smartphone

ABSTRAK

Tujuan projek ini adalah untuk merekabentuk aplikasi Android berdasarkan sistem automasi rumah. Konsep rumah pintar merupakan satu isu baru kepada masyarakat moden. Pembangunan perkakasan sumber terbuka Arduino telah meningkat naik sejak kebelakangan ini. Platform Arduino mempunyai spesifikasi yang baik, murah, dan mudah untuk digunakan. Projek ini dibahagikan kepada dua bahagian utama iaitu ibu bapa dan anak nod. Arduino Uno pengawal mikro dan Ethernet Shield digunakan untuk melaksanakan reka bentuk nod induk. Di samping itu, nod induk adalah pelayan rumah yang menetapkan komunikasi wayarles antara telefon pintar dengan nod anak sistem. Sementara itu sub-nod itu direka berdasarkan Arduino Uno disambungkan melalui Ethernet dan prototaip LED untuk menunjukkan peralatan rumah. Seterusnya, nod induk akan menghantar arahan untuk mewujudkan komunikasi wayarles antara telefon android dan nod induk. Aplikasi android direka untuk menawarkan pengguna antara muka pengguna grafik (GUI) dari jarak jauh demi mengawal peralatan rumah melalui pelayan web melalui Android. MIT App perisian Inventor 2 telah digunakan untuk mencapai aplikasi android dan Arduino IDE digunakan untuk mengintegrasikan secara meluas seluruh sistem termasuk menggunakan Protokol Internet Tempatan ditulis dalam bahasa HTML. Apabila mengawal peralatan, status pemberitahuan yang menunjukkan arahan yang diterima secara automatik memberi respon terhadap pengguna. Prototaip ini telah berjaya dibangunkan dan berkesan dalam menggunakan dikawal peralatan rumah tanpa wayar ke telefon pintar.

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LIST OF ABBREVIATIONS

APP	Application
GUI	Graphical User Interface
IDE	Integrated Development Environment
AVD	Android Virtual Devices
SDK	Software Development Kit

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CHAPTER I

INTRODUCTION

1.1   Project Introduction

Today we are living in twenty-one century where automation playing an important role in a human life. Home automation allows us to control household appliances trough a medium to be a controlling device. The new technology and integrated appear with perception and intelligence has changed for future development of the information technology from online things. The development of Internet of Things also created a new concept and wide development space for the intelligent household.

Home automation is automation of home, housework, or household activity which may include centralized control of lighting systems, to provide improved convenience, comfort, energy efficiency, and security. The concept has been around for a long time and products have been on the market for decades, though no one solution has broken through to the mainstream yet. It gives a lot of advantages to people especially the older and disabled person

which brings giving them to control and monitor their home appliances. On the other hand, the communication of home automation system can be categorized into two medium which are wireless or wired communication. The difference between wireless and wired home automation system is the home appliances are linked wirelessly to a host or central controller. Home appliances are physically linked to a server or central controller if the medium use wired as communication. To get rid of wired communication among devices, wireless technology had been applied in home automation. GSM based, web based, Zigbee based home automation had been implemented as the latest technologies used in smart home [1].

The emerging advancement in wireless and ubiquitous technology offers a unique opportunity to create pervasive environment and applications to support people in need. Smart home is conceived as one strategy to provide a level of independence at homes and improve their quality of life.

Smartphone runs a complete operating system and provides a platform for application developers and users. In science fiction, Google Android is considered as a robot with a human appearance. A study also found that, 75% of Android Smartphone market share and a total 136 million Android phones were sold in the third quarter of 2012 [2]. Android has become the top mobile gadget operating system in the market today and the Android phone has become the most popular and commonly used OS by society. To take an advantage of these technologies, developing a controlling household appliance by using a smartphone would be considered best. A comparative study is done on different operating system available and software use for developing such a system.

