e-FireXIT: A SMART ROUTE DECISION MAKING SYSTEM TO EMERGENCY EXIT

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Specially dedicated to

My beloved parents

Loo Peng Khoon & Lee Ah Hiong

My supervisor

Engr. Vigneswara Rao Gannapathy

and those people who have guide me throughout my journey of education

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ABSTRAK

Adalah dilaporkan bahawa apabila berlaku kebakaran, kebanyakan penghuni bangunan akan mengambil masa yang agak lama untuk menyelamatkan diri ke luar bangunan. Ini kerana orang ramai perlu mencari lokasi pintu keluar kecemasan. Lampu keluar kecemasan juga mungkin dihalang oleh asap hitam dan orang ramai akan terlepas pandang jika terdapat jarak di antara orang dengan lampu keluar kecemasan. Projek ini mencadangkan sistem e-FireXIT untuk menandatanagni masalah ini dan mengetuai penghuni bangunan menyelamatkan diri menggunakan laluan yang paling selamat dan terdekat ke pintu keluar kecemasan. Sistem tersebut juga boleh mengubah laluan secara automatik ke laluan yang selamat jika api berlaku menyebabkan laluan itu tidak selamat digunakan. Dengan menyatukan sistem pengumuman awam ke dalama sistem e-FireXIT, ia akan memberi pengumuman tentang laluan terselamat untuk digunakan. Kesannya, proses pemindahan akan menjadi lebih cepat.

ABSTRACT

It was reported that during fire break out, the building occupant spend more time to evacuate from the building. This is due to the people need to find where is the location of emergency exit doors. The exit signs are also covered by black smoke and they missed it if there is a distance between the people and the signs. This project proposed the e-FireXIT system to overcome the problems and guide the building occupant to emergency exit doors via the safest and nearest exit points. The system will reroute itself to another exit points if any of it is engulfed in fire that result not safe to exit. The public announcement system also integrated with e-FireXIT system to make an announcement on the safest exit points. Thus, through this system, the evacuation become more faster.

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LIST OF ABBREVIATIONS

PIC	–	Peripheral Interface Controller
PCB	–	Printed Circuit Board
LED	–	Light Emitting Diode
SMD	–	Surface Mount Device
RTD	–	Resistance Temperature Detector
IDE	–	Integrated Development Environment
GPS	–	Global Positioning System
SMS	–	Short Message Service
UTeM	–	Universiti Teknikal Malaysia Melaka

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CHAPTER I

INTRODUCTION

This chapter covered the Introduction of the project. It consists of objective, problem statement, scopes of project and thesis outline. It also highlights the problem of existing system and their limitations.

1.1 Introduction

The emergency exit lights are important signs during fire break out. When fire break out, it serves as a guide for the building occupant to escape through safest exit for immediate evacuation. However, current emergency exit signs are located near to the emergency exit. It will be covered by black smoke and become invisible to people eyes. Usually, they follow the majority people towards a same exit point and this reduces the evacuation rate because only one emergency exit point is utilized and focused on. A part from that, all paths used towards emergency exit doors will

gradually became not safe to use as the fire spread very fast. As a result, the public could not identify which emergency exits are safe to move. Hence, this project proposed an e-FireXIT: A Smart Route Decision Making System to Emergency Exit that designed to guide the building occupant to the safest emergency exit for effective and fast evacuation. It was also able to reroute the path to a safest emergency exit points.

1.2 Objective

The objectives of this project are:

a. To develop indication paths for the building occupant to reach the safest exit points for fast evacuation during fire break out.
b. To reroute the path to alternative exit points when any of the exits caught in fire and unsafe to enter.
c. To incorporate the public announcement system to make a real time announcement on safest exit point.

As a result, the people can escape faster by using the safest exit points.

1.3 Problem Statement

Many exit points' exits in a building, result exit paths for each floor is different due to its structure layout. When fire happens, the people in the building find difficulty to find emergency exits. The fire can suddenly appear at any exit points and block them to enter. This will cause the panic and probably trapped in fired building.

