


**MICROCONTROLLER BASED ON
FIRE ALARM SYSTEM USING
SENSORY AND MONITORING SYSTEM**

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MAY 2007

“I hereby declare that I have read this report and in my opinion this report in term of content and quality requirement fulfils the purpose for the conferring of the Degree of Bachelor in Electrical Engineering.”

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SENSORY AND MONITORING SYSTEM**


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**This project report is presented in partial fulfillment of the requirement for the
award of the Bachelor's Degree of Electric Engineering (Control,
Instrumentation & Automation) Hons.**

**Faculty of Electrical Engineering
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MAY, 2007

"I declare that this project report is the result of my own work expect as cited in references."

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Date : MAY, 2007

Specially dedicated to

My beloved father and mother ...

Mr.Letchamanan s/o Perumal & Mageswary d/o Pitchai

My beloved brother & sister ...

*Davindran s/o Letchamanan, Panimalar d/o Letchamanan & Surindran s/o
Letchamanan*

My inspirational motivator ...

All my friends,

Thank you for everything ...

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ABSTRACT

Fire alarm system plays an important role in maintaining and monitoring the safe of all kind environments and situations. However the usability of many existing fire alarm system is well known but could be produce with high cost. Subsequently, it is not affordable for the low income users. The main objective of this project is to produce a prototype of multilevel operating Fire Alarm system (M-FAS) with low cost. The M-FAS has two main systems, the detection system and the monitoring system. The detection system operates as the fire detector. This detection system has three detection components which are flame detector, smoke detector and heat detector. This paper discusses the design and implementation of a fire alarm system using the microcontroller which operates the entire system. The detectors are placed in parallel in different levels. Any signal from each detector at any level is monitored using the monitoring system. The monitoring system is developed by using the Visual Basic 6.0. The entire system is controlled by the microcontroller. The microcontroller is been programmed in such way by using the microC compiler. From the experiment done, the prototype of the M-FAS detects fire when existing of smoke, flame and heat sensed by the detectors, followed by the monitoring system which indicates smoke, flame and heat at that particular level. Finally when all the three sensors from each level triggered, the main buzzer and piezo buzzer at that particular level operates. Hopefully with the development of the M-FAS, it helps all the users at any level of income to have one at their home or office.

ABSTRAK

Sistem penggera kebakaran memainkan peranan yang penting dalam mengesan dan mengawal keselamatan peralatan dan keselamatan nyawa. Penggunaan sistem penggera yang wujud sekarang memang terkenal dan mampu dimiliki tetapi dengan harga yang mahal. Oleh itu, ia menyebabkan golongan yang berpendapatan rendah tidak dapat dan tidak mampu untuk memiliki sistem keselamatan tersebut. Objektif utama projek ini adalah untuk menghasilkan sebuah prototaip pengesan api bertingkat (M-FAS) pada kos yang rendah. M-FAS ini mempunyai dua sistem utama iaitu sistem pengesan dan sistem pemantauan. Sistem pengesan berfungsi sebagai pengesan kebakaran. Sistem ini mempunyai tiga jenis pengesan iaitu pengesan api, pengesan asap dan pengesan haba. Setiap jenis pengesan ini diletakkan di aras yang berbeza-beza. Sebarang pengesanan oleh pengesan-pengesan di setiap aras ditunjukkan dalam sistem pemantauan. Sistem pemantauan ini dibangunkan dengan menggunakan perisian Visual Basic 6.0. Manakala, keseluruhan operasi M-FAS dikawal oleh mikro-pengawal. Mikro-pengawal ini diprogramkan dengan menggunakan perisian *microC compiler*. Berdasarkan daripada eksperimen yang dijalankan, prototaip M-FAS ini dapat mengesan kebakaran apabila kehadiran asap, api dan haba dikesan oleh sistem pengesan. Sistem pemantauan pula dapat menunjukkan sebarang kehadiran asap, api atau haba pada setiap aras. Kebakaran yang dikesan menghasilkan bunyi amaran di ruang utama dan aras bangunan tersebut. Dengan pembangunan M-FAS ini, diharapkan ia membolehkan pengguna pelbagai peringkat mampu mempunyai sistem kebakaran di kediaman atau bangunan pejabat.

