



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**THE DEVELOPMENT OF SMART AUTOMATION  
SYSTEM WITH SMARTPHONE**

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

by

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**BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA**

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This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

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## ABSTRAK

*Smart Automation System adalah penyelesaian teknologi yang mengautomasikan dan menggabungkan aktiviti elektronik, elektrik dan teknologi untuk membolehkannya dikendalikan dari jarak tertentu dalam pelbagai tempat di rumah, pejabat dan sebagainya. Berdasarkan projek ini, ia menggunakan gabungan teknologi perkakasan dan perisian yang membolehkan kawalan peranti dalam rumah seperti Arduino Uno, perisian MIT Apps Inventor, perisian Proteus untuk simulasi serta beberapa komponen aktif dan pasif. Sistem ini membolehkannya mengawal dan mengintegrasikan keselamatan, pencahayaan dan sistem lain dengan kemudahan yang mudah dan selamat.*

## **ABSTRACT**

Home Auto Switch is a technology solution that automates and integrates electronic, electrical and technology activities to enable them to operate from a certain distance in various places at home. Based on this project, it uses a combination of hardware and software technologies that enable home-device controls such as Arduino Uno, MIT Apps Inventor software, Proteus software for simulations as well as some active and passive components. This system enables it to control and integrate security, lighting and other systems with easy and secure facilities.

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## LIST OF SYMBOLS

D, d	-	Diameter
F	-	Force
g	-	Gravity = 9.81 m/s
I	-	Moment of inertia
l	-	Length
m	-	Mass
N	-	Rotational velocity
P	-	Pressure
Q	-	Volumetric flow-rate
r	-	Radius
T	-	Torque
Re	-	Reynold number
V	-	Velocity
w	-	Angular velocity
x	-	Displacement
z	-	Height
q	-	Angle

## **LIST OF ABBREVIATIONS**

<b>OS</b>	Operating System
<b>GSM</b>	Global System for Mobile Communication
<b>PIR</b>	Passive Infrared Sensor
<b>LED</b>	Light Emitting Diode
<b>ABS</b>	Acrylonitrile Butadiene Styrene
<b>PFTE</b>	Polytetrafluoroethylene



# CHAPTER 1

## INTRODUCTION

### 1.0 Introduction

Nowadays, technology is improving, and humans have their own options and tools to facilitate their daily life. Everyone has more ideas that will implement various methods to reduce energy waste at home, in the office and others. For example, the human is too lazy to get out of bed and turn off the light of the switch, especially after returning from his workplace. For this reason, a Smart Automation System (SAS) has been introduced to solve the problem and the requirements with the supervision of the devices from smartphone.

For this project, a Smart Automation System (SAS) focuses on the switch that is mounted on the wall switch. The system does not need to make a wiring instead of creating a portable hardware. One of the factors of the device is to be more friendly and easier in their daily life. In this project, the devices focus on the electric switch for lights and fans. Wireless switching devices require an emphasis on the plug-and-play concept that the device can install externally on the electrical switch and does not need to modify the electrical circuit internally.

The purpose of the wireless switch is to provide a simple and inexpensive design to control the switching on and off electrical switches in which it must consist of Bluetooth for phone control. The wireless switch is connected to a smartphone via a Bluetooth module within a 10-meter radius. The advantage of the wireless switch allows the user to control the electrical switch anywhere such as in the office, at home, etc.

## **1.2 Problem Statement**

The idea of developing Smart Automation System with a smartphone has been inspiring to the people that they are looking for more ways to live with the latest technologist. The main use of electricity in the home, office and other places is the waste of electricity because users have forgotten to turn off the electrical appliance when they have not used it. This will affect the high electricity bill. However, consumers can reduce their electricity bill, cost of installation and it will improve their lifestyle because they have simple methods to control these devices.

## **1.3 Objectives**

This research consists of some objectives that need to achieve successfully at the end of the project as stated below:

1. To design a plug-and-play switch via smartphone that can control SAS remotely with Android application using MIT Apps Inventor.
2. To control the mechanism for ON and OFF that bolt on the switch by using servo motor.
3. To analyze reliability and power consumption of SAS.