Moreover, the smoke produced in the fire is usually thick, black and floated upward to the ceiling. If fire break out and it produces a lot of smoke, the people have to crawl on the floor to avoid it. The indoor illumination fluorescent lights are located on top of the ceiling; meanwhile the emergency exit signs are install above the emergency exit door. If the black smoke covers the upper lights from people's

view, people may get confused between the emergency exit signs and the illumination fluorescent lights. Thus, they could not find the direction to exit points.

Besides that, if the new building users are not familiar with the building evacuation plan, they will find difficulty to escape when fire break out. As a result, they will trap in the building. Furthermore, when fire break out, the new building users are spending more time to search for an emergency exit. This will cause delay and when time goes, the fire spreads very fast thus many exit points will become unsafe.

1.3.1 Highlighted Accident

In May 9, 2012, the News Straits Times [1] reported a Philippine department store caught in fire that results 11 employees died. When the fire occurred, 21 female employees were trapped in fire, seven missing and three survived by jumping from second floor window. According to Chief Inspector Mario Palarca of the provincial fire department told AFP news agency, "they could not find the emergency exit because of the huge volume of black smoke."

Figure 1.1: The fire incident in Philippine department store

1.4 Scopes of Project

1.4.1 User

The e-FireXIT system is designed to install in the building such as shopping complexes, schools, hotels and offices. The building occupant will be benefited during fire break out or any other emergency situations because the system can guide them towards the safest exit points.

1.4.2 Software Development

The project starts with software development before move to hardware development. In order to simulate and design the schematic circuit, software called Proteus ISIS 7 Professional is used. The schematic circuit is simulated and re-designed to achieve a desire output. Next, software called Proteus ARES 7 Professional is used to design Printed Circuit Board (PCB) layout based on the schematic circuit. The PCB layout will be used in hardware development to fabricate a real PCB. In addition, software called MPLAB IDE and C18 Compiler are used to write a programming for the Peripheral Interface Controller (PIC) microcontroller. The PIC model used is PIC18F4550.

1.4.3 Hardware Development

In hardware development, PCBs are fabricated in the fabrication laboratory. The hardware is mainly developed by surface mount components such as bi-colour LEDs and resistors. There is also a main controller box constructed with PIC, power transistors, voltage regulators and switches. The smoke sensor and temperature sensor (model LM35) are used to install on the exit points' ceiling. Last but not least, acrylic is used to construct the casing of the prototype to demonstrate the project functionality in a miniature building.

1.5 Brief Methodology

The project workflow was showed in Figure 1.2.

