FLOOD ALERT SYSTEM

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A report submitted in partial fulfillment of the requirements for the degree of Mechatronics Engineering

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APRIL 2010

"I hereby declare that I have read through this report entitle "Flood Alert System" and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Mechatronics Engineering)".

Signature	:	.....
Supervisor's Name	:	Miss Aziah Binti Khamis
Date	:	.....

I declare that this report entitle "Flood Alert System" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Date	:	12.5.2016

To my beloved mother and father

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ABSTRACT

A flash flood is a sudden, violent flood after a heavy rain. Every year there must be a lot of lives and properties lost because of this disaster. This is because the residents are not realized about the disaster that is going to happen. Accordingly, Flood Alert System is established to avoid this situation occurs every year by monitor, detect and warn the flood risk. By using the Manchester Code library provided in the PIC16F877A microcontroller and combination with Radio Frequency (RF) concept, the captured data from the transmitter are transferred to the receiver. The Manchester code programming will converts data captured to bit signal and combined it with clock signal in the microcontroller to form a single self-synchronizing data stream. At the transmitter, water detector will capture data and display it using Liquid Crystal Display (LCD) before send it to the receiver. The receiver will read the data and display the warning sign by various colours of Light Emitting Diode (LED) according to the water level and sounded if the water level is in the dangerous state.

ABSTRAK

Banjir kilat adalah salah satu bencana yang berlaku selepas hujan lebat. Setiap tahun banyak kehilangan nyawa dan harta benda yang disebabkan oleh bencana ini. Ini adalah kerana penduduk di kawasan tersebut tidak menyedari tentang bencana yang akan terjadi. Sehubungan dengan itu, Sistem Amaran Banjir dicipta untuk mengelakkan situasi ini berlaku setiap tahun dengan memantau, mengesan dan memberi amaran risiko banjir. Dengan menggunakan kombinasi antara perpustakaan Kod Manchester yang didapati di dalam mikropengawal PIC16f877A dan konsep Frekuensi Radio (RF), data yang direkod daripada Pemancar dapat dihantar ke Penerima. Pengaturcaraan Kod Manchester akan menukarkan data yang direkod kepada isyarat bit dan digabungkan dengan isyarat klok untuk membentuk aliran penyelarasan sendiri data tunggal. Pada bahagian pemancar, pengesan air akan mengesan tahap air dan memaparkan tahap amaran pada Pemapar Cecair Kristal (LCD) sebelum menghantar isyarat amaran tersebut kepada penerima. Penerima akan membaca data dan memaparkannya dengan menggunakan beberapa Diod Pemancar Cahaya (LED) yang berlainan warna mengikut tahap air dan berbunyi sekiranya tahap air pada tahap merbahaya.

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LIST OF ABBREVIATIONS AND SYMBOLS

A/D	-	Analog to Digital
AC	-	Alternating Current
ADC	-	Analog Digital Converter
AM	-	Amplitude Modulation
ASCII	-	American Standard Code for Information Interchange
CMOS	-	Complementary Metal Oxide Semiconductor
CPU	-	Central Processing Unit
DC	-	Direct Current
EEPROM	-	Electrically Erasable Programmable Read-Only Memory
FYP	-	Final Year Project
ICD	-	Implantable Cardioverter-Defibrillator
I/O	-	Input/Output
LCD	-	Liquid Crystal Display
LED	-	Light Emitted Diode
MSSP	-	Mobile Service Switching Point
MCLR	-	Master Clear
NiCAD	-	Nickel Cadmium
PC	-	Personal Computer
PCB	-	Printed Circuit Board
PIC	-	Peripheral Interface Controller
PSI	-	Pounds per Square Inch
PWM	-	Pulse Width Modulation
RF	-	Radio Frequency
SCR	-	Silicon Control Rectifier
SPI	-	Serial Peripheral Interface
UART	-	Universal Asynchronous Receiver Transmitter
USART	-	Universal Synchronous/Asynchronous Receiver Transmitter
UTeM	-	Universiti Teknikal Malaysia Melaka

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CHAPTER 1

INTRODUCTION

1.1 Problem Statement

Nowadays, flash flood is become a dangerous disaster to the human lives and properties due to the increasing in population. A flash flood is a sudden, violent flood after a heavy rain. Every year there must be a lot of lives and properties lost because of this disaster. This is because the residents are not realized about the disaster that is going to happen. To avoid this situation occurs every year, there must be a system which function as an observer to the river's water level for the resident. This will ensure that there are enough time to save live and properties. So, Flood Alert System is established to detect and warn the flood risk to the neighborhoods resident.