## 1.4 Scope

This project aims to create a prototype for a Smart Automation System with the ability to use technologies such as MIT Apps Inventor that it is open source program. The limitation of the prototype that it can only be implemented on the specific wall switch such as modern switch. The hardware is a portable device that use plug and play concept. It uses a clamp to support for the accessories by using a spring. The consumer no longer makes efforts to install the device instead of making it friendly and easier to use. This system will use Bluetooth to connect and communicate between Auto Switch devices and the Android application. For this SAS project, it focuses on servo motor coding with the Arduino platform, designing applications for Android-based phones using MIT Apps Inventor and designing a mechanism to turn ON and OFF switches. This project will give a great impact and benefits to users during the execution of a simple automation function.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.0 Introduction

In this chapter, the implementation of Smart Automation System and the feedback of technology used has been discussed based on different type of wireless and cost efficiency.

#### 2.1 Related Work

Smart Automation System introduced in recent years that implement the concept of Internet of Things. Automation application for residences are new implementation that gradually being adopted by consumer in advance technology although automation for commercial buildings is a mature technology. Home automation as a system that controlling the activities such as air-conditioning, lighting, electrical appliances, doors, alarms and others. Home automation has several advantages, such as comfort, greater safety and energy efficiency. Figure 1 shows the general system of home automation. The figure shows the different devices such as safety sensors, thermostat and others which is controlled through the central control panel through the Internet.

Nowadays, users want home devices to be connected wirelessly with advance technology such as Bluetooth, GSM and Wi-Fi. Each of these wireless technologies has its own meaning and specifications which is this project uses Bluetooth with an available one frequency of 2400 Hz, a speed of about 3 Mbps and a range of 100 meters. Designing a home automation system, there a few concerns to be addressed. The system should be designed in way to integrates new devices so

that these appliances can guarantee of their lifespan and controlled easily. The interface of the system should obtain diagnostic services in case of any problems happen and cost-effective so it can used by consumers in the market. (A., 2016)

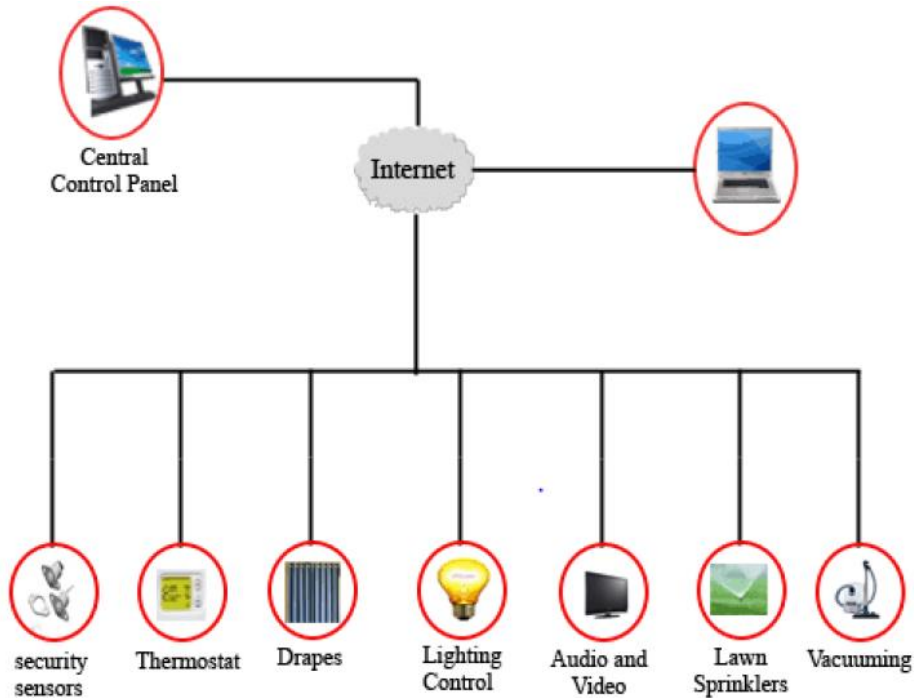


Figure 2.0: A General Home Automation System (A., 2016)

## 2.2 Application of Automatic Switch

An android application is a software application that runs on the Android platform. A typical Android application is designed for a smartphone due to Android platform is designed for mobile devices. As Kalshetty & Gaikward (2017) stated that Android is a designed open source framework for mobile devices that pack an operating system by Graphics User Interface (GUI). This application must start clicking on its icon in smartphone in order to control and monitor household appliances. Before entering the application, user must enter username, password and

turn Bluetooth on. GUI apps is easy to turn off the lights at night by setting the time to save energy in residential passages in terms of lighting control system as shown in Figure 2.1. (Kalshetty & Gaikwad, 2017)