To be capable of utilizing the technology available currently, there will be a need to design a product using this technology that will be beneficial to the lives of others. This action is considered as a huge contribution to the community [3]. In 2013, R. Piyare [4], Android based smart phone used with the home monitoring and control system. This system depend an embedded

micro-web server, with IP connectivity for accessing and controlling devices and appliances remotely.

1.2 Problem Statement

People need a work that can remotely be completed on its own by automatically switching on and off of any electrical appliances by a smartphone. Home automation offers many benefits from efficient use of energy to increase ease and innovative lifestyle. Despite these attractions and benefits, home automation has not yet received an acceptance and attention. Home automation is adopted for reasons of ease, security and energy efficiency. There is someone in every household who always forget to turn off the lights before bed. But rather than squabbling over it, families will soon have a simple solution yet affordable to control their energy consumption right onto their palm.

1.3 Objectives

To make sure this project work as planned, a few objectives were determined where these objectives will be followed as a guide through the whole completion process of this project in order to achieve the desired output. These objectives were provided by sequence of project from beginning until the end of project. A detailed explanation for each objective will be discussed as such develop a smart home system application using a smartphone, to design a smart system that allows control characteristics and finally to configure a running status and processes by a personal computer.

1.4 Scope of the project

As to ensure the completion of project achieves the stated objectives, the project shall be completed within a time given to accomplish the design a

smartphone android application using MIT App Inventor 2, implementation of hardware Arduino Uno and Ethernet shield while use an Internet Protocol to send a data to PC (webserver) through wireless communication to send a notification status as per user controlling the desired appliances.

1.5   Thesis Outline

The report structure is the detail of secret ingredients that is divided into several chapters. In this report, there are five chapters altogether which every part has been segmented equally depending upon its functionality like introduction, literature review, and methodology, results and discussion, and conclusion chapters.

Firstly, introduction chapter shall be prioritised first. The introduction chapter will cover briefly about the background and overview of this project. This chapter briefly discuss about the overview of the project such as introduction, objectives, problem statement and scope of the project.

Following that, second chapter contains the literature review or research on how to obtain information about the project. In order to get the information which is related, there will have many resources can gained from an Internet, journals, books and etc. Those figures describes about the research and information about the project. Every facts and information which found through journals of other references will be compared and the best methods have been chosen.

In chapter three, it mainly focuses on the methodology of the way the project is carried out. Steps, methods and processes of the experiment by referencing to a guided Gantt chart, schedules of a project will be discuss and it shall contribute to a successful thesis.

In chapter four, all the results and project findings such as result and analysis of a desired outcome is recorded. The result is well-presented by tables and figures in order to summarized the result part. Based on the outcome of all result, it then will be briefly discussed and included here.

Chapter five is the conclusion of the paper; this chapter will conclude the whole procedures of the project that including project finding, achievement analysis and conclusion of the research implementation that had been used.

Lastly, by compile all listed five chapters above will produced a proper full report of Projek Sarjana Muda on a fixed rule provided by UTeM.

1.6   Gantt Chart

The purpose of Gantt chart is to provide a graphical illustration of schedules that can be used as a guidance of planning, coordinating, and track specific tasks during this project implementation so that the project can be done according to time estimation.

Aktiviti Projek / Project Activities	SEM I (1–19)	SEM BREAK (20–24)	SEM II (1–16)
1. Proposal Planning	1–2		
2. Proposal Preparation	2–4		
3. Literature Review	4–6		
4. Study of software needed	5–7		
5. Study the coding involve	8–19	20–24	1–13
6. Software Simulation	8–19	20–24	1–13
7. Software Development		20–24	1–13
8. Software Testing		22–24	1–13
9. Thesis Preparation and Presentation		20–24	1–13