1.2 Project Objectives

The objectives of this project are:

i. to design an appropriate water level detector.
ii. to create and design circuit for transmitter and receiver.
iii. to capture data from water level detector to the transmitter.
iv. to run and troubleshoot the whole system to ensure it working properly.

1.3 Project Scope

This report will focus on the designing of an alert device with the implementation of PIC16F877A microcontroller in the RF application. The designing of the circuits, simulation and other related technical subjects will be covered on this report. The marketing of this alert device will not be covered.

1.4 Thesis Outline

Chapter 1: Discuss about the idea of the project that initiate the research, the objectives to accomplish by doing the research work, the scope or a clear boundary of the project research and thesis outline or short description of the report chapter.

Chapter 2: A review of another project related to research that can be used as a reference. In addition, descriptions of equipment used for the project is described here. The main equipment that was used in this project is PIC 16F877A microcontroller, receiver and transmitter module.

Chapter 3: Discuss about the methodology, technique, simulation software and technical consideration that was taken during the project analysis. This project is undertaken simulation by using Proteus 7 Professional version 7.6 and MicroC PRO for PIC version 3.2 before proceed to hardware fabrication. An overview about the project operation also include in this chapter.

Chapter 4: Discuss about the result of the study according to the methodology and techniques that was taken during the analysis. Both simulation and hardware analysis are discussed here. The value of appropriate parameters in the simulation are recorded and compared with the value in the hardware result.

Chapter 5: A brief summary of the project findings and also future recommendations are stated here. A conclusion has been made according to the objective and result analysis. The result shows that most of the objectives achieved however the system is not properly function due to a certain problem such as lack of technique.

CHAPTER 2

LITERATURE REVIEW

2.1 Wireless Weather Station

This Wireless Weather Station project is composed of a Remote Station and a Base Station. The Remote Station is solar powered and activated once a minute to collect and transfer data. The base station receives and buffers the incoming data and then transfers it via RS232 connection to a Personal Computer (PC) for processing.

2.1.1 The Design of Remote Station

The Remote Station consists of four functional sections; the sensors, the PIC16F873 microcontroller, the RF circuit and the power supply. For humidity sensing, the Humirel HS1101 capacitive sensor is used. This device when combine with a CMOS 555 timer operating as a stable multivibrator, produces a signal with a humidity dependent frequency. The Texas Instruments TLC 555 device is used in this design to minimize temperature effect due to the vibration. The temperature data is sensed with the LM335 which the output of this device is equal to the absolute temperature in degrees Kelvin divided by 100 [1]. Figure 2.1 shows PIC16F877A microcontroller pins assignment.

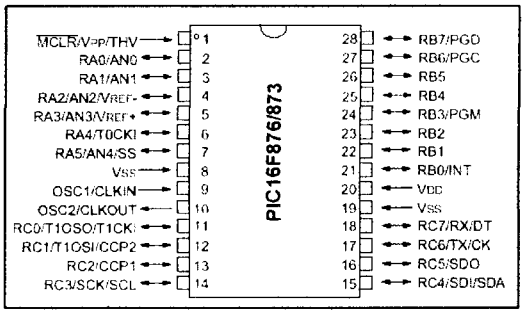

Figure 2.1: PIC16F873 Microcontroller

The other parameter used is pressure which is sensing by a Motorola MPX 5100A. Motorola MPX5100A operates from 0 to 16 Pound per Square Inch (PSI). Barometric pressure readings fall between 28 and 32 inches of mercury. This translates to 13.75 to 15.72 PSI. In this project, an amplifier circuit is added to increase the dynamic range of the output by subtract about 3.7 volts from the sensor output then multiplies the difference by 4. Since the MPX5100A can require as much as 10mA, a transistor 2N3906 was added to provide microprocessor controlled switching. Figure 2.2 shows Motorola MPX5100A device.

