



**Faculty of Electrical and Electronic Engineering Technology**



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**Bachelor of Electronics Engineering Technology (Telecommunications) with Honours**

**2022**

**DEVELOPMENT OF HOME APPLIANCES CONTROL SYSTEM USING  
MICROCONTROLLER FOR SMART HOME**

**NIK ADLI BIN NIK A'SRY**

**A project report submitted  
in partial fulfillment of the requirements for the degree of  
Bachelor of Electronics Engineering Technology (Telecommunications) with Honours**



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2022**

**BORANG PENGESAHAN STATUS LAPORAN  
PROJEK SARJANA MUDA II**

Tajuk Projek : DEVELOPMENT OF HOME APPLIANCES CONTROL SYSTEM USING  
MICROCONTROLLER FOR SMART HOME

Sesi Pengajian : 2022/2023

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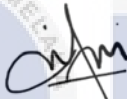
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I declare that this project report entitled “DEVELOPMENT OF HOME APPLIANCES CONTROL SYSTEM USING MICROCONTROLLER FOR SMART HOME” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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## APPROVAL

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 Electronics Engineering Technology (Telecommunications) with Honours.

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## DEDICATION

*To my beloved mother, ROHANI BINTI MOKHTAR, and father, NIK A'SRY BIN NIK MAN*

*and*

*To my family members.*



## ABSTRACT

A smart home is equipped with technology that allows smart gadgets to communicate with one another and gives users more control over their house. As a result of recent technological advancements, numerous devices can now link to one another using wireless control settings like Bluetooth and Wi-Fi through microcontroller. This project is carried out to develop a system that utilises the ESP8266 WiFi module as a microcontroller and various sensors to identify home appliances. It focuses primarily on the development of an IOT-based household appliances control system that can be automatically programmed based on user's preferences or be able to be managed via the internet. The ESP8266 WiFi module is used to send data to web servers and applications. In this project, a software for smart control is developed that can be automated while requiring minimal amount of human involvement, protecting the integrity of all the electrical appliances in the house. The technology also alerts the user to the quantity of electricity that is being used by displaying the data on the website that is linked to the system. In conclusion, the wireless system for controlling household appliances has been successfully developed, and can be monitored via a web browser or website.

## ***ABSTRAK***

Rumah pintar dilengkapi dengan teknologi yang membolehkan alat pintar berkomunikasi antara satu sama lain dan memberikan pengguna lebih kawalan ke atas rumah mereka. Hasil daripada kemajuan teknologi terkini, banyak peranti kini boleh berkomunikasi antara satu sama lain menggunakan tetapan kawalan wayarles seperti Bluetooth dan Wi-Fi melalui mikropengawal. Projek ini dijalankan untuk membangunkan sistem yang menggunakan modul WiFi ESP8266 sebagai mikropengawal dan pelbagai sensor untuk mengenal pasti peralatan rumah. Ia memberi tumpuan terutamanya kepada pembangunan sistem kawalan perkakas rumah berasaskan IOT yang boleh diprogramkan secara automatik berdasarkan pilihan pengguna atau boleh diuruskan melalui internet. Modul WiFi ESP8266 digunakan untuk menghantar data ke pelayan web dan aplikasi. Dalam projek ini, perisian untuk kawalan pintar telah dibangunkan yang boleh diautomasikan sambil memerlukan jumlah minimum penglibatan manusia, melindungi integriti semua peralatan elektrik di dalam rumah. Teknologi ini juga memberi amaran kepada pengguna tentang kuantiti elektrik yang sedang digunakan dengan memaparkan data di laman web yang dipautkan ke sistem. Kesimpulannya, sistem wayarles untuk mengawal perkakas rumah telah berjaya dibangunkan, dan boleh dipantau melalui pelayan web atau laman web.



