A PROJECT REPORT

ON

CONSTRUCTION OF AN AUTOMATED BOREHOLE REGULATOR

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A PROJECT WORK SUBMITTED TO THE DEPARTMENT OF PRODUCTION ENGINEERING, FACULTY OF ENGINEERING, UNIVERSITY OF BENIN, BENIN CITY, IN PARTIAL FULFILLMENT FOR THE AWARD OF BACHELOR DEGREE IN PRODUCTION ENGINEERING

JULY 2021

CERTIFICATION

This is to certify that this project was carried out by Emordi Charles with Matriculation Number ENG1506488 of Production Engineering Department, Faculty of Engineering in the University of Benin, Benin City, Edo State. under the supervision of Dr. I.D. ERHUNMWUN.

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DEDICATION

This thesis is dedicated to God Almighty, the Omnipotent, Omniscient and Omnipresent for the grace to accomplish this project work.

ACKNOWLEDGEMENTS

My appreciation goes to God Almighty, through the help of the Holy Spirit made me to choose Production engineering as my discipline.

I would like to thank the Production Engineering Department, University of Benin, for providing the platform on which I was engaged with this project.

I want to say a big thank you to our project supervisor, Dr. I. D. Erhunmwun

I want to thank my parents Mr. and Mrs Emordi for the encouragement and financial support throughout my time spent in the University of Benin.

A big thank you goes to Ajayi, Ufa, Henry, friends and my project members who made this possible.

I am highly grateful.

ABSTRACT

In Nigeria, a borehole is one of the best means of obtaining clean water in field condition. However, field operations in remote areas or in difficult conditions often require flexibility and imagination in avoiding and solving technical problems. The automated borehole regulator serves as a means to control the pumping of water between predefined upper and lower limits.

This system mainly works on a principle that “water conducts electricity”. 5 wires are dipped into the tank with a certain gap between each wire will indicate the different water levels. Based on the outputs of these wires, microcontroller displays water level using LEDs as well as controls the flow of water by controlling the motor of the pump. In the 1st phase, the program is burnt into the microcontroller and the 5 copper wires are used to indicate water level and a motor controls the flow of water. An increase in the water level is determined by the wires and the signal is sent to the microprocessor and afterwards displayed on the LCD screen.

The overall system testing of integrated design of voltage measurement device. The testing and integration is done to ensure that the design is functioning properly as expected thereby enabling the intended user(s) for which the project was targeted for, appreciate its implementation and equally approaches used in the design and integration of various modules of the project.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

The project “Construction of Automated Borehole Regulator” 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 offing the pump once the liquid gets to the higher threshold. Sustainability of available water resource in many reason of the word is now a dominant issue. This problem is quietly related to poor water allocation, inefficient use, and lack of adequate and integrated water management. Water is commonly used for agriculture, industry, 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. 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.

1.2 AIMS AND OBJECTIVES

The goal or aim of which the designed device is expected to accomplish is to regulate an automatic water level control with automatic regulator system. The project objectives are;

1. To design an automatic water monitoring and pumping system.
2. To minimize the human effort required for the pumping of water.
3. To eliminates the need for any manual switching of pumps installed for the purpose of pumping water from a reservoir to an overhead tank.

1.3 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 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 use d to achieve this aim, the automatic water level controller detects and control the water in the tank.

1.4 PROBLEM STATEMENT

Water is one of the most important natural resources available to man. The constraints in water supply poses a major challenge in most rural areas due to the inconsistency and unavailability of electricity. while the boreholes exist, the need for an automation of the control system becomes a widespread necessity and the construction of the automated borehole regulator helps to curb/mitigate this challenge. there is little to no consistency in the pumping of water into the

reservoir for the supply to most homes and the construction of an automated borehole regulator helps to reduce human effort, time, reduce waste and also increase the availability of water to be supplied.

1.5 LIMITATIONS OF THE PROJECT

It is significant to know that this design is limited to 12v, 5amps electric pump and cannot be used to control industrial water pump above 5 amps

1.6 SIGNIFICANCE OF THE STUDY

The measurement and control of the water level poses a problem and the automation of this process serves to solve the unavailability of water supply due to inconsistency in electricity and human effort and also reduce time and waste.

CHAPTER 2

LITERATURE REVIEW

Nowadays everybody has overhead tank at their homes, but the one who has a water tank above knows the kind of problems that they face. Water tank overflow is a common problem which leads to the wastage of water. Being electronics enthusiastic made a simple and handy circuit which will detect the water level and will raise an alarm upon getting the water tank full or a preset level. This simple transistor based water level indicator circuit is very useful to indicate the water levels in a tank. Whenever tank gets filled, we get alerts on particular levels. Here we have created levels by alarms & we have added LEDs to indicate the level of water and one buzzer to indicate full level. When tanks gets filled completely we get beep sound from buzzer. So now we do not have to worry about overflow and water out anymore.

People generally switch on the pump when their taps go dry and switch off the pump when the overhead tank starts overflowing which as stated earlier results in the unnecessary wastage and sometimes non- availability of water in the case of emergency. The project “automatic water level control with an automatic pump control system” is design 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 offing the pump once the liquid gets to the higher threshold. Sustainability of available water resource in many reason of the word is now a dominant issue. This problem is quietly related to poor water allocation, inefficient use, and lack of adequate and integrated water management. Water is commonly used for agriculture, industry, 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.

Several other 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. Most of them use the electrical conductivity of water by installing metallic 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, colorations, 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.

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 or using 555 timer IC .

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, 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. 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 the 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 (LEE DE FOREST in 1907).

