UNIVERSITI TEKNIKAL MALAYSIA MELAKA

WIRELESS CONTROL HOME APPLIANCES SYSTEM

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

by

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ABSTRAK

Laporan ini menerangkan Sistem Peralatan Rumah Kawalan Tanpa Wayar, yang mampu mengawal peralatan rumah dari mana tempat dengan liputan Wi-Fi. Isu aplikasi ini adalah untuk mengawal peralatan dari jarak yang terhad. Selain itu, isu lain adalah kebocoran gas dan penggunaan elektrik yang tinggi tidak termasuk di pasaran. Projek ini adalah untuk membangunkan prototaip untuk sistem kawalan rumah tanpa wayar, untuk mengawal dan memantau sistem menggunakan aplikasi Blynk melalui pelayan Blynk. Tambahan pula, untuk menganalisis dan menilai keseluruhan sistem. Ia adalah praktikal untuk mengawal peranti dari jarak yang jauh dengan menggunakan Aplikasi Blynk melalui pelayan Blynk. Projek ini menggunakan modul NodeMCU ESP8266 ditambah dengan Arduino Uno untuk menghantar atau menerima data signal antara pelanggan dan peranti. Ia boleh berkomunikasi dan menghubungkan melalui pelayan Blynk, dan menghantar isyarat elektrik ke relay 4-channel untuk mengawal peranti output, Normally-Open (NO) atau Normally-Closed (NC). Selain itu, projek ini telah menambah dua litar, iaitu pengesan kebocoran gas dan meter tenaga elektrik IoT. Dua litar ini digunakan untuk meningkatkan prestasi sistem serta untuk tujuan keselamatan. Litar tersebut yang terdiri daripada peralatan rumah kawalan wayarles, pengesan kebocoran gas, dan meter tenaga elektrik IoT mampu meningkatkan aplikasi projek dari segi keselamatan, mengawal peranti rumah dari mana sahaja dengan sambungan internet, dan mengawal penggunaan tenaga yang berlebihan. Sistem berfungsi dengan cekap, dan semua tugas dilakukan dengan jayanya sesuai dengan pengkodean tanpa kesalahan yang dikumpulkan dan dimuat naik dengan menggunakan perisian IDE Arduino.

ABSTRACT

This report describes a Wireless Control Home Appliances System, capable of controlling home appliances from anywhere or any place with a Wi-Fi coverage. The leading issue of this application is the distance to control the appliances is restricted. Moreover, other issues are gas leakage and high electricity consumption is not included in most home appliances on the market. This project is to develop prototype for wireless control home appliances system, to control and monitor the system using Blynk app via Blynk server. Furthermore, to analyze and evaluate the whole system. It is practical to control devices remotely by using the Blynk app through the Blynk server. This project utilized NodeMCU ESP8266 module coupled with Arduino Uno to transmit or receive data between the client and the devices. It can communicate and link through the Blynk server, and send the electrical signal to a 4-channel relay to control the output devices, Normally-Open (NO) or Normally-Closed (NC). Besides, this project has added two circuits, namely a gas leakage detector and an IoT electricity energy meter. Both circuits were used to improve the performance of the system as well as for safety purposes. The system worked efficiently, and all tasks were performed successfully in accordance with the coding without errors that were compiled and uploaded using the Arduino IDE software.

DEDICATION

Specially devote my beloved relatives, siblings and my colleagues to support and encourage me to finish this project. Not forget to my supervisor, Dr. Syed Najib Bin Syed Salim who have gave me a lot of advice and guidance during this project until successfully. Thank you very much to all of you.