TABLE OF CONTENTS

CHAPTER	TOPIC	PAGE
	TITLE	i
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xi
	LIST OF FIGURES	xii
	LIST OF ABBREAVIATIONS	xiii
	LIST OF APPENDICES	xv
I	INTRODUCTION	
	1.1 Aim	2
	1.2 Problem Identification	2
	1.3 Project Objectives	3
	1.4 Project Scope	3
	1.5 Project Limitation	4
	1.6 System Overview	4
	1.7 Thesis Structure	5

II LITERATURE REVIEW

2.1	Fire Alarm System: Related Work	7
2.2	Detection Component on Fire Alarm System	9
2.2.1	Smoke Sensor	9
2.2.2	Flame Sensor	11
2.2.3	Heat Sensor	12
2.3	PIC16F877A 40-Pin CMOS Flash Microcontroller	14
2.3.1	Features and Advantages of Microcontroller	15
2.3.2	Comparing the Microprocessor and Microcontroller	16
2.4	EAGLE ver4.13r1	16
2.5	microC Compiler	17
2.6	Visual Basic	18
2.7	Fire Alarm System Available in the Market	19

III METHODOLOGY

3.1	Introduction	21
3.2	Research Phase	22
3.3	Designing Phase	22
3.3.1	Designing the M-FAS Detection System	23
3.3.1.1	Smoke Sensor	24
3.3.1.2	Flame Sensor	24
3.3.1.3	Heat Sensor	25
3.3.1.4	Microcontroller	25
3.3.2	Designing the M-FAS Monitoring System	25
3.4	Development Phase	26
3.5	Analysis Phase	26
3.6	Project Development Planning Gantt chart	26

IV PROJECT DESIGN AND DEVELOPMENT

4.1	Hardware Development	27
4.1.1	Smoke Sensor Circuit	28
4.1.2	Flame Sensor Circuit	28
4.1.3	Heat Sensor Circuit	29
4.1.4	The Driver Unit Circuit	30
4.1.5	Microcontroller 16F877A Main Board Circuit	31
4.1.6	MAX232 +5V Powered Multi-Channel RS-232 Driver	33
4.1.7	Printed Circuit Board Layout	34
4.1.8	Hardware Construction	36
4.1.8.1	Sub-Unit Layouts	37
4.2	Software Development	40
4.2.1	Development of the Front Panel of GUI	41
4.2.2	Development of the microC Compiler language	42

V RESULTS AND ANALYSIS

5.1	M-FAS Hardware Detection Analysis	43
5.1.1	Smoke Sensor Analysis	44
5.1.2	Flame Sensor Analysis	44
5.1.3	Heat Sensor Analysis	45
5.1.4	PIC16F877A Microcontroller Analysis	46
5.2	M-FAS Monitoring System Analysis	46
5.2.1	Graphical User Interface (GUI)	47
5.3	Analysis on Comparison of the Cost	49

VI CONCLUSION AND RECOMMENDATION

6.1	Conclusion	50
6.2	Recommendation	51

REFERENCES	52
APPENDICES	54

		PAGE
1.1	Introduction and objectives of the study	54
1.2	Research methodology	55
1.3	Research results and discussion	56
1.4	Conclusion and recommendations	57
1.5	References	58

LIST OF TABLES

TABLE NO.	TITLE	PAGE
2.1	Features and advantages of the types smoke sensor	10
2.2	Features and advantages of the flame sensor	11
2.3	Features and advantages of the heat sensor	12
2.4	Product features by manufacturers	19