In those days the active component like resistors, inductors and capacitors etc. Of the circuit were separated and distinct unite connected by soldered lead with the invention of a transistor in (1984 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 thousands of millions of tiny transistors, capacitors are fabricated, An IC can be either analog digital depending on its intended application. Level sensor detect the level substance that flow including liquid s slurries, granular materials and powders. All substance that 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 or discrete (point) levels

(Md Jahidul Islam, in 2016) came up with the following setup.

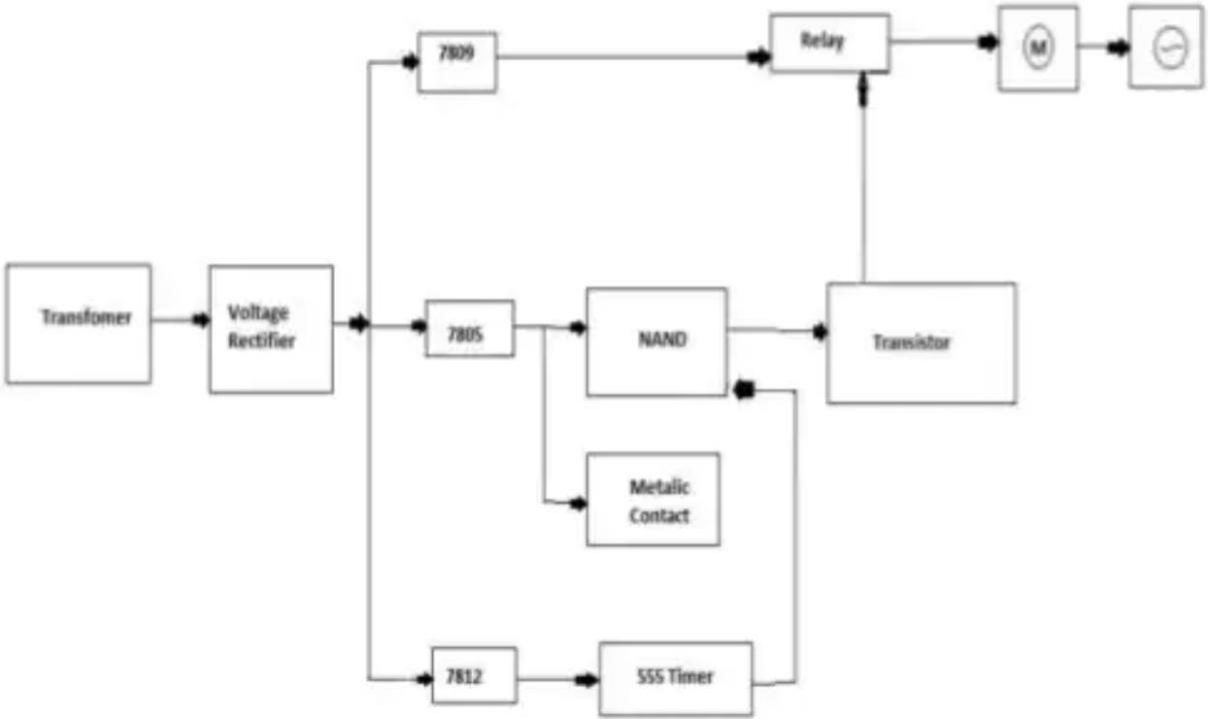

Figure 1

Here in this circuit, a 230v to 15 volt AC step down centre tapped transformer is used as DC is required so after that a rectifier circuit is there for rectification. For rectification we are using 1N4007 four diodes; as we are using four diodes so that is a full wave rectifier. That rectifier will convert 15 V AC to almost 13V DC ,but for proper work more DC current is required, for that reason we used capacitors, and that makes increase in dc volt from 13 volt DC to almost 17 volt DC. Here we are using 1000 µF capacitors. That 17 volt DC then send to the input of three voltage regulator ICs -7809, 7805, 7812 respectively and output from those voltage regulators ICs are 9,5,12 volt DC respectively. The output of IC 7805 provides VCC to the NAND gate and is also used to supply the DC voltage to support current flow between the metallic contacts. IC 7809 provides VCC for the BJT to run the relay. The output of IC 7812 is used to give VCC to 555 Timer IC. That 74F00 is a NAND gate IC, upper contact as signal A goes to pin 1, and lower contact as Signal B goes to pin 2, those are the inputs of NAND gate, and the output as signal Q

goes to pin no 4(reset) of the timer IC, As our requirement is to always find the upper water level, for that reason we directly add a wire in between signal A and pin no 2 (trigger) of timer IC, we are using Two LEDs two indicate high and low state of timer IC. The output from timer IC goes to NAND gate input and that input is shorted, as input is shorted so work as NOT gate and output from that NOT gate goes to the base of the BJT and collector of the BJT is connected with the output of the 9 volt voltage regulator IC, the emitter of BJT is grounded. A diode and a 100µF capacitor are used across relay for protection purpose. Relay two coil pin is connected with 9 volt voltage regulator and with collector. NC and COM pin is connected with 230 V AC source and pump in series. When relay is not energized then there is continuity in between NC and COM pin. Contacts are connected with 5V DC source, so when water is in touch with contact then as voltage is shorted so that becomes 0 , and that is equivalent to 0 of Boolean digit ,and if not touch then contact contain 5 volt so that is equal to 1 of Boolean digit. When the output of the NOT gate is 0 then only relay get energized, as when the base of the BJT is 0 current will flow through relay coil and goes to ground through emitter thus make relay active. Here BJT work as switch. When there is no water in the tank then the two inputs of (signal A, B) NAND gate is 0 and for that the output of the NAND gate is 1. That output (signal Q) will go to pin no 4(Reset) of timer, and a direct 1 (signal A) will go to pin no 2(trigger). The timer IC work as bi-stable mode, by making trigger input low the output of the ckt. goes to high state ,and by making the reset input low we cause the output to go into the low state, so for that reason output from the timer is 0 and for that not gate output is 1 ,as not gate output is not 0 so relay is not energised. So pump is still ON state. When water is in touch with B contact the output of the NOT gate is still 1, so relay is still not active. When both A and B contacts touch with water then output of the NOT gate is 0 the relay get energised, and discontinuity in between COM and NC pin of relay, so pump is then in off state.

