CONSTRUCTION OF AUTOMATIC WATER LEVEL CONTROLLER FOR BOTH OVERHEAD AND UNDERGROUND TANKS

BY

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EE/2008/282

DEPARTMENT OF ELECTRICAL/ELECTRONIC ENGINEERING

FACULTY OF ENGINEERING CARITAS UNIVERSITY

AMORJI-NIKE, ENUGU

AUGUST, 2013

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BEING A PROJECT SUMITTED TO THE DEPARTMENT OF

ELECTRICAL/ELECTRONIC ENGINEERING

FACULTY OF ENGINEERING CARITAS UNIVERSITY

AMORJI-NIKE, ENUGU

IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE

AWARD OF BACHELOR OF ENGINEERING (B.ENG) DEGREE IN

ELECTRICAL/ELECTRONIC ENGINEERING

AUGUST, 2013

CERTIFICATION

This is to certify that this project "Construction of an automatic water level controller for both overhead and underground tank" was carried out by Ogbidi Joseph .A. and submitted to the department of Electrical/Electronic Engineering, Faculty of Engineering, Caritas University Amorji Nike Enugu. For the award of Bachelor of Engineering (B.Eng.).

The construction has been under the supervisor of Engr. Ezeh and has been duly approved.

________________________ ________________________

Engr. Ezeh M. O. Date

Project Supervisor

________________________ ________________________

Engr. Ejimofor C.O Date

Head of Department

________________________ ________________________

External Examiner Date

DEDICATION

This project is dedicated to God Almighty for His infinite mercy and love, and to Ogbidi family.

ACKNOWLEGEMENTS

I sincerely appreciate my distinguished parents Mr. & Mrs. R.D OGBIDI for their love and parental care, my honourable Head of department, Engr Ejimofor C.O, I want to appreciate Engr. Ezeh for his tremendous contributions to this work and advice he gave me during the course of this work, and not forgetting all my lecturer Engr. Mbah P.N. Engr, Prof. Ochiagha G.C, Engr. Ochi, Engr. Ezeh M.O., Engr Okonkwo, Engr. Ozoani, Engr. Emesoba, Engr. Chijioke and my Dean Engr. Prof. S.N. Ojobor. I pray that God will keep you strong for your families

Finally, I appreciate all my course mates, all my friends who have in one way or the other contributed immensely to the construction of this project. May God bless us all.

ABSTRACT

Automatic water level controller for both overhead and underground tank is designed to monitor the level of water in a tank. It displays the level of water and when it is at the lowest level; a pump is activated automatically to refill the tank. When the tank is filled to its maximum capacity, the pump is automatically de-energized. Several circuits are put together to ensure proper working of this design, and the block diagram includes the supply unit, the micro-processor unit, the sensor unit, the display unit and the pump drives unit. The power unit is responsible for turning on the entire circuit. Some components are used to set up power unit and they include; a 15v step down transformer, a bridge rectifier circuit, a smoothening capacitor and a voltage regulator IC. The microprocessor (AT89S50) controls virtually all the actions carried out in this design. (AT89S50) is used in the design. The sensor unit is responsible for sensing the level of water and transfer the current position of water to the microprocessor. The display unit in the circuit is use to physically show the current position of water in the tank, the properties of seven segment display are been used.

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CHAPTER ONE

INTRODUCTION

1.0 BACKGROUND

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. 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.

1.1 AIMS AND OBJECTIVES

The goal or objectives of which the designed device is expected to accomplish is to build an automatic water level control with automatic control system. In this project sensors are place at different level of the tank and with the aid of this sensors, the micro-controller monitor the level of the liquid at any particular point in time, some of the objectives are

1. to design an automatic water monitoring system
2. to incorporate an interactive medium between the end user and the machine
3. to prevent over labor of the pumping machine and prevent it from getting bad
4. to avoid wastage of water

5. since the demand of electricity is very high, automatic water level control saves energy

1.2 JUSTIFICATION

Automatic water level monitor came into existence because of human error and inconsistence 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 leads to the development of the ideal of an automatic water level control and automatic pump short down.