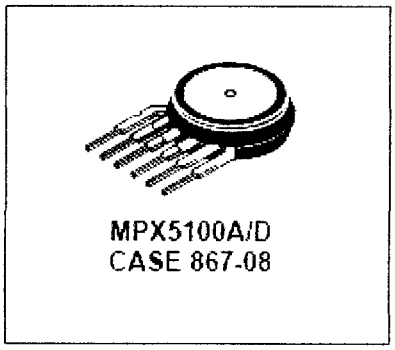

Figure 2.2: Motorola MPX5100A

The using of PIC16F873 microcontroller is because it had the right mix of program and a data memory, a 10-bit Analog/Digital (A/D) and three timers. Timer is used to measure a period of the humidity signal. The A/D is used to measure the temperature and pressure sensors as well as to monitor the battery voltage. An external 4.096 volts 0.1% reference from National Semiconductor was used to maximize the accuracy. With the 10-bit A/D, a resolution of 4 milivolts per count was provided.

The solar panel was used as the Remote Station power supply. When the sun is shining on the solar panel, enough power is generated to drive the 50mA current source formed. This current acts as a trickle charger for three AA Nickel Cadmium (NiCAD) batteries. A switch mode regulator provides 5 volts for the microprocessor and sensors. This is followed with a linear regulator that provides the 3.3 volts for the RF circuit. The RF design was built by a transmitter module TX5002.

2.1.2 The Design of Base Station

The Base Station is also built around the PIC16F873 microprocessor. For this application, the second onboard oscillator to generate a real time clock and configured the Mobile Service Switching Point (MSSP) as a Universal Asynchronous Receiver Transmitter (UART) for asynchronous communication with the host PC. RS232 buffering and level translation is accomplished through the MAX232. A standard DB25 connector is used to connect to the PC. No voltage conversion is required between the RF receiver Data In pin and the microprocessor since the minimum input voltage for the Peripheral Interface Controller (PIC) is 2 volts.

The power is provided via a 9 volts wall mount power supply driving a 78L05 regulators for 5 volts and an LT1121 for 3.3 volts. A single green LED is used to provide a power indicator. When the microprocessor detects the reception of valid data packet, additional current is injected into the LED causing it to pulse. When data is transferred from the transmitter, the receiver detected and decoded the data into American Standard Code for Information Interchange (ASCII) format. Figure 2.3 shows the Remote Station, Antenna and Solar Cell of the project.

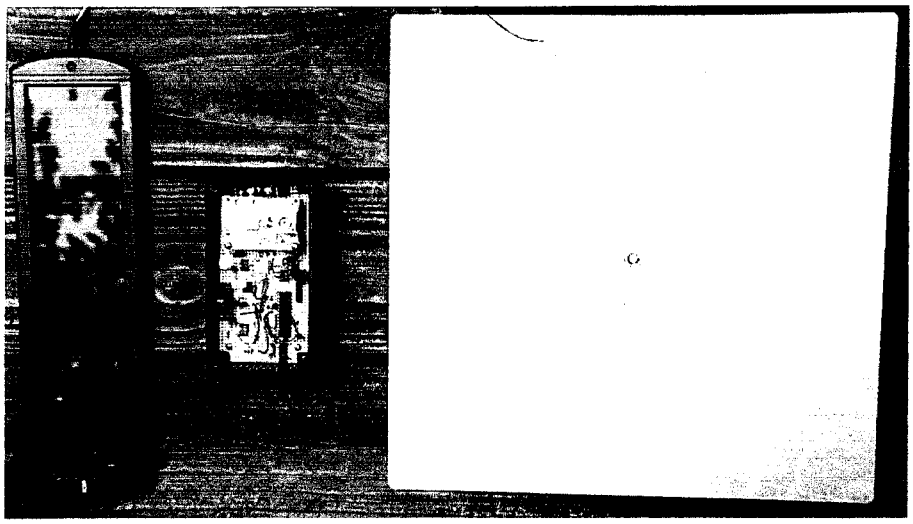

Figure 2.3: Remote Station, Antenna and Solar Cell

2.2 Wireless Smoke Detector

Smoke detector is one of the common devices in a house security system. This project demonstrate microcontroller to read data form the smoke detector and react when the smoke detector detects smoke. Figure 2.4 shows the flow operation of this project.

