SMART MONITORING WATER TANK

SYUHADA NABILAH BINTI SAIRIN

(10DTK14F1037)

ARFINAH BINTI SOFYAN

(10DTK14F1105)

DIPLOMA IN ELECTRONIC ENGINEERING (COMPUTER)

SEBERANG PERAI POLYTECHNIC

DECEMBER 2016

Table of Contents

CHAPTER 3: METHODOLOGY

CHAPTER 6: CONCLUSIONS & RECOMMENDATIONS

REFERENCES

ACKNOWLEDGEMENT

ABSTRACT

Smart Monitoring Water Tank (SMWT) is a project undertaken aims to resolve problems of water wastage. This is because excessive use of watered nowadays is very worrying as water consumption unplanned, wasteful and attitude is one that is not responsible. This system of Smart Monitoring Water Tank is produced to overcome the problems that often occur in schools, homes and especially in the mosque. We can see the use of water in the mosques, especially the use of water for ablution (Wudu') in the water tank is not so controlled. Here is a simple versatile project which indicates the level of water and automatically controls it by using Arduino UNO and Ultrasonic Sensor Module. With this project, the water in the tank can be monitored through this system. If it is marketed, the project was able to put themselves in the business sector and internationally. In addition, it is also can facilitate the work and reduce water wastage.

ABSTRAK

"Smart Monitoring Water Tank" (S.M.W.T) merupakan satu projek yang dilaksanakan bertujuan untuk menyelesaikan masalah dalam pembaziran air. Hal ini disebabkan, pembaziran air yang berleluasa semakin membimbangkan pada hari ini dan etika yang tidak bertanggungjawab amatlah dikesali. Oleh itu, sistem *"Smart Monitoring Water Tank"* diperkenalkan untuk membantu mengurangkan masalah pembaziran air di tempat-tempat seperti sekolah, rumah, dan terutamanya di masjid. Hal ini kerana, kita dapat lihat penggunaan air di masjid esperti untuk mengambik air sembahyang atau Wuduk di dalam kolah air tidak dikawal dengan baik. Projek ini sangatlah mudah untuk mengawal jumlah air dalam kolah atau tangki menggunakan *Arduino UNO* dan *Ultrasonic Sensor Module*. Dengan projek ini, jumlah air di dalam tangki dapat dilihat dengan lebih baik melalui system ini. Sekiranya projek ini dikormesialkan, ia boleh meletakkan tahap perniagaan di peringkat antarabangsa. Tambahan lagi, ia juga boleh memudahkan kerja dan mengurangkan pembaziran air.

CHAPTER 1

INTRODUCTION

1.1   Background Project

As we know, water is the most important resource in every living thing. In fact, the not-living thing also used too much water for operate. In this day, water wastage always has been worrying because water is a fragile resource that needs to be protected.

So this project purpose is to prevent water wastage in the water tank. Commonly, we will see water tank in place such as in school, mosque or home. There, they are using traditional water system by using Ballcock or Float Valve and Stopcock. A Ballcock is a mechanism or machine for filling water tank, such as those found in flush toilets. Toward the end of the discharge process, the ballcock responds to the drop in water level refills the tank. Although this does not stop the wastage of water, it avoids the flooding that would otherwise occur after a single-point valve failure.

As a result, we have planned to design this project to gain control of the spilling water in the water tank by using electronic components that more sophisticated. In this project, we used Arduino UNO. This Arduino based automatic water level indicator and controller project we are going to measure the water level by using ultrasonic sensors.

1.2 - Problem Statement

Excessive use of watered nowadays is very worrying as water consumption unplanned and wasteful actions and attitude is one that is not responsible. This is because water is very important and very limited resources. Only less than 1% only cleans water available on earth. Thus, this system of **Smart Monitoring Water Tank** really helps the problem of water wastage. Here is a simple, versatile project which indicates the level of water and automatically controls it by using Arduino UNO and Ultrasonic Sensor Module. Basic principal of ultrasonic distance measurement is based on ECHO. When sound waves are transmitted in environment then they return back to the origin as ECHO after striking on any obstacle. So we have to only calculate its traveling time of both sounds means outgoing time and returning time to origin after striking on any obstacle. And after some calculation we can get a result that is the distance. This concept is used in our water controller project where the water motor pump is automatically turned on when water level in the tank becomes low. This project can be used anywhere such as water tanks in schools, homes and especially in the mosque. We can see the use of water in the mosques, especially the use of water for ablution (Wudu') in the water tank is not so controlled. The water sometimes overflows and is not well controlled. And, there is also the use of old water pump system. Therefore, the project innovated to a more modern and sophisticated

