

**SMART RESCUE NAVIGATIONAL SYSTEM FOR  
FIRE-FIGHTERS (SRNS)**

**MOHD ZUBAIDI BIN ISMAIL**

**FACULTY OF ELECTRICAL ENGINEERING  
UNIVERSITI TEKNOLOGI MARA  
MALAYSIA**

## ACKNOWLEDGEMENT

First, I thank to Allah for the strength He has given to complete a thesis. My appreciation goes to my family who has been so supportive mentally and financially throughout this project also providing me the opportunity to study in UiTM Shah Alam and provide support in terms of spirit and financial. I would not been able to further my studies to this level without them. Their love and endless motivation is my source of energy for a greater level of achievements.

To Dr. Nur Idora bin Abdul Razak, my supervisor, I would like to express my deepest gratitude for giving me the opportunity to work with her I have learnt and gained much from her, not only the insights in the field of my project but also her support, invaluable guidance, and the philosophies of life throughout her mentoring. Her words of wisdom will always be kept close to my heart.

Last but not least I would like to thank all members of Electrical Engineering Faculty for providing this course and giving this golden chance to take in depth knowledge on embedded system.

Thank you.

Mohd Zubaidi Bin Ismail  
Faculty of Electrical Engineering  
Universiti Teknologi MARA (UiTM)  
Shah Alam, Selangor Darul Ehsan  
Malaysia

## **ABSTRACT**

This project develop Smart Rescue Navigation System for Fire-fighters using MATLAB software in order to calculate and analyze the movement and location of fire-fighters in closed high-rise building which unavailability in GPS signal. The aim of this project is to analyze the data that have been acquired from the sensors by using third party software which supported by MATLAB by creating 3D environment graphic for incident commander to decide the best possible escapee for fire-fighters over voice radio. This system connected in mesh network consist of fixed unit (FU) set up close to the incident-scene for incident commander to monitor and Portable Unit (PU) attached to the fire-fighters. This system enable commander in charge to see the movement of fire-fighters with the sensors attached on to the fire-proof suit. The IMU sensors already build in the tracking device as to analyze the movements of fire-fighter whether it's crawling, walking or running as well as to pinpoint fire-fighters location with least positioning error.

## TABLE OF CONTENTS

<b>CONTENTS</b>	<b>PAGE</b>
Declaration	i
Dedication	ii
Acknowledgement	iii
Abstract	iv
Table of Contents	v
List of Figures	viii
List of symbols / Abbreviations	ix
<b>CHAPTER 1: INTRODUCTION</b>	
1.1 Introduction	1
1.2 Background of study	
1.2.1 MATLAB	2
1.3 Problem statement	4
1.4 Objective	
1.5 Scope of work	5
1.6 Thesis overview	6
<b>CHAPTER 2: LITERATURE REVIEW</b>	
2.1 MEMS	7
2.2 Basic MEMS Theory	
2.2.1 Single-Axis Yaw Gyroscope	8
2.2.2 3-Axis Accelerometer	9
2.2.3 Magnetometer	
2.3 MEMS Sensor Fusion	10
2.4 Trusted Portable Navigator	12
2.5 Mobile Augmented Reality	13

**CHAPTER 3:            METHODOLOGY**

3.1	Introduction	14
3.2	Flow chart	15
3.2.1	Research project	16
3.2.2	Software and Device Selection	
3.2.3	Software and device Compatibility	17
3.2.3.1	Portable Unit and Fixed Unit	17
3.2.3.2	Sensor Monitor UDP and Sensor Monitor PRO	18
3.2.3.2.1	Setup LAN connection between PC and Smart Phone	
3.2.3.2.2	Setting up Sensor UDP (Android) and Sensor Monitor (Iphone)	21
3.2.4	Obtaining Data from Sensor	23
3.2.4.1	Read Sensor Data	
3.2.4.2	Processing and Visualizing Sensor Data	25

**CHAPTER 4:            RESULTS AND DISCUSSION**

4.1	Introduction	26
4.2	Results	
4.2.1	Normal Walking	
4.2.2	Walking Straight and Turn Right	28
4.2.3	Walking Straight and Turn Left	29
4.2.4	Run Straight and Turn Right	31
4.2.5	Run Straight and Turn Left	32
4.2.6	Crawling Straight	33
4.2.7	Crawling Straight and Turn Right	34
4.2.7	Crawling Straight and Turn Left	36