Relay again become deactivate only when the not gate output is 1(As shown in Truth Table of Automatic Water Level Controller).

2.1 METHODOLOGY

This system mainly works on a principle that “water conducts electricity”. 5 wires are dipped into the tank with a certain gap between each wire will indicate the different water levels. Based on the outputs of these wires, microcontroller displays water level using LEDs as well as controls the flow of water by controlling the motor of the pump. In the 1st phase, the program is burnt on the microcontroller. Then the necessary connections are made according to the circuit diagram. As per construction, 5 copper wires are placed on the tank at a marginal distance which will actually indicate the level of water in the tank and the motor will control the flow of water accordingly. After the system is powered the motor starts running and water is slowly filled into the tank.

When the level of water increases in the tank the 5 wires detects the level of water and sends in the signal to the microprocessor where the microprocessor detects and displays the water level on the LCD display. The microcontroller not only displays the water level status but also sends in signal to the electric motor which controls the flow of water transferring capacity as per necessity.

Outcomes of the above discussed technique are as follows:

a) Controls the motor automatically.

b) Reduces human effort.

c) Cheap, reliable and user-friendly.

d) It can be used in any industry concerned with fluids.

CHAPTER THREE

3.0 METHODOLOGY

In this chapter we shall be looking at the methods used to achieve the stated goal. In practice, there are so many methods that can be used in order to achieve water level control and automatic pump regulator. The following method that will be discussed is used because it is easy to operate and has a fast response; the circuitry is not bulky; the design if efficient to an extent (ensures that the tank is always full) and lastly, has a low power consumption.

3.1 COMPONENT DESCRIPTION

3.1.1: 755 HIGH TORQUE 12V DC MOTOR

The 775 dc motors have a standard size of 66.7 x 42.0 mm. The 42.0 is the outer diameter as the motor is cylindrical, where 66.7 mm is its height. The number 775 stands for this standard size. It is in the same fashion to the number with 130/ 140 motor.

Figure 2: 12v DC motor

TECHNICAL SPECIFICATIONS:

- Motor model: 755 motor
- Voltage: DC 12V-24V
- No-load speed: About 4,000 rpm at 12V, About 8,000 rpm at 24V
- No-load current: about 180MA
- Shaft Diameter: 5mm (Shaft head has a cutting length of 15mm)
- Shaft length: 18mm
- Body length: 60mm
- Front steps diameter: 17.4 mm
- Former high level: 4.7 mm
- Motor Overall Length: 98 mm
- Motor outer diameter: 46.5mm,
- Diagonal installation pitch: 28.8 mm
- Mounting hole size: M4
- Mounting hole:2
- Torque: 2kg.cm or 0.2N.M

3.1.2: BUCKETS

Two buckets are used in the construction of this project. One serves as the water reservoir and the other as the overhead tank.

Figure 3: bucket

3.1.3: PVC PIPINGS

PVC pipings were very handy in the construction of the water pump which will be described shortly.

Figure 4:PVC pipings

3.2 CIRCUITRY DESCRIPTION

3.2.1: BC547

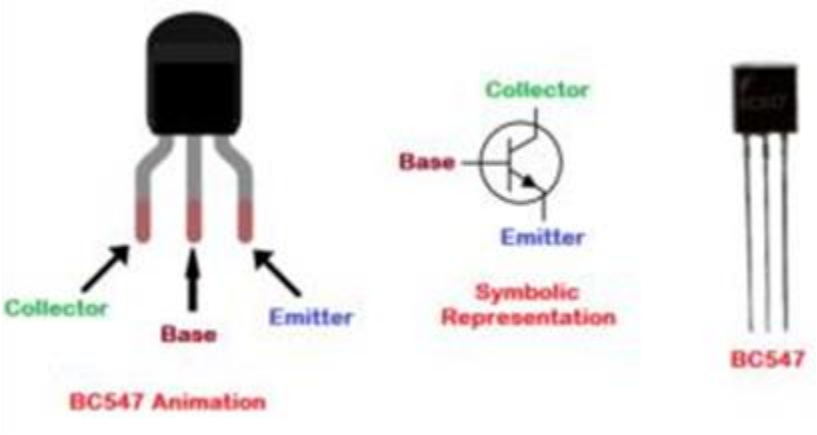

Figure 5:BC547 (Transistor)

It is basically an NPN bipolar junction transistor (BJT). The word transistor is a combination of two words, transfer and resistor. So, the basic purpose of transistor is transfer of resistance. A transistor is normally used for amplification of current. The larger current at the emitter and collector can be controlled by the small amount of current at the base. BC547 can be used commonly for amplifiers and switches. Similar to all the other transistors BC547 has also three terminals e.g. collector terminal, base terminal and emitter terminal respectively. The amount of current flowing from base to the emitter controls the amount of the current flowing through the collector. BC547 is usually used for amplification and switching purposes. Its maximum current gain is around 800. Proper voltage supply is known as biasing. BC547 is biased in a way that it is partially on for all the applied inputs, for the amplification purpose. The input signal is amplified at the base and then transferred to the emitter.

