

INTELLIGENT FIRE DETECTION AND ALERT SYSTEM

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BORANG PENGESAHAN STATUS LAPORAN
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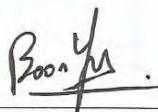
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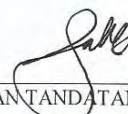
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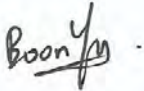
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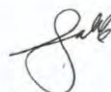
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This project specially dedicates to my family especially my parent. Thank you for their mentally support. Thank you my supervisor and all lecturers who guide me, and to all my friends for your help and support.

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ABSTRACT

This project used two different sensors, which are temperature sensor (LM35) and flame sensor to investigate fire happening. This project consists of two parts, which are transmitter and receiver. Arduino Uno is used as the microcontroller to control the sensor nodes and to give alert when there is over temperature and flame detected. At the transmitter, XBee router nodes collect data from sensors that connected to Arduino and transmit to the XBee coordinator that attached to Laptop. LabVIEW software is used to display and analyze the possibility of fire happening. The main advantage of this project is two XBee transmitter nodes are used to transmit data at different location at the same time. In addition, this project design an interactive and user friendly Graphical User Interface (GUI) for investigation purpose.

ABSTRAK

Projek ini menggunakan dua sensor yang berbeza, iaitu sensor suhu (LM35) dan sensor api untuk menyiasat kebakaran berlaku. Projek ini terdiri daripada dua bahagian iaitu pemancar dan penerima. Arduino Uno digunakan sebagai pengawal mikro ke nodus sensor. Di pemancar, nod XBee router mengumpul data dari sensor yang disambungkan ke Arduino dan menghantar kepada penyelar XBee yang disambungkan kepada Laptop. Perisian LabVIEW digunakan untuk memaparkan dan menganalisis kemungkinan kebakaran berlaku. Kelebihan utama projek ini adalah dua nod pemancar XBee digunakan untuk menghantar data pada lokasi yang berbeza pada masa yang sama. Di samping itu, projek ini mereka satu interaktif dan mesra pengguna grafik pengguna (GUI) untuk tujuan penyiasatan.

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LIST OF ABBREVIATIONS

ADC	-	Analog to digital converter
API	-	Application Programming Interface
COM	-	Component Object Model
CSMA/CA	-	Carrier sense multiple access/collision avoidance
DSSS	-	Direct Sequence Spread Spectrum
GPIB	-	General Purpose Interface Bus
GUI	-	Graphical User Interface
IDE	-	Integrated Development Environment
IEEE	-	Institute for Electrical and Electronic Engineers
LCD	-	Liquid Crystal display
LED	-	Light Emitting Diode
PCB	-	Printed Circuit Board
RF	-	Radio Frequency
SOC	-	System on chip
VISA	-	Virtual Instrument Standard Architecture
WSN	-	Wireless Sensor Network

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CHAPTER I

INTRODUCTION

This chapter will cover the introduction of the project where it involve of the project background, overview of project, problem statement, objective of project, scope of project and thesis outline.

1.1 Project Overview

Fire detection is very important for early detection and promptly extinguishing fire in short time. This system introduces an intelligent fire detection which using two types of sensors which are temperature sensor and flame sensor and transmit them using ZigBee technology. ZigBee is a typical wireless communication technology which is widely used in wireless sensing network. The reason of using two types of sensor is to reduce the possibility of false alarm. For instance, people smoking and heating in the room might cause the alarm to switch on. In this situation,

public will become panic without knowing that is false alarm. In addition, this system design an interactive and user friendly GUI (Graphical User Interface) to display and analyze possibility of fire happening. More important is this system give high alert to public and system's user when fire happen.

1.2 Problem Statement

This part will discuss in details about advantages and disadvantages if conventional wired fire alarm system which lead to the development of wireless fire alarm system to overcome the limitations of conventional wired fire alarm system.

1.2.1 Conventional Wired Fire Alarm System

Conventional panels have been around ever since electronics became small enough to make them viable. They are no longer used frequently in large buildings, but are still used on smaller sites such as small schools, stores, restaurants, and apartments. [1]



Figure 1.1 Conventional wired fire alarm system. [1]

A conventional system employs one or more initiating circuits, connected to sensors (initiating devices) wired in parallel. These sensors are devised to decrease the circuits resistance when the environmental influence on any sensor exceeds a predetermined threshold. In a conventional system the information density is limited

to the number of such circuits used. At times, a floor plan of the building is often placed near the main entrance with the defined zones drawn up, and LEDs indicating whether a particular circuit/zone has been activated. Another common method is to have the different zones listed in a column, with an LED to the left of each zone name. [1]

The main drawback with conventional panels is that one cannot tell which device has been activated within a circuit. The fire may be in one small room, but as far as emergency responders can tell, a fire could exist anywhere within a zone. [1]

Advantages: [1]

- Cost effective for small applications.

