

*DESIGN AND DEVELOPMENT OF AUTOMATIC WATER PUMP CONTROLLER SYSTEM*

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## *CHAPTER ONE*

### *INTRODUCTION*

#### *1.1 Background of the study*

Water is transparent, tasteless, odorless, and nearly colorless chemical substance, which is the main constituent of earth's streams, lakes, and oceans. The fluid of living organisms is one of the most important elements to a person's life. The human body is composed of 75% and that of the Earth takes 71 percent (Claire, 2020). The Water Level Controller System is an Electronic Equipment which when electrically connected to the starter of any given pump-set motor will control the operation of the pump-set depending upon the water level drops below pre-set level in overhead tank, switch OFF the Pump-set when water level in the overhead tank becomes full, switches ON the pump-set when water level is low in tank, and switches OFF the pump-set when there is sufficient water in the tank. Automatic water level controller system is an engineering project. And it can automatically switch ON and OFF the domestic water pump-set depending on the tank water level. You can implement this motor driver system at your home or college using less costly components. The main advantage of this water controller system is that it automatically controls the water pump without any user interaction.

The project "Automatic water level control with an automatic pump control system is designed to monitor the level of liquid in the tank. The system has an automatic pumping system attached to it so as to refill the tank once the liquid gets to the lower threshold, while switching OFF the pump once the liquid gets to the higher threshold.

Sustainability of available water resource in many parts of the world is now a dominant issue. This problem is quietly related to poor water allocation, inefficient use, and lack of adequate and integrated water management. This water level control, controls monitor and maintain the water level in the overhead tank and ensures the continuous flow of water round the clock without the stress of going to switch the pump ON or OFF thereby saving time, energy, water, and prevent the pump from overworking. Besides this, liquid level control systems are widely used for monitoring of liquid levels in reservoirs, silos. Proper monitoring is needed to ensure water sustainability is actually being reached with disbursement linked to sensing and automation, such programmatic approach entails microcontroller based automated water level sensing and controlling system.

### **1.2 Statement of the problem**

Water sensors used are built with conductive materials, which mean that they are subject to rusting or corrosion. When rusting occurs, the sensors will stop conducting, thereby causing the device to stop working. The essence of this project therefore is to ensure water management system incorporating a controller to control, monitor and maintain the water level in the overhead tank and ensure the continuous flow of water without overworking the pump.

### **1.3 Aim and objective of study**

The aim of this project is to design and develop an automatic water pump controller system. **1.4 Objectives**

In order to achieve the goal of this project, the following objectives will be pursued;

1. To study the controller model and observe its characteristics.
2. To suggest any ideas that can lead to future improvement of the controller system.
3. To carry out extensive literature review on the subject matter.
4. To carry out design of an automatic water monitoring system.
5. To carry out detail design of the component of the controller.

### **1.5 Significance of the project**

Automatic water level monitor came into existence because of human error and Inconsistency that is associated with manually operated water pumping machine. This is because it takes time for individual who is manually operating the water pump to turn OFF the pumping machine and this may cause water spillage and at times the individual might not know that the water level has drop so low until the tank is completely empty. This was the problem that led to the development of the idea of an automatic water level controller and automatic pump short down. Water is commonly used for agriculture, industries, offices, schools and domestic consumption. Therefore, efficient use and water monitoring are potential constraint for home or office water management system. Moreover, the common method of level control for home appliance is simply to start the feed pump at a low level and allow it to run until a higher water level is reached in the water tank.

### **1.6 Scope of the project**

The project was design to automatically control the pump which ensures constant reserve of water in the reservoir. The scope of the design was to keep concise and simple to in other not to introduce unnecessary complexities and render it generally

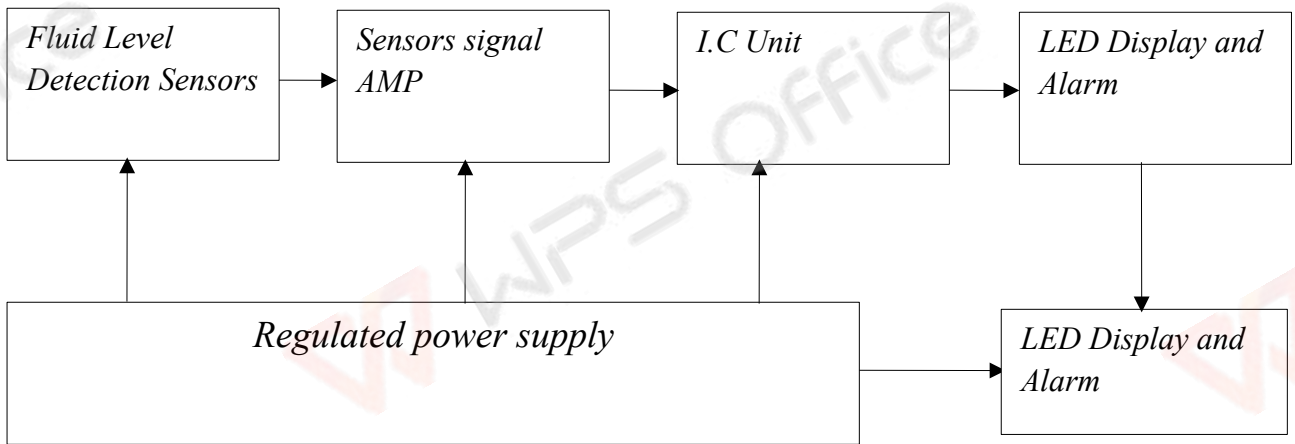
uncomfortable. The system does not have attached complex peripheral device which though impossible for the detail printable information has been excluded for reasons of affordability material of low range and less accurate performances as opposed to a well built automatic water pump was used to achieve this aim, the automatic water level controller detect and control the water in the tank.

## ***CHAPTER 2***

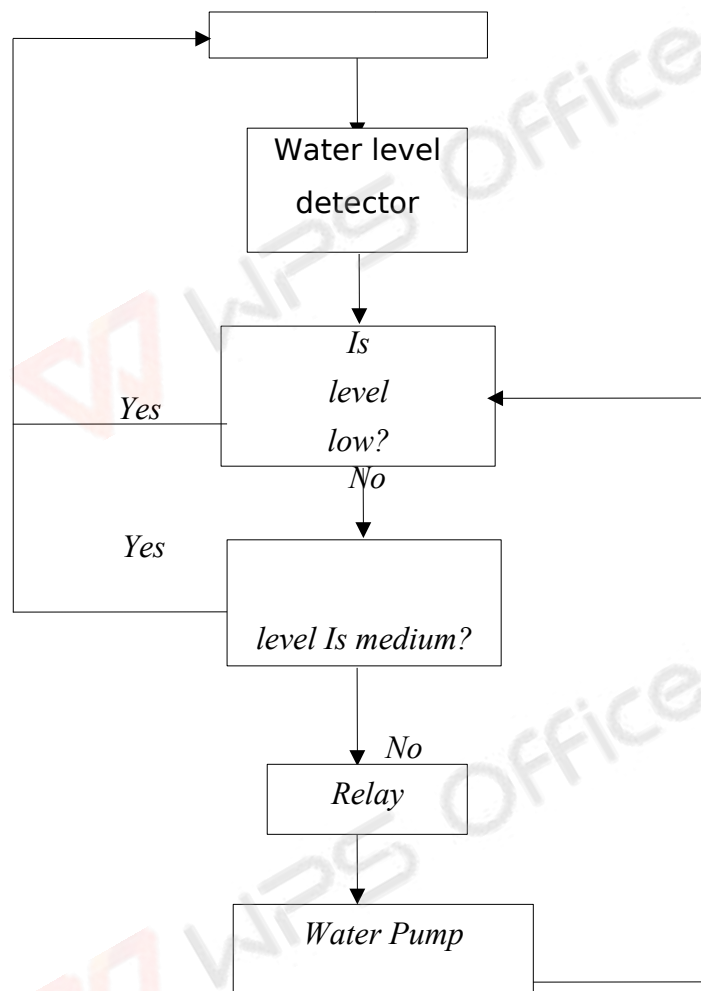
### ***LITERATURE REVIEW***

An automatic water level control detects the water level in the tank and also ensures continuous water flow round the clock because of its automatic controller system. This automatic water control is made up of microcontroller written in C programming language this program is burn into an IC called AT89S52 with 40 pins ( Anas Kuzechie, 2021 ). The level measurement consist of determining the distance from the upper surface of a liquid in a reservoir or vessel or any arbitrarily chosen mark located above or below this surface by itself the level is not an independent physical quantities describing the state of a substance through direct and indirect level, some examples of direct level measurement are dipstick, the bubbler, immersion electrode, capacitor type ,liquid level radiation type liquid level measurement . for instance the dipstick, it is very simple, the stick being dipped periodically through a hole and the hole and the immersion mark is being read off with the aid of the calibration on the stick. Then, the direct level measurement are sight glass ,depending on the manometer principle, the transparent tube is place in a convenient and its being connected to the lower part of tank and graduated for safety reasons, the top the bright glass is vented into the tank and the sight has isolation valve top and bottom while the micro base; water level controller has the ability to switch on the pumping machine when the water in the tank has gone below gauge level automatically switches OFF the pumping machine when the water in the tank has reach its maximum level. Electronics circuit has undergone

tremendous changes since the invention of a triode by LEE DE FOREST in 1907. In those days the active component like resistors, inductors and capacitors etc of the circuit were separated and distinct unit connected by soldered lead with the invention of a transistor in 1947 by W.H Brattain and I. barden, the electronic circuit became considerably reduced in size. it was due to the fact that transistors were not only cheaper, more reliable and less power consumption but was much smaller in size than an electronic tube. To take advantage of small transistors size, the passive component too were reduce in size there by making the entire circuit very small development of printed circuit board(PBC) further reduce the size of electronics equipment by eliminating bulky wiring and tie point. In the early 1960s a new field of micro-electronics was born primarily to meet the requirement of the military which was to reduce the size of it electronics equipment to approximately one tenth of it then existing volume. The drive extreme reduction in the size of electronic circuit has lead to the development of micro-electronics circuit called integrated circuit (ICS) which are so small than their actual construction is done by technicians using high powered microscopes. An integrated circuit is a complete circuit in which both the active and passive component are fabricated in on a tiny single chip of silicon, Active component are those which have the ability to produce gain example are transistors and field effect transistors (FET). An integrated circuit sometimes called a chip or microchip is a semi-conductor wafer on which thousand of millions of tiny transistors, capacitors are fabricated, An IC can be either analog or digital depending on its intended application. This can be done by increasing or decreasing the number of level detector and associated component. with a Diodes full-wave rectifier used in powering the system through a volts battery. A schematic circuit and block diagram is shown below in Figure 2.1, and also a flow chart was represented in Figure 2.2