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
1.1	Overview of Microcontroller Based Fire Alarm System	4
2.1	Resistance vs. Temperature Graph	13
2.2	Basic structure of a microcontroller	14
2.3	PIC16F877A 40-Pin CMOS Flash Microcontroller	14
2.4	Eagle 4.13r software	17
2.5	MicroC V 5.0 Compiler	18
3.1	Related Phases in Developing the M-FAS	22
4.1	Smoke Schematic Circuit	28
4.2	Flame Schematic Circuit	29
4.3	Heat Schematic Circuit	30
4.4	Driver Unit Schematic Circuit	31
4.5	Microcontroller main board schematic circuit	32
4.6	Pin configuration of the Microcontroller 16F877A	32
4.7	Pin configuration of the MAX- 232	33
4.8	Multi-Channel RS-232 driver schematic circuit	33
4.9	PCB layout of the smoke circuit	34
4.10	PCB layout of the flame and heat circuit	35
4.11	PCB layout of the driver unit circuit	35
4.12	PCB layout of the microcontroller main board circuit	35
4.13	PCB layout of Multi-channel RS-232 driver circuit	36
4.14	Prototype of the buildings	37
4.15	Front View of the Subunit (External)	38
4.16	Front/Back view of the sub-unit (Internal)	38
4.17	Top View (External) of the Sub-Unit	39
4.18	Bottom View (External) of the Sub-Unit	39

4.19	Bottom View (Internal) of the Sub-Unit	40
4.20	Front Panel of GUI	41
4.21	IDE Overview of the microC	42
5.1	The output waveform from Infrared Smoke Sensor	44
5.2	The output waveform from Flame Sensor	44
5.3	The output waveform from Heat Sensors	45
5.4	The output waveform from PIC16F877A	46
5.5	GUI of the Fire Alarm System in Operating Mode	47
5.6	The GUI display when any of one sensor triggered	48
5.7	The GUI display when all the three sensors triggered	48

LIST OF ABBREVIATIONS

M-FAS	-	Multilevel Fire Alarm System
PIC	-	Programmable Interfere Controller
UV	-	Ultra Violet
IR	-	Infrared
NTC	-	Negative Temperature Coefficient
PTC	-	Positive Temperature Coefficient
CMOS	-	Complementary Metal Oxide Silicon
RAM	-	Random Access Memory
ROM	-	Read Only Memory
I/O	-	Input/Output
A/D	-	Analog to Digital
DIP	-	Dual in Package
CPU	-	Centralized Personal Unit
EAGLE	-	Easily Applicable Graphical Layout Editor
LED	-	Light Emitting Diode
VB	-	Visual Basic
GUI	-	Graphical User Interface
LDR	-	Light Dependent Resistor
EEPROM	-	Electrical Erasable Programmable Read Only Memory
SPDT	-	Single Pole Dual Toggle
PCB	-	Printed Circuit Board
MHz	-	Megahertz
IDE	-	Integrated Design Environment

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	SD 3443/SE 3470 Manual Datasheet	54
B	Flame Datasheet	56
C	Heat Datasheet	58
D	PIC 16F877A Datasheet	60
E	Flowchart of PIC 16F877A Source Code Behavior	68
F	Flowchart of Visual Basic Source Code Behavior	68
G	Flowchart of the Process Involved in the Development of the Entire M-FAS	70
H	Gantt chart PSM I	71
I	Gantt chart PSM II	72
J	Visual Basic Source Code	73
K	Microcontroller PIC 16F877A Source Code	78
L	Price List	81
M	Presentation Slide Show	82
N	Snap shot of the project	98
O	Complete Seminar Paper (IEEE Format)	104

CHAPTER I

INTRODUCTION

A lighted cigarette, a burning splinter, an overheated electrical appliance or just about any of these can trigger a fire and add to this presence of foam sofa sets and nylon settings and the poisonous gases that their burning emanates. It hardly needs a few minutes to render persons helpless, even before they realize what is happening.

The well known companies that deal with security system are such as ADT Security Service and the Chubb Alarm. The companies have been the innovative leader in the security services. These companies product offering includes intruder alarms and other highly sophisticated fire alarm systems. The fire alarm system that has been built up by these companies are high in cost and need more maintenance to be carried out by the specified companies authority.