1.3 - Objective

There are some objectives need to be achieved in order to accomplish this project. These objectives will act as a guide and will restrict the system to be implemented for certain situations:

- The main of objective for this project is to develop water level control system, to control the water level in the tank and to reduce wastage of water. To check the level of water in the tank is depending on the water level switches. When the water level becomes very low, the buzzer will sound and the LCD will display the level of water. So, we can estimate how much water can be used in a day.

1.4 - Scopes of Project

The main scope for this project is for the mosque which provides Muslims for prayer. This system of Smart Monitoring Water Tank really helps the problem of water wastage. Ultrasonic sensor HC-SR04 is used to measure distance in range of 2cm-400cm with accuracy of 3mm. The sensor module consists of ultrasonic transmitter, receiver and the control circuit. The ultrasonic sensor module works on the natural phenomenon of ECHO of sound. A pulse is sent for about 10us to trigger the module. After which the module automatically sends 8 cycles of 40 KHz ultrasound signal and checks its echo. The signal after striking with an obstacle returns back and is captured by the receiver. When the water level becomes Very Low, the buzzer sound and the LCD will display the water level.

1.5 - Significant of Project

The importance of Smart Monitoring Water Tank System

Water is essential for life. Humans need it for drinking and food preparation. It is also vital to our natural environment, supporting plants and animals. Water is critical to our economy, generating and sustaining wealth through activities such as agriculture, commercial fishing, power generation, industry, services, transport and tourism. However, water is a fragile resource that needs to be protected. Thus, in this project, we designed a simple but very efficient **Smart Monitoring Water Tank** which this system can control the use of water in case of waste which could harm our future. This project can be used anywhere such as water tanks in schools, homes and especially in the mosque. It can control the water in the tank by using Arduino UNO. Basic principal of ultrasonic distance measurement is based on ECHO. When sound waves are transmitted in environment then they return back to the origin as ECHO after striking on any obstacle. So we have to only calculate its traveling time of both sounds means outgoing time and returning time to origin after striking on any obstacle. And after some calculation we can get a result that is the distance. This concept is used in our project to controlled and reduce the wastage of water.

CHAPTER 2

LITERATURE REVIEW

2.1   INTRODUCTION

Before we want to create a project, we have to make a detail research. This is because we can identify the problem statement and can find the way to solve the problem. In the process while making the project, of course we can face a lot of problem, hence the research that we make can be a guideline for us to reduce the problem and make a preparation. Study on existing project and make an innovation can also help us to make sure that the product's function can be more effective.

The report that we want to be produced needed a few factors that should be taken consideration until that project implemented. To get a quality project result, we need to study about the type of material, design, components that we used framework installation, installation method and maintenance, level of product safety, structural strength, and project size and so on that we need make it and consider the result that we get. This is all ensure that no any problems would arise during the completion or even when presenting the project.

Hence, systematic and detailed planning must be arranged for produce a complete and perfect project. First step that we need make is the design or sketching for us to get the real image of machine that we want to be produced. Due to this, the work design and study that we made is a continuing process and it involving problem solving activity creatively namely which is known as literature study.