When the input voltage is applied at its terminal, some amount of current starts to flow from base to the emitter and controls the current at collector. The voltage between the base and the emitter (VBE), is negative at the emitter and positive at the base terminal for its NPN construction. The polarity of voltages applied for each junction is shown in the figure below.

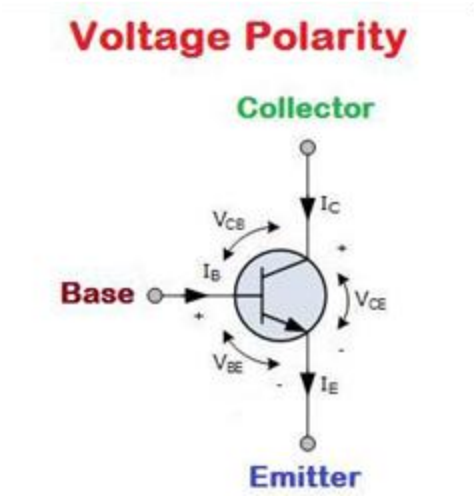

Figure 6:voltage polarity

3.2.2: 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.

Figure 7:Resistor

3.2.3: PIEZO BUZZER

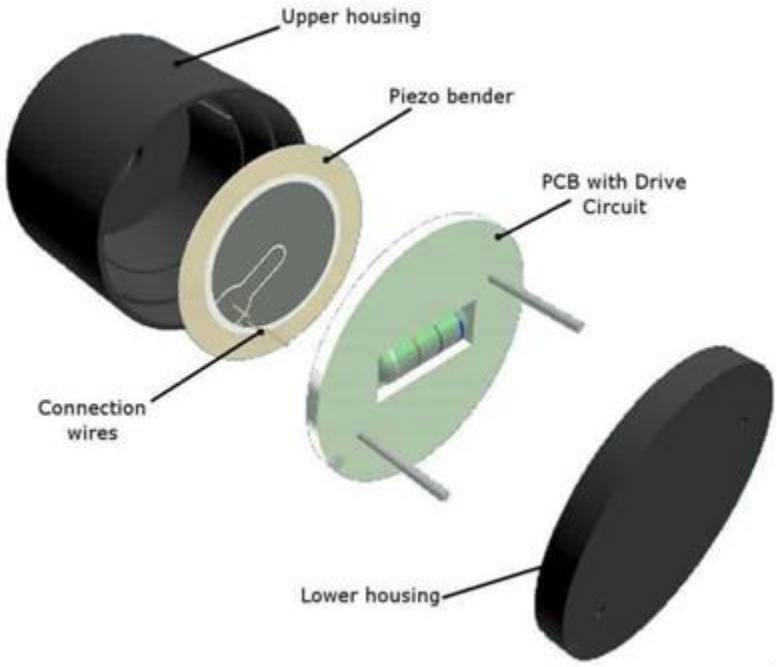

Figure 8:Piezo buzzer

Piezoelectric sound elements have a very unique convention. There is no magnetic field, and no coil used in the construction. The base material in the assembly remains fixed. Piezo buzzers have a wide operating voltage ranging from 3 – 250V, and low current draws, typically <10 mA. ISL piezo buzzers feature a unique slim-line profile since they don't have as many internal components, and are attractive to applications with physical size constraints.

Figure 9:Coupled piezo buzzer

3.2.4: RELAY

A relay is an electrically operated switch. They commonly use an electromagnet (coil) to operate their internal mechanical switching mechanism (contacts). When a relay contact is open, this will switch power ON for a circuit when the coil is activated.

It has the following terminals:

COIL- This is the other end of the coil. These are the terminals where we apply voltage to in order to give power to the coils (which then will close the switch). The polarity does not matter. One side gets positive voltage and the other side gets negative voltage.

NO- This is Normally Open switch. This is the terminal where the device is connected that we want the relay to activate when the relay is powered. The device connected to NO terminal will be deactivated when the relay has no power and will turn on when the relay receives power. We will use this terminal for powering the pump.

NC- This is the Normally Closed Switch. This is the terminal where we connect the device that we want powered when the relay receives no power. The device connected to NC will be active when the relay has no power and will deactivate when the relay receives power.

COM- This is the common terminal of the relay. When the relay is powered and the switch is closed, COM and NO will be shorted. If the relay isn't powered and the switch is open, COM and NC get shorted.

It is used in normally open mode. A 1N4007 diode and a 100μF capacitor are connected in parallel to the magnetizing coil terminals. This is done because when voltage input to the relay coil is removed and its magnetic field collapses, a huge reverse voltage is produced. Without proper protection, this voltage will cause the contact that is switching the relay coil to arc and will in time destroy it

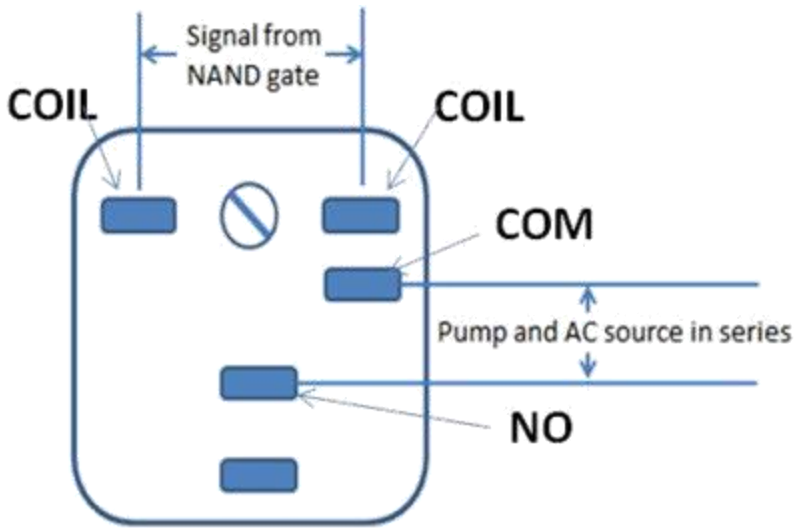

Figure 10:Relay terminal layout

Relays allow a low current circuit to control one or more higher current circuits.