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 detect and control the water in the tank

1.4 CONSTRAINS

The biggest setback experience during the course of this project is difficulties in finding the design of the project, secondly sourcing of material and component I used for the project were difficult to find like pump and buffer for programming

1.5 LIMITATIONS OF THE PROJECT

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

BLOCK DIAGRAM OVERVIEW

This project report writing is written is design in such a way that each chapter is related to the next as shown below

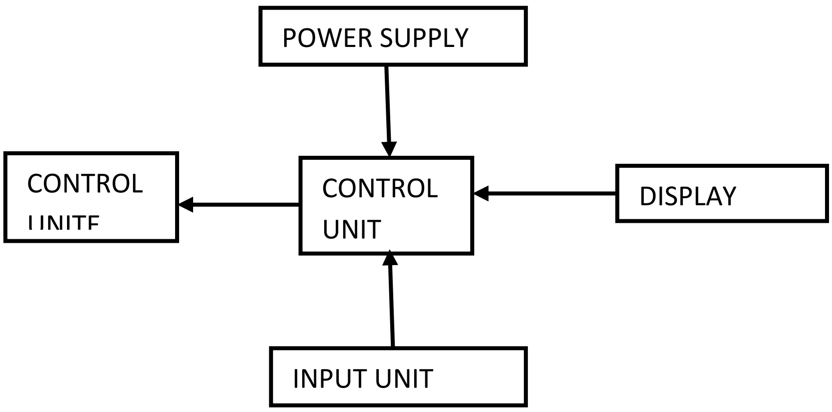


FIG 1.0 BLOCK DIAGRAM OF AUTOMATIC WATER LEVEL CONTROL WITH PUMP

1.6 PROJECT RESPORT ORGANISATION

The organization of this project report is well detailed and vast in its coverage it covers all the activities encountered during the research work. The first chapter of this work took care of the introduction, aims and objective, scope, Justification and project report organization. Chapter two highlight on literature review chapter three highlight on description of system and some of the component used were emphasized chapter four highlight on the system design and implementation, construction, testing and packaging of the pump. Chapter five is all about the conclusions problem encountered recommendation and cost of the project.

CHAPTER TWO

2.0 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, 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 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 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 thousand of millions of tiny transistors, capacitors are fabricated, An IC can be either analog digital depending on its intended application.

2.1 SENSORS

Level sensor detect he 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

CHAPTER THREE

3.0 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 over head 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 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. The system was designed using functional blocks as shown in the block diagram bellow 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 the final design schematic circuit diagram of the method is shown below in the figure

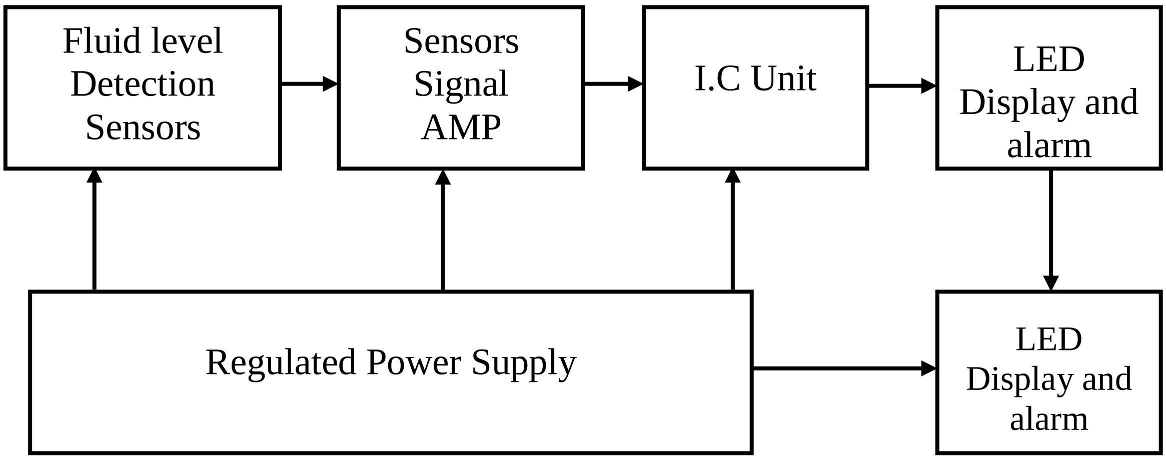


FIG 3.0 PROJECT BLOCK DIAGRAM

3.1 SYSTEM ANALYSIS

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

3.2 FLUID LEVEL DETECTOR SENSORS

Sensors are devices that convert physician property or a change in the physician 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 tupe 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 sensor.

