TANK WATER LEVEL SENSOR

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This report is submitted in partial fulfillment of the requirements for the award of Bachelor of Electronic Engineering (Industrial Electronics) With Honours

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Dedicated to my family, specially to my beloved mother, father and sisters, my lectures and lastly my friends

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ABSTRACT

This project details the process used to develop the tank water level sensor. In particular tank water level is used pump system and probe.

The aim of this project is to improve the accuracy with which the water level in this tank is measured. It also aims to provide information about the level of the water so that the usage of the water can be saved. Other than that, this water level sensor also can be applied in industry where the chemical liquid in the tank can be measured. So that if the chemical liquid is going to overflow, the buzzer will alarm thus the quality of the environment can be improved.

The Tank Water Level Sensor consists of a hardware platform that is controlled by a microcontroller. Connected to the microcontroller are the Ultrasonic sensor and Liquid Crystal Display. All of this hardware is controlled by the microcontroller's embedded firmware.

The prototype developed for this project is functional and the results of all the testing undertaken have been successful.

ABSTRAK

Projek ini menceritakan mengenai sesuatu proses yang digunakan untuk membuat tangki pengesan paras air. Di dalam keadaan tertentu, kebanyakan pengesan paras air menggunakan sistem pam dan alat yang dimasukkan ke dalam tangki.

Matlamat projek ini adalah untuk memperbaiki ketepatan mengesan paras air di dalam tangki. Matlamat projek ini juga adalah untuk menyediakan maklumat tentang paras air, maka penggunaan air dapat dikurangkan. Selain daripada itu, pengesan paras air ini juga boleh diaplikasikan dalam industri dimana cecair kimia di dalam sesebuah tangki dapat diukur. Jadi apabila cecair kimia ini mencapai aras limpahan air, penggera akan berbunyi, dengan itu kualiti alam sekitar akan terjamin.

Tangki pengesan paras air ini mengandungi perkakasan yang dikawal oleh mikropengawal. Mikropengawal ini disambungkan dengan sensor Ultrasonik dan paparan cecair kristal. Semua perkakasan ini dikawal oleh mikropengawal perisian kekal terbenam.

Prototaip bagi projek ini telah berfungsi dan hasil dari ujikaji yang dijalankan menunjukkan keberkesanan projek ini.

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CHAPTER I

INTRODUCTION

1.1 Overview

Level sensors detect the level of substances that flow, including liquids. The substance to be measured can be inside a container or can be in its natural form for example river or lake. The level measurement can be either continuous or point values. Continuous level sensors measure level within a specified range and determine the exact amount of substance in a certain place, while point-level sensors only indicate whether the substance is above or below the sensing point. This project used continuous level sensor that is ultrasonic sensor.

The water level sensor is a reliable circuit; it takes over the task of indicating and controlling the water level in the overhead water tanks. It is being used to detect liquid level, as the liquid to be measured either can be inside a water tank or can be in its natural form.

It is designed to not only indicate the amount of water present in the overhead tank but also gives an alarm when the tank is full. It also prevents 'dry run' of the pump in case the level in the underground tank goes below the suction level.

This water level will be monitoring by the LCD display and display the status of the tank like LOW, MEDIUM or HIGH. This circuit produces alarm when water just touches the highest and lowest level. The main goals for this project were to determine the best way to monitor water level. This project addresses the need for water level sensors that are relatively simple to use and accurate over a broad range of hydraulic conditions.

1.2 Project Objective

The main objectives of this project are:

i) To model a tank water level sensor using PIC microcontroller that can be used to sense the water level and digital level.

ii) To monitor the water level in the tank either it LOW, MEDIUM or HIGH using LCD display.

iii) To monitor the level of corrosive liquid, this is stored in a huge tank periodically, and to draw as well as to fill the tank.

iv) To prevent overflow and wastage of water by warning when the tank is about to brim.

v) To be a practical and effective method of measuring the depth of the water.

1.3 Problem Statement

In most houses, water is first stored in an underground tank and from there it is pumped up to the overhead tank located on the roof. People generally switch on the pump when their taps go dry and switch off the pump when the overhead tank starts overflowing. This results in the unnecessary wastage and sometimes non-availability of water in the case of emergency.