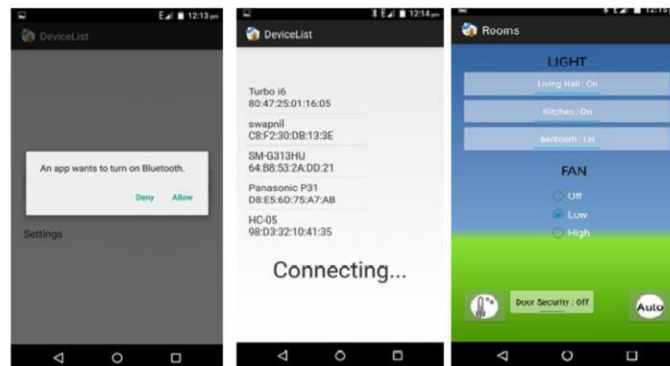


Figure 2.1: GUI shows process of connecting to Bluetooth module (Kalshetty & Gaikwad, 2017)

Based on research conducted by Howedi & Jwaid (2016), MIT Apps Inventor App is an open source project and created by Android Apps that anyone can download the source code to run their own dedicated servers from the App Inventor website ([ai2.appinventor.mit.edu](http://ai2.appinventor.mit.edu)) as shown in Figure 2.2. The apps inventor consists of two parts that can choose the components for the application and determine the behavior of the application. Users can customize, modify and operate with functionality of the system. The important thing, students can share their applications in a place of public access without having to purchase a developer license. The system is designed as to be easy to use, simple and low cost. (Howedi & Jwaid, 2016)



Figure 2.2: MIT Apps Inventor process of connecting to Bluetooth module (Howedi & Jwaid, 2016)

### 2.3 Wireless of Automatic Switch

According to a study by Singh, Pal & Rai (2015), the GSM mobile phone is a mobile phone that contains a SIM (Subscriber Identity Module) card. The system has a specific number that the communication takes place and is wireless and the mechanism works in GSM (Global System for mobile communication technology). In the form of SMS via an Android application, the user transmits instructions to the system to verify the devices. The owner of the house will receive an SMS, which is the GSM modem that provides the means of communication. The SMS message via GSM public networks as a text message is sent to the GSM modem. The microcontroller will execute the command when the GSM modem receives the message. The advantage is more safety and security system can be installed in the house easily which mean home's owner will be informed in case of anything happen. (Singh, Pal, & Rai, 2015)

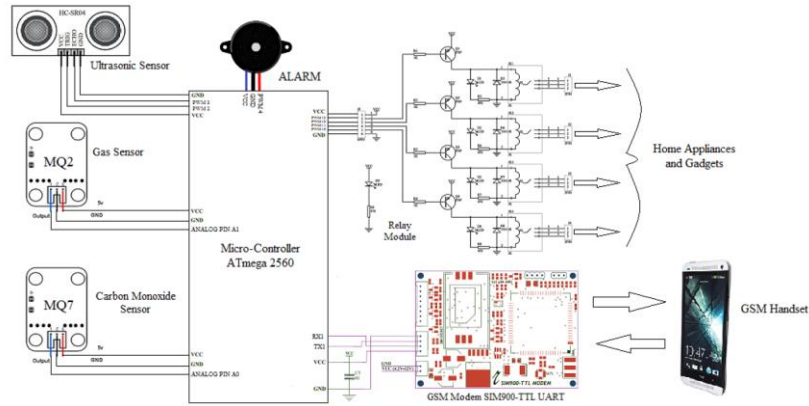


Figure 2.3: Circuit diagram of GSM Module (Singh, Pal, & Rai, 2015)

As study by Poonam & Kalshetty (2017), Bluetooth based Smart Automation System using Android implemented to reduce and minimal human efforts as shown in Figure 2.4. Cost is reduced by low cost communication system like Bluetooth and Wi-Fi to make it more efficient and effective. The system can control household appliances and provide security to a disabled or old people. In addition, it can control home appliances such as lights and fan. It will save energy by auto off lights at night. Bluetooth module being used is the HC-05 module and it is allowing to transmit and receiving signals. Bluetooth module receives the text from Android phone and transmits it to the serial port of the Arduino Uno. The Bluetooth module HC-05 is a master or slave module. By default, the factory setting is slave. The role of the module (master) can only be configured with the commands. Slave modules can accept connections but cannot begin a connection with another Bluetooth device. The master module can initiate a connection to other devices. (Poonam & Kalshetty , 2017)