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 to 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 = $^{VP}/_{VS}$ = $^{NP}/_{Ns}$ and power out = power in or Vs x Is = UP X IP

VP = primary voltage

NP = number of turns in primary coil

IP = primary input current

Vs = Secondary output voltage

NS = 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.

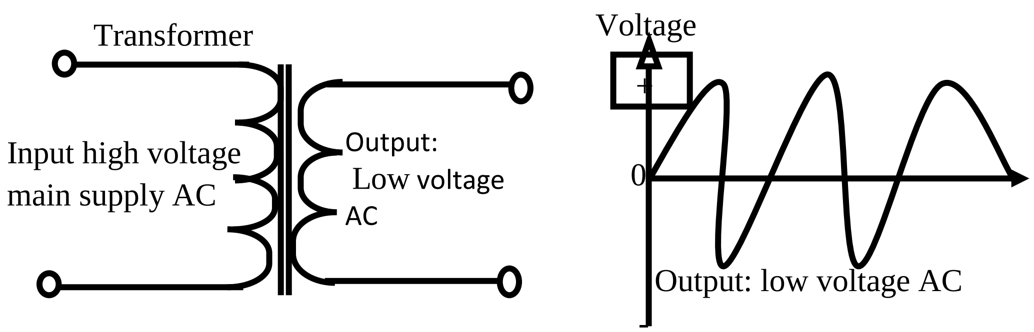


FIG 3.1 TRANSFORMER CIRCUIT REPRESENTATION

DIODES

The term diode usually implies a small signal device with current typically in the milliamp range. A semiconductor diode consist of a PN junction and has two (2) terminals, an anode (+) and cathode (-) current flows from anode to cathode within the diode. Diodes are semiconductor device that might be described as passing current in one direction only. The latter part of that statement applies equally vacuum tube diodes. Diodes however are far more extremely versatile in fact. Diode can be used as voltage regulators, turning devices in radio frequency tuned circuit, frequency multiplying device in radio frequency circuit, mixing devices application or can be used to make logic decision in digital circuit. There are also diodes which emit “light” known as light emitting diodes or LED.

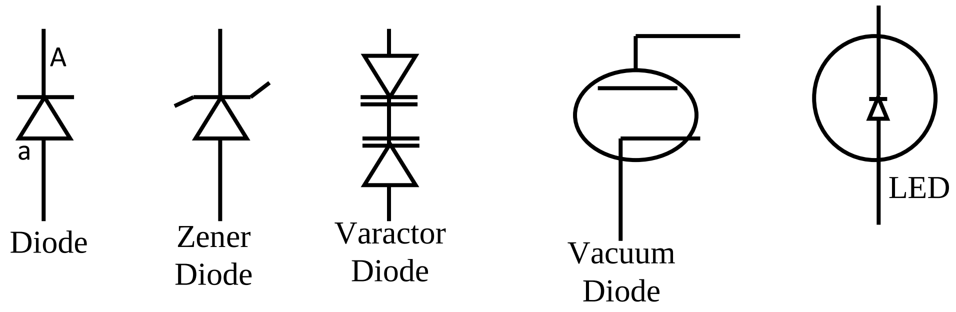


FIG 3.2 SYMBOLS OF DIODES

3.4 TYPES OF DIODES

The first diode in figure is a semiconductor diode which could be a small signal diode of the IN914 type commonly used in switching application, a rectifying diode of the IN4001 (400v 1A) type or even one of the high power, high current stud mounting types. You will notice the straight bar end has the letter “K” this denote the ‘cathode” while “a” denotes anode current can only flow from anode to cathode and not in the reverse direction, hence the “arrow” appearance. This is one very important property of diodes.

