

HANDPHONE TRIGGERED SWITCHES

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ABSTRAK

Telefon Bimbit Pemicu Suis (HTS) adalah satu sistem yang boleh mengawal penggunaan kuasa elektrik. Penyelidikan ini tertumpu kepada bagaimana untuk menghasilkan suatu sistem yang sesuai dan mudah untuk diaplikasikan dan juga menggunakan kos yang mampu dimiliki oleh semua orang. Di dalam projek ini, alat utama yang digunakan adalah pengawal mikro Arduino Uno. Unit pertama mengandungi inisialisasi dan pemantauan berurutan peranti yang dilengkapi dengan alat BM. Bahagian kedua dari program ini adalah dengan menghantar mesej iaitu arahan dengan menggunakan telefon bimbit kepada pengawal mikro Arduino Uno. Selepas itu pengawal mikro Arduino Uno telah menerima isyarat masukan (arahan) dari BM. Kemudian, pengawal mikro Arduino Uno menghantar isyarat keluaran untuk mengaktifkan atau mematikan barangan elektrik seperti lampu. Selepas program utama selesai, sistem akan mengaktifkan atau mematikan beberapa barangan elektrik yang diingini.

ABSTRACT

Handphone Triggered Switch (HTS) is a system that can control the usage of electricity power. This research is focused how to made up a system that suitable and easier to install it and also the cost than can be affordable for everyone. In this project, the main device that we used to control all the system is Arduino Uno MC. The first unit contains the initializations and sequential monitoring of the equipped BM device. The second part of the program is send the messages (commands) by using smartphone to the Arduino Uno MC. Then, Arduino Uno MC gets the commands from BM. After that, Arduino Uno MC sends the commands to the outputs to ON or OFF the electrical appliances, such as, lamps. When the main program are finished, the system will switch ON or OFF the desired device.

DEDICATION

To my beloved parents.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

AVR	-	Advanced Virtual RISC
BM	-	Bluetooth Module
CPU	-	Central Processing Unit
HP	-	Hand Phone
IC	-	Integrated Circuit
LED	-	Light Emitted Diode
MC	-	Microcontroller
PC	-	Personal Computer
PCB	-	Printed Circuit Board
RAM	-	Read-Access Memory
ROM	-	Read-Only Memory
TTY	-	Text Telephone (Teletypewriter)
USB	-	Universal Serial Bus

CHAPTER 1

INTRODUCTION

This chapter covers the introduction of the project, background study, the problem statement, the project objective, the scope of work, the project significance and the whole summary for this chapter.

1.1 Background

The wastage of usage the electricity power is happening every day. To solve this problem, a new remote control system was created without spends a lot of money and named as “Handphone Triggered Switches”. It can be reduces the wastages of using electricity consumption. So, with this remote control system, the owners can control automatically switch ON and OFF all the electrical appliances easily.

1.2 Problem Statement

The purpose of this project is implemented to reduce the wastage of electricity used, so this system has been created to solve this problem. There are the problem statements that as a reason why we created this system. The problem statement for this project is the wastage of using electricity consumption is higher. According to TNB (2013), the electricity usage in year 2012 is almost reached to hundreds billion

kilowatt (kWh). Besides that, the usage of Arduino Uno microcontroller is not wide in Malaysia. We decided to choose this device to use in this project because we want to expose to the others about Arduino Uno, the function and the advantages about this device.

1.3 Objective

The main purpose of this project is to reduce the wastage of used the electricity consumption [4]. Based on these objectives, we created a new system that able to control the electrical appliances at home. Besides that, a remote control application was created by using the technology. In this project, the technology that will use is a smartphone, and it will control all electrical appliances, such as lamps. So, with this product, “Handphone Triggered Switches”, it will control the electrical appliances.

The others purpose of this project is this system are easy to apply at every house [2]. The homeowners can make it by own selves because the equipments are easy to find at electronic stores. Other than that, the system provides availability due to development of a low cost system [11][9][6][5][2][1]. This is because all the equipments are affordable for everyone. The home appliances control system with an affordable cost was thought to be build that should be mobile providing remote access to the appliances. These devices should be controlled as well as turn ON or OFF required. Most of the times it is were done manually. Now it is necessity to control devices more effectively and efficiently at anytime [9][6].