Based from the currently existing fire alarm system that are available in market with high cost, a multilevel fire alarm system or M-FAS with low in cost has been developed. The M-FAS consists of two subsystem; detection system and monitoring system.

The M-FAS detection system has smoke detecting capabilities based on infrared sensory. It also incorporates the heat and flame detector that is connected to the infrared smoke detectors in parallel.

The M-FAS monitoring system is associated with detection system in order to ease the emergency location determination. The monitoring system has smoke, flame

and heat indicator in each level. When all of these sensors are triggered, the status indicator is turned ON. This alarm is considered as a true alarm to prevent from alarm triggering and safety precautions.

Finally, the microcontroller is used as the main part of M-FAS that controls the entire operations involved in the emergency situation. The microcontroller based fire alarm system described in this thesis, could be the best thing to safe lives and reduce property losses with low cost.

1.1 Aim

The main purpose of this project is to design and implement a multilevel fire alarm system (M-FAS) that can be produced at a low cost with effective and competitive usage. This system is designed to be more users friendly and easy to operate at any level.

The M-FAS is also been designed to be further working vision using minimum hardware at the lower level of processing. These systems are directed at specific applications.

1.2 Problem Identification

The existing fire alarm system in market nowadays, is too complex in term of its design and structure. Since the system is too complex, it needs regular preventive maintenance to be carried out to make sure the system operates well. Meanwhile, when the maintenance is been done to the existing system, it could raise the cost of using the system. Therefore, the proposed M-FAS are designed with a low cost and all level users can have one for a safety purpose.

1.3 Project Objectives

In determining the purpose and the direction of this project, there are several objectives that need to be accomplished in developing the M-FAS. This project aims to achieve the following objectives.

- i) To design a low cost microcontroller based fire alarm system.
- ii) To develop the prototype of the fire alarm system using heat, flame and smoke detector.
- iii) To develop the monitoring system to safeguard the user and their belongings and at the same time being user friendly to accommodate the need of the masses.

1.4 Project Scope

In a way to achieved above objectives, this project need to be implemented as below:

- i) This fire alarm system also incorporates the heat and flame detector that is connected to the infrared smoke detector in parallel.
- ii) The microcontroller is used as the heart of this fire alarm system that controls the entire operations involved.
- iii) The fire alarm system is capable to locate and identified the place that is in fire where by it is monitored using the monitoring system.
- iv) Capable to display the output from each sensor in the monitoring system.

1.5 Project Limitation

The project has been limited to a desired area of condition which is estimated by 8m x 4m. Besides that, the estimated height of desired area is 2.5m. This is to make the system more sensitive and obtain a quick feedback from the desired area of condition.

1.6 System Overview

Figure 1.1 describes that the M-FAS consists three main parts of detecting sensors which is connected to the microcontroller device. The fire alarm system has smoke detecting capabilities based on infrared sensory.