The next diode is the simplest form of vacuum tube or valve it simply has the old cathode and anode these term were passed on to modern solid state devices vacuum tube diode are mainly only of interest to restores and tude enthusiasts. The third diode is a zener diode which is fairly popular for the voltage regulation of low current power supplies whist it is possible to obtain high current zener diodes most regulation today is done electronically with the use of dedicated integrated circuits and pass resistors the last diode is the light emitting diode or LED, A led actually doesn't emit as much a plastic lens installed over it and this concentrates the amount of light.

3.5 LIGHT EMITTING DIODES OR (LED)

Light emitting diodes commonly called LED they do dozens of different jobs and are found in all kinds of devices. Among other things they form the numbers on digital close, transmit information from remote controls, light up watches and tell you when your appliance are turned on collected together they can form images on a jumbo television screen or illuminate a traffic light. Basically, LED are just ting light bulbs that fit easily into an electrical circuit but unlike ordinary incandescent bulbs, they don't have a filament that will burn out and they don't have get hot. They are illuminated by the movement of electron in a semiconductor material. Many circuits use a LED as a usual indicator of some sort even if only as an indicator of power supply being turned on. A sample calculation of the dropping resistor is included below.

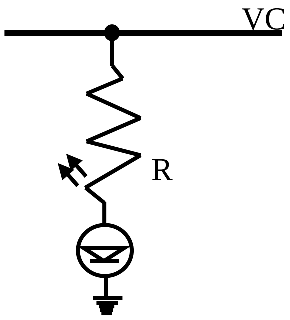


FIG 3.3 LIGHT EMITTING DIODES

Most LED operate at 1.7v although this is not always the case and it is wise to check. The dropping resistor is simply the net supply voltage minus the 1.7v led voltage then divided by the led brightness current express as "amps" (ohms law) note the orientation of both cathode and anode with respect to the ground end and the supply end usually with led the longer lead is the anode. LED has several advantages over conventional in can descent lamps for thing, they don't have a filament that will burn out, so they last much longer. Additionally, their small plastic bulb makes them a lot more durable. They also fit more easily into modern electronic circuits but the main advantage is efficiency, in conventional in can descent bulb the light production process involve generating a lot of heat the filament must be warm this completely waste energy.

3.6 BRIDGE RECTIFIER

A bridge rectifier can be made using four individual diodes, but it is also available in special packages containing the four diodes required. It is called full-wave rectifier because it uses the entire AC waves (both positive and negative section) 1.4v is used up in the bridge rectifier because each diode uses 0.7v when diodes conducting as shown in the figure below. The maximum current they can pass rates bridge rectifiers and the maximum reverse voltage they can withstand this must be of least three times the supply RMs voltages so the rectifier can withstands the peak voltage.

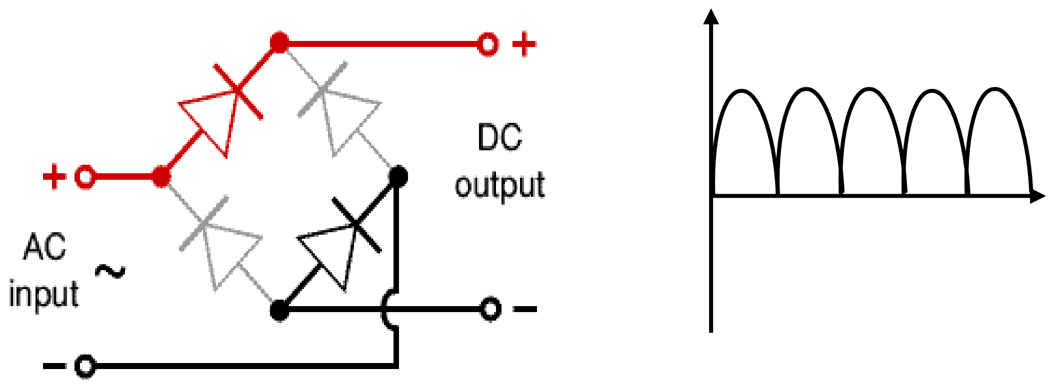


FIG 3.4 BRIDGE RECTIFIER CIRCUIT REPRESENTATION

Alternate pairs of diode conduct changing over the connections so the alternating directions of AC are converted to the direction of DC.