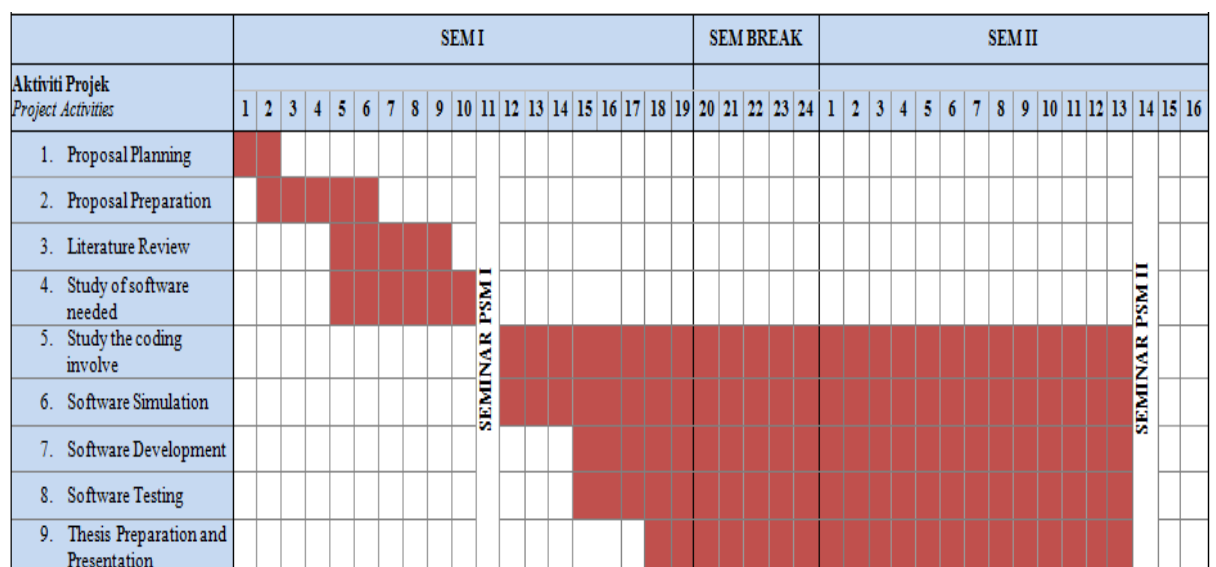*(SEMINAR PSM I at week 19; SEMINAR PSM II at weeks 14–16 of SEM II)*

Figure 1.0 Gantt chart of PSM

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

This chapter discuss about reviews of existing project created to get an idea about the project design, conception and any information that related to improve the projects. With different concept and design, there are other creations and innovations of projects done by other people.

2.2   History and developing era of Android

The idea of developing a smart home has begun since early of 20th century. In 1915 to 1920, the emergence of electrical home appliance began;

domestic servants meant the household needed cheap and mechanical replacement [5]. In 1960, the first "wired home" was built by American hobbyist. After microcontroller has been invented, a lot of work has been done to develop the Smart Home system. During 1990, Smart Home system has been developed based on the merging of telematics and communication system "The Internet". Since 1990, The Internet technology and Smart Home system was tied strongly. The concept of the "Internet of Things" enhances Smart Home system tremendously. Recently, Smart Home system has reached another level of intelligence by way wireless communication. The low cost characteristic of Wireless Sensor Network, often abbreviated as WSN, it can extend the network that has been applied to the Smart Home system. By using WSN, problem with messy wires and the difficulty of setting up can be avoided. Besides that, the usefulness and simplicity of Smartphone also can be applied to Smart Home system as an attractive user interface to control appliances remotely using Android application. All of the controlling tasks are done through a microprocessor, for example Arduino, which enables the communication and upon receiving some commands controls the different systems in the house. Finally, the commands to control the appliances in the house are sent by a central control unit such as computer and smartphone (Android).

In 2013, J. Bangali [7], depended on wireless sensor network to present the design and implementation of a smart home system. In April 2014, M. Nikose [8], proposed a system deals with remote control system of smart appliances based on Zigbee wireless sensor network.

2.3   Background theory

The system consists of two units: the mobile station and the microcontroller unit with the Ethernet module, and the light system. Arduino Uno Board is used as the microcontroller board. The mobile phone is used as