**FIGURE 2.1: BLOCK DIAGRAM**



**FIGURE 2.2: FLOW DIAGRAM**

## 2.1 The Adaptation of Sensors

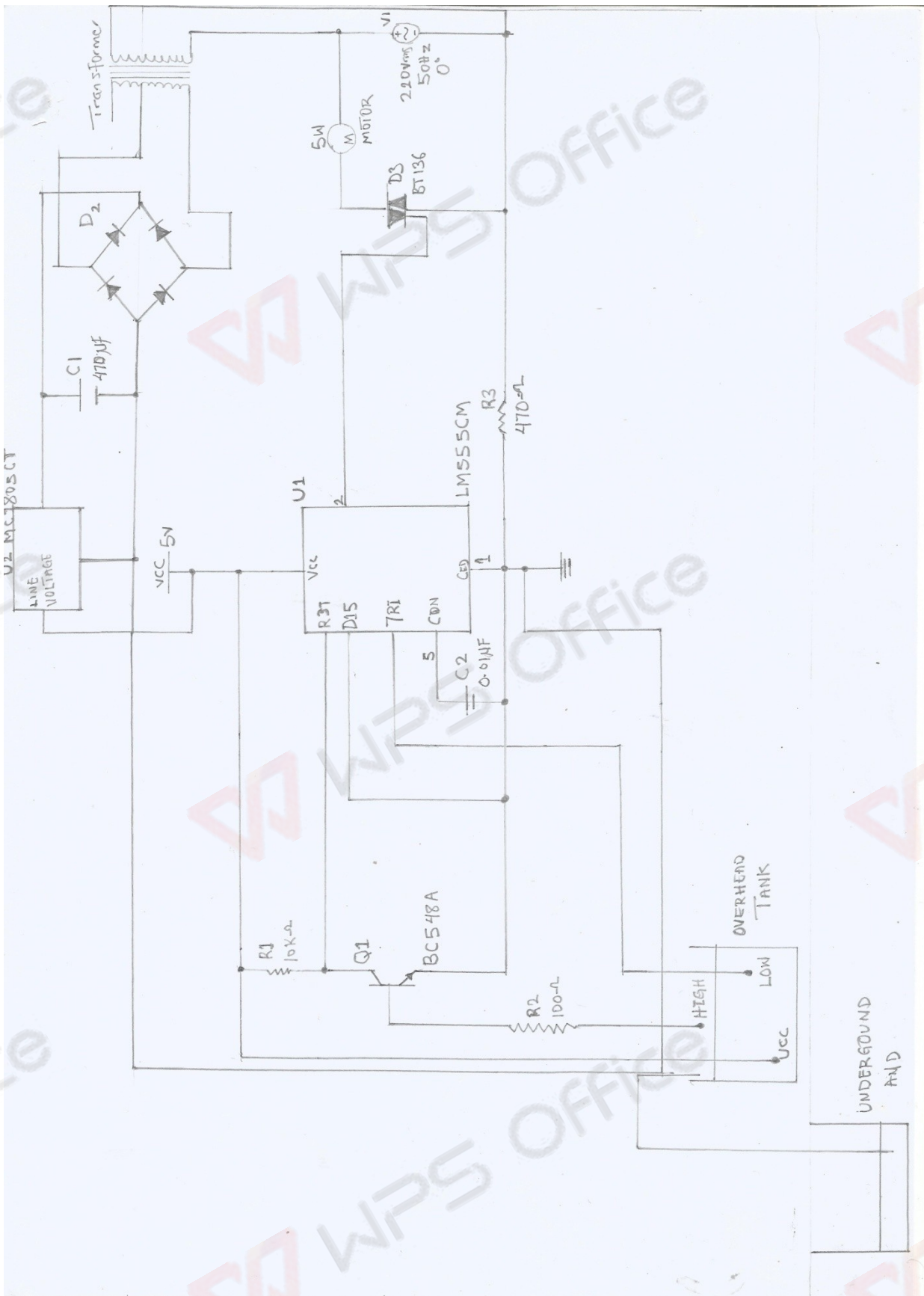
Level sensor detect the level substance that flow including liquid slurries, granular materials and powders. All substances flow to become essentially level in their containers (or other physical boundaries) because of gravity. The substance to be measure can be inside a container or can be in its natural form (e.g. river or lake) . The level measurement can be either continuous or point value. Continuous level sensors measure within a specified range and determine the exact amount of substance in a certain place. Hill point level sensors only indicate whether the substance is above or below the sensing point generally the latter detect levels that are excessively high or low. There are many physical and application of variables that affect selection of optimal level monitoring method for industrial and commercial processes. The selection criteria include the physical phase (liquid, solid or slurry), temperature, pressure or vacuum, density (specific gravity)of medium, agitation ,acoustic or electrical noise ,vibration ,mechanical shock, tank or bin size and shape also important are the application constraint price, accuracy, appearance response rate, ease of calibration or programming ,physical size and mounting of the instrument on discrete (point) levels. Several works have been done on the control of water pumping machine and level indication but these systems have their own disadvantages as a result of the method of sensing employed. Ishwar and Yadav (2013), constructed experimental setup which consists of a motor pump which is switched ON when the overhead tank is about to go dry and switched OFF when the overhead tank is about to overflow. Metallic contacts sensors are used. When water comes in contact with these sensors, the circuit gets completed and signal is generated. This signal is fed to logic circuit to get correct

actuator signal. The logic gate used is NAND gate. They have concluded by saying that this system is very beneficial in rural as well as urban areas. It helps in the efficient utilization of available water sources. If used on a large scale, it can provide a major contribution in the conservation of water for us and the future generations. Ejiofor and Francisca (2007), used a microcontroller to automate the process of water pumping in an over-head tank storage system and has the ability to detect the level of water in a tank. The pump will switch on/off accordingly and display the status on an LCD screen. The automatic water level monitor used in the study consists of the following major units: sensors, microcontroller, display unit, and the pump and the core work of detecting the level of water is done by the comparator. Taking advantage of the electrical conductivity property of water, the copper conductors are used as the water level sensor. When water touches the copper, sensor positioned at a particular level in the tank, voltage is transferred to the copper which in turn is transferred to the comparator circuit for further processing. The LM324 comparator is used to compare the inputs from the electrodes in the tank and with a pre-set resistance and output a HIGH or a LOW with respect to the result from the comparison. The author concludes by saying that the research successfully provided an improvement on existing water level controllers by its use of calibrated circuit to indicate the water level and use of DC instead of AC power thereby eliminating risk of electrocution. A table was drawn below to show components used in the circuit.

TABLE 2.1 COMPONENTS USED IN THE CIRCUIT

COMPONENT	SPECIFICATION	QUANTITY
<i>Metallic Contacts</i>		2
<i>Transformer</i>	230V/18V, 50Hz	1
<i>Diode</i>	IN40001,50V	4
<i>Voltage Regulator IC</i>	MC7805CT	1
<i>Water Pump</i>	5W/230V	1
<i>555 Timer IC</i>	5V(4.5V – 16V)	1
<i>Triac IC</i>	BT136	1
<i>LED</i>	3-5V	1
<i>Transistor</i>	BC 548	2
<i>Capacitor</i>	0.01 $\mu$ F & 470 $\mu$ F	2
<i>Resistor</i>	100 $\Omega$ & 470 $\Omega$ , 10 $\Omega$ K	3

Figure 2.2 Circuit Component



Throughout history, people have devised systems to make water supply to their communities and homes more convenient. As the need for water availability increased, a water storage tank was invented that is used to provide water storage for use in many applications. ( Water level indicator circuit diagram and its application, 2019)

Today, the use of overhead tanks has been adopted by almost all homes and factories. These tanks are refilled by the use of an electric pumping machine, but they present another challenge of overflow and water dissipation. Many electronic designs have been built to solve the problem of water overflow in the overhead tank. A water level alarm circuit design consisting of 555 timer Integrated Circuit was designed to indicate the water level in the overhead tanks. The circuit produced a clear sound when the water level reaches its level point. According to the design, if the water does not reach the level of the probe, the actable multi vibrator of the circuit will not produce any oscillation. Therefore, no sound will be produced by the circuit. If the water level reaches the probe, then current flows in the water, therefore, the sound is produced by the circuit. Therefore, an actable multi vibrator produces an oscillation and the buzzer will produce a beep to indicate that the water level has reached a particular level. (Mallikarjun G . Hudedmani, Nagaraj S.N et al ( 2018).

In 2012, Anyanwu C.N, Mbajiorgu C.C and Anoliefo E.C had another system and it was developed based on the fact that water conducts electricity. As the water level rises or falls, the detection probes and the control circuit detect the same and the signals were used to turn the pump motor ON or OFF, as the case may be. The probe placed in the upper tank sends signal to the NE555 IC controller to act accordingly.

Another designer developed a system that could monitor and initiate pumping using Ultrasonic sensor by Okhaifoh1 J.E, Igbino C.K and Eriaganoma K.O (2012). Stating that assuming the tank is empty when the system is switched ON, the microcontroller sends a pulse of 10  $\mu$ s to the trigger pin of the sensor. The sensor then transmit an 8 x 40 KHz sound wave to enable the echo pin, the reflected sound wave is receive to disable the echo pin. The time it takes to transmit and receive the sound wave is used by the microcontroller to calculate the distance. If the distance calculated is less than or equal to the preset minimum distance, the pumping machine is automatically switched ON and the process continues.

With every houses today having an overhead tank for sufficient storage and distribution of water more mechanized system of low cost and easy conservation and maintenance has been put in place for conventional water pump machines which are only manually operated with a huge monitoring effort to determine the water level before it can be refilled. Most of the time, due to negligence, we may not know until all the water in the tank has dissipated, leading to downtime in the case of an industrial environment (Petruzzello et al, 2021) The evolution in the water management system and the need for a more convenient and reliable system has continued to pose a great challenge for innovative engineers. However, far from the conventional water pumping machine, there has been a slight change in the system. Today, in most industries, there are systems that indicates the water level in the overhead tank for onsite evaluation. In order to eliminate downtime in industries, this automatic water pump controller would have some measure of artificial intelligence built into the system, thus solving those big challenges. If implemented in buildings, it will lead to good water management due to its automation. It has keypad that enables the user schedule a daily routine pumping say

every 7:30am weekdays. It is designed to overcome the shortcomings of the conventional water pumping machine through its automated function. Not only are manual pumping machines strenuous to operate, there is always an overflow of the overhead tank during pumping, which leads to waste of water. Water dissipation especially in offices and industrial environments, often cause downtime of normal work activities, as water is required for routine daily office cleaning. ( Esiobiue, et al, 2021 ).