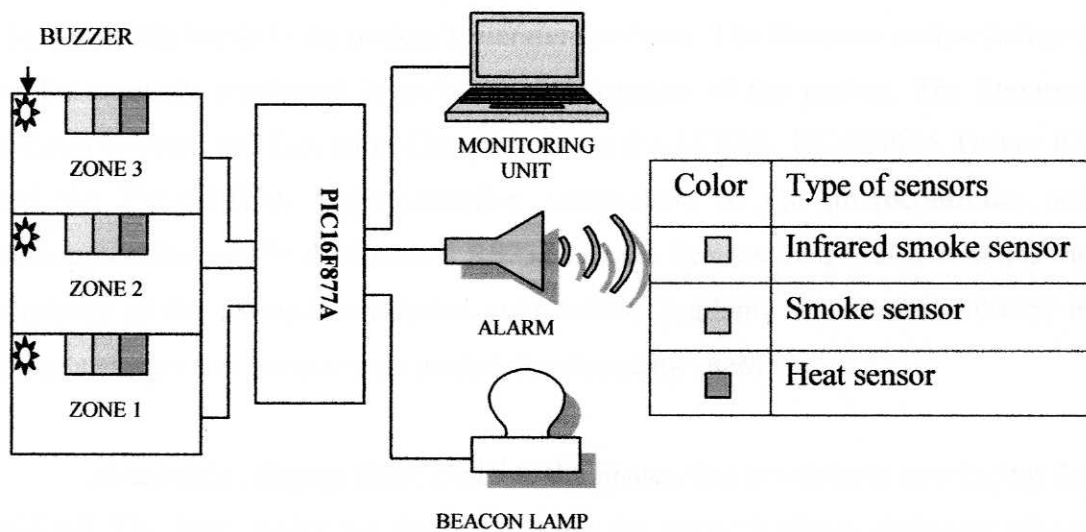


Figure 1.1: Overview of Microcontroller Based Fire Alarm System

The M-FAS also incorporated the heat and flame detector that is connected to the infrared smoke detectors in parallel. This alarm system is considered as a true alarm system when all of these three detectors or sensors are triggered. This is to prevent from false alarm triggering and safety precautions.

The PIC 16F877A microcontroller acts as a heart of the Fire Alarm System. This PIC controls the entire operating system. The entire signal received from the sensors is then judged by the PIC and consider either enough information to prove the existing of fire or to reset if any of this sensor do not respond.

Besides that, the fire alarm system also includes a strobe light, a main alarm and buzzer in each level which alerts people. This buzzer and main alarm are activated once the PIC gets a signal from the three sensors that are connected in parallel.

1.7 Thesis Structure

This thesis is constructed into six chapters. The first chapter explains the problem statements, objectives, scopes and limitations of the project. The second chapter of this thesis is the project's literature reviews. The literature review is based on the research conducted towards the development of the project. The literature reviews covered are Detection Components on the M-FAS, ULN2003A Driver IC, and the PIC16F877A Microcontroller, comparison of the microcontroller and microprocessor, and Multi-Channel RS232 Driver. Besides that, it also contains the summary of the research conducted onto several available inventories software in today's market and the previous project developed by UteM student.

Meanwhile, chapter three explains the phases that involves in developing the M-FAS. The four phases involved which are the research phase, designing phase, development phase and the analysis phase. Chapter four discussed the project development where it describes the system design process involved and the development of the hardware and software. In chapter five, it explains the results of the system development of this project and its analysis based on the system operation and the system's function. This chapter also represents the GUI interpretation if fire is triggered at each level.

Finally chapter six contains the conclusion of the project and the recommendation suggestion for the continuity of the project and future upgrade. This chapter can be referred to other individuals who are interested in continuing developing this project.

CHAPTER II

LITERATURE REVIEW

As mentioned earlier in the project objective that, one of the main reason of this fire alarm system is the cost factor. Subsequently, to design a system that can achieve this objective some studies have been carried out those involving three main subtopics such as previous case study on fire alarm system, studies of hardware and software.

2.1 Fire Alarm System: Related Work

According to Wang, Niihau Xiao and Jianmei, Bao Minzhong [1], the purpose of the fire alarm system is to detect a fire at an earlier stage and then led to give a high reliable judgments result. An important point is that alarm is there to cause the operator to responds. If the operator does not notice an alarm and make an appropriate response to it, then in the alarm system has failed. It has been also suggested by Brown, Campbell [2] that for an alarm to be alarm it must be require positive response from the operator.

The alarm system proposed by Nur Azirah Bte Abd Aziz [3], is consists of three sensors; infrared smoke sensors, thermistor heat sensor and infrared sensor. The infrared smoke sensor is designed to identify a fire while in its smoldering or early flame stage, replicating the human sense of smell. The thermistor heat sensor which detects abnormally high temperature or rate of temperature rises. The infrared sensor for intruder alarm is used to detect any motion at the entrance of the house where it acts as a burglar alarm system. Once, the fire has been detected it automatically