Various type of water pumping system that available in market nowadays, but this system alone with the traditional system can't overcome the intrusion problem. To make this system more efficient and useful for agriculture industry, it should be upgraded to be more efficient. This project is designed with the monitoring system to make the users easy to monitor the level of water on the tank. Water monitoring system is a safe option to monitoring tank levels as it doesn't require climbing on top of the tank and reaching in to make measurements. All it involves is monitor the water level on the LCD display, displaying the level of the water.

1.4 Project Scope

In order to build this project, the scope is developed to

i) Design and build the tank water level sensor using PIC microcontroller and sense by ultrasonic sensor.
ii) Develop and analyze the water level sensor.
iii) Simulate the circuit constructed in Proteus.
iv) Apply the technique to the sensor, testing and troubleshooting.
v) Project report write-up.
vi) Software: Proteus, PIC Compiler, DXP 2004 Protel and Assembly Language Programme.

1.5 Methodology

Figure 1.5 is the methodology of my project during these two semesters.

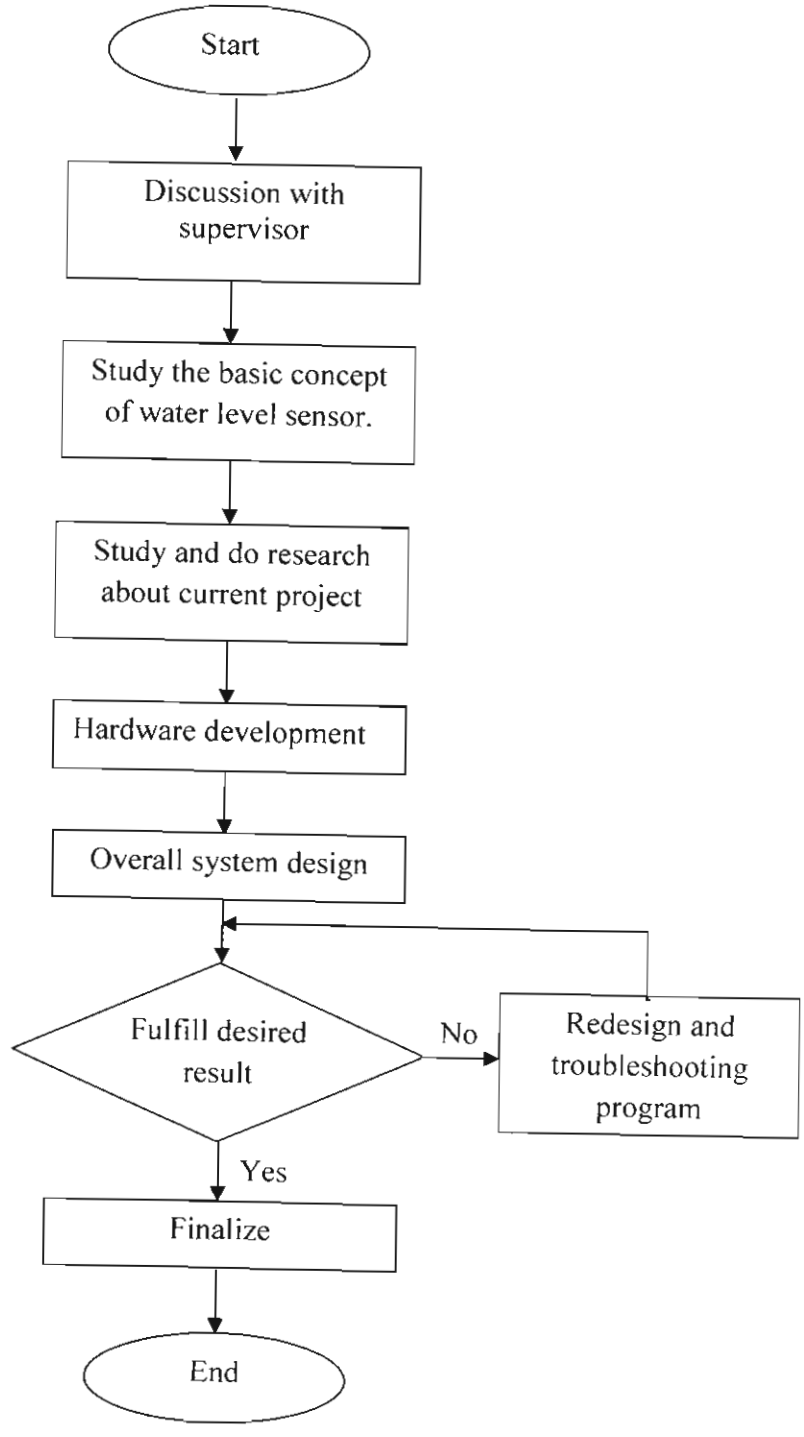

Figure 1.5 : Methodology of this Project

1.6 Thesis Outline

Chapter 1 gave an introduction about the project as well as problem statement, objective and project scope for project.