A flow chart showing how the project works is illustrated in Figure 2.4 below.

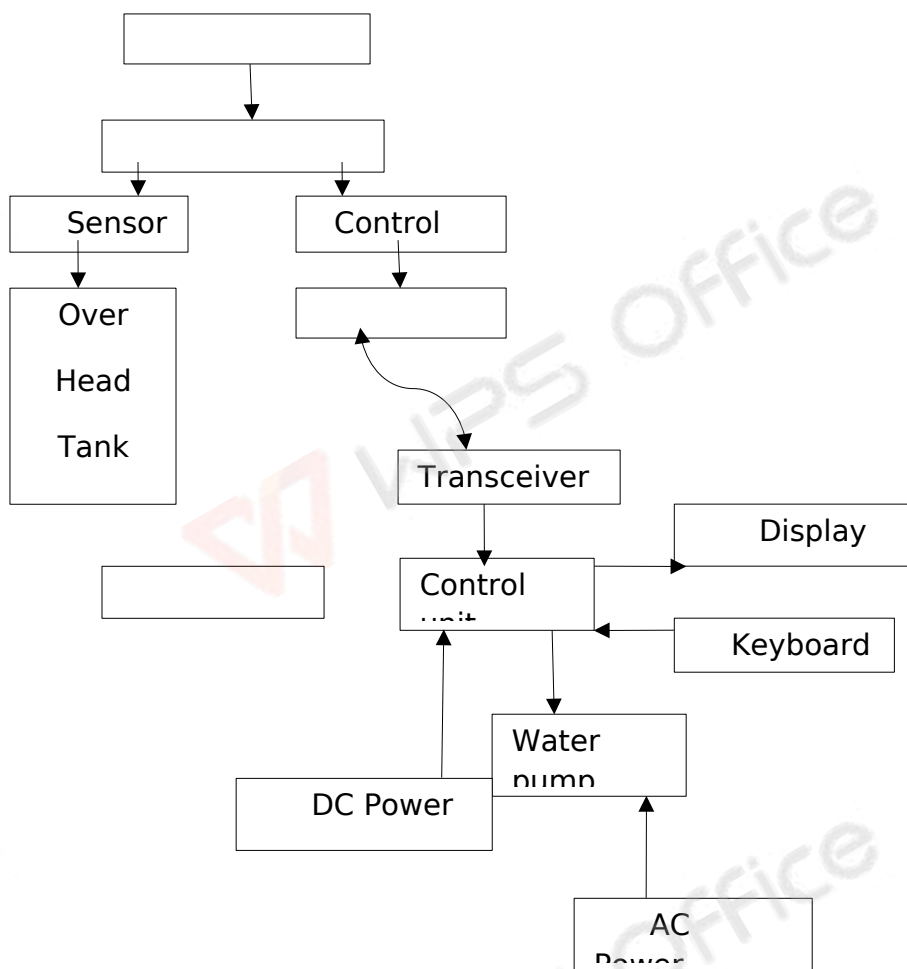


FIGURE 2.4: Block Diagram of the System

In this system the water level monitoring section is charged by the solar system; of course, this allows constant monitoring. The power capacity is 2x4.2V dc, which means

that the system lasts for days without severe sun rays. The transmitter is radio frequency, RF transmitter to avoid any form of interference. The best way to summarize this process is a block diagram. The following diagram is classified into the basic blocks of the system to give a clearer explanation of the working principle of the system.

As the world grows globally, even more developed designs has been made to make water pumping control system more easy and efficient with the use of software like Arduino. (Mohammed Ahmed Halfous, et al (2017). Arduino is an open source physical computing platform for creating interactive systems that can stand alone or collaborate with software on computer. Arduino was designed for artists, designers, and others who want to incorporate physical computing into their designs without having deep knowledge of electrical engineering. The Arduino hardware and software are open source (developable). The open source philosophy fosters a community that shares its knowledge generously. This is great for beginners as help is often nearby available geographically and also online, at varying skill levels, and on bewildering arrays of topics. Example projects are presented not just as pictures of the finished project, but include instructions for making your own or as a starting point for incorporation into your derivative or related projects. The Arduino project was developed in an educational environment and is a very popular educational tool. The same open source philosophy that created the community which generously shares information, answers, and projects also shares teaching methods, curricula, and other information. The Arduino water controller system control the water level by using ultrasonic sensor. Basic principle of ultrasonic distance measurement is based on ECHO. When sound waves are transmitted in environment, they return back to the origin as ECHO after striking on any obstacle. So, we can calculate its traveling time to the target and back to

source. After some calculations we can come to a result in the form of distance. The Arduino language programmed into a system board as shown in Figure 2.5 is a concept used in water controller project where the water motor pump is automatically turned on when water level in the tank becomes low.

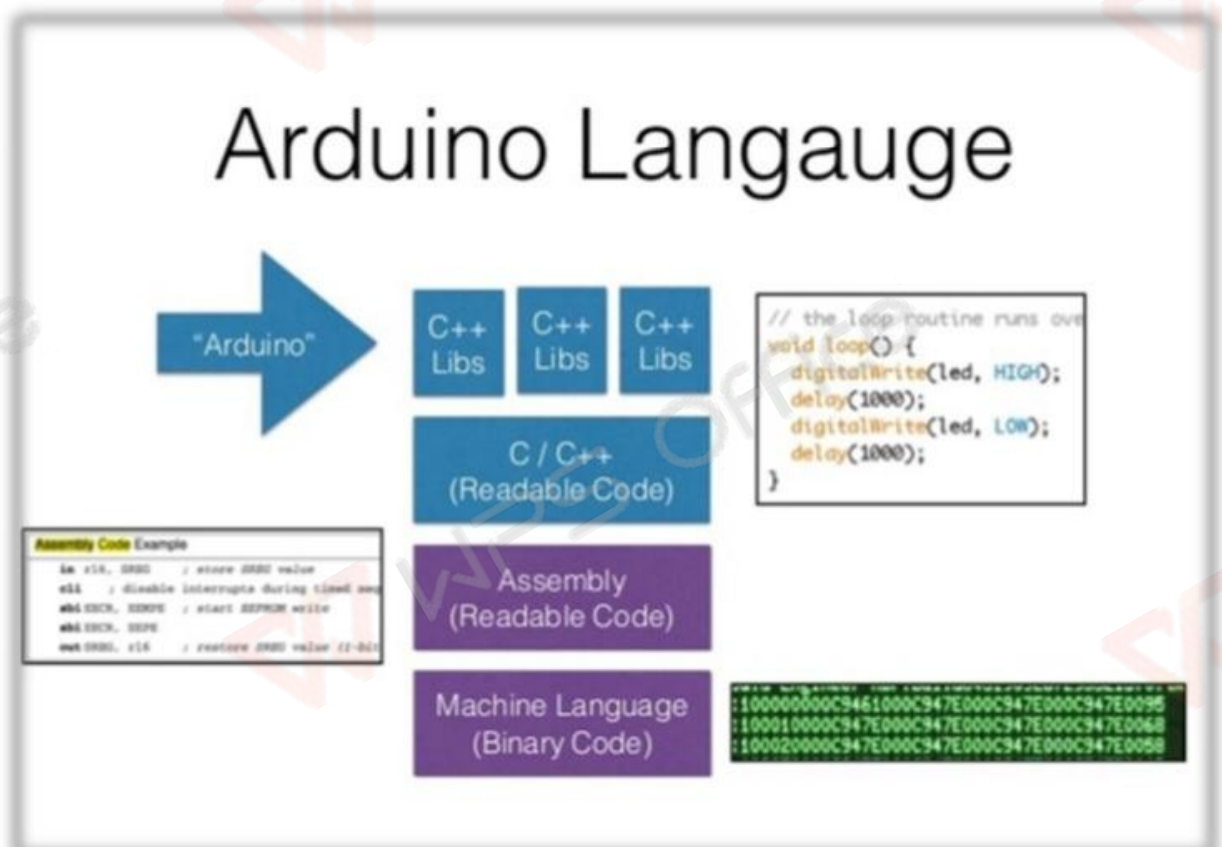


FIGURE 2.5: Programming Arduions Processor Board

Figure 2.6 shows the block diagram of the system with Ultrasonic module as sensor connected to Arduino

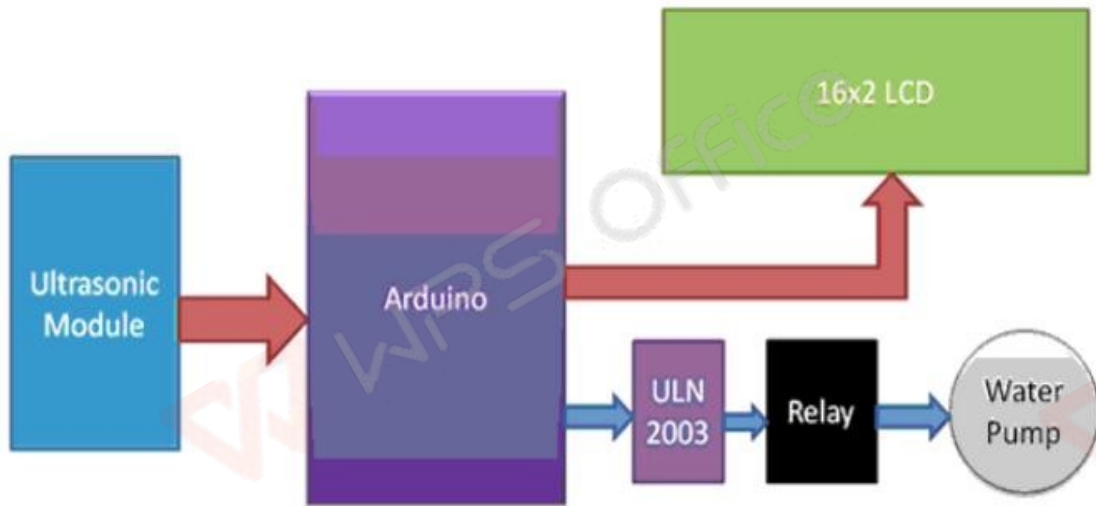


FIGURE 2.6: Block Diagram for Arduino Level Controller

In the circuit Ultrasonic sensor modules “trigger” and “echo” pins are directly connected to pin 7 and 6 of Arduino as shown in figure 2.7.