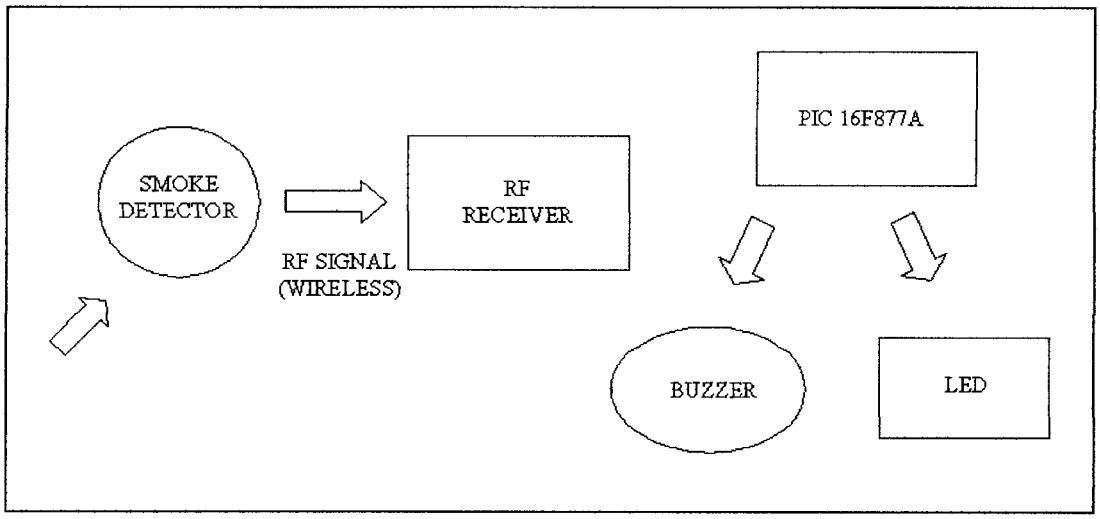

Figure 2.4: System Overview of Wireless Smoke Detector

The Smoke Detector is a device that sense smoke and beep loudly when it detect smoke. It is a wireless device and used a 9 volts battery to operate and send the signal via RF transmitter and a remote control encoder. The interface between PIC16F876A microcontroller and Smoke detector will involve a RF receiver to receive data. At the receiver, a remote control decoder PT2272 decodes the received data as shown in the Figure 2.5.

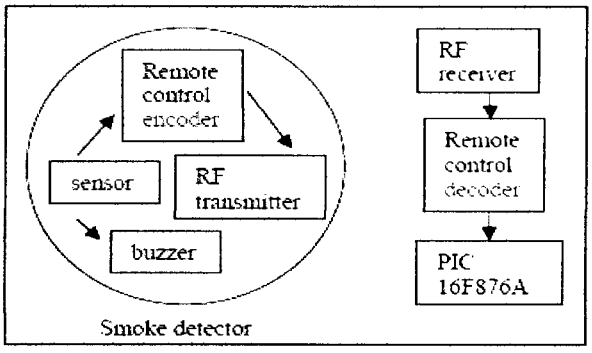

Figure 2.5: Interface PIC16F876A microcontroller with Smoke Detector

The power supply used can either Alternating Current (AC) to Direct Current (DC) adaptor or 9-12 volts battery to power up the circuit. Higher input voltage will produce more heat at LM7805 voltage regulator. Anyhow, LM7805 will still generate some heat at 12 volts. There are two types of power connector for the circuit which are DC plug and 2510-02 (Power Connector). To stabilize the voltage at the input side and output side of the LM7805 voltage regulator, two types of capacitors 0.1uF and 100uF are connected in parallel at the both side of regulator [2].