2.2 – REVIEW OF EXISTING SYSTEM
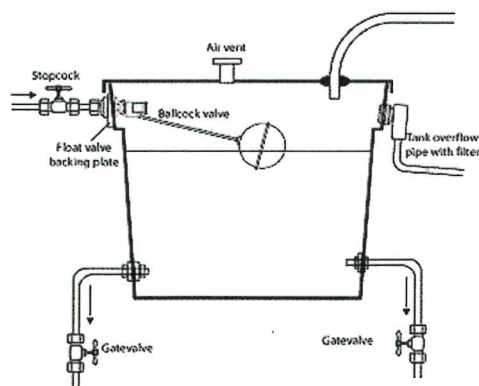
Figure 2.2a : Existing Water Tank System

2.2.1 – Review of Existing Components / Tools

i. Ballcock (Float Valve)

A ballcock or also called as Balltap or Float Valve is mechanism or machine for filling water tanks such as those found in flush toilets, while avoiding overflow and backflow. The float is often ball-shaped, hence the name ballcock. The valve is connected to the incoming water supply, and is opened and closed by the lever which has the float mounted on the end. When the water level rises, the float rises with it, once it rises to pre-set level, the mechanism forces the lever to close the valve and shut of the water flow.

Figure 2.2.2.a : Ballcock / Float Valve

ii. Stopcock

Figure 2.2.2.b : Stopcock

7

A stopcock is a form of ball valve used to control the flow of a liquid or gas. Compared to the progressive control of a gate valve a stopcock's is coarse, confining their use principally to on-off applications. Stopcocks are used to grossly regulate the flow of tap water in residential and commercial services.

2.3 BACKGROUND PROJECT

2.3 - Components use in the project

2.3.1 – Arduino UNO

Figure 2.3.1 : Arduino UNO

Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software,

which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (*shields*) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

2.3.2 – Relay

In this project, we use relay. Relay are electromechanical switches. They have very high current rating and both AC and DC motors can be controlled through them because motor will be completely isolated from the remaining circuit. Two common available SPDT relays are shown in the picture below.
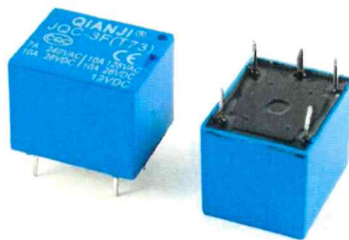

Figure 2.3.2.a : Relay

Working of a relay

Relays consist of electromagnet, armature, spring and electrical contacts. The spring holds the armature at one electrical contact and as soon as a voltage is applied across the electromagnet, it coils the armature, changes its contact and moves to another electrical contact. The figure below describes its working.
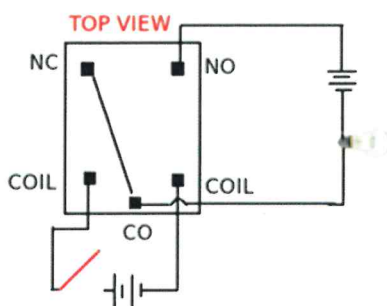
Figure 2.3.2.b : Circuit of Relays

Terms associated with relays:

- **Normally Open (NO):** contacts connect the circuit when the relay is activated; the circuit is disconnected when the relay is inactive.

- **Normally Closed (NC):** contacts disconnect the circuit when the relay is activated; the circuit is connected when the relay is inactive.

- **Change Over (CO):** It's the common contact.

- **Coil:** It's the electromagnet coil inside relay.

Relay ratings:

- **Coil rating:** It's the voltage at which the coil gets fully activated. Some also have coil resistance mentioned on them. Relay coil voltage rated 6V and 12V are the most commonly available.

- **Contact rating:** It depends on whether AC or DC current is passing through the contacts. The blue colored relay shown in the start of this page has a rating of 12A at 120V AC, 5A at 250V AC and 10A at 24V DC.

Relay triggering circuit:

Depending upon a relay's coil rating, some may require current greater than 100mA. If an IC cannot provide this much current, a transistor is used as a switch to trigger the relay as shown below. Don't avoid the protection diode (D1 shown in circuit) as it will protect transistor from back e.m.f induced in relay coil.

2.3.3 – LED Diode

Figure 2.3.3.a : LED Diode

In electronics a diode is a two-terminal electronic component which conducts electric current asymmetrically or unidirectional. It conducts current more easily in one direction than in the opposite direction. The term usually refers to a semiconductor diode, the most common type today, which is a crystal of semiconductor connected to two electrical terminals, a P-N junction. A vacuum tube diode, which was the first type of diode invented but is now little used, is a vacuum tube with two electrodes; a plate and a cathode.

