# DESIGN WATER TANK LEVEL CONTROLLER

**MOHD FAIRUZ MASROM**

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**MOHD FAIRUZ MASROM**

**A report submitted in partial fulfillment of the requirements for the degree of Bachelor In Electrical Engineering (Industrial Power)**

**Faculty of Electrical Engineering**

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**2009**

" I hereby declare that I have read through this report entitle "Design Water Tank Level Controller" and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Industrial Power)

Signature : .....

DR. MUSSE MOHAMUD AHMED
PENSYARAH
Fakulti Kejuruteraan Elektrik
Universiti Teknikal Malaysia Melaka

Name : Assoc. Prof Dr. Musse Mohamud Ahmed

Date : 13 MAY 2009

I declare that this report entitle "*Design Water Tank Level Controller*" 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.

Signature : 

Name : MOHD FAIRUZ MASROM

Date : 13 MAY 2009

Dedicated to my beloved parents...Masrom Kasmo,

and Noraini Abdullah

Thanks for being supportive,caring and loving

## ACKNOWLEDGEMENT

Bissmillahirahmanirahim. In the name of Allah S.W.T, the most gracious and merciful, praise to Allah the lord of universe and may blessing and peace of Allah be upon his messenger Muhammad S.A.W. Thanksgiving to Allah because He has give me the opportunity to complete my final year project and final year report. Without His blessing, I can't complete this task in the time given.

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Apart of that, to my supportive friends who have helped me all the time during the process to finish the final year project and final year report. I manage to construct, understand, simulate the given circuit diagram and finally get a good preliminary result which is meet my objective of my design. Those entire things become possible because of brilliant ideas, helping and support from all my friends.

Last but not least, special thank all technicians who have helped me to finish this project and report. I also would like to express my thankful to all of my family for the moral and financial support. For those whom I forget to mention, please forgive me and thank for your help and support.

# ABSTRACT

Every design come out when there is a problem. The design is to create to solve the existing problems. Now, people who used conventional pump have replaced with electrical pump but they find it very inconvenient to the condition of water pump motor when it operates. As a solution of this problem, one project has been designed known as Water Tank Level Controller. This design consists of two elements; control circuit and sensing mechanism. The methodology of this design can be done by several steps. First, simulate the control circuit. Second run the simulation to get the results. Then, design the sensing mechanism. Forth, synchronize between the control circuit and sensing mechanism. Lastly, do several testings. The expected results were the control circuit that produced a great output and there is no problem with that circuit. From the sensing mechanism, the system will well-operated. In its entirety, the sensing mechanism and control circuit should be synchronized well between each other. The design needs less supervision and less maintenance. Sensing mechanism that used to sense the water level in this project is easy to build. The control circuit is also easy to fabricate on general purpose PCB board because it just used common electronic components. Water Tank Level Controller is very user friendly because it doesn't require frequent supervision. The life time of the water pump motor can be expanded because the motor operated only on demand. This design also increase efficiency of overhead tank but at the same time reduces the power consumption. Hence, if the design can reduce power consumption and the objective of this design are achieved.