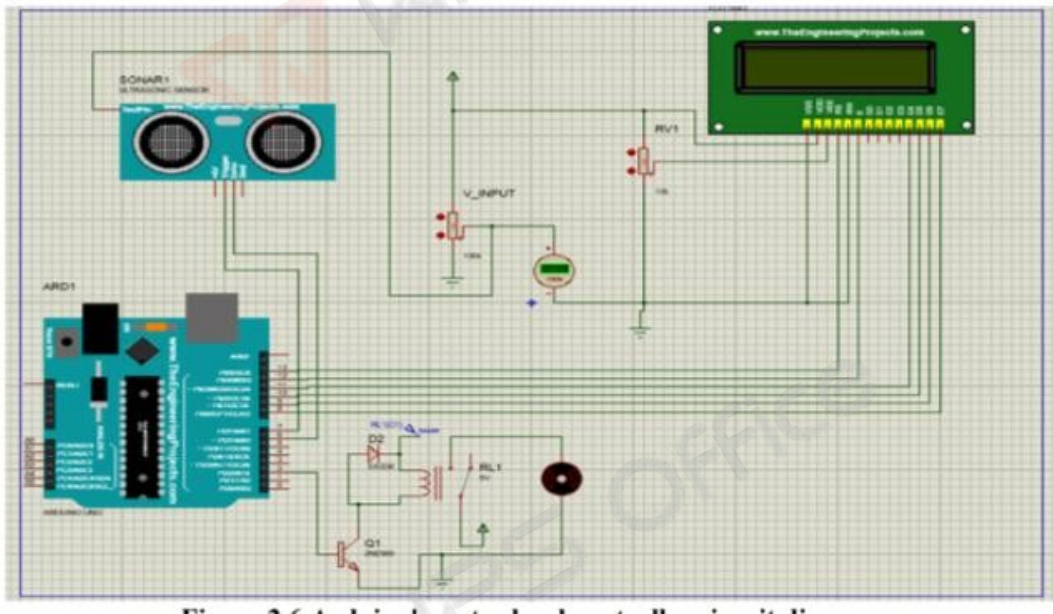


FIGURE 2.7: Arduion Water Level Controller Circuit Diagram

The use of electric pumps to pump water from a source to where it is needed and during retrieval was successfully done, nevertheless with a number of shortcomings [Chaiko Y et al (2008)]. The shortcomings are reflected in the challenges of achieving high energy efficiency and extended lifespan of the pump by controlling when to pump, when to stop pumping and how to monitor the level of water in a storage tank. Human intelligence (which in this particular case is highly unreliable, costly, inefficient and prone to errors) was employed to address these issues. However, this led to wastage of human resources as well as the inefficient maximization of the performance and life span of the electric pump. Putting a check to these issues will require an improved operation of the electric water pump which has led to the design and development of several electric water pump controllers (Wara, S, T., et al, 2016)). The MBACWPMLI(Microcontroller based Automatic Machine for water pumping machine with water level indicators using Ultrasonic sensor presented in this paper was designed with focus to eliminate the difficulties involved in monitoring and controlling the pump while maximizing the performance and life span of the electric water pump. Several works has been done on the control of water pumping machine and level indication but these systems have their own disadvantages as a result of the method of sensing employed. Most of them use the electrical conductivity of water by installing metallic conductors at separate levels along the tank height to act as sensors. Over time, the sensor corrodes as it comes in contact with the water, thereby making it loose its electrical conductivity. This also result in reduced water quality due to contamination of the water - change in the pH level, introduction of stains, colourations, deposits and change in taste of the water. In general, the water becomes unhygienic for use and hazardous to health over time. The proposed system addresses these shortcomings as it uses ultrasonic sensor as its sensing device which do not come in contact with water. ( J.E. Okhaifoh et al ) . A

comprehensive flow chart was illustrated in Figure 2.8 showing the mad out process of the Microcontroller Based Automatic Control For Water Pumping Machine With Water Level Indicators.

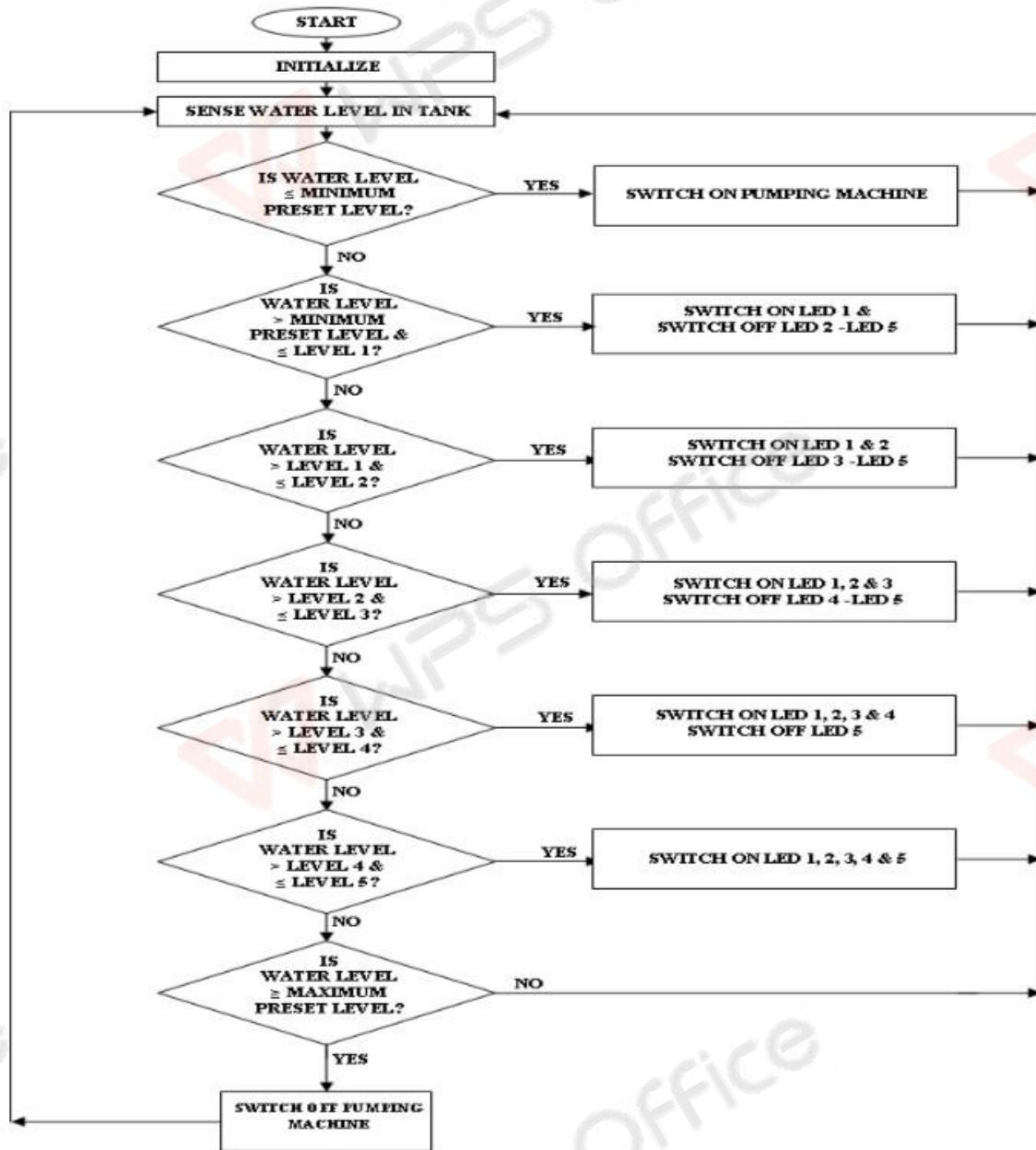


FIGURE 2.8: Flow Chart Of Microcontroller Based Automatic Control For Water Pumping Machine With Water Level Indicators

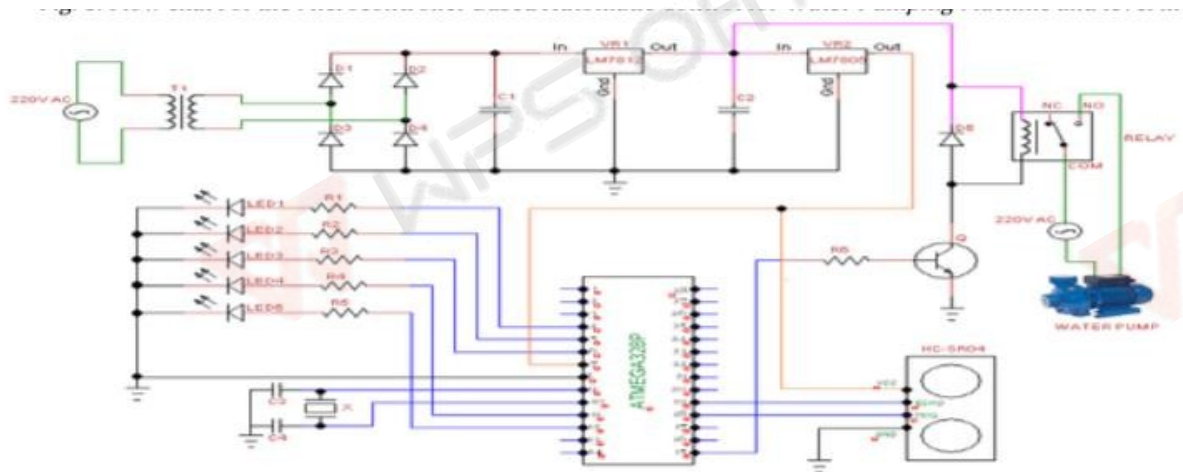


FIGURE 2.9: Complete Circuit Diagram Of The Microcontroller Based Automatic Control For Water Pumping Machine With Water Level Indicator