## ACKNOWLEDGEMENTS

Assalamualaikum and Peace Be Upon You. First and foremost, I would like to take this opportunity to express my grateful to Allah S.W.T because gave me a good health to finish up my final year project. I also would like to express my gratitude to my supervisor, DR. NOR AZLAN BIN MOHD ARIS for their precious guidance, words of wisdom and patient throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) for both of my parent for the financial support, which enables me to accomplish the project. Not forgetting my fellow colleague, BEET Cohort 9 S2/1 for the willingness of sharing his thoughts and ideas regarding the project.

My highest appreciation goes to my parents, and family members for their love and prayer during the period of my study. An honourable mention also goes to DR. NOR AZLAN BIN MOHD ARIS for all the motivation and understanding.

Finally, I would like to thank all the staffs at the FTKEE, fellow colleagues and classmates, the Faculty members, as well as other individuals who are not listed here for being co-operative and helpful.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

The Internet of Things, or IoT, is the collective term for the billions of physical objects that are now linked to the internet and actively collecting and exchanging data. This smart home control system brings the IoT system to easily user control the home appliances wireless even far from home. Smartphone, laptop, tablet and other that has been connected to the internet can be used by users to control their own home equipment.

The internet of things (IoT) can make physical manufacturing and distribution as efficient as the internet has long made information work. Hundreds of millions, if not billions, of embedded internet-enabled sensors throughout the world offer an incredibly rich set of data that organisations can use to track assets, automate processes, and collect information about the safety of their operations. Researchers can use the IoT to gather information on people's preferences and behaviours, but doing so carries significant privacy and security risks.

A smart home is one that has technology that enables communication between smart devices and provides you more control over your home. Recent developments in technology have made it possible to use wireless control settings like Bluetooth and Wi-Fi, enabling various devices to connect with one another. The Arduino board can be connected to the computer wirelessly by using a WIFI shield as a Micro web server, which reduces costs and enables the Arduino to work independently[1]. A wireless router or hotspot is required for the Wi-Fi shield since it acts as the gateway for the Arduino to connect to the internet. In

order to control and monitor household appliances remotely, a web-based home automation system is being developed.

## **1.2 Problem Statement**

In the present era, very rapid and sophisticated technological change is always a conversation. The topic that is always discussed when new devices are released in the market is how long they last, how good they are. However, in doing research on something new, there are some problems that need to be faced. This problem is not only faced by individuals but also faced by large organizations in problem solving. Home appliances control system is not something usual in this country but there are some issues that arise in doing reforms. One of them is the selection of suitable equipment according to specifications. It also needs to be compatible with other equipment in order to function properly.

The smart home project this time will make it easier for users to control and status a device at home that can be controlled anywhere. The problem that existed before the project was thought of was the excessive consumption of electricity so that the bill soared and in turn made it difficult to make payments. The project is very efficient as it helps calculate automatically and display the total electricity bill over time. In addition, to facilitate one's daily work, the control of this home appliance is only at your fingertips where it can be controlled through the respective devices.

## **1.3 Project Objective**

- 1) To develop a system that can control home appliances using microcontroller.
- 2) To display the status of the home appliances on website.
- 3) To display information of electricity's power consumption information (Ampere).



## 1.4 Scope of Project

The scope of this project is to develop a home appliances control system that control and monitoring an appliance, send information and store in the webpage. The webpage platform system can display the current electricity consumption in watts in real-time. This system consists of a microcontroller (NodeMcu) as the brain of the system and as a medium of transmitting the information through wireless network. The sensor that uses in this system is ACS712 current sensor to measure the energy of LED and Dc Motor that act as Lamp and fan home appliances.



## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction Home appliances control system

Today, upgraded service especially in internet sector cause all information is easily to search. The technology of IoT will facilitate the collection and exchange of data through the cloud. Therefore, such ideas are used for community work that will facilitate human daily routines. In home automation, there are some appliances that connect and control through phone such as fan, lamp, refrigerator and other. To achieve it, a sensor is need to respond with all appliances. A sensor is a device that monitors and responds to environmental input.