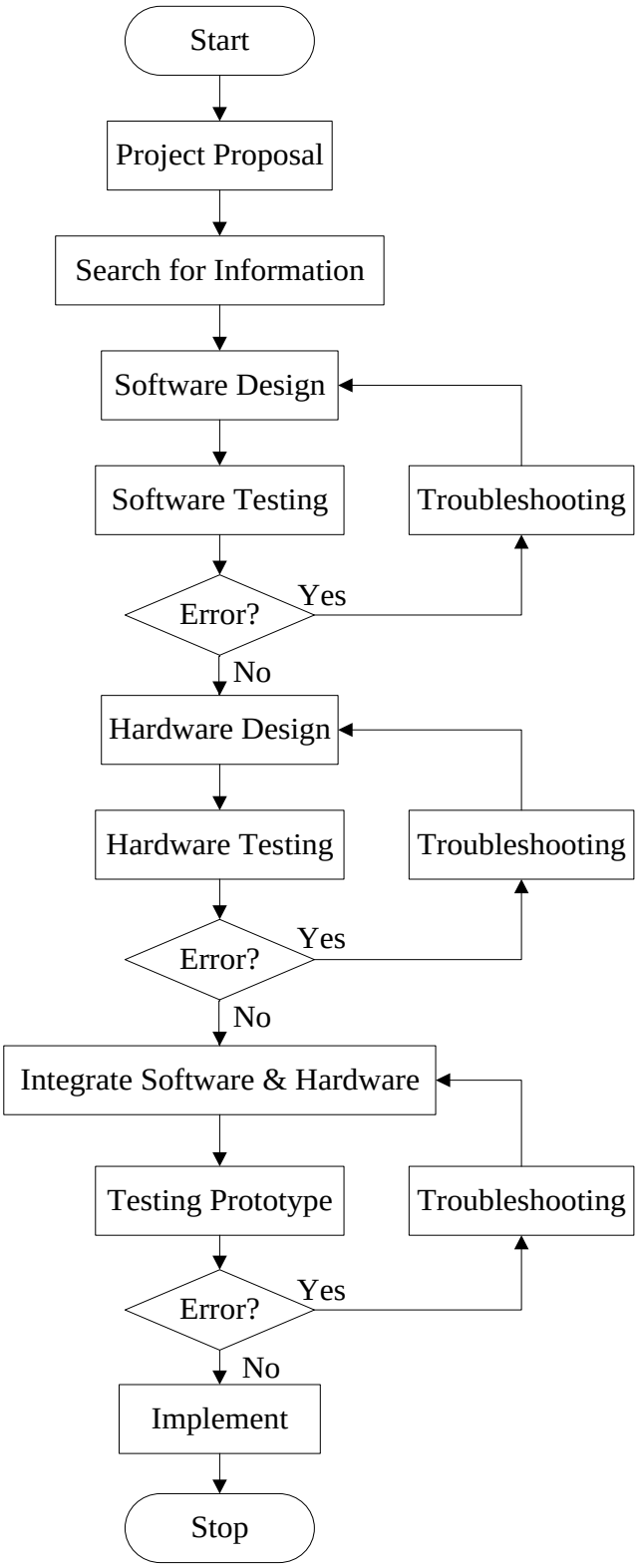

Figure 1.2: Project workflow

All the information for this project are gathered from various resources such as internet, journals, conferences and news articles. The gathered information is useful to develop the e-FireXIT system.

The project starts with software design by designing a schematic circuit and simulating it in Proteus ISIS 7 Professional environment. Next, the Proteus ARES 7 Professional is used to design the PCB layout based on the schematic circuit. Then, MPLAB IDE and C18 Compiler are used to write a programming for the microcontroller. The programming will test and debug to build a perfect and stable coding.

In hardware design, the PCB is fabricated according to the design layout. There are total nine PCB boards in use: one controller board and eight LEDs display boards. Next, the surface mount components such as LEDs and resistors are soldered on the fabricated PCB boards. Each PCB is tested individually to observe the output. A troubleshooting is performed on the circuit if a desired output is not obtained.

The software and hardware are integrated and tested for its functionality. If there are any errors occurred, a troubleshooting will be performed to ensure both software and hardware work properly. This is the method used to achieve the desired result. Then, a prototype is built to make it resembled a miniature building and installed the e-FireXIT system on it.

1.6 Thesis Outline

The thesis consists of five chapters such as Introduction, Literature Review, Methodology, Result and Discussion, and Conclusion and Recommendation. The first chapter devotes the brief idea of e-FireXIT. Then, it moves on to objectives and problem statements. Finally, brief methodology will highlight the method to build this project. A detailed methodology will be presented in Chapter 3.

Chapter 2 concerns about the theoretical background of the project. The research is based on journals, standards, books, conferences and internet. The information obtained is valuable to develop the project. Understanding about

electronic components data sheets also important as it provides the information about its characteristics and how to properly use it.

Chapter 3 discusses the detail procedures to build the prototype such as hand soldering and de-soldering SMD components. In first part, it shows how the schematic circuit is simulated and fabricated into a real PCB board. In second part, it includes the design and development of the prototype starts from a basic sketch.

Chapter 4 observes the result of this project. First, it highlights the result of LEDs display board and controller board individually. The second part explains the result of combining LEDs display and controller boards into a full function system.

Chapter 5 explains the project conclusion and recommendation. A brief conclusion is given to conclude the findings of e-FireXIT system.