1.4 Scope

The scope of work for this project is about the basic of Arduino Uno microcontroller. It is because the usage of an Arduino Uno is not wide in Malaysia. The researches have been done about Arduino Uno to know more details about an

Arduino Uno, how it is work, the software that used for this device and others. Afterwards is about Arduino Uno coding that have been used in this system. The language for Arduino Uno coding is the same familiar C programming language except that everything is ready for us to use. The coding for the Arduino Uno is just need an Input and an Output coding. An Input of this system is the Bluetooth Slave to connected wirelessly with the gadgets (smartphone, PC) and to control the LED to switch ON or OFF.

1.5 Project Significance

This project will give the most benefit to homeowners, company, hostel and factory. But, the main focus for this project is the homeowners. The benefits from this project are the homeowners can reduce the wastage when use electrical appliances. This system is easy to apply at every houses and also low cost system. Others than that, homeowners can control the “Handphone Triggered Switches” anytime. It can ON or OFF the electrical appliances with just send the message. This system can be applied at home, office, school and anywhere. But in this project most focus to apply at home.

1.6 Conclusion / Summary

The wastage of using electricity consumption is increasingly nowadays. It is because they will switch ON the lights and they forgot to switch OFF back. In this chapter are covered the background, the problem statement, the objectives, the scope of work and project significance for this project.

CHAPTER 2

LITERATURE REVIEW


This chapter is discusses the information and theory relates to this project also the overview of major component involved. Factors that should be consider while developing this project also will be covered. The literature reviews will start with reviewing the Arduino Uno microcontroller and remote control system.

2.1 Statistic of mobile phone users in Malaysia

According to Jawarkar (2008), there has been tremendous rise in number of mobile customers in world (> 2 billion). Due to widespread growth of cellular network and drastic reduction in call rates and lower-end handsets, mobile usage has percolated all sections of society. Mobile phones have changed the lifestyle of many consumers, especially those in younger generations. Most school children and youth have owned at least one mobile phone. Mobile phones offer a range of applications, from telephone conversation and simple text messages (SMS), to multimedia messaging services (MMS) and Internet access, depending on the capability of individual mobile phones and the services available. These applications have been made possible through various developments in mobile telephone technology such as GPRS, WAP and the 3G standard (Karim, Darus and Hussin, 2006). The latest telephone technology nowadays is 4G Long-Term Evolution (LTE).

In Malaysia, several major telecommunication operators such as Celcom Malaysia, Digi Telecommunicaton, and Maxis Communication Bhd. have been granted licenses to operate the new 3G standard (Karim, 2006). Broadband internet service providers are now moving into a second phase of market development, from marketing broadband as a high-speed Internet access service to an enabler of higher end services such as triple play and digital home concepts (Lee and Lee, 2006).

Table 2.1: List ranks the existing countries of the world by the number of mobile phones user.

38	 Australia	30,200,000 ^[48]	22,700,000 ^[49]	133.0	December 2013
39	 Saudi Arabia	46,000,000	27,137,000	169.5	Jun 2013 ^[50]
40	 Malaysia	30,379,000	28,250,000	106	2013 ^[51]
41	 Chile	21,000,000	17,094,270	122.9	Dec. 2013 ^[52]
42	 Nepal	18,240,670	26,620,020	86.82	Apr. 2014 ^[53]
42	 Ethiopia	18,000,000	85,000,020	21.8	Dec. 2013 ^[54]

According to the list ranks the existing countries of the world by the number of mobile phones in use that shown in Table 1, Malaysia was ranked in 40th places. The total number of mobile subscribers in Malaysia is approximately 30,379,000 (MCMC, 2010) with a penetration rate of around 106% due to multiple subscriptions. There has been an increase in the popularity of pre-paid mobile telephones following the development of pre-paid systems where the user purchases a fixed amount of access beforehand rather than the traditional system of paying for use afterwards. This convenient system has influenced the penetration rate tremendously, particularly among youth subscribers, who account for more than 30% of the total of mobile subscribers in Malaysia.