# ABSTRAK

Setiap rekaan lahir apabila sesuatu masalah berlaku. Rekaan dihasilkan bagi mengatasi masalah tersebut. Kini, pengguna yang menggunakan pam konvensional telah menukarnya dengan pam elektrik tetapi mereka berasa tidak selesa kerana tidak mengetahui keadaan motor pam sama ada ia berfungsi atau tidak. Bagi penyelesaian masalah ini, satu projek telah direka yang dikenali sebagai Pengawal Tahap Tangki Air. Rekaan ini mengandungi dua bahagian iaitu litar kawalan dan mekanisme penderiaan. Kaedah perlaksanaan projek ini terdiri daripada beberapa langkah. Langkah pertama adalah melakukan simulasi litar kawalan dan jalankan simulasi untuk mendapat hasil dan keputusan. Kemudian, mencipta mekanisme penderia. Selepas itu, selaras antara litar kawalan dan mekanisme penderiaan. Akhir sekali, lakukan beberapa ujian. Keputusan yang dijangka adalah litar kawalan akan berfungsi dengan baik dan tiada masalah dengan litar itu. Pada mekanisme penderiaan pula, dijangkakan sistem itu akan beroperasi dengan lancar. Secara keseluruhannya, keputusan yang diharapkan adalah mekanisme penderiaan dan litar kawalan akan dapat diselaraskan dengan baik antara satu sama lain. Kelebihan projek ini adalah ia dapat beroperasi tanpa penyeliaan dan penyenggaraan yang kerap. Mekanisme penderiaan yang berfungsi untuk mengesan paras air di dalam projek ini mudah. Litar kawalan pula mudah untuk difabrikasi pada papan PCB serba guna kerana ia hanya menggunakan komponen asas elektronik. Pengawal Tahap Tangki Air adalah mesra pengguna kerana ia tidak memerlukan penyeliaan yang kerap. Jangka hayat motor pam pula boleh dilanjutkan kerana ia hanya beroperasi mengikut permintaan. Reka bentuk ini juga meningkatkan kecekapan sistem Pengawal Tahap Tangki Air dan dalam masa sama mengurangkan penggunaan kuasa. Oleh itu, jika reka bentuk tersebut boleh mengurangkan penggunaan kuasa dan sebagainya, maka objektif projek ini telah tercapai.

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# NOMECLATURE

OHT: OVERHEAD WATER TANK

LED: LIGHT-EMITTING DIODE

MS: MALAYSIA STANDARD

GRP : GLASS-REINFORCED PLASTICS

FRP : FIBRE-REINFORCED PLASTICS

PE: POLYETHYLENE

SIRIM: STANDARDS AND INDUSTRIAL RESEARCH INSTITUTE OF MALAYSIA

TTL: TRANSISTOR-TRANSISTOR LOGIC

CMOS : COMPLEMENTARY METAL-OXIDE SEMICONDUCTOR

PCB: PRINTED CIRCUIT BOARD

FYP-1: FINAL YEAR PROJECT 1

FYP-2: FINAL YEAR PROJECT 2

# LIST OF APPENDICES

# CHAPTER 1

# INTRODUCTION

## 1.1 Background

Water tanks are liquid storage containers; these tanks are usually stored water for consumer consumption. Water tanks provided for the storage of drinking water portable, irrigation agriculture, fire suppression, agricultural farming and livestock, chemical manufacturing, food preparation and many other applications.

Today technology of water tank system consists of mechanical sensor and water pump motor. When the water decrease from the actual level the mechanical sensor will detect that situation and it will send the signal to ON the water pump motor. After the water reaches the actual level, the mechanical sensor will sent the signal to switch OFF the water pump motor. The condition of water pump motor and mechanical sensor that located in the water tank cannot be determined by the consumer because there is no indication system in the water tank system.

As a solution of this problem, Water Tank Level Controller has been designed. The difference between this design and existing technology is this design consists of indication system to show the condition of the water tank system.

There are a lot of advantages if the consumers change the existing water tank system to Water Tank Level Controller. The advantages such as this design can prevent motor from damages for long lasting usage, this design also capable to reduce water billing and energy consumption.

## 1.2 Problem statement

Every building must have an Overhead Water Tank (OHT). Today, most of the consumers have changed the conventional pump with an electrical pump. Unfortunately, consumers find very inconvenient to know their water pump system because there is no indication system to show the situation of the water pump system. If the mechanical sensor fails, there are a plenty of water wastage as well as wastage of power consumed by the motor pump. Every problem must have a solution. Therefore the solution of this problem is Water Tank Level Controller. This design consists of two elements: control circuit and sensing mechanism.

## 1.3 Objective

Every design must have its objectives to ensure the success of the design. The main objective of this design is to improve today is technology that just used only mechanical sensor in the water tank system. With this designed the water tank system will consist sensing mechanism, water pump and indicator system to show the situation of the water tank. The indicator system will show whether the water in the tank is low or full.

