



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**THE DEVELOPMENT OF PLUG-AND-PLAY
AUTOMATIC SWITCH**

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

by

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I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Bachelor Degree of Electrical Engineering Technology (Automation Industry and Robotic).

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ABSTRAK

Automatic Switch adalah sistem yang menggabungkan rangkaian komunikasi yang menghubungkan peralatan elektrik dan membolehkannya dikendalikan dan dipantau dari jarak tertentu di berbagai tempat. Automatic Switch adalah pendekatan yang berbeza untuk mencapai pelbagai objektif untuk membantu pengguna menguruskan penggunaan elektrik mereka. Dalam projek ini, Automatic Switch dikawal menggunakan telefon berasaskan Android. Reka bentuk sistem adalah berdasarkan kepada perisian Arduino, perisian MIT Apps Inventor, perisian Proteus untuk simulasi, beberapa komponen pasif dan aktif dan lain-lain komponen elektrik. Projek ini membentangkan pelaksanaan perkakasan bagi sistem kawalan multiplatform untuk automasi rumah dan gabungan kedua-dua teknologi perkakasan dan perisian. Keputusan sistem menunjukkan bahawa ia boleh diklasifikasikan sebagai peranti palam dan mainan, mudah, selamat, dipercayai, kos yang cekap dan ekonomi.

ABSTRACT

Automatic Switch is a system that incorporating a communication network that connects the electrical appliances and enable them to be controlled and monitored from certain distance at various places. Automatic Switch is a different approach to achieve multiple objectives range in order to help users to manage their electricity usage. In this project, the Automatic Switch is controlled using Android based phone. The system design is based on Arduino software, MIT Apps Inventor software, Proteus software for simulation, several passive and active components and others electrical components. This project presents the hardware implementation of a multiplatform control system for house automation and combination of both hardware and software technologies. The system results shows that it can be classified as a plug and play devices, convenient, secure, reliable, cost efficient and economic.

DEDICATION

To my beloved parents,

Mrs. Wasiyem and Mr Mohd Redwan,

Who raised me,

Love you both.

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LIST OF SYMBOLS

Tx = Transmitter

Gnd= Ground

Vcc = Power Supply

mm = millimeter

m = meter

V = voltage

mah= milli-Amphere-hour

N-m = torque

Fu = torque or strength

Su = sheer strength of the nut

Ats = Cross-sectional area through which the sheer stress

° = degree or angle

LIST OF ABBREVIATIONS

OS = Operating System

GSM = Global System for Mobile Communication

SMS = Short Message Service

PIR = Passive Infrared Sensor

LDR = Light Dependent resistor

LED = Light Emitting Diode

PLC = Programmable Logic Controller

IP = Internet Protocol

LACS = Lighting Automatic Control System

LCU = Local Control Unit

LCD = Liquid Crystal Display

ROM = Read-only Memory

ABS = Acrylonitrile Butadiene Styrene

PLA = Polylactic Acid

CHAPTER 1

INTRODUCTION

1.0 Introduction

In this technological advancement world, human have the option and tool to make their daily life much simpler and easier. Nowadays everyone will implement various methods to conserve and reduce wastage of energy at their homes. Besides that, the needs to remotely control electrical appliances become more demanding due to convenience it's provided. For this particular reason, a Smart Home Automation system is introduced to aid this problem and requirement. Mostly owner forgot to turn off their home electrical appliances such as light, fan and others before leaving their home. This system is aim to enable owner to supervise their home electrical appliances from smart phone.

The Smart Home Automation system for this project is focus at plug and play wireless switch. In this project, the devices can only install at several electrical switches such lights and fans. The wireless switch devices does not need to be install or modified the electrical switch circuit internally but on the contrary with emphasis of plug-and-play concept the device can simply install to the electrical switch externally. This is the main selling point or feature of this device.

The purpose of wireless switch to provide an easy, simple and cost-efficient design to control on-off mechanism of the electrical switches. The wireless switch system must consist of Bluetooth enables phone to provide the owner with interface to control the

on-off of the electrical switches. The wireless switch device is connected with smart phone via Bluetooth module at range up to 10 meter. This project makes it possible to have, smart home automation at affordable cost that can perform task like other smart home automation system. Wireless switch enables user to control various types of electrical switches in any places such as classroom, home, office and etc.

The advantages using Bluetooth enables Android Operating System (OS) phone is to reduce the complexity of designing the system which can lead to high cost development. Besides that Android OS is widely use of mobile phone user, according to The Verge approximately 80% of smart phone user is Android user. Furthermore, using an open sources program such as MIT Apps Inventor to create an app for the system is hugely convenient and able to reduce development cost.

1.1 Problem Statement

There are several reasons that had inspired to this idea of development of Automation Switch (plug-and-play). The main purpose is to manage electricity usage at home, office and etc. This is due to electricity wastage that happened among user that forgot to turn off the electrical appliances when they no longer use it. Automatic Switch can be implemented at broad places and doesn't need expensive or extra work to be installed. It can reduce cost in term of installing and also able to reduce the electricity bill.