11

The most common function of a diode is to allow an electric current in one direction (called the forward direction) while blocking current in the opposite direction (the reverse direction). Thus, the diode can be thought of as an electronic version of a check valve. This unidirectional behavior is called rectification, and is used to convert alternating current to direct current, and remove modulation from radio signals in radio receivers.
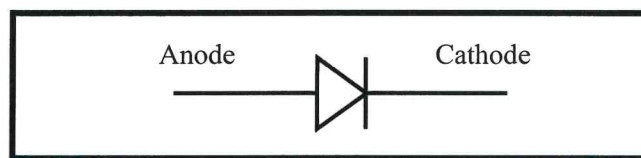

Figure 2.3.3.b : Diode Symbol

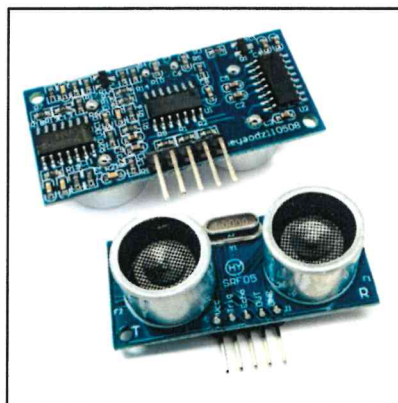**2.3.4 – Ultrasonic Sensor Module**

Figure 2.3.4a : Ultrasonic Sensor Module

Ultrasonic Sensor Module are divided into three broad categories: transmitters, receivers and transceivers. Transmitters convert electrical signals into ultrasound,

12

receivers convert ultrasound into electrical signals, and transceivers can both transmit and receive ultrasound. Ultrasound can be used for measuring wind speed and direction (anemometer), tank or channel fluid level, and speed through air or water. For measuring speed or direction, a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure tank or channel level, the sensor measures the distance to the surface of the fluid.
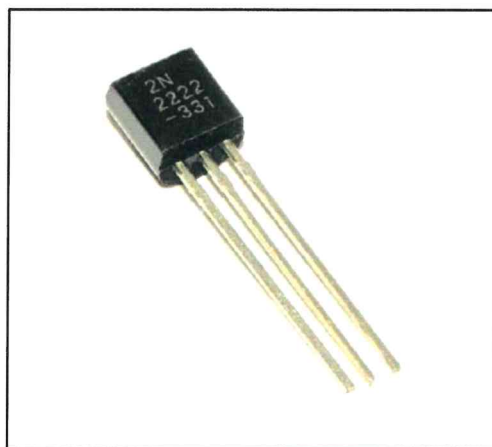
2.3.5 – Transistor 2N222

Figure 2.3.5a : Transistor 2N222

The 2N222 transistor is a common negative-positive-negative (NPN) bipolar junction transistor (BJT) that finds use in many different kinds of electronic equipment. It is used for both analog signal amplification and switching applications. The functioning parts of the 2N2222 transistor are enclosed in what is known as a TO-18 package, which resembles a small metal can. The broad range of uses for the 2N2222 transistor, and its small size, make it — and its variants — the most widely used transistors in electronics.

The functioning portion of the 2N2222 transistor is a NPN BJT construct. The 2N2222 transistor is made of either germanium or silicon that has been saturated with either a

positively or negatively changed material in a process called "doping." The 2N2222 has a positively charged section sandwiched between two negatively charged sections. The resulting two connections between the three sections are where the 2N2222 derives the name "bipolar junction transistor." The materials used are arranged in the order of negative, positive, then negative, so the device is also said to be a NPN transistor.

The 2N2222 has three wire leads used to solder it to circuit boards: the collector, the emitter, and the base. When an electronic signal is present at the transistor's collector, applying a signal to the transistor's base will cause a signal to emit from the device's emitter. In this way, the 2N2222 is often used to switch signals on and off.

2.3.6 – Piezo Buzzer

A buzzer is a mechanical, electromechanical, magnetic, electromagnetic, electro-acoustic or piezoelectric audio signaling device. A piezo electric buzzer can be driven by an oscillating electronic circuit or other audio signal source. A click, beep or ring can indicate that a button has been pressed.