The second objective of this design is to increase the efficiency of the water tank system. Today, water tank system just consists of mechanical sensor and water pump. By using this design, water tank system consist not only mechanical sensor and water pump but also consists of an indication system.

By using this design, the water pump is controlled by a sensing mechanism in the water tank. When the tank is empty, the sensing mechanism will send a signal to the control circuit. After receiving the signal, the control circuit will send information to relay and the relay will operates the water pump. This process shows that the water pump operated only when it is needed. This will prevent any wastage of the water and damage of the pump motor for long term usage.

The description of the fourth objective is that the Water Tank Level Controller can be used in rural residential area where the pressure of water always low. If the consumer want to use this design in the rural residential area, consumer must use the suitable water pump motor to ensure getting enough power to pump the water to the water tank.

The success of the design depends on the consumer. Therefore, the last objective is to design a Water Tank Level Controller system that the consumer can easily understand the operation of the system and the user can operate it without any problem. This objective will ensure this design will be acceptable among the consumers.

## 1.4 Scope

Scope of this project is to design water tank controller that can be used for commercial building, residential area, factory, airports, hotels and etc. For example, this design can be used for Jusco shopping complex that still under construction located near Tesco Melaka Sentral. This design is used to control the water flow into the water tank. Usually, this design can be installed in the large capacity water tank to ensure the water flow is always continuous without any problem. This design also can be used in the residential building but the water pump motor horsepower must be suitable with the usage. The difference between this design and today's technology is this has water level indicator system.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

A literature review discusses published information in a particular subject area, and sometimes information in a particular subject area within a certain time period. A literature review can be a simple summary of the sources, but it usually has an organizational pattern and combines both summary and synthesis. Literature review depends on the situation and it may evaluate the sources and advise the reader on the most pertinent or relevant.[1]

This project will focus on water level controller. All the literature review and research is focusing to the water level controller. The following studies were reviewed to gain an idea during this project.

## 2.2 Literature Review

### 2.2.1 Overhead Water Tank, Vastu Shastra [2]

The article was explaining about construction of Overhead Water Tank in India [2]. The article has described the principle for the construction of Overhead Water Tank in a flat or a building. The principles that are related with the project of Water Tank Level Controller are:

i. Overhead Water Tank should place at least 2 feet above uppermost slap and it should not touch the slap.

ii. Avoid having plastic Overhead Water Tank. If it is a plastic tank, it should be of blue or black. This will lead to absorption of sunrays

iii. Overhead Water Tank should be different tank for drinking, cooking and for toilet and bathroom.

### 2.2.2 Water Level Indicator with Alarm [3]

This article has explained the operation of this circuit [3]. This circuit not only indicates the water level present in Overhead Water Tank level but it also gives an alarm when the Overhead Water Tank is full. The circuit operations for this circuit are:

i. When the water tank empty, the wire in the water tank is in open circuit state. During this situation, the 180kΩ resistor will pull the switch to open and LED will turn OFF.

ii. When the water starts filling up, first wire in the tank is connected to S1 and the wire will short circuited by the water. This condition will close the S1 and turn the LED ON.

iii. As the water continues to fill the tank, the LEDs 2, 3 and 4 will light up gradually

iv. When the water is full, the transistor is pulled high by the water and this saturates the transistor and turning the buzzer ON.

v. The SPST switch must ON otherwise the buzzer will not sound.