Home appliances control system (HACS) is appliances which can control over internet. Using Internet of Things(IOT) the all appliances can manage through devices which phone, laptop, tab and other. IoT technology can also be used to construct a new idea and a large development zone for smart homes in order to achieve intelligence, comfort, and improve people's lives[1]. In order to operate household appliances like lights, fans, air conditioners, room heaters, televisions, refrigerators, dishwashing machines, and others, simple Arduino software with a sensor is required[3]. This is accomplished by combining microcontroller-based device such as the Arduino UNO with sensor like accelerometer, magnetic and flame sensor. The readings from the sensor affect the state of our appliances, which can then be viewed on the cloud platform.

We know, the main key in the success of a smart home is IoT, but we should also look at how to manage home appliances by saving electricity to reduce costs. The characteristic of smart home not just viewing at the system, but also seeing how it may

minimize electricity waste. Energy saving in smart home is wattage reduce to avoid the waste of electricity in our house. A smart home can be created utilising simulation software as a scheduling system and end-user application interface for tracking and managing energy usage in the house using user-controlled hourly energy-usage schedules. The outcome shown that energy waste can be avoided by organizing, monitoring, and controlling daily power consumption[4].

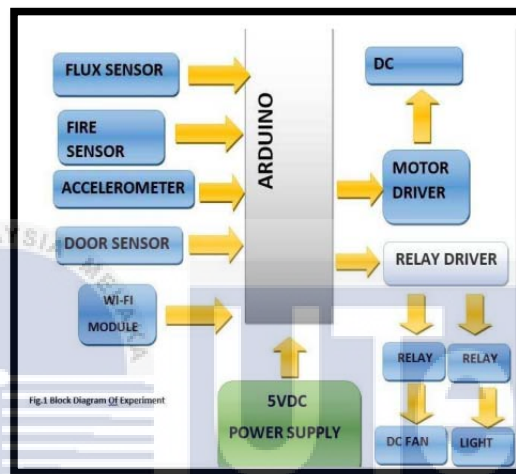


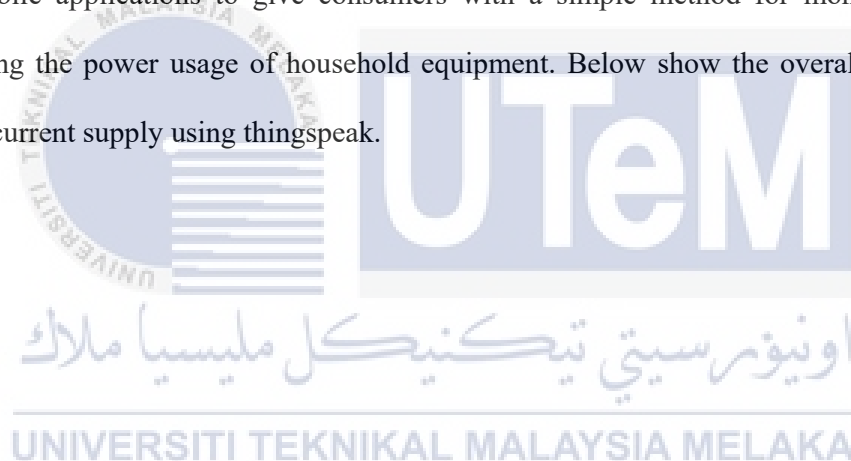
Figure 2.1: Block Diagram Of System[5]

## 2.2 Smart Electricity Monitoring and Control system

Smart electricity is measure the energy use in home like television, washing machine, refrigerator, and other home appliances. Energy use is efficient maintains a balance between supply and demand. Waste of energy can lead to an increase in financial capital, environmental quality and human comfort. Therefore, the government advises consumers to manage their electricity consumption well. As such, this paper will explore the widespread application of the Internet of Things (IoT) to achieve energy efficiency[6]. To control and monitoring the data, the home devices need connect with the network. This project is attaches the IoT in order to control or remotely by mobile devices. The sensor will have embedded

with home appliances so that the sensor can send the data on microcontroller and lastly control the appliances through mobile. On the mobile application, the statistic of power consumption will display in detail which are voltage, current, power and so on. When the circuit detect the overloading through application the alarm will triggers.