(Note: The larger the system the less competitive the price mainly due to higher installation costs.)

Disadvantages: [1]

- Cost, not competitively priced for larger systems.
- Detection of smoke or a fire is done by zone, which could be multiple areas rather than specifying a specific location. This could delay emergency responders from locating the fire.
- Conventional panels are often called “dumb” panels because of the inability to provide detail information, such as:
 - Device locations.
 - No details on event history.

1.2.2 Wireless Fire Alarm System

Wireless fire alarm appears to solve the drawback of conventional wired fire alarm system. Wireless fire alarm has several advantages and limitations: The advantages of wireless fire alarm as below: [2]

- Wireless fire alarms are easy to install anywhere. The main advantage of any wireless system is its portability. While conventional wired systems need to be hardwired in place, wireless systems need no more than a few nuts, bolts, and screws. As a result, they can be installed anywhere and moved around as need be.
- Wireless fire alarms are easy to modify – wireless alarm is easy to modify when need to update the layout of building. Wireless fire alarms can be moved around as necessary to obtain the best protection possible, no matter what changes go on in the building.

The limitation of wireless fire alarm as below:

- Wireless fire alarms have range restrictions. For large areas, a wireless system can have an issue with transmitting information to the main control panel. [2]

1.3 Objectives of project

Objectives or goal of the project are very important to ensure that a project can achieve the target that has been set. The main objectives of this project are listed as below to achieve a real time intelligent fire detection sensor network:

- ✓ To design a portable and easy installation fire detector and alert system.
- ✓ Reduce possibility of false alarm.
- ✓ Develop star topology wireless sensor network.
- ✓ To design an interactive and user friendly GUI to display and analyze data.

1.4 Scope of project

This system is best suited only for small indoor environment such as offices, store rooms and houses. Two sensor nodes were used to demonstrate the wireless sensor network in star topology. Warning temperature range is set to 40° C to 45° C, over temperature range was set to above 45° C. The tolerance of temperature is 2° C due to sensitivity of temperature sensor with surrounding environment. LabVIEW 2012 software is used to develop an interactive and user friendly Graphical User Interface (GUI).

1.5 Thesis Outline

There are five chapters included in this thesis. Chapter I is Introduction which covered project overview, problem statement, objectives and scope of project. Overall, this chapter introduced the project in details.

Chapter II is Literature Review which covers related theories and previous works regarding this project. Theories part discussed about introduction of wireless sensor network using ZigBee and introduction to ZigBee and XBee. Previous works discussed on similar project journal papers.

Chapter III is project Methodology. It included project planning, project structure, project overview, hardware development and software development. It covered the process of design the project in details.

Chapter IV consists of Result and discussion. All the results from software and hardware are discussed in details in this section. This section also introduces the product prototype that has been designed.

Chapter V is Conclusion which summarizes the overall thesis. This section also conclude the potential commercialization that of this project. In addition, this section also proposed future development that can help to improve the project.

CHAPTER II

LITERATURE REVIEW

This chapter introduces in details Wireless Sensor Network using ZigBee technology. This chapter also discuss in details about ZigBee and XBee. Then, five similar journals paper are studied and discussed. Finally, the comparison between journals paper are analyzed in table form.

2.1 Introduction of Wireless Sensor Network using ZigBee

A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to monitor physical or environmental conditions. A WSN system incorporates a gateway that provides wireless connectivity back to the wired world and distributed nodes (see Figure 2.1).

The wireless protocol you select depends on your application requirements. Some of the available standards include 2.4 GHz radios based on either IEEE 802.15.4 or IEEE 802.11 (Wi-Fi) standards or proprietary radios, which are usually 900 MHz. [3]



Figure 2.1 WSN Components, Gateway, and Distributed Nodes. [3]

2.1.1 Potential Application

Engineers have created WSN applications for areas including health care, utilities, and remote monitoring. In health care, wireless devices make less invasive patient monitoring and health care possible. For utilities such as the electricity grid, street lights, and water municipalities, wireless sensors offer a lower-cost method for collecting system health data to reduce energy usage and better manage resources. Remote monitoring covers a wide range of applications where wireless systems can complement wired systems by reducing wiring costs and allowing new types of measurement applications. Remote monitoring applications include: [3]

- Environmental monitoring of air, water, and soil
- Structural monitoring for buildings and bridges
- Industrial machine monitoring
- Process monitoring
- Asset tracking