At the receiver, LED and buzzer are used as Peripheral Interface Controller (PIC) microcontroller output. One Input/Output (I/O) pin is needed for one LED as output of PIC microcontroller. The connection for a LED to I/O pin is shown in Figure 2.6. The function of R11 is to protect the LED from over current that will burn the LED. When the output is in logic 1, the LED will ON, while when the output is in logic 0, the LED will OFF. For the buzzer, when the output is in logic 1, the buzzer will activate (beep), while when the output is in logic 0, the buzzer will deactivate. The connection for a buzzer to I/O pin is shown in Figure 2.7.

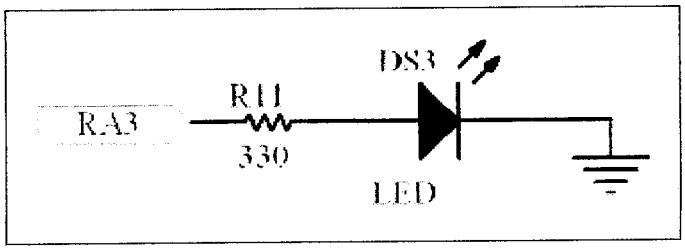

Figure 2.6: The Connection for A LED to the Microcontroller I/O Pin.

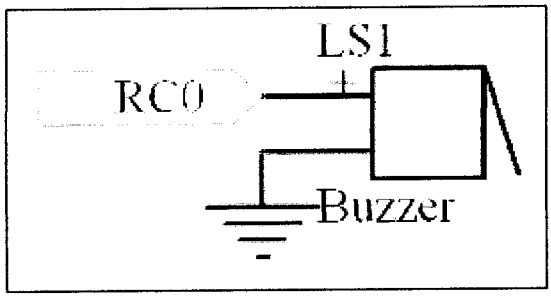

Figure 2.7: The Connection for a Buzzer to the Microcontroller I/O Pin.

2.3 Temperature Monitor Robot using Radio Frequency

The Project Temperature Robot using RF is an exclusive project where the Robot transmits the analog values from a remote place to the receiver where the user can receives the data continuously on the display panel. The data which are recorded continuously in this project are temperature. This analog quantity is taken and converted into corresponding digital values using an eight channel of Analog to Digital Converter (ADC). This converted digital value then transmitted from the microcontroller using RF transmitter and an encoder. The RF modules used are STT-433 MHz Transmitter, STR-433 MHz Receiver, HT640 RF Encoder and HT648 RF Decoder. Figure 2.8 shows the receiver and transmitter module. The processed data from ADC is sent to Intel 8051 microcontroller. The microcontroller passes this data to the RF transmitter through RF Encoder. The encoder continuously receives the data from the microcontroller, passes the data to the RF transmitter.

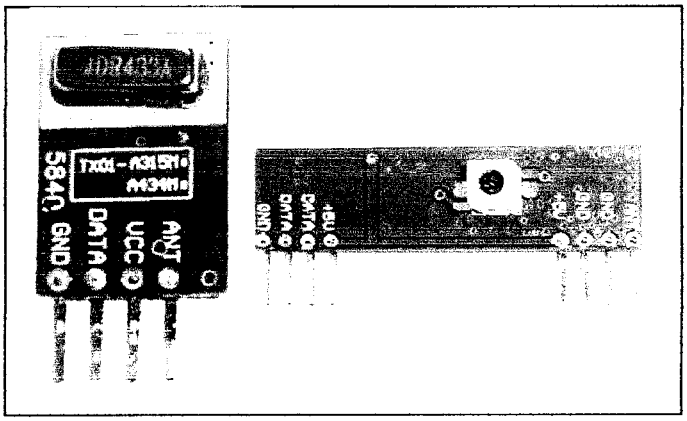

Figure 2.8: STT-433 MHz Transmitter and STR-433 MHz Receiver