Relays provide these benefits:

1. Thinner cables can be used to connect the control switch to the relay thereby saving weight, space and cost.
2. Relays allow power to be routed to a device over the shortest distance, thereby reducing voltage loss
3. Heavy gauge cable only needs to be used to connect a power source (via the relay) to the device.

Figure 11:30A Relay

3.2.5: LM2596 POWER SUPPLY

This is a step-down(buck) switching regulator, capable of driving a 3A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3 V, 5 V, 12 V, and an adjustable output version.

Specifications of DC-DC Buck Converter Step Down Module LM2596 Power Supply

- Conversion efficiency: 92%(highest)
- Switching frequency: 150KHz
- Output ripple: 30mA9maximum)
- Load Regulation: ± 0.5%
- Voltage Regulation: ± 0.5%
- Dynamic Response speed: 5% 200uS
- Input voltage:4.75-35V
- Output voltage:1.25-26V(Adjustable)
- Output current: Rated current is 2A,maximum 3A(Additional heat sink is required)
- Conversion Efficiency: Up to 92% (output voltage higher, the higher the efficiency)

- Switching Frequency: 150KHz
- Rectifier: Non-Synchronous Rectification
- Module Properties: Non-isolated step-down module (buck)
- Short Circuit Protection: Current limiting, since the recovery
- Operating Temperature: Industrial grade (-40 to +85) (output power 10W or less)

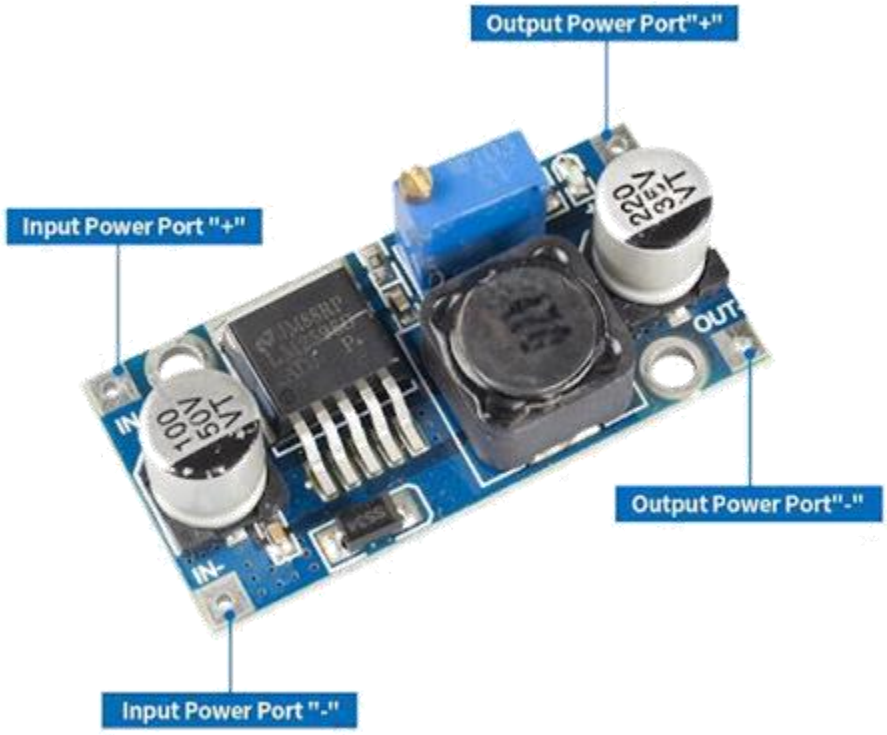

Figure 12:Power supply

3.3 TOOLS USEDSS

3.3.1: SOLDERING IRON

Soldering is a joining process used to join different types of metals together by melting solder. Solder is a metal alloy usually made of tin and lead which is melted using a hot iron. The iron is

heated to temperatures above 600 degrees fahrenheit which then cools to create a strong electrical bond.

Figure 13:Soldering iron

3.3.2: HOT GLUE GUN

A hot glue gun is a hand-held, pistol-like device that heats a round stick of solid adhesive, so that when it melts, and a user pulls the trigger, the melted glue can be squirted out of the nozzle at the gun tip. Hot glue guns (also called hot-melt glue guns) are used to bond a broad range of materials. Most hardware stores and many department stores carry hot glue guns and glue sticks.

Figure 14: Hot glue gun

3.4 WATER PUMP CONSTRUCTION PROCESS

STEP 1: MAKING THE IMPELLER HOUSING

Figure 15

To start of the build, we will start by obtaining the impeller housing. For this, we will need the PVC pippings and some adhesive glue. Two diferrent special parts are joined together

and then a straight pipe is attached at the top. This straight pipe is the outlet of the impeller housing.

STEP 2: MAKING THE IMPELLER

Figure 16: Impeller construction

Next we need to make the impeller. The bottom of the impeller will be made out of a plastic sheet. The diameter of the housing is taken note of and a compass is used to draw a circle slightly smaller than the impeller housing onto a piece of plastic. It is then cut out and sprayed with white for beautification purpose. After cutting and spraying, a hole is drilled in the center so it can be mounted onto the motor at a later time.