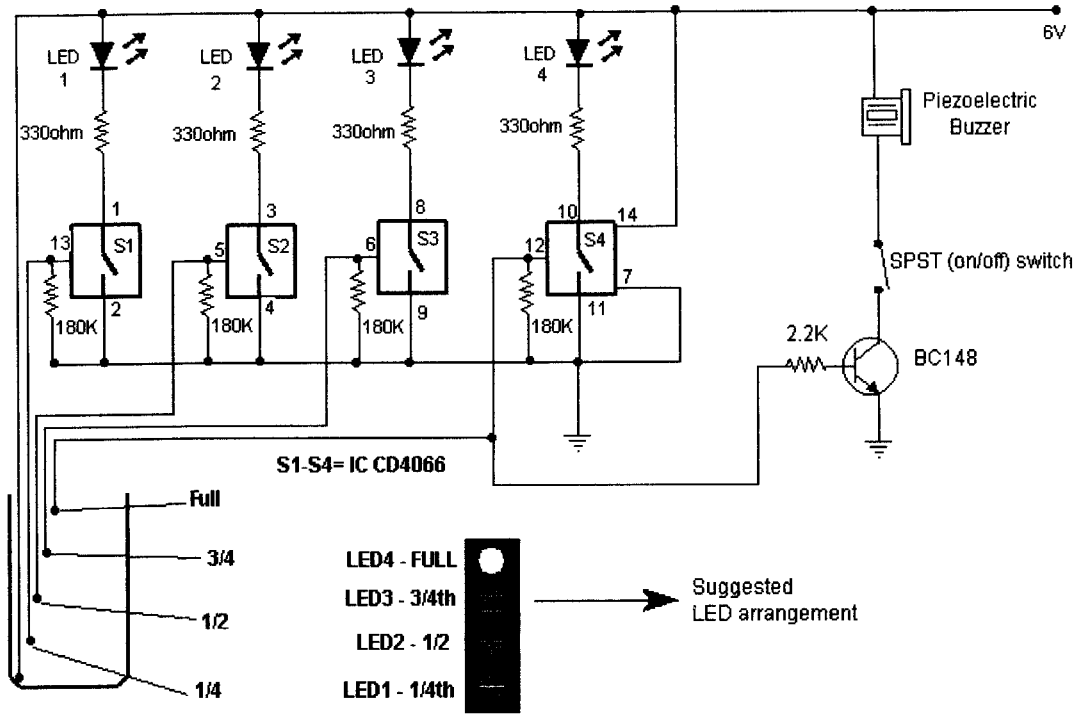


Figure 2.1: Circuit Diagram of Water Level Indicator with Alarm

### 2.2.3 Active Control (Product Information) [4]

Based on the article, Active Control Liquid Level Control Systems are used to monitoring liquid level in the tank, reservoirs, silos, dams and etc [4]. The system provides visual multilevel as well as continuous level indication with Audio Visual Alarm at desired levels and Automatic Control Pump based on users requirement. The system consists of three main components:

i. Probe

Made from seal stainless steel tube, in which magnetic level is sensor enclosed. It is top mounted in the tank. Since the sensor is sealed in the tube, they are not in contact with the liquid.

ii. Actuating Float

The float, in its vertical movement, operates the magnetic sensors as it reaches their levels. The sensor sends a signal to the control panel, which in turn provides the necessary outputs of the level indication, alarm and control.

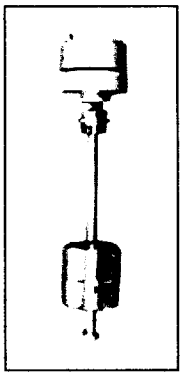

Figure 2.2: Actuating Float

iii. Control Panel

It is mounted at any suitable location. It converts the signal from probe into visual level indication, level alarm and pump/valve control.

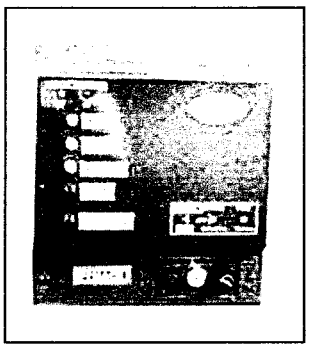

Figure 2.3: Control Panel

### 2.2.4 Soldering Guide [5]

This article provides many information and guideline such as how to solder in easy way. Soldering is defined as "the joining of metals by a fusion of alloys which has relatively low melting points". There are three things need to be emphasized during soldering:

i. Safety precaution
   - The element or tip of the soldering iron must never been touch.
   - The mains flex with the tip of the iron must be avoided touching to each other
   - When not in use the soldering iron, return it to its stand.
   - Work in a good ventilation area.
   - After soldering, hand should be washed cleanly.