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LIST OF SYMBOLS

M	-	**Mega**
Hz	-	**Hertz**
K	-	**Kilo**
Bps	-	**Basis Points**
s	-	**second**
V	-	**Voltage**

LIST OF ABBREVIATIONS

IoT	Internet of Things
SMS	Short Message Service
MQTT	Message Queuing Telemetry Transport
AC	Alternating Current
PC	Personal Computer
Wi-Fi	Wireless Fidelity
TCP	Transmission Control Protocol
IP	Internet Protocol
iOS	iPhone OS/mobile operating system
DPCM	Differential Pulse Code Modulation
LED	Light-emitting Diode
DTMF	Dual Tone Multi Frequency
Arduino IDE	Arduino Integrated Development Environment
LPWAN	Low Power Wide Area Network
UNB	Ultra Narrow Band
6loWPAN	IPv6 over Low-Power Wireless Personal Area Networks
IETF	Internet Engineering Task Force
IEEE	Institute of Electrical and Electronics Engineers
BLE	Bluetooth Low Energy
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
ASTM	American Society for Testing and Materials

EPC	Energy Performance Certificate
RF	Radio frequency
RFID	Radio-Frequency Identification
NFC	Near-Field Communication
LAN	Local Area Network
EIB	European Installation Bus
ID	Identity Document
IBM	International Business Machines
OASIS	Structured Information Standard Advancement Organization
QoS	Quality of Service
SoIP	Storage over Internet Protocol
CFL	Compact Florescent Light
DTMF	Dual Tone Multi Frequency
NO	Normally Open
NC	Normally Close
GPIO	General Purpose (Input/Output)
USB	Universal Serial Bus
UART	Universal Asynchronous Receiver-Transmitter
ADC	Analog to Digital Converter
PWM	Pulse Width Modulation
LTE	Long-Term Evolution
FYP	Final Year Project

CHAPTER 1

INTRODUCTION

This chapter discusses the background of the project, the concept of the system, problem statement, the objectives required to achieve during project development, and the scope of the project that describes the primary studies for the project.

1.1 Background

IoT is an Internet of Things acronym that refers to, particularly the identifiable items, and their theoretical introduction on the web [1-2]. The development of the Internet of Things (IoT) has further enhanced the design of a smart gadget [3]. Gadgets can be linked and accessed through the internet. Smartphones are not only smart gadgets but used for all types of traditional appliances that capable of communicating and accessing the Web, such as smart TVs, smart sensors, and many more. Buildings or workplaces are ideal places for smart and easy automation management. A Smart Home system can connect smart gadgets and offer the household a unified interface to interact with their home devices. The IoT technology is utilized in innovative thinking and unimaginable construction for IoT housing to strengthen the standards for daily life comforts [4].

Home automation suggests the automated and electronic handling of personal or household choices, activities and equipment [5]. Many management systems are used in the development of home automation construction. Home automation allows manipulating appliances in the house from a portable device anywhere in the world. However, in most cases, home automation defines households more precisely, such as lighting, equipment,

electrical stores, heating, and ventilation units linked to a remotely operated network. Home automation can be done without human intervention and able to use the equipment to handle things in the building. IoT is to send data from the internet to machine interaction without a person or a human interaction. Recently, The IoT has brought many benefits to our daily life that make everything smart. It is very useful and convenient for the next generation.

In this project, it is not only to control the home appliances from a far distance but in case of an accident occurred in the house, such as gas leakage, a warning message and notification are sent to the victim's phone and email through the Blynk server. Another external circuit that was added to this project is the IoT Electricity Energy Meter. This circuit can measure current consumption and monitor energy usage at any time through the Blynk application.

1.2 Concept of the System

Figure 1.0 indicates the architecture or structure of the wireless control home appliance system. Blynk is a useful communication protocol based on a published and subscribed system, which is used to publish or subscribe operations to exchange information between the clients and the server. For the system, Blynk acts as the main protocol to exchange data information between devices (Computer or Smartphone) and other devices such as lamp (light bulb), fan kettle and application of IoT electricity energy meter via the NodeMCU ESP8266 module. Furthermore, Blynk also exchanges data information between devices (Computers or Smartphones) and the gas leakage detection application via the Arduino Uno.