Next we need to make the blades of the impeller. To do this, a long thin piece of plastic is cut it into 6 smaller pieces which are then glued onto the already made disk appropriately.

Figure 17

STEP 3: ATTACHING THE MEMBERS

Figure 18

The impeller housing described in step one is actually one part. The other part is attached to the motor.

A hole is drilled at the center of the other part of the housing where the shaft of the motor will fit through. A rubber is placed between the PVC housing and the motor itself to prevent the slightest drop of water from getting into the armature winding of the motor.

It is secured to the motor using screws having created hole for that on the PVC and the rubber

Figure 19

Step 4: Attaching the Impeller and Closing of the Pump Housing

After the impeller is dried and ready, it is fixed to the motor's shaft ad glued with adhesive. Once the glue dries, the impeller is rotated maually to make sure it does not chafe against the sides or bottom.

Next the pump's housing is brought together and sealed For this, another PVC piece is used to bring the two piece together. Before attaching the PVC piece, a hole is first drilled at the point of the pump's outlet. This will serve as an exit for the water. The blades of the impeller were at a height where they didn't touch the circle that is attached to at the front.

Figure 20

STEP 5

When testing the pump, the suction part must be fully immersed in water in order to have an outlet.

A larger motor or laying the pump down horizontal instead of vertical

would increase the performance.

Figure 21

3.4.1: WORKING PRINCIPLE OF THE CONTROL UNIT

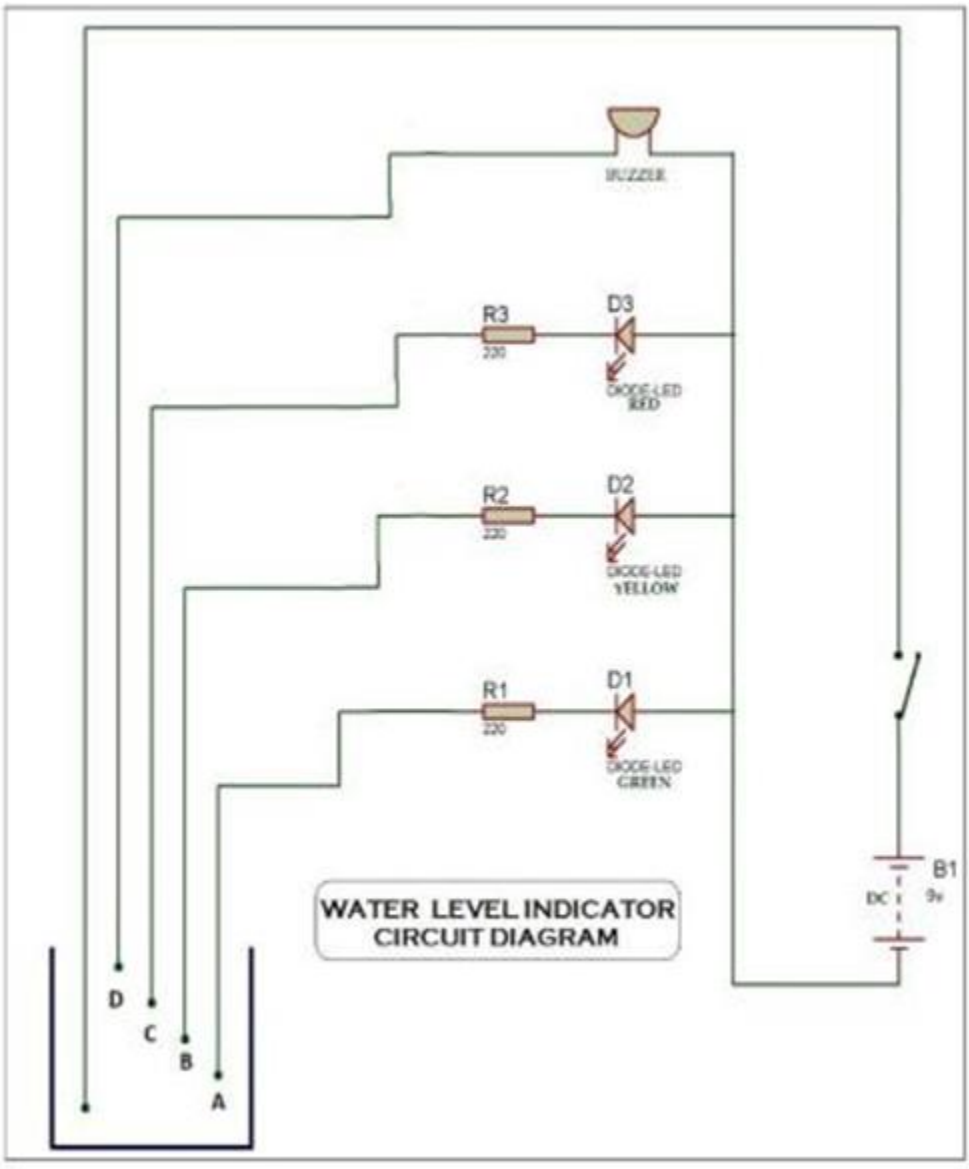

Figure 22: Water level indicator circuit diagram

A simple water level indicator can be made using resistors, LEDs, etc. For this it may be designed a water sensor by using conducting wires. In this paper, we have designed the sensor to measure water up to four levels. Take 5 segments of insulated conducting wires.

Tore out the ends of these wires, approximately 1cm. Adjust the length of the wire segments according to the water levels as shown in the diagram. The wire with Black colour is connected to buzzer. The wires with colours Yellow, Red, & Green are adjusted to check Level1, Level2, Level3 and Level4 respectively.