ii. Prepare soldering iron
   - Plug in and place the soldering iron in its stand
   - The sponge in the stand must be damped
   - Need a few minutes to warm up the soldering iron.
   - On the damp sponge wipe the tip of the iron.
   - On the tip of the iron melt a little solder.

iii. Ready to start soldering
   - Near the base of the handle, hold the soldering iron like a pen.
   - Onto the joint to be made touch the soldering iron.
   - Onto the joint feed a little solder.
   - While keeping the joint still, remove the solder, then the iron,.
   - Inspect the joint closely.

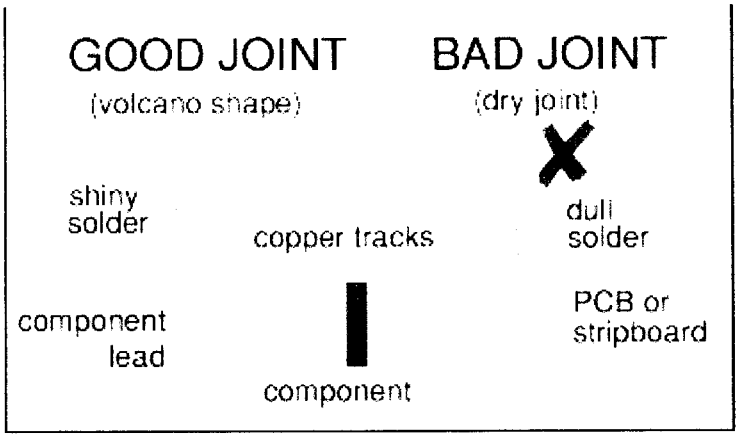


Figure 2.4: Soldering Type

At some stage desolder a joint to remove or re-position a wire or component if needed. There are ways to remove the solder:

i. With a desoldering pump (solder sucker)

- Locks the pump by pushing the spring-loaded plunger down.
- Soldering iron is applied both the pump nozzle and the tip of the joint.
- Wait a second or two for the solder to melt.
- Suck the molten solder into the tool by pressing the button on the pump to release the plunger.
- Remove as much solder as possible by repeat it if necessary.
- Unscrewing the nozzle to emptying the pump occasionally.

### 2.2.5 A-130JTX [6]

GP-130JTX is one of the products from Panasonic. This product is powerful and reliable. Besides that, it operates in low noise condition but still provides high efficiency. The motor pump power of this product is 130W with suction head length is 9m, meanwhile the discharge head is 21m. The discharge capacity is 18 L/min. Since the discharge head size is longer therefore it will affect the maximum discharge value which is 30 L/min. size of suction and is 3/4 inches.

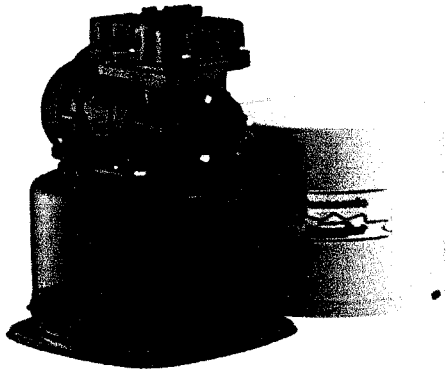

Figure 2.5: A-130JTX Water Pump

### 2.2.6 GP-129JX [7]

GP-129JX is one of the products from Panasonic. This product is powerful and reliable. Besides that, it operates in low noise condition but still provides high efficiency. The motor pump power of this product is 125W with suction head length of 9m, meanwhile the discharge head is 21m. The discharge capacity is 30 L/min. since the discharge head size is longer therefore it will affect the maximum discharge value which is 30L/min. size of suction and discharge pipe is 1 inch.