After a design in developing the automatic controller water pumping system with sensors in Sudan University of Science & Technology, ( Hozuifa, Abd Elkariem Yacob Bakheet, 2016) The development of automation and control processes in industrial applications has increased significantly over the past decades. Involvement of human activities in industrial processes has caused so many problems, like safety, health and industrial damages both to humans and the developmental activities within the level of industrial production and service delivery. The effect of automation and control systems in recent production and service delivery development has improved the safety and reliability in technology and most human services in the developing countries. Some of

the industries involved in the development of automation and control systems are the oil/gas industries, power generation companies, water and sewage treatment plants, chemical industries, pharmaceutical, food and beverage industries and some *basic systems used by service providers* in small companies and homes. Automation processes is now aiming to progress in the so called complete automation which will remove all human machine interface will not be needed but just to enter parameters of the process to be controlled and the machine performs the rest of the designed activities. A control system is an interconnection of components connected or related in such a manner as to command, direct, or regulate itself or another system. Automatic control systems enable to operate processes in excellent and accurate manner. Considering some process applications in the industries, the need of control systems to achieve industrial targets and objectives by continually measuring process variables such as temperature, pressure, level, flow and concentration, taking into actions such as opening valves, slowing down pumps and turning up heaters in order to maintain measured process variables at the operator's set point values. With this idea for the future development in technology, software applications like the microcontroller can help to achieve this aim for complete automation processes. The pump control system based on three main points are the places where the sensors at the tanks, first sensor at top level of the overhead tank and the second at a quarter level of the overhead tank and the third sensor level at the suction level of the submersible pump in the underground tank. The submersible pump cannot draw water from the underground tank only if the water level in the underground tank reaches water level sensor at the underground tank. The microcontroller controls the implementation process according to the level of water in the overhead tank and the underground tank and decides if the pump working or not. The microcontroller stops the pump if the overhead tank is full or the occurrence of any

error in the sensor signals or if the underground tank is empty. The microcontroller runs the pump if the water level in the underground tank reaches the water sensor level of the draw submersible pump and the water level in the overhead tank is not touching any of these sensors (tank is empty) or touching the sensor at the quarter of the overhead tank level (not full). Microcontroller signals pass through the driver then to relay for the implementation of the process of turning on or off the submersible pump. There are three Light Emit Diode (LED) indicators of the water level. Red Light Emit Diode (LED) indicates the water level in the underground tank is less than suction level of the submersible pump, yellow Light Emit Diode (LED) indicates the overhead tank is full, and green Light Emit Diode (LED) indicates the water level reaches a quarter level of the overhead tank or slightly more than this. Not only the Light Emit Diode (LED) will switch on but also the buzzer when the fill of the overhead tank as it is been illustrated in figure 2.10. The flow chart shows the process at which the system is been operated along side with the connection of the circuit illustrated in figure 2.11 and figure 2.12 respectively.

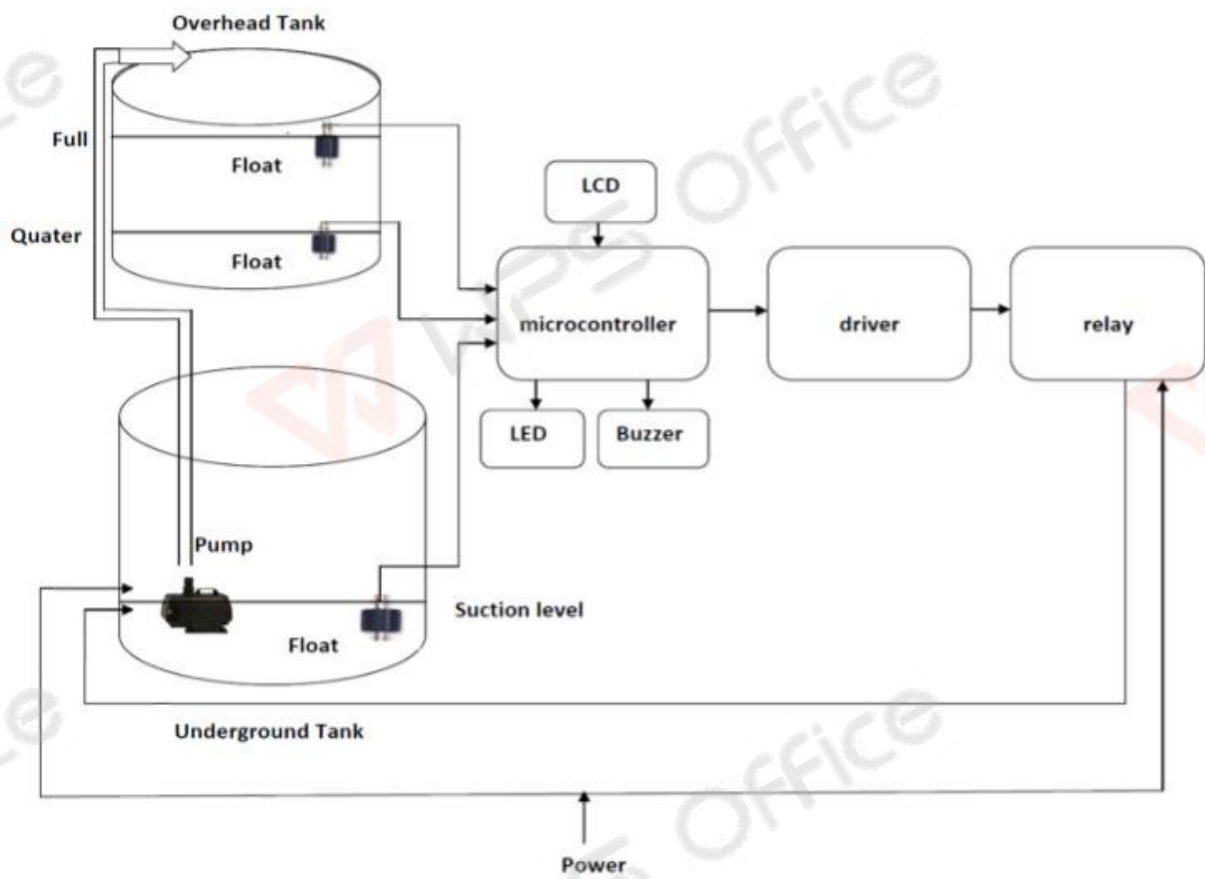
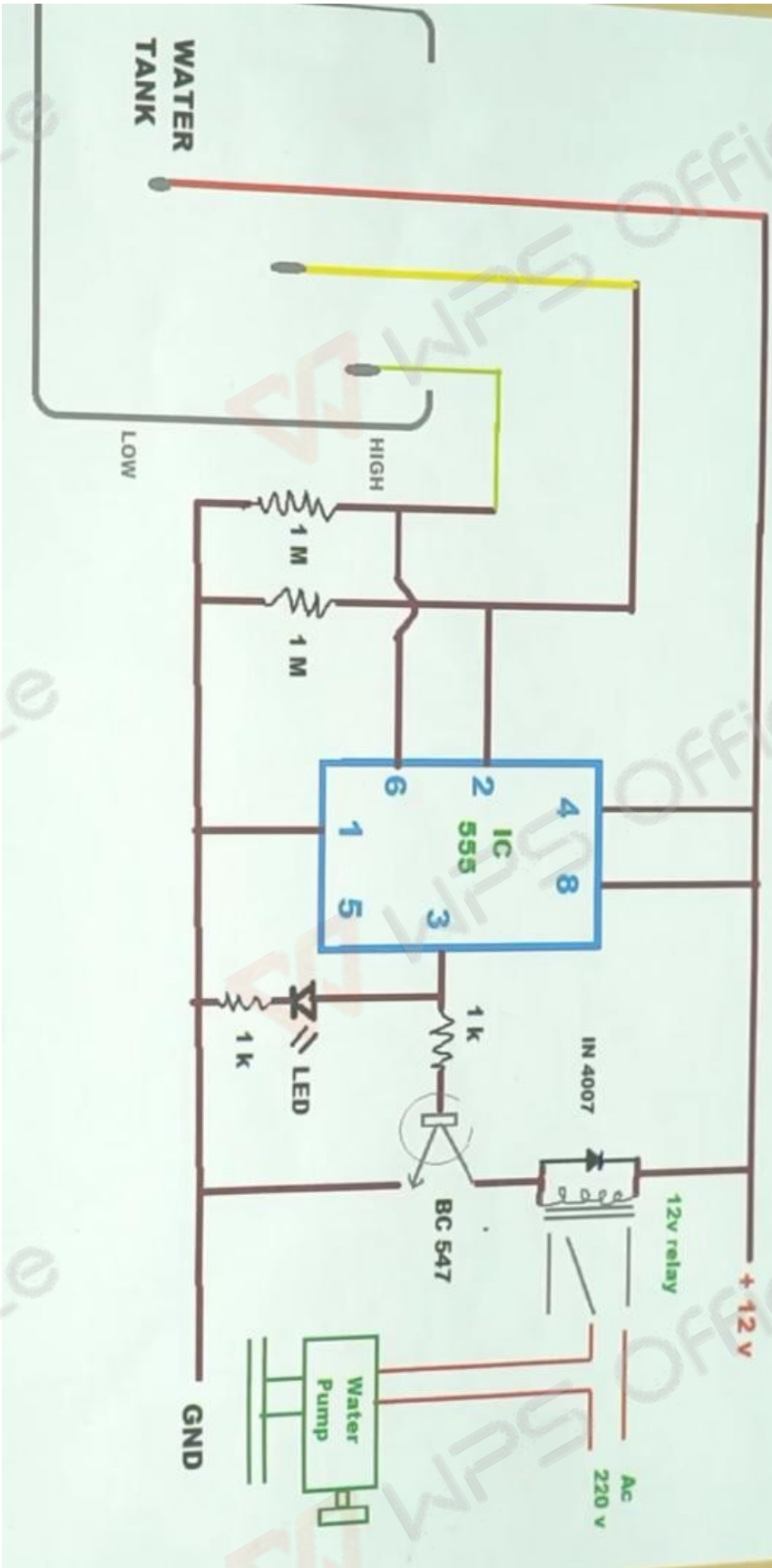