Chapter 2 is a literature review where the main part of tank water level sensor will be described and understanding all components that will be used for this project. The purpose of this chapter is to provide an overview the scope of study for this project.

Chapter 3 is methodology section where the methods or steps that have been used to approach the water level sensor will be explained thoroughly.

Chapter 4 is the result and discussion where all the result of the analysis will be shown. Discussion and observation of the outcome of the research in relation to evidences obtained from project and theories will be made in this chapter.

Chapter 5 is conclusion for this project, which describe the overall project based on the observation of the result obtained and summarize the entire project. This chapter also discusses the recommendation for future planning.

CHAPTER II

LITERATURE REVIEW

This chapter consists of some information about water level sensor and also an overview of the literature that has been published in relation to the level sensors.

2.1 Components Used in Tank Water Level Sensor

2.1.1 Microcontroller

PIC is a family of Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC was originally an acronym for "Programmable Intelligent Computer".

PICs are popular with developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

The PIC architecture is distinctively minimalist. It is characterized by the following features with separate code and data spaces (Harvard architecture). Have a small number of fixed length instructions.

Most instructions are single cycle execution (4 clock cycles), with single delay cycles upon branches and skips. It has a single accumulator (W), the use of which (as source operand) is implied (i.e. is not encoded in the opcode). All RAM locations function as registers as both source and/or destination of math and other functions.

Other than that, this microcontroller has a hardware stack for storing return addresses also has a fairly small amount of addressable data space (typically 256 bytes), extended through banking. Data space mapped CPU, port, and peripheral registers.

The program counter is also mapped into the data space and writable (this is used to synthesize indirect jumps). Unlike most other CPUs, there is no distinction between "memory" and "register" space because the RAM serves the job of both memory and registers, and the RAM is usually just referred to as the register file or simply as the registers.

This PIC is particularly suited to implementation of fast lookup tables in the program space. Such lookups are O(1) and can complete via a single instruction taking two instruction cycles. Basically any function can be modeled in this way. Such optimization is facilitated by the relatively large program space of the PIC and by the design of the instruction set, which allows for embedded constants.

To summarize, a microcontroller contains (in one chip) two or more of the following elements in order of importance:

i) Instruction set
ii) RAM
iii) ROM, PROM or EPROM
iv) I/O ports
v) Clock generator
vi) Reset function
vii) Watchdog timer
viii) Serial port
ix) Interrupts
x) Timers
xi) Analog-to-digital converters
xii) Digital-to-analog converters

a) PIC 16F877A

PIC stands for 'Peripheral Interface Controller', general instrument as small, fast, inexpensive embedded microcontroller with strong input/output capabilities. The PIC18F877A is CMOS Flash-based 8 bit microcontroller.It packs into 40-pin package with 3 ports for input/output which are Port A, Port B, Port C and Port D. In this project, PIC16F877A will be use. PIC16F877A is in either baseline core or mid-range core devices in the PIC's family core architecture. PIC16F877A also have enhanced core features, eight-level deep stack, and multiple internal and external interrupt sources.

PIC18F877A has been chosen because of its USART (Universal Serial Asynchronous Receiver Transmitter) function. In this project, USART is used to communicate between hardware and PC serial port. The details explanation of USART function will be discussed in the next sub-chapter.

Besides, this microcontroller also has input/output port just enough for the project application. Figure 2.1shows Pin Diagram for PIC18F877A.