3.7 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.

VOLTAGE REGULATORS OUTPUT VOLTAGES

NAME	VOLTAGE
LM7805	+ 5 Volt
LM7809	+9 Volt
LM7812	+12 Volt
LM7905	-5 Volt
LM7909	-9 Volt
LM7912	-12 Volt

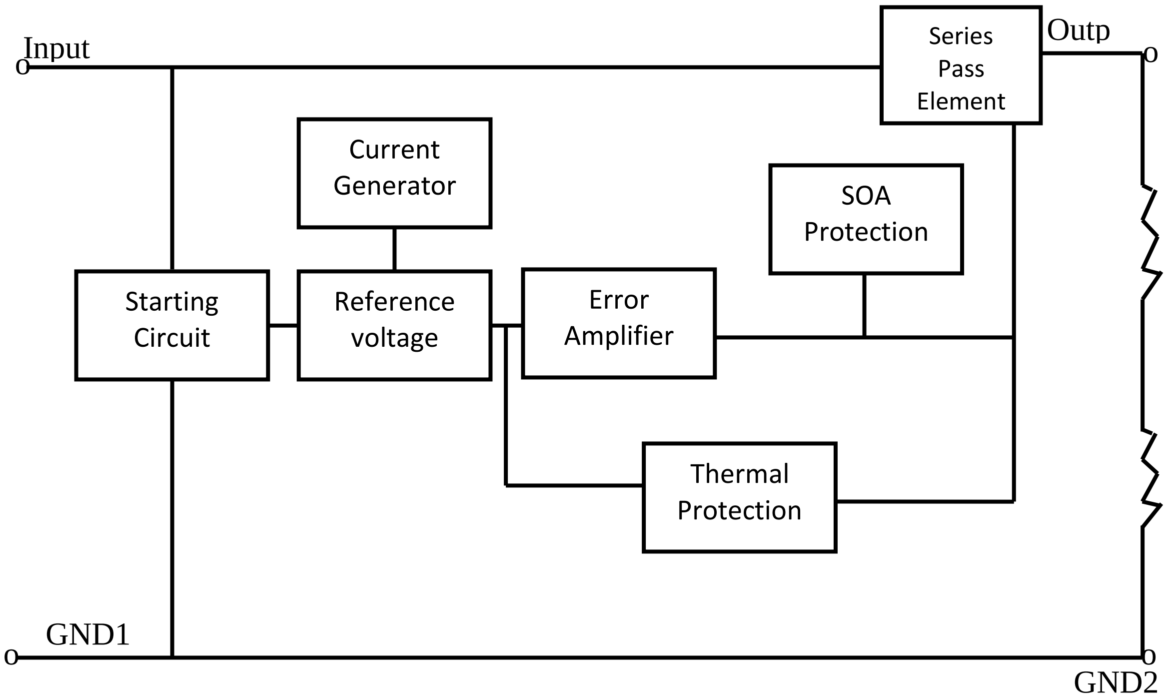


FIG 3.5 LM7805 INTEGRATED CIRCUIT INTERNAL SCHEMATIC

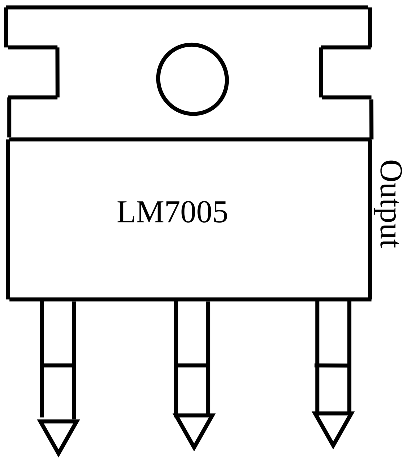


FIG 3.6 DIAGRAM OF LM7805 (VOLTAGE REGULATOR)