FIGURE 2.10: Block Diagram Of The Pump Control System

# Creative etc. Automatic water level controller



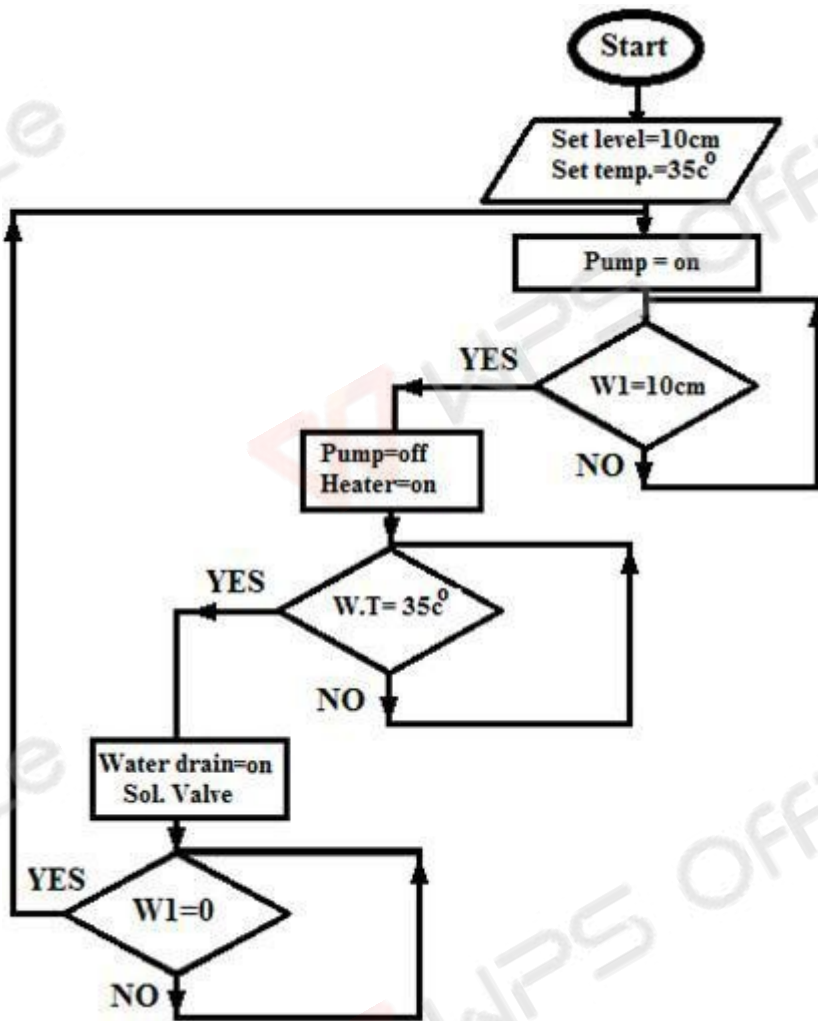


FIGURE 2.11: Flow Diagram Of The Pump Control System

## **CHAPTER 3**

### **METHODOLOGY**

There are many methods of designing an automatic water level control with switching device but all these methodologies require human assistance. In this project an automatic water level control for both overhead and underground tank with switching device is designed using electronic control to refill the water without human intervention. The system design was carefully arranged to refill the water tank any time water get low to a certain level finally the system automatically shut down the water pump by putting the electric pump off when the tank is full. The approach used in this work is the modular design approach the overall design was broken into function block diagrams. Where each block in the diagram represent a section of the circuit that carries out a specific function. In this method the circuit is designed to display 3 different level using three sensors to monitor the inflow of water in the tank. However these displays can be increased and decrease depending upon the level resolution required. This can be done by increasing or decreasing the number of level detector and associated component. Diodes full-wave rectifier are used to power the system through a volts battery the rectifier output is filtered using capacitor C through C3 respectively.

#### **3.1 System Analysis**

This project design automatic water level controller for both overhead and underground tank with switching device is to ensure a higher rate of water monitoring the major component used in the project design are fluid level detection sensors, micro-controller IC AT78S50, the power supply unit, relays switch and LEDs.

#### **3.2 Fluid level Detectors Sensors**

Sensors are devices that convert physical property or a change in the physical property into a more easily manipulated form e.g. voltage, displacement, resistance the major forms of energy that sensors can detect can be classified as motion, temperature and light pressure, electrical, magnetic, chemical and nuclear. It is important to know that a wide variety of sensors can measure temperature but are tube may be more useful to an electronic circuit because it convert temperature to an electrical signal compatible with electronic circuit. The number of sensors and transducers available for use in modern industrial system seem almost unlimited. The fluid level detection sensors are input transducers used to accept input signal to the IC 4066 and for other operation of the tank the performance of the device for easy maintenance and service the fluid level detection sensor works on the principle that water conduct electricity. Therefore different level of water should allow flow of current through the fluid level detection sensors.

### **3.3 Step Down Transformer**

A transformer is a device consisting of two closely coupled coils called primary and secondary coils. An AC voltages applied to the primary appears across the secondary with a voltage multiplication proportional to the primary appears across the secondary with a voltage multiplication proportion to the turn ratio of the transformer and a current multiplication inversely proportional to the turn ratio power is

conserved turn ration =  $V_P/V_S = N_P/N_S$  and power out = power in or  $V_s \times$

$$I_s = V_P \times I_P$$

$V_P$  = primary voltage

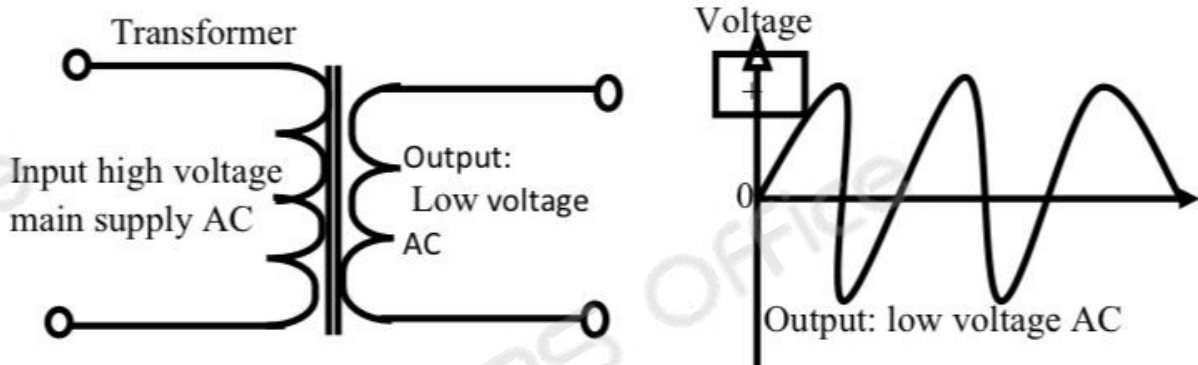
$N_P$  = number of turns in primary coil

$I_P$  = primary input current

$V_s$  = Secondary output voltage

$N_S$  = number of turns on secondary coil

For the 12 volts step down transformer needed for this project, the turn ratio is 240:12 it is represented as shown below in figure 3.1



*circuit, frequency multiplying device in radio frequency circuit, mixing devices application or can be used to make logic decision in digital circuit.* Figure 3.1: Transformer Circuit

### 3.15 Sensor Procedure

A Float switch is a type of level sensor, a device used to detect the level of liquid within a tank. The switch may be used to control a pump, as an indicator, an alarm or to control other devices. One type of float switch uses a mercury switch inside a hinged float. Another common type is a float that raises a rod to actuate a micro switch. One pattern uses a reed switch mounted in a tube; a float containing a magnet surrounds the tube and is guided by it. When the float raises the magnet to the reed switch, it closes. Several reeds can be mounted in the tube for different level indications by one assembly. This can be seen in Figure 3.15 of an opened float switch from a sump pump.



Plate 3.15 Float switch on



Float switch off

A very common application is in sump pumps and condensate pumps where the switch detects the rising level of liquid in the sump or tank and energizes an electrical pump which then pumps liquid out until the level of the liquid has been substantially reduced, at which point the pump is switched off again. Float switches are often adjustable and can include substantial hysteresis, That is the switch turn ON point may be much higher than the “ shut OFF” point. This minimizes the ON-OFF cycling of the associated pump. Some float switches contain a two -stage switch. As liquid rises to the the trigger point of the first stage, the associated pump is activated. If the liquid continues to rise (perhaps because the pump has failed or its discharge is blocked ), the second stage will be triggered. This stage may switch of the source of the liquid being pumped,trigger an alarm or both. This shown in Plate 3.16



**A Sump Pump with a Float Switch**

### 3.16 Microcontroller Unit

The AT8952 is a low power high performance CMOS 8-bit microcomputer with 4 k bytes of flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel high density nonvolatile memory technology and is compatible with the industry standard MCS-51 instruction set and pin out. The on-chip flash allows the program memory to be reprogrammed in system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with flash on a monolithic chip, the Atmel AT8952 is a powerful microcomputer, which provides a highly flexible and cost effective solution to many embedded control applications.

The AT8952 is designed with static logic for operation down to zero frequency and support two software selectable power saving modes. The idle mode stops the CPU while allowing the RAM, timer/counter, serial port and interrupt system to continue functioning. The power down mode saves the RAM contents but freezes the oscillator disabling all other chip functions until the next hardware reset. A diagram is illustrated below in figure 3.12

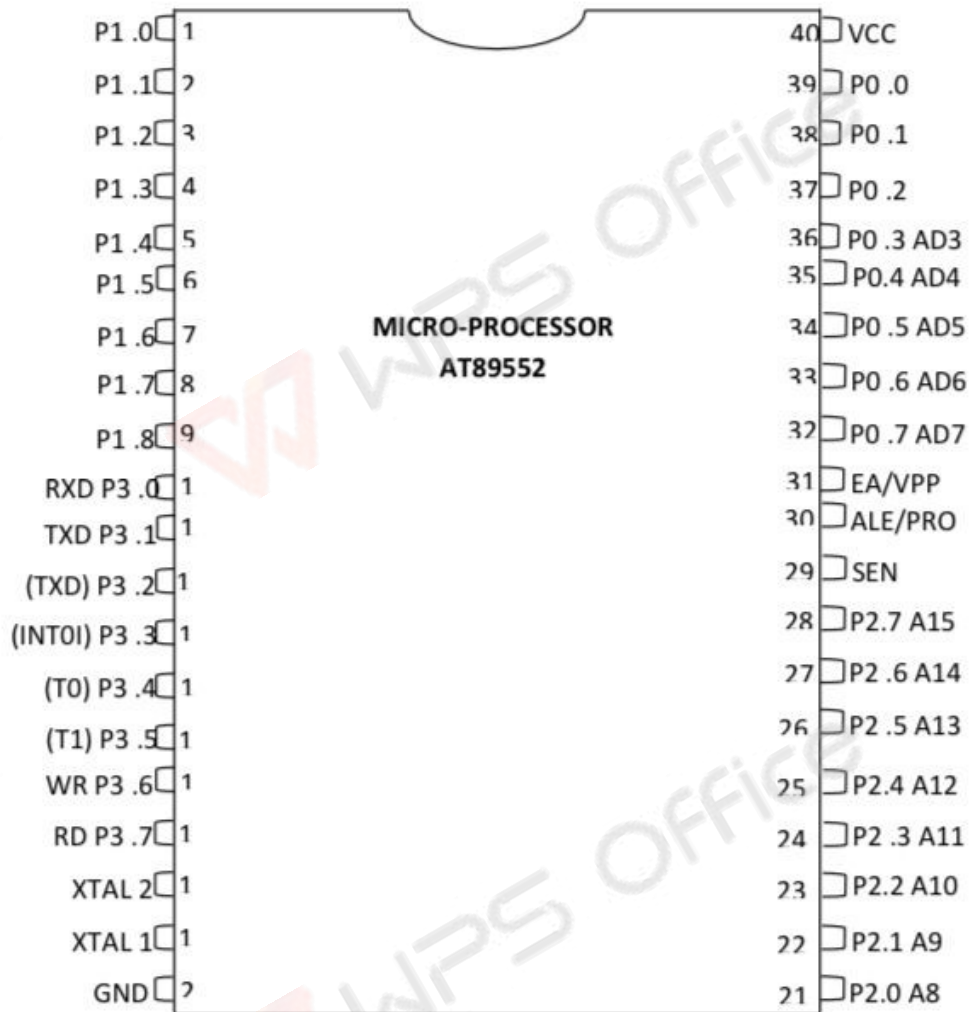


Figure 3.12 Pin Configuration

## CHAPTER 4

### SYSTEM TESTING

After the Fabrication and implementation phase, the system built needs to be tested for effectiveness and durability and also ascertain if there is need for it to be modified. The system was first assembled using breadboard. All the components were properly soldered to the Veroboard from whence some tests were carried out at various stages. To ensure proper functioning of components, the components were tested using a digital multimeter.