Water level indicator works through the following circuit diagram. Here this circuit is connected to 9 volt dc voltage source. The positive end of the dc source is connected to the over head water tank and the negative end of the dc source is connected the diode leds and the buzzer accordingly.

The other end of the leds are connected to the 220 ohm resistors and the resistor ends are connected to the separately to the over head water tank. The buzzer's other end is connected to the over head water tank here the resistor is not connected. One switch is connected between the positive voltage source of the circuit and the battery.

WORKING PRINCIPLE

Metallic contacts are placed both at the lower and upper area of the tank. When water filles the gap between them, the adjoining circuit is closed and a signal (current) flowed.

When the water stared filling to the tank water tank then the red LED glows, next when the level reaches 50% of the water tank, the orange LED glows after that, the yellow LED glows indicating 75% then the green LED comes on when the tank is full. The buzzer sounds when tank is going to be over flow.

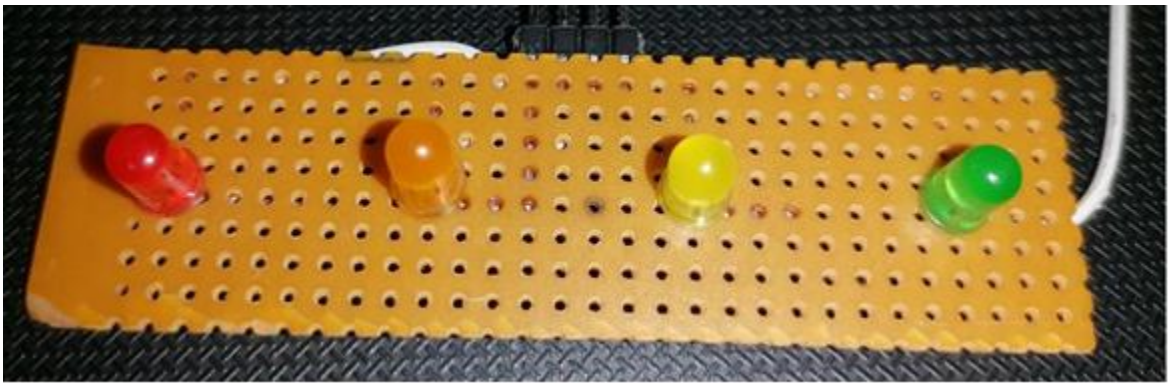

Figure 23

ARRANGEMENT OF WORK

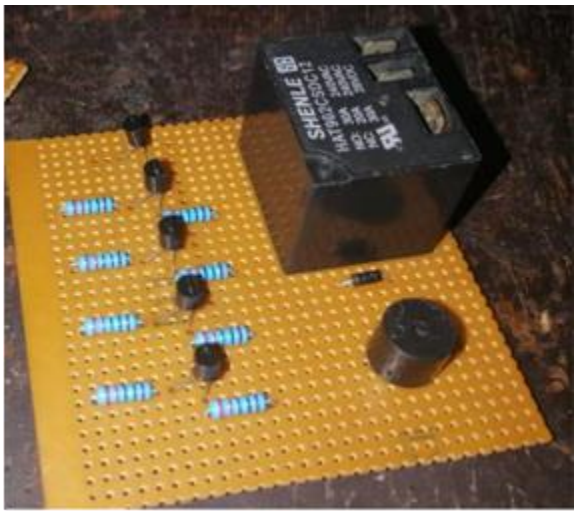

Figure 24

LIST OF MATERIALS USED

Table 1: list of materials used

S/N	Name of Component	Type	Quantity
1	Vero board (Dot)	Small size	1
2	Light Emitting Diodes	1 Green, 1 Red, 1 Orange, 1 yellow	4
3	DC Voltage Source	12V 4.5AH Battery	2
4	Piezo Buzzer	5-15V	1
5	Resistors	220R	8
6	Relay	12V 30A	1
7	Wires	1.5mm2	5 yards
8	LM2596 Power Supply	3A	1

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This chapter entail the overall system testing of integrated design of voltage measurement device. The testing and integration is done to ensure that the design is functioning properly as expected thereby enabling the intended user(s) for which the project was targeted for, appreciate its implementation and equally approaches used in the design and integration of various modules of the project.

4.1 COMPONENT TEST

Similar component like resistor were packed together. The other component include capacitor, switch, transformer, resistor, Diodes (rectifier) LED, transistor ,voltage regulators etc. Reference was made to color coding data sheet to ascertain the expected value of resistors used. Each resistor was tested and the value read and recorded. Also for transistor test the DIMM was switched to the diode range. The collector, base, emitter junctions were tested in the following order. The collector, emitter and base pins were gotten from the data analysis on power transistor.

4.1.1 TRANSISTOR TEST

Table 2

	Black probe	Red probe
1st test on pins	collector	Base
2nd test on pins	Emitter	Base

4.1.2 VOLTAGE REGULATORS

A voltage regulator also called a “regulator” has only three legs and appears to be a comparatively simple device but it is actually a very complex in integrated circuit. A regulator converts varying

input voltages and produces a constant “regulated” output voltage. Voltage regulators are available in a variety of output. Last two digits in the name indicate the output voltages in the table below.

Table 3

VOLTAGE REGULATORS NAME	OUTPUT VOLTAGES
LM7805	+ 5 Volt
LM7809	+ 9 Volt
LM7812	+ 12 Volt
LM7805	- 5 Volt
LM7809	- 9 Volt
LM7812	- 12 Volt

It came through that among all the component used here the one that consumes the higher power is the light emitter diodes (LED) which need as much as 12-voit to glow and draws as maximum as 500mA of current. As a result of this, I decided to use 12-voit 9amps rated battery for this design.