A smart monitoring and control system (SMACS) is a system that uses hardware and the Internet of Things to monitor household appliance power use (IoT)[2]. It features an Arduino Uno, LCD, ACS712 current sensor module, relays, and AC sources. Then, thingspeak is used to store the data in cloud storage. A mobile application (Virtuino) also has access to the data and uses graphical and numerical displays to visualise it. This study uses mobile applications to give consumers with a simple method for monitoring and controlling the power usage of household equipment. Below show the overall system of reading current supply using thingspeak.



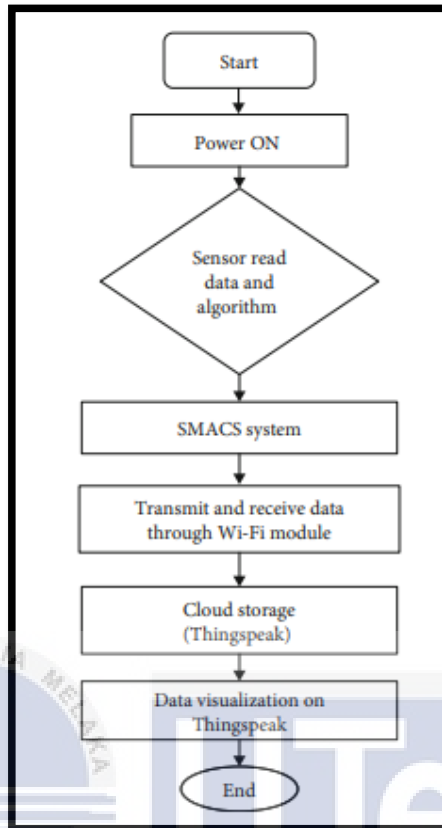


Figure 2.2: The flowchart of SMACS system[2]

## 2.3 System Implementation in Smart home

Smart home control system uses many ways in order the home appliances can be controlled and monitor wirelessly. There have two implementations to making smart home which are using Bluetooth and using Wi-Fi.

### 2.3.1 Smart Home System Using Bluetooth

Automation has made rapid advancements during the past ten years. One of the latest developments in smart home technology is the ability to control a variety of household appliances, such as lights, fans, air conditioners, heaters, televisions, refrigerators,

dishwashing machines, and others. To establish a Smart Home, we used Bluetooth and an Android smartphone.

The Arduino Uno, Bluetooth module, Power supply, Relay module, and Android application on the smartphone are the system's primary components. This smart home system work by turn ON the Bluetooth controller in smart phone. Bluetooth controller is application to pairing the smart phone with Bluetooth HC-05 module.[3] After pairing, configure unique keys for each appliance in the app. After that one layout will appear on screen of smart phone which is many button that can turn On and Off. Overall appliance now can turn On or Off. Best feature is the other appliances can control even some appliances is turn on.

This smart home system using Arduino as brain to control appliances via Bluetooth device. Its bring benefit for user because of user friendly. Next, the system implements the LDR to control the street light operation for energy efficiency. Lastly, it simplifies the procedures involved in switching using the conventional technique to save time and extend the life of the switch.

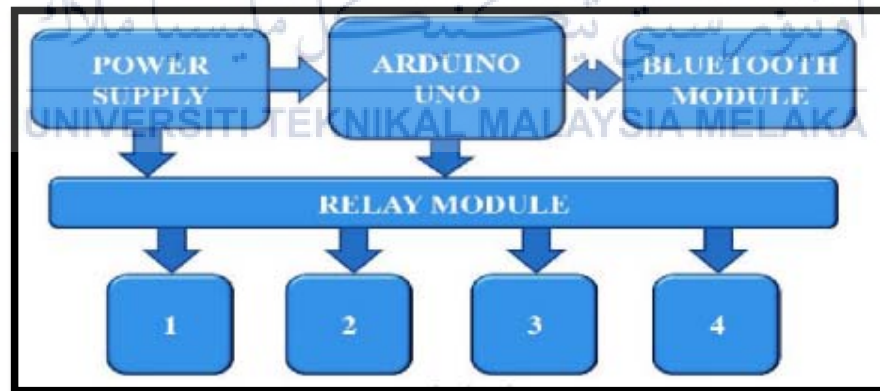


Figure 2.3: Block Diagram of using Bluetooth system[3]