2.2 Statistic electricity consumption in Malaysia

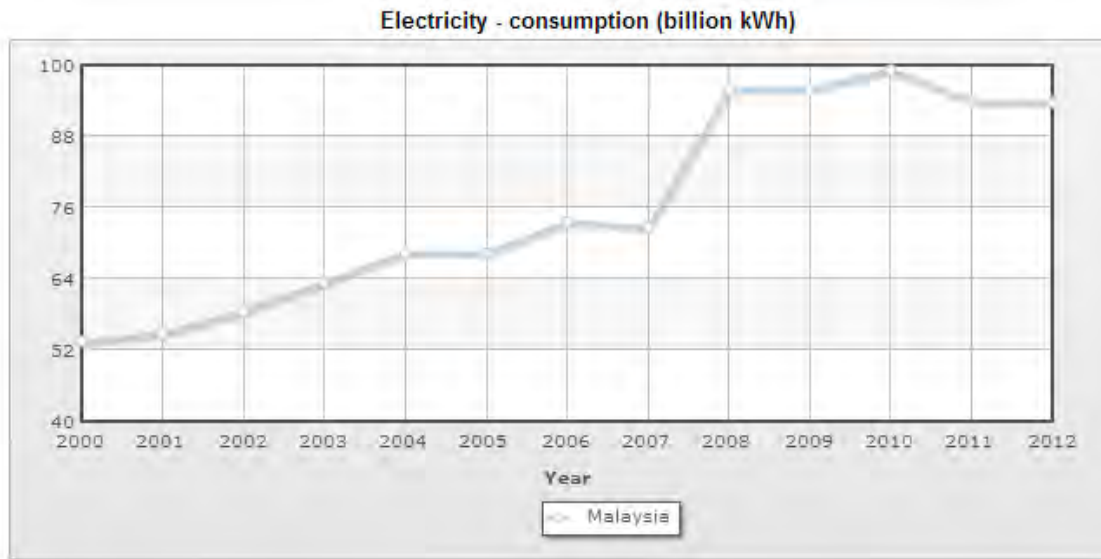


Figure 2.1: Electricity consumption (billion kWh)

Table 2.2: The statistics of electricity consumption from year 2000 until 2012 (billion kWh)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Malaysia	53.42	54.87	58.59	63.48	68.4	68.4	73.63	72.71	95.98	95.98	99.25	93.8	93.8

Based on this statistic from Graph 1 and Table 2, it shows that the electricity consumption in Malaysia from year 2000 until 2012 in billion kWh. From this statistic, that shows the increases the electricity consumption from year 2000, 53.42 billion kWh, until year 2006, 73.63 billion kWh. In 2007, it slightly decreased to 72.71 billion kWh and ascending in year 2008, 95.98 billion kWh, until year 2010, 99.25 billion kWh. In year 2011 it decreased to 93.8 billion kWh and maintain until year 2012. Even though the values are decreased but the values of electricity consumption still high and almost reach hundred billion kWh.

2.3 Arduino Uno microcontroller

2.3.1 About Arduino Uno microcontroller



Figure 2.2: Arduino Uno microcontroller

Kadir, A. (2012a) mentioned that an Arduino Uno is the one of electronic components that has microcontroller ATmega 28 (the function as a computer). This device can create an electronic network of moderate to complex. From handling the LED until controlling the robot can be done by using Arduino. Moreover, with the addition of some electronic components, this device can be used for remote monitoring via the internet, such as monitoring the patients in hospital and controlling of devices in the home.

Arduino hardware includes the main mother board (which houses the AVR microcontroller) and the Arduino shields. The shields are small breakout boards which contain hardware modules like Zigbee modules, EEPROM modules, Motor drivers and others designed to be able easily connected with the Arduino board.

Kadir, A. (2012b) also mentioned that an Arduino Uno contains microprocessor (Atmel AVR) and be equipped with oscillator 16 MHz (to ensure

that the operations carried out with the time that have been specified), and regulator 5V. There are the numbers of pins that have at device Arduino Uno. Pin 0 – Pin 13 that used for Digital Signal, and has the values 0 or 1. Pin A0 – A5 that used for Analog Signal. Arduino Uno comes with 2kB of Static Random-Access Memory (SRAM) size to hold the data, 32kB of Flash Memory, and Erasable Programmable Read-Only Memory (EEPROM) for storing the data.

2.3.2 Connected to PC

According to Kadir, A. (2012c), an Arduino Uno is connected to a PC by using a USB cable. It also can be used without being connected to a PC, but it needs the size of 9V external sources. When the Arduino Uno is connected to the PC and the PC was turned on, that are two indicators that will indicate that the device does not have a problem.

