CHAPTER I

INTRODUCTION

1.1. Research Background

Switch is commonly well known and important for people nowadays. Almost every electricity appliance uses a switch to turn on/off the appliance and even every building has many switches to control the appliances inside the building. A basic function of switches in mostly electrical appliances, especially lighting fixtures in this thesis report, are connecting and cutting off appliances' electricity current. Besides that, nowadays along with the technology growth, switches physically and functionally have changed. Switches can be digitally shaped like cell phone's keypads to turn on/off the phone or working together with dimmers to set light intensity by controlling the amount of current by spinning the buttons.

Mostly, one switch button can only handle one light that is close to it. It is because the switch is connected with the light directly through cables and if the distance between the switch and the light is farther, more cables will be needed and the cost spent will be increased. Not to mention when the customer wants to add another light bulb, traditionally adding new locations for light switch control, room configurations or energy savings was costly and destructive due to the need to pull new wire through walls and ceilings to the desired locations (Leviton Manufacturing Co., Inc., n.d.). In a building architecture, if there are more lights that have to be controlled, there will be more switch buttons have to be used by customers. Those switch buttons are usually placed in one or two lines horizontally. It will make difficulties for customers to recognize and get use to each light's switch button. Especially for buildings which are used for business, like restaurant, supermarket, etc., there are usually some important switch buttons that are not allowed to be interfered. If there are many other switch buttons around them, customers will be confused, even more if they are in a rush. Therefore, some customers give labels on

each switch button to avoid something bad happened like Costa Coffee in Bangalore should put Post-It labels on their light panel to get to figure out what switch does what (Rambow , 2006). Besides, in a building architecture, switches cannot be moved easily or swapped one another since they are connected by cables to the lights. So, if a customer wants to move the switch, he should change the cable into the new one. Otherwise, customer could also attach another cable to the previous position switch's cable. However, this way would be risky when the attachment's installation is not done right. Therefore, the matter will be bigger, more difficult, and cost a lot of money.

Most of the light switch turns on and off the light by flipping the switch that is on a wall somewhere (Lewis, n.d.). But along with technology growth, some manufacturers tried to make wireless switches that are more energy efficient, flexible, and user friendly by adding some features. One of features they are offering is a dimming feature on the switches. Customers can set the light's brightness intensity. This feature helps customers to safe energy cost and longer bulbs life. There are many kinds of wireless dimmer switch already either a keypad switch or a touch screen one. However, most manufacturers put the dimmers inside the switch panels. It will cause the switch panels become hot when dimmers get overheated. Thus, when overheating keeps going on, the heat from the switch panels will be too noticeable. It will make customers feel uncomfortable to use it. Another additional feature offered by some manufacturers is a RF remote control in addition to the switch panel on the wall as its main controller. However, the remote controllers are not controlling the lights directly. The remote controllers still have to communicate with the main controller. Therefore, customers still have to break the wall to place the main controller. It is not flexible enough since the customers cannot just use the RF remote controllers alone. Besides, both the main controllers on the wall and the RF remote controllers have a button limit. Both of them just can handle some options of lighting action, either just turning off/on the lights or preset lights. It is not convenient enough since customers

need to put another addition switch panel and a new faceplate when they need to place another light in the room. However, customers should prepare external power supplies to power up the additional switches if the main controller cannot support anymore.

In terms of communication among lights and devices in the system, most of wireless dimmer switches utilizes simple radio frequency (RF). RF communication has a range limit to deliver the signal. Therefore, most of wireless dimmer switches need RF repeaters to expand the range. Apart from the features and communication terms, most of wireless dimmer switches require dimmer resetting whenever the customers change the bulbs. It is not flexible and efficient enough for customers since the customers have to open switch panels' faceplate to reset the dimmer.

From those phenomena, as thesis materials, there will be a research for developing a wireless touch screen switch panel connected with ZigBee. By using this wireless touch screen switch panel, customers do not need any cables to connect switch panel to the wall. Since the wireless touch screen switch panel utilizes batteries, it can be placed anywhere in the room or customers can place it on a wall switch mount. It will be more flexible and handy for customers to set up and use the switch panel. By adding a sleep mode feature in this switch panel, the switch panel could be expected to have a longer battery life compared with no sleep mode feature on the switch panel. The wireless touch screen switch panel can handle several lights and detect which lights are still on or off. This switch panel also have dimmer feature. There are three levels brightness intensity available for customers to choose. A special feature offered by this wireless touch screen switch panel is there are some light profiles available for customers. Customers can set which lights to turn on/off and the lights' dimmer settings in a profile. Customers can also edit or remove the light profile in the future. Customers also do not have to reset the dimmer if they have to change the bulbs. Besides, there is a memory feature that allows customers to keep the user profiles that were set before. Therefore, customers do not have to remake the

