

NETWORK WIRELESS SMOKE DETECTOR
BY USING RF

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BY USING RF

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DEDICATION

Specially dedicated to my father, mother, brother and my friends for their loving, understanding, cares and support.

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ABSTRACT

This project Network Wireless Smoke Detector using RF system was build to make sure that our residence is a safe place. This smoke detector system was a network wireless system; which is the smoke detector circuit and the control unit was connecting without using wire. In this project, the type of smoke detector has been use is ionization type. Besides that, this project was focus on microcontroller PIC16F876A. The microcontroller is a important part in wireless smoke detector system. Function of microcontroller is to control the input and output signal, and then it will process the input to give a correct output at that time. Meanwhile, this network wireless system communicates by using Radio Frequency (RF) signal between detector circuit and control unit.

ABSTRAK

Laporan ini mengandungi maklumat tentang Rangkaian Pengesan Asap tanpa menggunakan wayar. Sistem pengesan asap ini beroperasi tanpa menggunakan wayar; dimana litar pengesan asap dan unit kawalan dihubungkan tanpa menggunakan wayar. Didalam projek ini, jenis pengesan asap yang digunakan ialah dari jenis "Tonization". Projek ini juga tertumpu kepada penggunaan mikropengawal PIC16F876A yang merupakan penggerak utama sistem ini. Mikropengawal berfungsi megawal isyarat masukan dan memproses masukan tersebut untuk mengeluarkan keluaran seperti yang dikehendaki. Manakala, isyarat yang terlibat dalam komunikasi antara litar mengesan dan 1 unit kawalan ialah isyarat Frekuensi Radio (RF).

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LIST OF SYMBOL / ACRONYM

| | |
|-----|---------------------------------|
| CCS | CUSTOM COMPUTER SERVICES |
| dB | DECIBEL UNIT |
| DSP | DIGITAL SIGNAL PROCESSING |
| LED | LIGHT EMITTING DIODE |
| I/O | INPUT AND OUTPUT |
| PCB | PRINTED CIRCUIT BOARD |
| RAM | RANDOM ACCESS MEMORY |
| PIC | PERIPHERAL INTERFACE CONTROLLER |
| ROM | READ ONLY MEMORY |
| LF | LOW FREQUENCY |

CHAPTER 1

INTRODUCTION

1.1 Background

This system has been creating to make sure that our life and properties are safe from fire. The warning from this system is important so that it can warn people to save their life. So this system can decrease the accident that cause from fire. In this system, the microcontroller is use to control all the input and output signal. The type of PIC that use in this system is PIC16F876A. It is 8-bit microcontroller with 22I/O, operate with 5V supply and operating speed is 20MHz. The RF Receiver (315MHz) is super regeneration design ensures sensitive to weak signal, low power consumption (4mA) and it cover small dimension. This system also use addressable remote control decoder that up to 12 tri-state code address pin and wide range operating voltage 4-15V. Lastly, the smoke detector that I want to use is ionization type because it more sensitive on smoke compares photoelectric type. This detector is wireless connection with build in remote control encoder and RF transmitter. It operates with 9V battery.

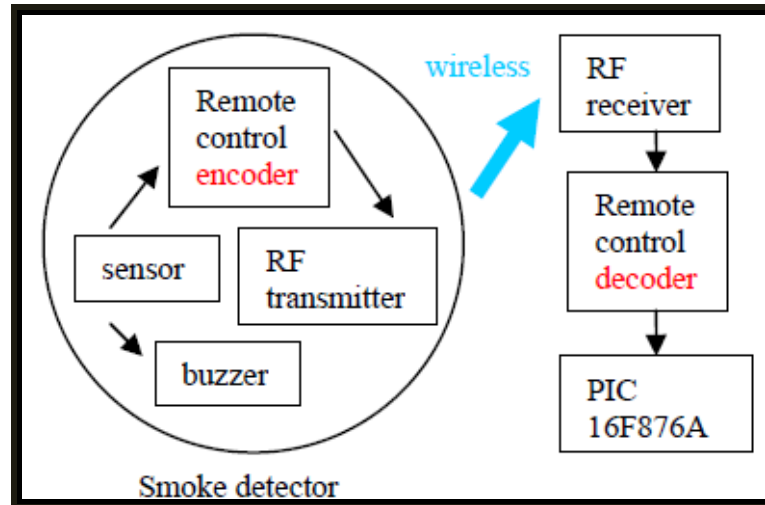


Figure 1.0: System overview

1.2 Objective

The objective of this project is to design, implement, construct and prototype the network wireless

1.3 Problem Statement

Problem Statement:

1. Installing smoke detector system using cable is difficult and expensive.
2. Smoke detector and the buzzer are combining in one circuit and don't have the control unit.
3. Many smoke detector systems now days still cannot show which one smoke detector give the warning.

1.4 Scope

1. Use PIC16F876A.
 - 256 bytes of EEPROM data memory.
 - It is a Universal Asynchronous Receiver Transmitter.
2. Use two smoke detector (Ionization type)
3. This smoke detector is using 9V battery to operate.
4. This project is using an IC remote control (PT2272) to encode data.

1.5 Methodology

Project Planning

- Identify project and discussion with supervisor
- Prepare Gantt Chart for guidelines and progress of project

Literature Review

- Background reading and reference
- Search for suitable and practical circuits

Building the Hardware

- Components and parts identification
- Data gathering and analysis.
- Assembly the component on the board and test run the operation. If any problems occur after testing the circuit, the process of troubleshooting must be held.