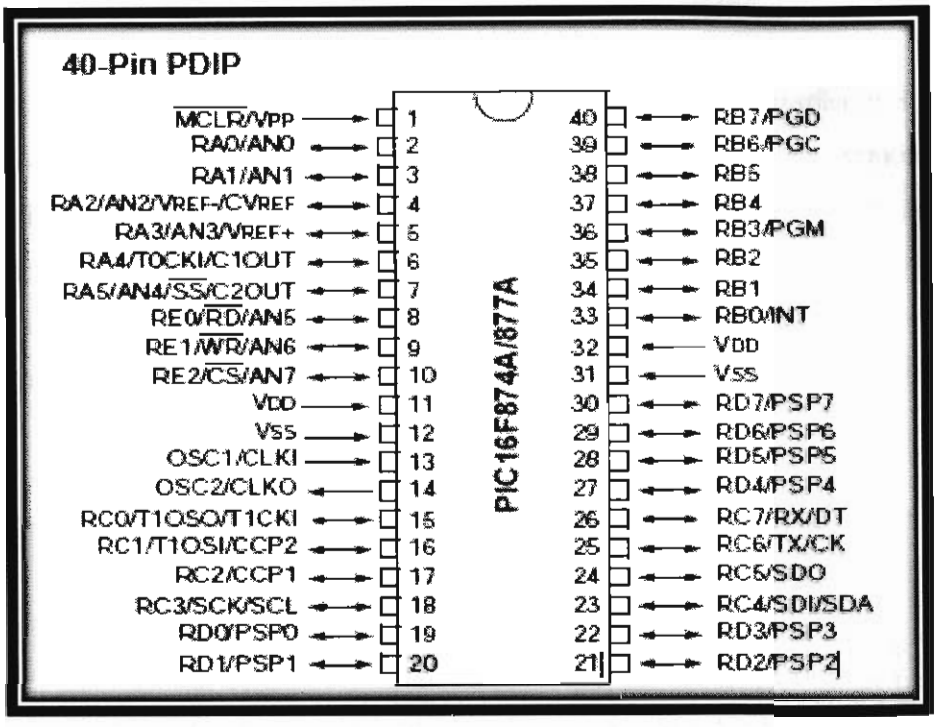

Figure 2.1: Pin Diagram PIC 16f877A

2.1.2 Liquid Crystal Display (LCD)

LCDs with a small number of segments, such as those used in digital watches and pocket calculators, have individual electrical contacts for each segment. An external dedicated circuit supplies an electric charge to control each segment. This display structure is unwieldy for more than a few display elements. The pixels being set one row after the other, in passive matrix displays the number of rows is limited by the ratio of the setting and fading times.

In the setup described above (known as "twisted nematic") the number of rows is limited to about 20. Using an alternative "supertwisted nematic" setup VGA quality displays (480 rows) can be easily built. As of 1995 most notebook computers used this technique.

There are a wide variety of shapes and sizes of LCD. Line lengths of 8, 16, 20, 24, 32 and 40 characters are all standard in one, two, and four-line versions. Each character is displayed using 5x7 pixel font matrix. The module has a character generator ROM capable of displaying ASCII characters. Most LCD modules conform to a standard interface specification. A 14-pin access is provided having eight data lines, three control lines and three power lines. Figure 2.2 shows the front view of LCD.

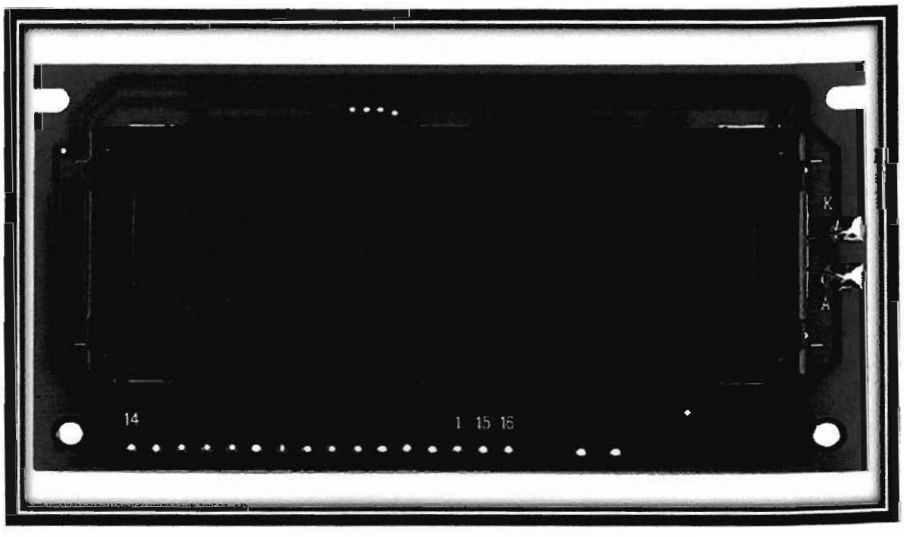

Figure 2.2: 2 x 16 character LCD