Resistors were tested to ensure that they were within the tolerance value. All faulty resistors were discarded, and the pump was also tested to ensure that it was working properly. This makes the automatic water control system function as planned so that when the pump is turned on to fill up the overhead tank when it is about to dry and then it switches off when the overhead tank is about to overflow.

#### 4.1 Component Test

The float switch plays a very important role in the fabrication of an automatic water controller system as it is used to sense the level of the upper and lower points of the water in the overhead tank. It operates in a mechanical way and it consists of a connection head, an immersion tube with one to four magnetic sensor elements and a float. As shown in figure 4.1



FIG 4.1 INNER VIEW OF A FLOAT SWITCH

This float switch also have its working principle as the helps it to function properly when is been connected line in line with the pumping machine. This working principle is shown in Figure 4.1.1

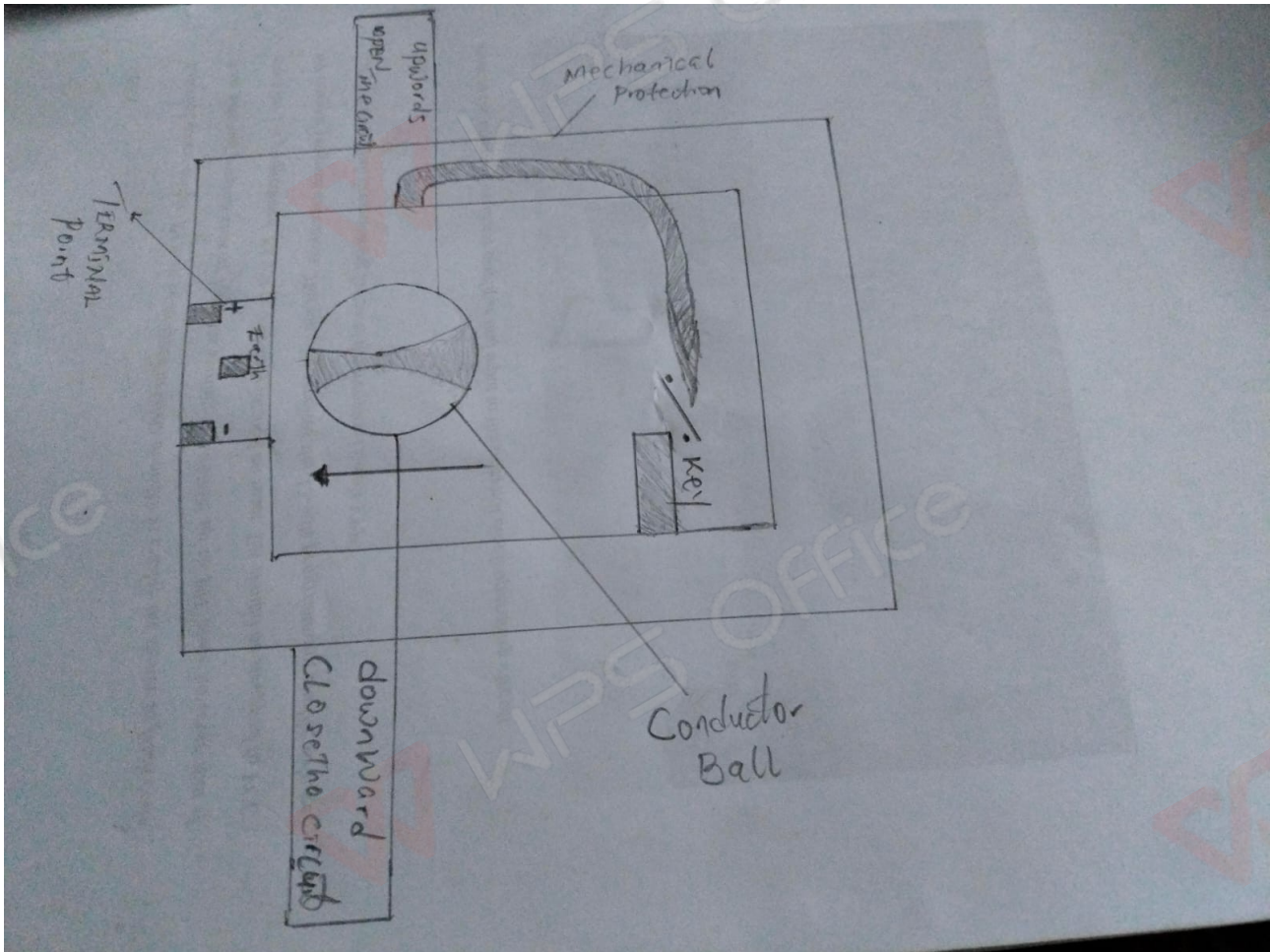
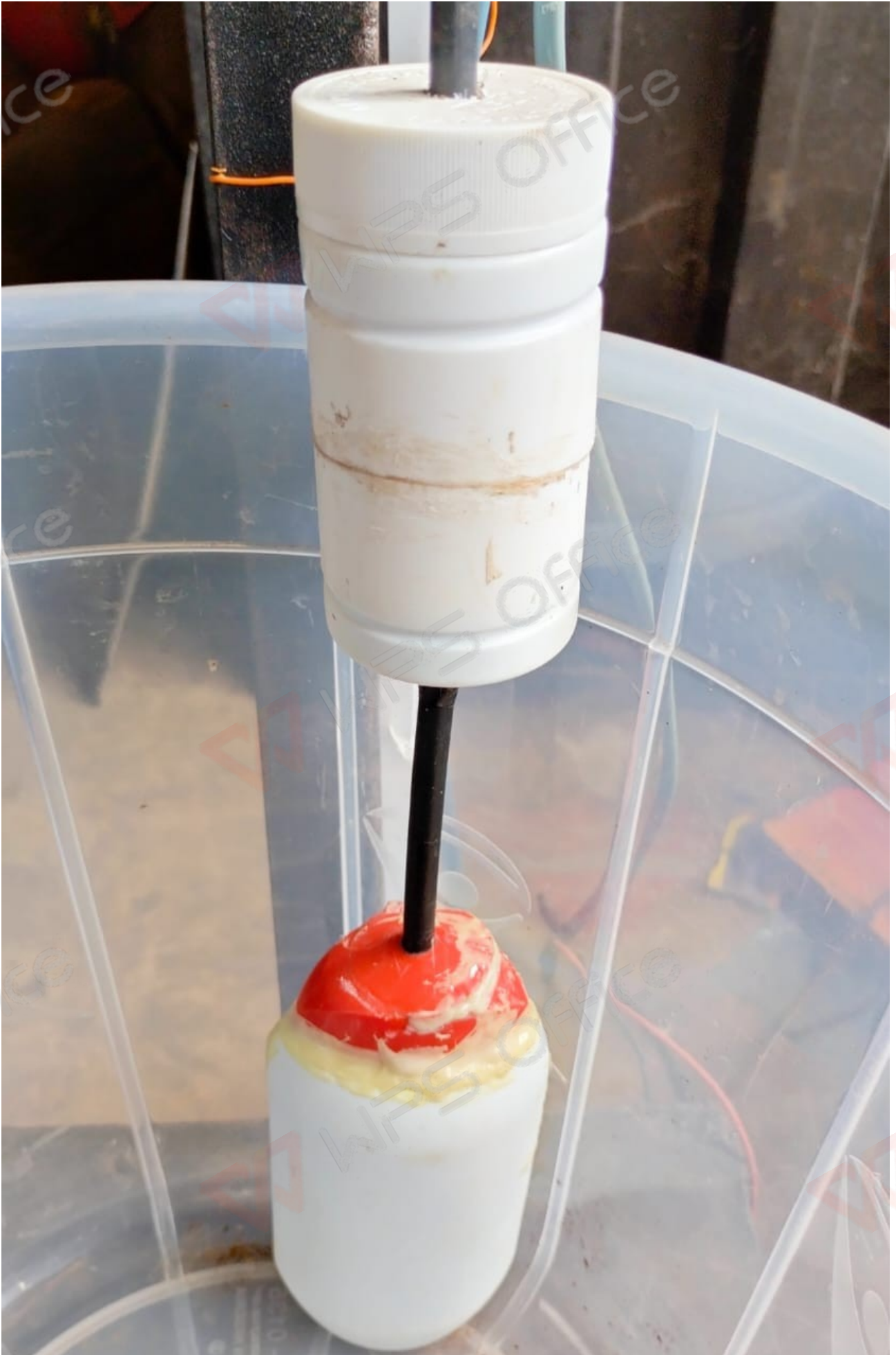


Fig 4.1.1 Working Principle of a Float Switch



#### 4.2 PUMPING MACHINE

The Pumping machine is also vital as it is used in moving fluid or gases (water) or slurries, by mechanical actions, typically converted from electrical energy into hydraulic energy. Water pumps can also be classified into two major types according to the method they use to move the fluid; Underground and surface pumps. Fig 4.2 shows the types of pumps.