4.1.3 OTHER TEST

The bucket used as tank in my project was tested in other to make sure there was no leakage, the hose or pipe conveying the water from the lower tank to the upper tank was tested or checked for any kind of breakage or leakage.

4.2 EXPERIMENTED RESULT VS ACTUAL RESULT

Table 4: table showing experimented results vs actual results

Component	Experimented value	Actual value	Unit	Tolerances
Regulator	5.00	5.02	Volts	
Transistor	RBE 520 RBC 510	550 548		
Capacitor	10 10 30	10.20 10.15 29.82	Micro Farads	

Resistor	999 1899 218 9998	1000 2000 220 10000	Ohms	5%

4.3 SYSTEM TESTING AND INTEGRATION

This involves checks made to ensure that all the various unite and subsystem function adequately also there has to be good interface existing between the output /input unite subsystem. When the totality of the modules was integrated together, the system was created and all modules and sections responded to as specified in the design through the power supply delivering into the system designed.

After the design and implementation phase, the system built has to be tested for durability and effectiveness and also ascertain if there is need to modify the design the system was first assembled using breadboard .all the component were properly soldered to the Vero board from

whence some test were carried out at various stage .to ensure proper functioning of component expected data, the component were tested using a digital multimeter (DMM). Resistors were tested to ensure that there within the tolerance value. Faulty resistor were discarded. The voltage regulator, the resulting output was 5.02v which is just a deviation of 0.20v from the expected result of 5.00v, the pump was also tested to ensure that it was working properly.

4.4 SUMMARY OF TEST RESULTS AS WATER LEVEL INCREASES

Table 5: table showing water level increase

Water level in Tank	**Light emitting diodes(LEDs) state**				**Pumping Machine state**
	LED 1	**LED 2**	**LED 3**	**LED 4**	
≤minimum	Off	Off	Off	Off	On
> minimum & ≤ level 1	On	Off	Off	Off	On
> level 1 & ≤ level 2	On	On	Off	Off	On

> level 2 & ≤ level 3	On	On	On	Off	On
> level 3 & ≤ level 4	On	On	On	On	On
> level 4& < maximum	On	On	On	On	On
≥ maximum	On	On	On	On	Off

4.5 SUMMARY OF TEST RESULTS AS WATER LEVEL DECREASES

Table 6: table showing water level decrease

Water level in Tank	Light emitting diodes(LEDs) state				Pumping Machine state
	LED 1	LED 2	LED 3	LED 4	
< maximum & > level 4	On	On	On	On	Off
≤ level 4 & > level 3	On	On	On	On	Off
≤ level 3 & > level 2	On	On	On	Off	Off
≤ level 2 & > level 1	On	On	Off	Off	Off
≤ level 1 & > minimum	On	Off	Off	Off	Off
≤ minimum	Off	Off	Off	Off	On

Tables 2 and 3 shows a summary of the test results. A water source was used to supply water to the pumping machine which was connected to a water storage tank. The water storage tank was made of an almost transparent container. When the system was connected to a voltage source and powered ON, the pumping machine was automatically switched ON and the LEDs came ON as the water rises to their respective levels. When the water rose to the maximum point, the pumping machine was automatically switched OFF.

4.6 BILL OF ENGINEERING MEASUREMENT AND EVALUATION

Table 7: table showing the bill of engineering measurement and evaluation

S/N	Name of Component	Type	Quantity	Price (₦)
1	Vero board (Dot)	Small size	1	200

2	Light Emitting Diodes	1 Green, 1 Red, 1 Orange, 1 yellow	4	80
3	DC Voltage Source	12V 4.5AH Battery	2	9000
4	Piezo Buzzer	5-15V	1	150
5	Resistors	220R	8	80
6	Relay	12V 30A	1	300
7	Wires	1.5mm2	5 yards	500
8	LM2596 voltage regulator	3A	1	1500
9	Buckets		2	1400
10	Water hose	1m length	1	400
11	Adaptable box	4”*2”*2”	1	1800
12	Lead	1.5mm2 thick	1 roll	350
13	Soldering Iron	Any	1	1200
13	Soldering Iron	Any	1	1200

4.7 PROBLEMS ENCOUNNTERED

During the course of designing this system, there were series of problems encountered which came on the way of achieving the desired goals of this project. Some parts required redesigning and the calibration of the sensors also created a bit of problem. After installing the pump, I noticed that

the bucket was punched there by making water to leak, this was so challenging because it leads to me changing the tank which affected the budget.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

Going through the planning, flow process, design and software implementation, the system has been a tough one, the chapter one to four has actually tried as much as possible to explain vividly almost all (if not all) what is involved in the construction of this project. After the complete design of the system, the deviation between the expected result and the actual result was very close. The performance and efficiency was beyond expectation and from every ramification the design of automatic water controller was successful

The water level Indicator employs a simple mechanism to detect and indicate the water level in an over head tank or any other water container. The sensing is done by using a set of four probes which are placed at four different levels.

We can 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.

In these days, when the Earth's reserve of consumable water is decreasing every moment, every drop has its value.

Water level controller is a simple yet effective way to prevent wastage of water. Its simplicity in design and low cost components make it an ideal piece of technology for the common man.

5.1.1 APPLICATION

Water level Indicator can be used in Hotels, Factories, Homes, Apartments, Commercial complexes, Drainage, etc. It can be fixed for single phase motor, three phase motors, fuel level indicator in vehicles, liquid level indicator in the huge container companies on the tank walls.

5.2 RECOMMENDATION

I strongly recommend that government should set up industries for production of basic electronic component locally and establish research centers in each university to enable student have good sound practical knowledge on electronics component and their operation.

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