- (i) The first indicator is a little light labelled ON will light up.
- (ii) The second indicator is a little light on PIN 13 will blink.

However, these circumstances are not meant Arduino Uno can be used. We need to install the driver before use it.

2.3.3 Arduino Language

Software to be used to connect with Arduino Uno can be downloading at <http://www.arduino.cc/>. On the website there is the software for Windows, Mac OS X and Linux platform.

Kadir, A. (2012d) said that the command that used in the Arduino Uno has a few similarities with command C and C++. Basic elements in C and C++ can indeed

be used to write a sketch, but not all C and C++ command can be used. There are few commands that used in Arduino Uno sketch;

- (a) `int ()` to convert the value of the argument is `int ()` be type of `int`. This type is useful to accommodate integers ranging between -32,768 to 32,767.
- (b) `if ()` is needed to deal with problems that require decision making. For example, there are two choices that will determine the LED light will turn ON or turn OFF based on a condition. These will be solved by using `if` command.
- (c) `Serial.begin()` is useful for determining the speed of sending and receiving the data via the serial port. Commonly used speed is 9600 bits per second (bps).
- (d) `Serial.println()` in principle is same as `Serial.print()`. In fact, `Serial.println()` need to add “`\r\n`” (carriage return and linefeed) which gives the effect of the displacement of lines in the display.

2.3.4 Arduino versus microprocessor versus microcontroller

2.3.4.1 Arduino

An Arduino is a PCB containing an Atmel AVR microcontroller and usually providing a set of connectors in a standard pattern. The microcontroller is typically pre-programmed with a “bootloader” program that allows a program (called a ‘sketch’) to be loaded into the microcontroller over a TTY serial connection (or virtual serial over USB connection) from a PC.

2.3.4.2 Microprocessor

A microprocessor is an IC that contains only a central processing unit (CPU). The IC does not contain RAM, ROM or other peripherals. The IC may contain cache memory but it is not designed to be usable without any external memory.

Microprocessors cannot store programs internally and therefore typically load software when powered on, this usually involves a complex multi-stage “boot” process where “firmware” is loaded from external ROM and eventually an operating system is loaded from other storage media, such as hard disk. It is typically found in a personal computer.

2.3.4.3 Microcontroller

A microcontroller is an IC that contains a CPU as well as some amount of RAM, ROM and other peripherals. Microcontrollers can function without external memory or storage.

Normally, microcontrollers are either programmed before being soldered to a PCB or are programmable using In-System-Programming (ISP or ICSP) connectors via a special “programmer” device attached to a personal computer. Typical microcontrollers are much simpler and slower than typical microprocessor.

2.4 Handphone Triggered Switch

C. K. Das (2009) mentioned that the aim of the proposed system is to develop a cost effective solution that will provide controlling of home appliances remotely. The system provides availability due to development of a low cost system. The home appliances control system with an affordable cost was thought to be built that should be mobile providing remote access to the appliances. Though devices connected as home appliances consume electrical power. These devices should be controlled as well as turn on/off is required. Now it is a necessity to control devices more effectively and efficiently at anytime.

Based on C. K. Das (2009), they are developed a cellular phone based home and office appliances controller. The system is designed for controlling arbitrary devices, it includes a cell phone which is connect to the system via headset. To active the cellular phone unit on the system a call is to be made and as the called is answered, in response the user would enter the two/three digit password to access the system to control devices. As the caller press the specific password, it results in turning ON or OFF specific device. The device switching is achieved by Relay. Security preserved because these dedicated passwords owned and known by selected persons only. For instance, our system contains an alarm unit giving the user a remote on/off mechanism which is capable of informing up to five different numbers over telephony network about the nature of the event. This is the block diagram for the system in the journal;