Finishing

- Testing of prototype in operation, application and result
- Presentation on outcome of project
- Preparation and presentation of technical report

1.6 Report Structure

Chapter 1 briefly explains the introduction of the Network wireless smoke detector using RF. It consist objectives of the project, research or background study of network wireless smoke detector using RF that had been done before, problems statement of the project, the scope and the methodology of the project.

Chapter 2 will be discussed about general knowledge on literature review of network wireless smoke detector using RF. It will be explained on the method and approach that had been used in previous research and also explained on the relationship of the research information and the theory.

Chapter 3 will be discuss on methodology in more detail by using the data collection method, data process method, analyze the data, and flow chart. All this will describe the process in detail of each part starting from the scratch until complete.

As for the chapter 4, it will be covered the entire conclusion, finding project analyze the project progress, suggestion or opinion and also further research in future.

CHAPTER 2

LITERATURE REVIEW

2.1 Smoke Detector

In home security, there are several type of detector which like flood detector, smoke detector and temperature detector. This project is focus to create a network wireless smoke detector by using RF signal.

There are two type of Smoke Detector which are ionization type and photoelectric type.

Ionization Detectors

Ionization detectors have an ionization chamber and a source of ionizing radiation. The source of ionizing radiation is a minute quantity of americium-241 (perhaps 1/5000th of a gram), which is a source of alpha particles (helium nuclei). The ionization chamber consists of two plates separated by about a centimeter. The battery applies a voltage to the plates, charging one plate positive and the other plate negative. Alpha particles constantly released by the americium knock electrons off of the atoms in the air, ionizing the oxygen and nitrogen atoms in the chamber. The positively-charged oxygen and nitrogen atoms are attracted to the negative plate and the electrons are

attracted to the positive plate, generating a small, continuous electric current. When smoke enters the ionization chamber, the smoke particles attach to the ions and neutralize them, so they do not reach the plate. The drop in current between the plates triggers the alarm.

Photoelectric Detectors

In one type of photoelectric device, smoke can block a light beam. In this case, the reduction in light reaching a photocell sets off the alarm. In the most common type of photoelectric unit, however, light is scattered by smoke particles onto a photocell, initiating an alarm. In this type of detector there is a T-shaped chamber with a light-emitting diode (LED) that shoots a beam of light across the horizontal bar of the T. A photocell, positioned at the bottom of the vertical base of the T, generates a current when it is exposed to light. Under smoke-free conditions, the light beam crosses the top of the T in an uninterrupted straight line, not striking the photocell positioned at a right angle below the beam. When smoke is present, the light is scattered by smoke particles, and some of the light is directed down the vertical part of the T to strike the photocell. When sufficient light hits the cell, the current triggers the alarm.

Which type is better?

Both ionization and photoelectric detectors are effective smoke sensors. Both types of smoke detectors must pass the same test to be certified as UL smoke detectors. Ionization detectors respond more quickly to flaming fires with smaller combustion particles; photoelectric detectors respond more quickly to smoldering fires. In either type of detector, steam or high humidity can lead to condensation on the circuit board and sensor, causing the alarm to sound. Ionization detectors are less expensive than photoelectric detectors, but some users purposely disable them because they are more likely to sound an alarm from normal cooking due to their sensitivity to minute smoke particles. However, ionization detectors have a degree of built-in security not inherent to photoelectric detectors. When the battery starts to fail in an ionization detector, the ion current falls and the alarm sounds, warning that it is time to change the battery before

the detector becomes ineffective. Back-up batteries may be used for photoelectric detectors.

So in this case, I have choose Ionization type because it more suitable for my project.

2.2 Microcontroller

A **microcontroller** (also MCU or μC) is a functional computer system-on-a-chip. It contains a processor core, memory, and programmable input/output peripherals. Microcontrollers include an integrated CPU, memory (a small amount of RAM, program memory, or both) and peripherals capable of input and output.

It emphasizes high integration, in contrast to a microprocessor which only contains a CPU (the kind used in a PC). In addition to the usual arithmetic and logic elements of a general purpose microprocessor, the microcontroller integrates additional elements such as read-write memory for data storage, read-only memory for program storage, Flash memory for permanent data storage, peripherals, and input/output interfaces. At clock speeds of as little as 32 KHz, microcontrollers often operate at very low speed compared to microprocessors, but this is adequate for typical applications. They consume relatively little power (milliwatts or even microwatts), and will generally have the ability to retain functionality while waiting for an event such as a button press or interrupt. Power consumption while sleeping (CPU clock and peripherals disabled) may be just nanowatts, making them ideal for low power and long lasting battery applications.

Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, remote controls, office machines, appliances, power tools, and toys. By reducing the size, cost, and power consumption compared to a design using a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to electronically control many more processes.

2.2.1 Microcontroller PIC

The full name of PIC is Peripheral Interface Controller. There are many type of PIC that we can find in market like example PIC16FXXX, PIC16C5XX and PIC17CXXXX. In my project, I have chosen to use PIC that have been produced by Microchip Technology. Below are several type of PIC that company have been procedure:

2.2.1.1 PIC16F84A

PIC16F84A which have been shown in figure 2.1 have 18-pin. Below is the features of the PIC16F84A.

High Performance RISC CPU Features:

Only 35 single word instructions to learn

- All instructions single-cycle except for program branches which are two-cycle
- Operating speed: DC - 20 MHz clock input DC - 200 ns instruction cycle
- 1024 words of program memory
- 68 bytes of Data RAM
- 64 bytes of Data EEPROM
- 14-bit wide instruction words
- 8-bit wide data bytes
- 15 Special Function Hardware registers
- Eight-level deep hardware stack
- Direct, indirect and relative addressing modes
- Four interrupt sources:
 - External RB0/INT pin
 - TMR0 timer overflow
 - PORTB<7:4> interrupt-on-change
 - Data EEPROM write complet