user profiles in case there should be a reset needed on the device in the future. There are also some addition features that are Insta-On/Off and refresh option in this device. Insta-on/off allows customers to instantly turn on/off all the lights from the main menu. Therefore, the customers do not need to turn off the lights one by one or waste a user profile for turning off/on all the lights. In case there will be another device developed and used at the same time or a network issue between the device and lights which will cause the device is not synchronized with one or any lights' current states, the device will recognize and update the display on the next button touched by the customer. There is also a refresh button in the main page can be used to resynchronize the device with the lights manually. Therefore, the customers will recognize if in the future the network connection or electricity is down. In short, by using this wireless touch screen switch panel, customers could control the lights yet keep saving the energy and longer the bulbs life in a handy and flexible way.

1.2. Identified of Research Problem

- How to develop a handy and low power wireless switch panel by using an LCD and a touch screen sensor as an input media and connected through ZigBee communication line to deliver commands from customers?
- How to develop a reliable dimmer feature in a wireless switch panel for customers?
- How to develop user friendly light profiles in a wireless switch panel for customers?
- How to develop a reliable user interface that can detect and show the customers which lights are still on or off in a wireless switch panel?

1.3. Range of Research

- The things developed in this research are the wireless dimmer touch screen switch panel and the Zigbee network that connects all the devices

while the lamp controllers are already developed before the research is begun.

- This wireless dimmer touch screen switch panel is aimed to be used on any rooms with a ZigBee installed and connected in a PAN (Personal Area Network) on every light's lamp controller, for example some rooms in Triple Hex.
- In this research, the electricity appliances handled by this wireless dimmer touch screen switch panel are just the lights in a room the switch panel located. However in the future's development, this wireless dimmer touch screen switch panel could control more appliances (e.g. locking/unlocking the door and controlling windows' shades)
- In this research, there will be three over four bulbs in light prototypes that will be controlled and only one bulb that can be dimmed by this wireless dimmer touch screen switch panel. It is because the last bulb controller's IC is error and cannot be programmed and the rest two non dimmable bulbs controller do not support dimming feature. However in the future, the amount of the lights controlled by this wireless dimmer touch screen switch panel depends of the amount of the lights in a room the switch panel located.
- In this research, the dimmer levels are limited into three steps. However in the future, the dimmer levels can be set based on customers want or need.
- The wireless dimmer touch screen switch panel is using four A2 rechargeable batteries or a powerbank as its power source. The switch panel will go on sleep state when there is no touch for 15 seconds to save the energy consumed on the device.

1.4. Aims and Purposes of Research

- To develop a handy and low power wireless switch panel by using an LCD and a touch screen sensor as an input media and connected through ZigBee communication line to deliver commands from customers.
- To develop a reliable dimmer feature in a wireless switch panel for customers.
- To develop user friendly light profiles in a wireless switch panel for customers.
- To develop a reliable user interface that can detect and show the customers which lights are still on or off in a wireless switch panel.

1.5. Contribution

The benefit from this thesis' research is aimed to control the lights, save the energy, and make the bulbs' life longer in a handy and flexible way in any rooms with a ZigBee installed and connected in a PAN (Personal Area Network) on every light's lamp controller, for example some rooms in Triple Hex. Besides that, as the other benefit, by doing this thesis' research, the student could get more knowledge and experience about microcontroller, LCD, ZigBee communication, and touch screen sensor.

1.6. Thesis Outline

The generic structure used in this thesis' writing is mentioned as follow:

CHAPTER I: INTRODUCTION

This chapter consists of historical background, problems, research's limitations, aims and purposes, research's benefits, and thesis' writing generic structure.

CHAPTER II: LITERATURE REVIEW

This chapter outlines theories that are relevant to the research conducted. The theories underlie discussions and definitions written in this thesis report.

CHAPTER III: RESEARCH METODOLOGY

This chapter gives a brief overview of research conducted. This chapter outlines literature studies about components used in a device developed in this research, the tools needed, and device's design, implementation, and testing developed in the research conducted.

CHAPTER IV: ANALYSIS AND DISCUSSION

This chapter presents the result of tests performed on the device developed, along with the analysis and discussion about the result gained.

CHAPTER V: CONCLUSION AND SUGGESTIONS

This chapter provides the summary and suggestions of the device developed based on the research had been done.