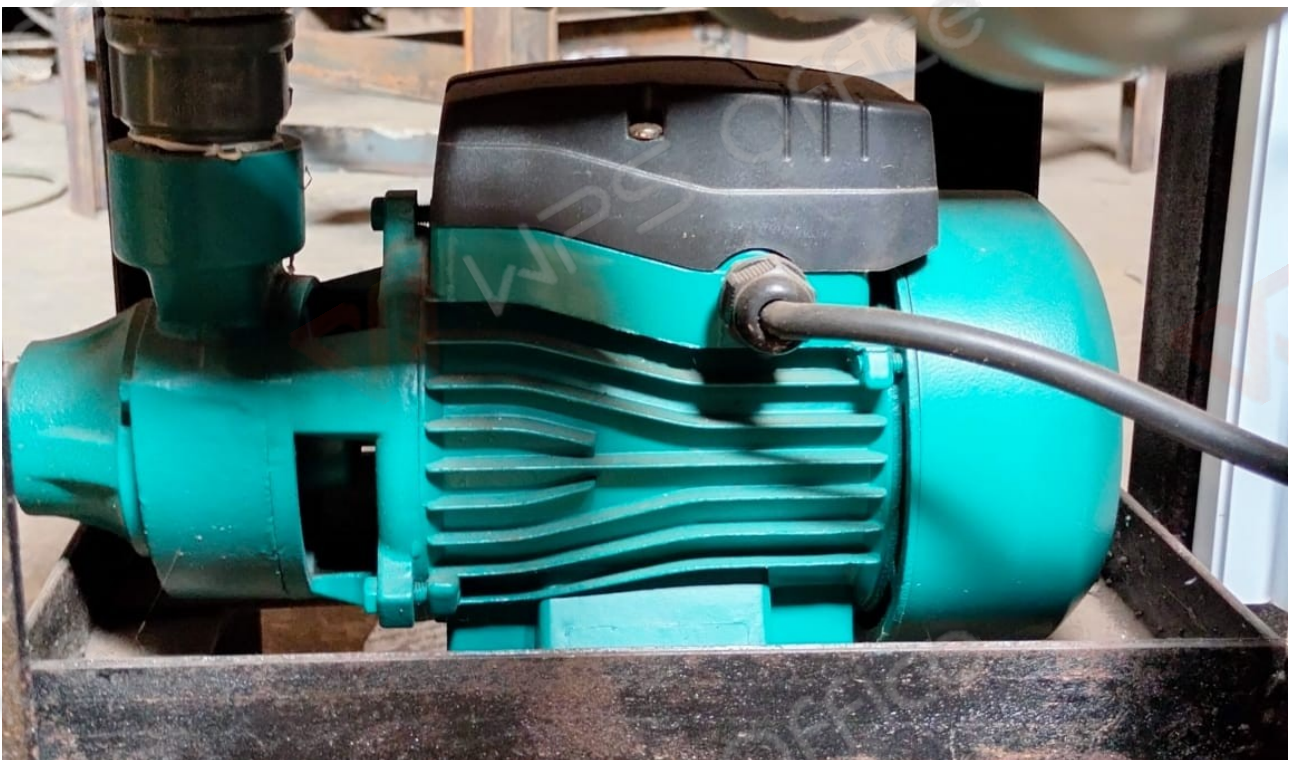


FIG 4.2 Surface Pumping Machine

### 4.3 Overhead and Surface Tank

The overhead tank is the storage where the water is been pumped into from the surface tank or underground depending on the type of pump used in pumping the water this can be seen in our homes, schools, etc. As is shown in Fig 4.3



FIG 4.3 Overhead and Surface Tanks

#### 4.4 Table Steel

The table steel act as a frame and support to the pumping machine and also to the switch control just to hold it firm and gives it balance. This can been seen in Figure 4.4



FIG 4.4 Table Steel

#### 4.5 Control Switch

The control switch is a small control for an electrical device which you use to turn the device on or off. This is shown in Figure 4.5

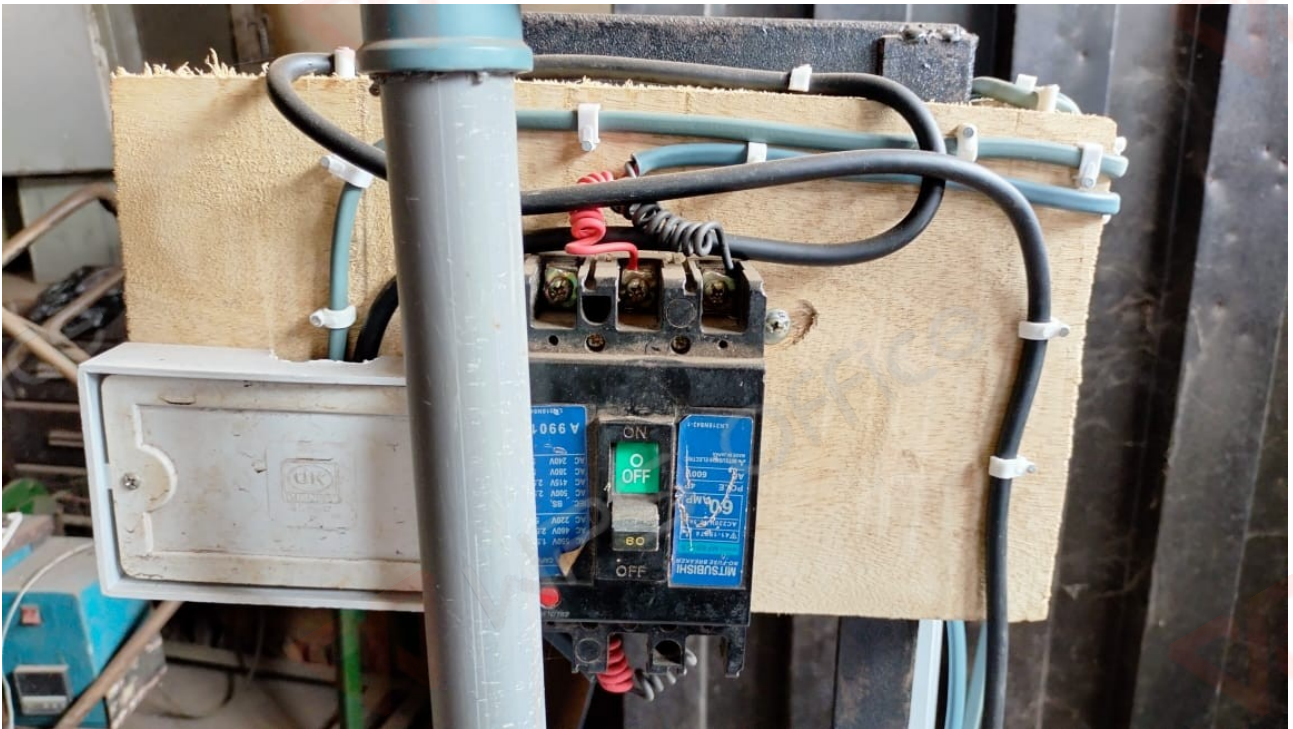


FIG 4.5 Control Switch

#### 4.6 Discussion

In contrast of the normal way of installing a water pumping system in our home, school, offices etc without a controller system which helps in monitoring the upper and lower level of the water in the overhead tank, utilizing the automatic water controller system, we were able to fabricate a float switch which work with a mechanical principle with the use of immersion tube and four magnetic sensors. It is been connected to the pumping machine of 0.5HP capacity in a line by line connection to a breaker which helps in reducing the current flowing through it and also to protect the pump from overcurrent\overload or short circuit. The pvc pipes of 1mm is connected to the input port or in-let of the pump and directly to the surface tank which is the water supply source , Same pipe of 1mm is connected to the out-let of the pumping machine straight to the over-head tank which supplies water to the house for proper use. The float switch is placed inside the overhead tank and set to a desired level for upper level so as to enable the sensor to tell when it has reached its desired level to cut the system and stop the pumping machine to prevent it from over-flowing and also pick-up back by starting the pumping machine to fill up the overhead tank again before it gets dry. This system has shown to be able to ease stress from every user going to and fro either to switch ON or OFF the pumping machine .

#### 4.7 Test Result

NO OF TEST	TIME IN SEC	CAPACITY OF OHT	CAPACITY OF ST
1	0.44 SEC	20 LT	100 LT
2	0.52 SEC	25 LT	100 LT
3	0.60 SEC	30 LT	100 LT

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Table 4.7 Test Result

This test was carried out to check how long a 1mm pipe pump of 0.5HP can fill up this three overhead tanks with a capacity of 20lt , 25lt and 30lt to its upper level set at same point for each OHT to get their stop time at which the pumping machine stopes. ST stands for surface tank while OHT stands for overhead tank.

#### 4.8 Cost of Materials

S/N	COMPONENT	VALUE	QUANTITY	UNIT	BULK COST
1	Pumping machine	0.5HP	1	25,000	25,000
2	Magnetic balls(sensors)	---	4	1,000	4,000
3	Angle Bar	5mm	2	5,500	11,000
4	Electric Wire	1.5mm	12 yad	150	1,800
5	Switch Breaker	60Mpa	1	15,000	15,000
6	Drum surface Tank	100lt	1	6,800	6,800
7	Overhead tank(Rubber)	20lt	1	2,200	2,200
8	PVC Pipe	1mm	1	2,150	2,150
9	Pipe Socket	-----	4	200	800
10	Gum	-----	1	1,200	1,200
11	Tap head	-----	1	150	150

Table 4.8 Cost of Material

**The total cost of the component stated in Table 4.8 is 70,000 Naira only this data is been recorded in respect to the current cost of this material in the market.**

## CHAPTER 5

### CONCLUSION AND RECOMMENDATION

Recently it has been recorded that Earth's reserve of consumable water(fresh water) is decreasing every moment,and every drop has its value. Water level controller is simple but yet an effective way to prevent wastage of water. Its simplicity in design and its low cost components make it an ideal piece of technology for the common man. the automatic water level controller is a big deal as concerned with the house hold applications as well as other water saving purposes including agricultural sector and industries. Due to the survey result, it is found that the automatic water level controller system has a rising demand and it is a good asset from the electronics perspective. Therefore we conclude that this system is very beneficial in rural as well as urban areas,It helps in the efficient utilization of available water sources.If used on a large scale, it can provide a major contribution in the conservation of water for us and the future generations.

#### Advantages of Automatic Water Control System

- water level controller is ideal as it is difficult to access overhead tanks.
- water level controller is fully automatic.
- water level controller has compact and elegant design.
- water level controller is simple and easy to install.
- water level controller has safe operation of motor/pump within permissible voltage

limits.

#### Disadvantages

- It is a passive electrical system and hence it requires continuous power supply.