### 2.3.2 Smart Home System Using Wi-Fi module

The internet of things (IoT) is the system that can control or monitor through internet connection. IoT's system is important in industry for this era because it can manage the equipment through wireless network. Apart from factory use, The internet of things (IoT) is also used for private purposes such as to control the home appliances. The Internet of Things (IoT) is the network of physical objects like furniture, machinery, cars, and buildings that are equipped with electronics, software, sensors, actuators, and network connections to facilitate data gathering and exchange. (5). Depending on what needs to be controlled, the control system is a system that has the ability to control other entities. In the control application, both local and remote control are available. The challenge of smart home system is the protocol to transfer the data. WebSocket protocol has lower average latency than both HTTP and lengthy polling. For Internet of Things applications, it is highly advised to use the protocols CoAP, MQTT, XMPP, RESTFUL, AMQP, and WebSocket.[7]

Users can manage their energy more effectively and efficiently with the use of control systems. The current in this experiment is managed by the control system, and it will be stopped if an overcurrent is discovered. The use of household appliances can be made more conscious among users due to this control system. Relay is utilised in the portion of the control system where it serves as protection by cutting off and delaying the current when an overcurrent situation arises. To run the IoT with smart home system, the open source IOT platform with the lowest cost is the ESP8266 Wifi module. This device is important to control appliances through web server and mobile application.

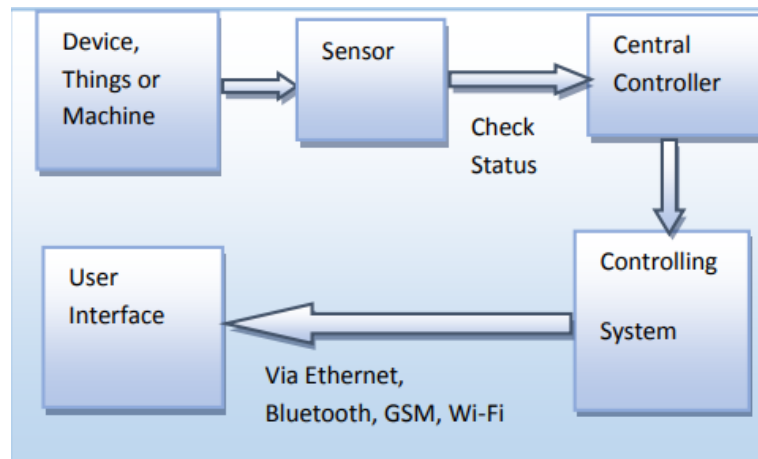

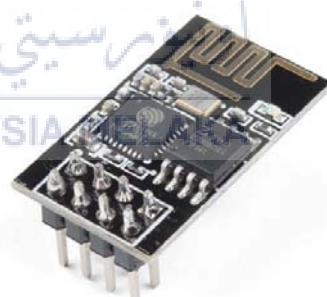


Figure 2.4: Basic Block Diagram of using Wifi connection[8]

### 2.3.3 Comparison Bluetooth Module And Wifi Module

Table 2.1: Comparison Bluetooth and Wifi Module

	Bluetooth Module	Wifi module
<b>Brand name</b>	 HC-05	 ESP8266
<b>Range (m)</b>	40m - 400m	46m - 1000m
<b>Security protocol</b>	None	WEP, WPA, WPA2, and WPA3
<b>Power Consumption</b>	Less power	High power