1.2 Objectives

This research consists of several objectives that need to be successfully achieved at the end of the project as stated below:

- i. To design an user interface for Android based phone that can control Automatic Switch remotely.
- ii. To design and control the mechanism for ON and OFF state of the wall mounted light switches by using servo motor.
- iii. To analyze power consumption and reliability of Automatic Switch.

1.3 Scope

This project aims to create a prototype for an Automatic Switch system with efficiently utilize of the existing technologies like using MIT Apps Inventor which is free open source program. Control of a broad type of devices is taking into consideration. However, the limitation of the prototype is can only be implemented on wall mounted switched. In order for users to control the system, this project will develop on the Android based phone applications, which can help user with the interaction and control with their electrical devices especially at home. For this project, its more focus on designing Android based phone application by using MIT Apps Inventor open source software, coding for the servo motor using Arduino platform and designing an mechanism for ON/OFF of the switches. This system will use Bluetooth to communicate between user Android application and the devices (Automatic Switch). Furthermore, Arduino Uno acts as control unit where it functions to control the whole process in the Automatic Switch system. Besides that, this project will use servo motor where it will be place in the Automatic Switch device where the devices will achieve ON and OFF control mechanism. Most importantly this project will attempt to implement simple automation functionality and act as plug-and-play devices that can benefit to the user.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In this section, the review of technology used and implementation of Smart Home Switches System based on various type of wireless and control modules for energy and cost efficiency technology has been discussed.

2.1 Literature Survey

In order to control home electrical appliances remotely via Short Message Service (SMS), Home Automation using Global System for mobile communication is introduced by Ihedioha and Eneh. The system indicates using automation of electrical device used in daily tasks at home. It control major parts of electrical device such as lights, fans and more advanced tasks such as viewing of the house interiors and extension for surveillance purposes via remotely. The Home Automation system is also offers a comfortable, convenient and safe environment for occupants. The user can control their house by actuating the electrical appliances. Besides that, Home Automation system includes various type of sensors for examples temperature sensing, fire detection and motion sensor, lock system and etc. The main objective of this system is to design a GSM-enabled distributed control application platform for industrial automation and home appliances. Ihedioha and Eneh using a complete and ready-to-use Nexys2 circuit board to implement to this system.

Bluetooth based Home Automation system via smart phone is proposed by Piyare and Tazil in order to provide greater mobility and convenience where the system is low cost and secure. Wireless communication is used to communicate between smart phone and home appliances. The Arduino BT boards are connected with the appliances. Furthermore, other appliances can also be connected to the system with minor adjustment to the system. The smart phone code is written in python because it is portable and can run on widely mobile using Symbica Operating System Platform. The system is required for the users to enter password for the Arduino BT and smart phone to access the home electrical appliances. This will ensure a protection from unauthorized users. (Piyare and Tazil, 2011)

Arduino is used as controller in the development of Automation lighting for efficient use of energy in classroom situation. The classroom is divided into grids by the system. The relay control will adjust the lighting in the classroom for a particular area based on the presence of human. This system using Android mobile system Apps via Bluetooth to control the lighting based on voice command. The system will provide mobility and remote command execution. PIR sensor is placed at every entrance of classroom, so that the sensor can detect a human entering the classroom. Smart phone applications are needed to control the lighting based on voice input sent via Bluetooth. (Suresh, 2016)

Wireless smart power saving system for home automation are proposed by Shah, Pathrabe and Patel where the system included an electrical door lock and power saving module. The user home power saving module will switch on if a correct password is entered in door lock. The entire electrical appliance in the house is automatically switched ON based on the presence of the owner. The supply of power to electrical appliances such as lights and fans is dependent to the temperature of the room and intensity of illumination of the natural daylight. RF modules that are low cost, user friendly and widely available in market

is used in this system in order to prevent the wastage of power in convenient and cost efficient methods. (Shah, Pathrabe and Patel 2012)

Marimuthu has discussed about his studies in home automation using Bluetooth. There are several techniques Marimuthu discussed which are the control of home appliances, the controller used and number of devices controlled. He states that there are two types of communication to implement at Home Automation system which wired and wireless technology for wired technology, existing electrical wiring and cable we used to connect all the appliances. Power lines systems have a medium that carried a signal by the electrical wires or cables. For wireless technology, included three devices for convenience communication between two or more devices which is GSM with operating frequency range between 380-1989MHz). Bluetooth module (range between 0-10meters) and XBEEE Modules (range between 0-100km). (Marimuthu et al.,2016)

Nupur, Payal and Kajal are proposed an automation system where widely types of electrical appliances such as lights, fan, air conditioner and others can be controlled using an Android smart phone application via Bluegiga with Bluetooth module. This method is cheap and secure for smart phone. The electrical appliance is connected using Arduino BT board. Wireless communication is established between smart phone and electrical appliances. In order to provide sufficient high voltage and current compatibility. An Arduino BT board with relays is used to connect the different home and office appliances. The smart phone application will sent commands to the appliances to switch on or off. A feedback circuit also been implemented to indicates the real-time states of the appliances after receiving commands from smart phone either in on or off state. (Nupur, Payal and Kajal, 2014)