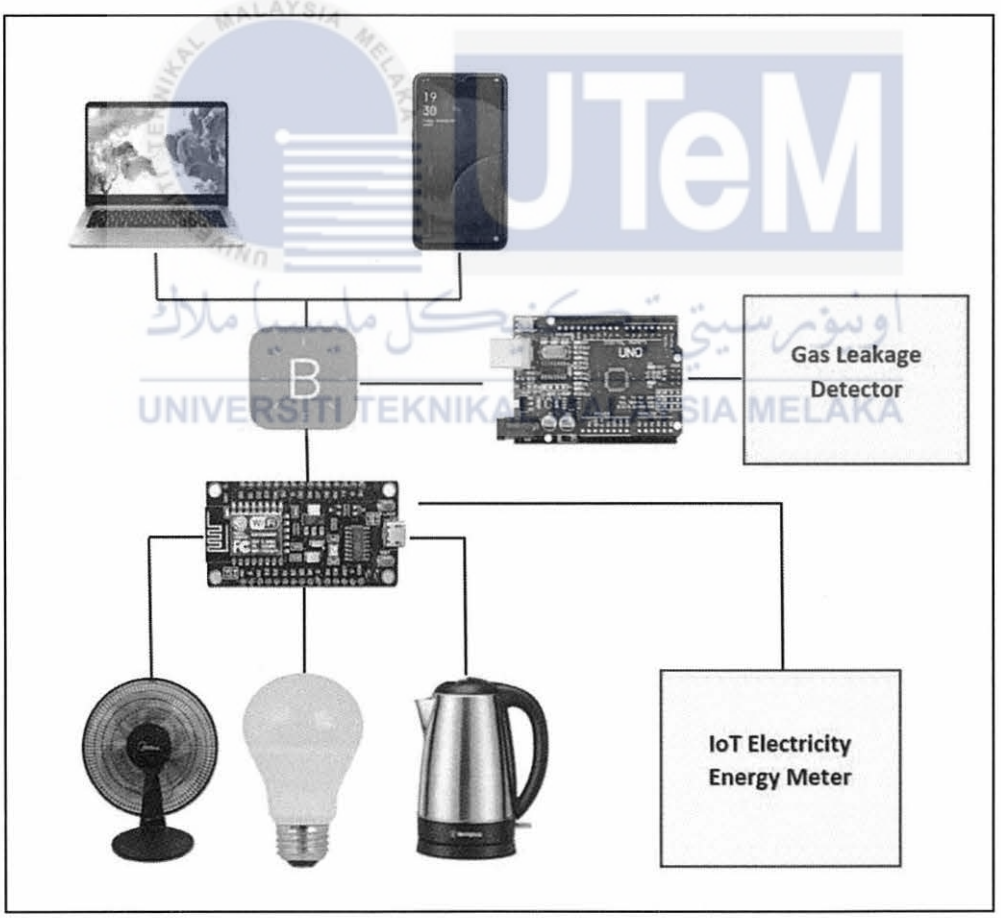

Figure 1.0: Architecture of wireless control home appliances system

1.3 Problem Statement

Previously, most of the people utilized Bluetooth technology for controlling home appliances. The leading issue of this application is the distance to control the appliances is restricted, which means the appliances cannot be controlled remotely from a long distance, only via a short distance. This problem can overcome by replaced the Bluetooth technology with wireless technology. Moreover, other issues are gas leakage and high electricity consumption. On the issue of gas leakage, it might cause fire, especially when the homeowner is not at home. The main reason is that currently the security component is not included in most home appliances on the market. Besides, as for the issue of high electricity consumption, excessive electricity consumption might occur when the owner left their house without switching off the electrical appliances. This scenario could lead to increased electricity bills. Therefore, this project able to overcome the unresolved task and subsequently solve the problems or tasks by measuring the stability of the current flow.