Figure 2.3.6.a : Buzzer

2.3.7   Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators.

Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implemented within integrated circuits.
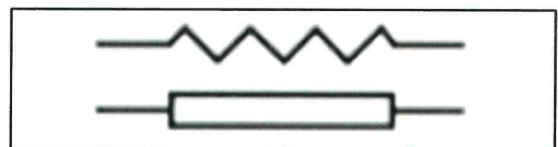

Figure 2.3.7.a : Resistor   **Figure 2.3.7.b : Symbol of Resistor**

2.3.8 – LCD

LCD (liquid crystal display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, LCDs allow displays to be much thinner than cathode ray tube (CRT) technology.

An LCD is made with either a passive matrix or an active matrix display grid. The active matrix LCD is also known as a thin film transistor (TFT) display. The passive matrix LCD has a grid of conductors with pixels located at each intersection in the grid. A current is sent across two conductors on the grid to control the light for any pixel. An active matrix has a transistor located at each pixel intersection, requiring less current to control the luminance of a pixel. For this reason, the current in an active matrix display can be switched on and off more frequently.

Figure 2.3.8.a: LCD Display 16 X 2
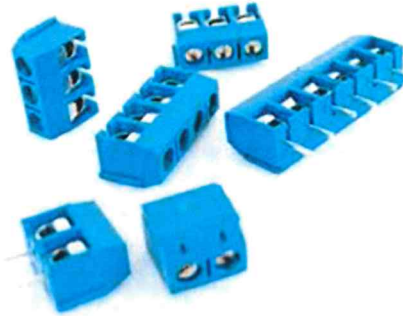
2.3.9 - Terminal Blocks

Figure 2.3.9a : Terminal Block

Terminal blocks are insulated bases used to connect wires, printed circuit boards, and other electronic components to one another. Depending on the application, a terminal block may be designed to accept clips, stripped wires, plugs or other specialized connectors. They are regularly used in telecommunications operations and as secure mounts for computer and electronic equipment circuit boards. Wires and other components can be affixed to terminal blocks through soldering, screws, clamps, tabs, tubular screws and plugs. The most basic types of terminal blocks involve simply the plastic base, conductive metal plates and screw fittings. With screw fittings, input wires can be fitted with spade terminals clamped into place or simply wound around terminal connections. Terminal block mounts include a variety of quick disconnect shapes, jumpers and specialized plugs.

2.4– Software used in the project

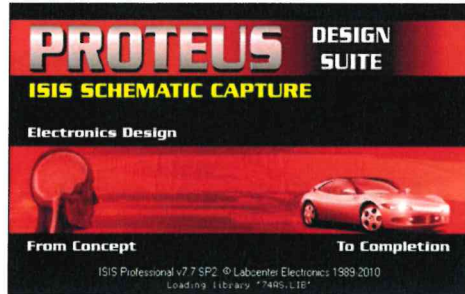### 2.4.1 - Proteus ISIS Application

Figure 2.4.1.a : Proteus ISIS Application

The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB layout design. It can be purchased in many configurations, depending on the size of designs being produced and the requirements for microcontroller simulation.

2.4.2 - PCB Wizard

Figure 2.4.2.b PCB WIzard

PCB Wizard is a powerful package for designing single-sided and double-sided printed circuit boards (PCBs). It provides a comprehensive range of tools covering all the traditional steps in PCB production, including schematic drawing, schematic capture, component placement, automatic routing, Bill of Materials reporting and file generation for manufacturing.

CHAPTER 3

METHODOLOGY

3.1 - INTRODUCTION

Methodology can be the analysis of the principles of methods, rules, and postulates employed by a discipline, the systematic study of methods that are can be or have been applied within a discipline or a particular procedure or set of procedures. Methodology includes a philosophically coherent collection of theories, concepts or ideas as they relate to a particular discipline or field of inquiry.

Methodology refers to more than a simple set of method rather it refers to the rationale and the philosophical assumptions that underlie a particular study relative to the scientific method. This is why scholarly literature often includes a section on the methodology of the researchers. Each step of project is a process to complete the project. Every step must be followed one by one and must be done carefully.