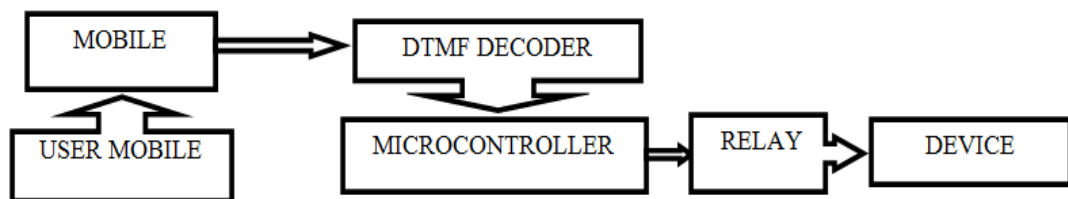


Figure 2.3: The system from journal

For the project, the system is slightly same as in journal, but we used other components to do this project. This is the block diagram of the system for the project;

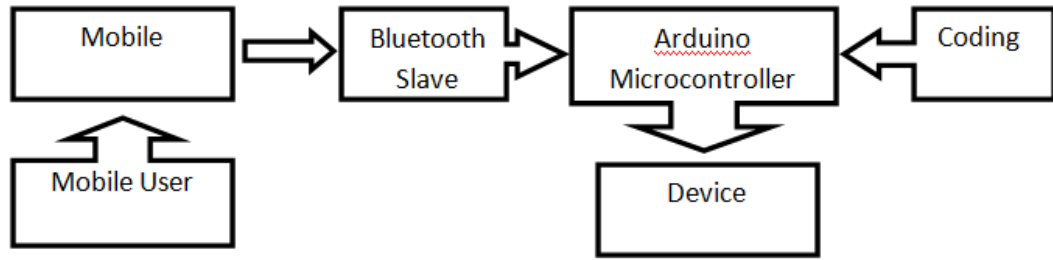


Figure 2.4: The Handphone Triggered Switch system

Firstly, the user will connect their mobile phone with Bluetooth slave and control it by using one application from android which is BTInterface Free Trial BETA. After that, Arduino microcontroller will get input from Bluetooth slave that has the command from mobile phone. Then, Arduino microcontroller will send the output to device (LED). The servo will turn ON or OFF the desired devices.

2.5 Bluetooth Module HC-06

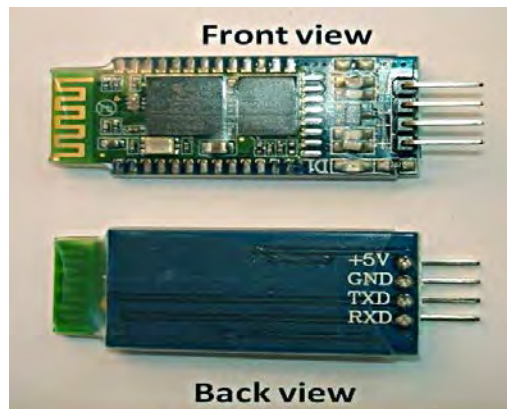


Figure 2.5: Bluetooth Module (Device)

This HC-06 Bluetooth module is the most economical and easiest way to go wireless. This module allows to wirelessly extending the serial interface. Hence any

program running on the Laptop feels its controlling a local serial port, which is over a wireless Bluetooth link.

The 4 pins are +5V, GND, TXD, RXD. Supply voltage should be 3.3 to 6 V. Absolute maximum is 7 V.

Default pairing code: 1234

Default baudrate: 9600

HC-04 is almost identical to HC-06. The only difference is that HC-04 is for industry and HC-06 is for civil. Other than that, they are the same. The maximum baudrate can be configured to 1 382 400 bps, but 115 200 bps is recommended for reliability purposes.

Below shows how the Bluetooth module is connected to the Arduino or other microcontroller device. The Bluetooth module also works in 3.3 V power supply.

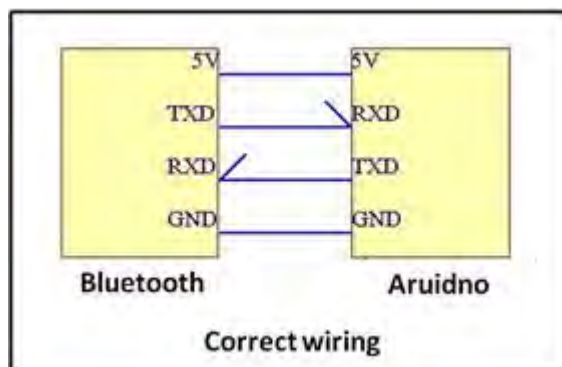


Figure 2.6: Bluetooth module wiring