UNIVERSITI TEKNOLOGI MARA

DECISION SUPPORT SYSTEM USING FPGA FOR BUILDING EVACUATION SYSTEM

NURUL FATIHAH BINTI JUSOH

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Electrical Engineering

May 2017

ABSTRACT

Evacuation procedures are very crucial to every high rise building where evacuation times must be kept to a minimum. Previous work on an emergency evacuation for high-rise building was focused on improving the evacuation plan. To date, the research has tended to focus on how to improve the safety system in the building rather than how the hardware support can improve emergency evacuation. Consequently, this unsystematic evacuation plan may result in panic, trap, stampede, as well as injuries. In view of the fact that occupants' information for instance, the location *i.e.* floor levels and rooms that involved in fires are insufficient; hence an improved occupants' information for occupants and evacuees has been an interest in this work. The Uniform Building By-Laws 1984, laws of Malaysia is referred to fulfill the standard requirement for evacuation safety system. The standard among others outline the regulations of installing automatic fire detector system of high rise building. The high rise building of interest is educational occupancies for institutional building with building specification with central air conditioning for two or more "*storey*" and within a gross floor area 500 square meter till 1000 square meter. In this work, the hardware support for improving emergency evacuation is designed known as decision support system, "*op_sys*" with six main groups by employing FPGA EP2C35F672C6 Altera Family device for high-rise building. The *"op_sys"* is designed to improve occupants' information if an emergency situation such as fires occurs. The "*op_sys*" has an ability to identify which wireless alarm sensor, displaying, and analyzing which floor in the building is currently detecting fires. The decision support is handled by Controller Alarm and Controller System Floor, respectively by displaying the data output through FPGA board depend on the three varieties of manually selected modes at FPGA board. The "*op_sys*" has been verified and converted 28 sub-modules with no syntax error and using 108 over 33216 of total logic element. The timing analyzer shows that the transmission- line data delay from the source to destination data arrived is 0.657ns at 2.697ns clock delay with zero report meta-stability of the device at positive signed display slack value of 0.391ns. The compilation for verification, hardware verification functionality, simulation waveform functionality, and timing analysis shows the results is consistent and meet the specification requirement with the theoretical analysis. Furthermore, the estimated of four alarm sensors and controller system floor is required if the system is implemented for the future work

ACKNOWLEDGEMENT

First and foremost, I would like to state my greatest gratitude to ALLAH S.W.T that gives me an opportunity to complete this research.

I would like to express my gratitude and appreciation to my project supervisors, Dr.Suhana Binti Sulaiman, and my co-supervisor Dr. Shukreen Hana Binti Herman for their consistent assistance and guidance as well as their valuable time, encouragement and patient in completing this research.

Thousand thanks and huge appreciation, especially to my beloved husband, Mr. Mohd Ikhsan Bin Kamarudin for the sharing knowledge and continual support to me and not forget to my son and daughters, Muhammad Hakim Syafie'e, Nurul Aina Damia, Nurul Aleesya Afiqah, and my baby Nurul Aqila Marissa for their patient and happiness that made me strong in completing the thesis.

Last but not least, thanks to my family and my parents, friends and anybody who involved directly or indirectly, for their support, understanding, help and advice.

Thank you.

TABLE OF CONTENTS

CHAPTER ONE
INTRODUCTION

1.1 INTRODUCTION

This chapter introduces brief research work with the background study. Also included are the problem statements and the rationale of the study .The rationale of the study explains the logical reasons for technique used and developed involving the particular information or assumption. The thesis organization of the study is detailed in the last section of this chapter.

1.2 OVERVIEW OF THE STUDY

With the rapid development of economy, science and technology, high-rise buildings are emerging to facilitate for home and offices. High-rise building is a tall building or structures that are used as a residential, office or institutional building, and shopping complex building. In the United States, the National Fire Protection defines a high-rise as being higher than75 feet (23 meters), or about 7 stories [1-2]. While, according to the building code of Hyderabad, India and Emporis Standards (Real State Information Industry in Germany), a high-rise building is one with four floors or more, or being equal or higher than 15 meters in height [3], and as a multi-story structure between 35-100 meters tall, or a building of unknown height from 12-39 floors [4], respectively.

National Fire Protection Association (NFPA) is a global non-profit organization establish in 1896 at United State, U.S and devoted to eliminating death, injury, property and economic loss due to fire, electrical, and related hazards [5]. Based on NFPA [1], in 2007-2011, an estimated 15,400 reported (an estimated 3%) high-rise structure fires per year resulted in associated losses of 46 civilian deaths, 530 civilian injuries, and $219 million in direct property damage per year. These results has shown that there is demand for high-rise building to be researched for the development and improvement system or building evacuation strategies during an emergency situation, for instance in fire safety