3.8 RESISTORS

Resistance is the property of a component which restricts the flow of electric current. Energy is used up as the voltage across the component devices the current through it and this energy appears as heat in the component. Resistance is measured in ohms, the symbol for ohm is an omega in is quite small for electronics so resistance is often given in Kn and Mn, kn = 1000n IMn = 100000n. Resistors used in electronic can resistance as low as 0.1n or as high as 10mn resistor are connected in series and parallel

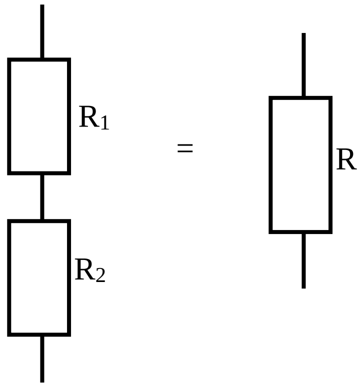


FIG 3.7 RESISTORS CORRECTED IN SERIES

When resistors are connected in series their combined resistance is equal to the individual resistance added together for example if resistor R_1 and R_2 are connected in series their combined resistance R is given by:

Combined resistance in series $R = R_1 + R_2$ and can be further extended depending on the number of resistor. The combined resistance in series will always be greater than any of the individual resistance.

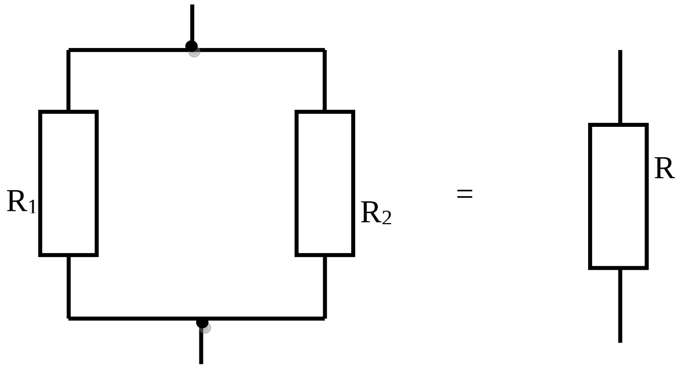


FIG3.8 RESISTORS CONNECTED IN PARALLEL

When resistors are connected in parallel their combined resistance is less than any of the individual resistance. There is a special equation for the combined resistance of two resistors R_1 and R_2 combined resistance in parallel R = $\frac{R_1 + R_2}{R_1 \text{ X } R_2}$

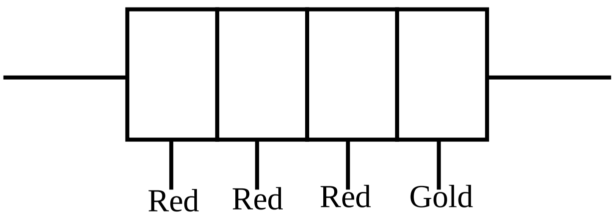
For more than two resistors connected in parallel a more difficult equation must be used. This adds up the reciprocal ("one over") of each resistance to give the reciprocal of the combined resistance R: $R = 1/R_1 + 1/R_2 + 1/R_3$.

3.9 HOW TO READ RESISTORS VALUES

Brown	Red	Orange	Yellow	Green	Blue	Violet	Gray	White
1	2	3	4	5	6	7	8	9

Must resistor have four bands

1. The first band gives the first digit
2. The second band gives the second digit
3. The third indicate the
4. The fourth band is use to show the tolerance of the resistor



22 x 100

= 2200 ohms

3.10 TRANSISTOR

A transistor is a semiconductor device, commonly used as an amplifier or an electrically control switch. The transistor is the fundamental building block of the circuitry in computers, cellular phones, and all other modern electronics because of its fast response and accuracy, the transistor is used in a wide variety of digital and analog functions, including amplification, switching, voltage regulation, signal modulation and oscillators. Transistors may be packaged individually or as part of an integrated circuit, some with over a billion transistors in a very small area. They are contain to electronics and there are two main types, NPN and PNP

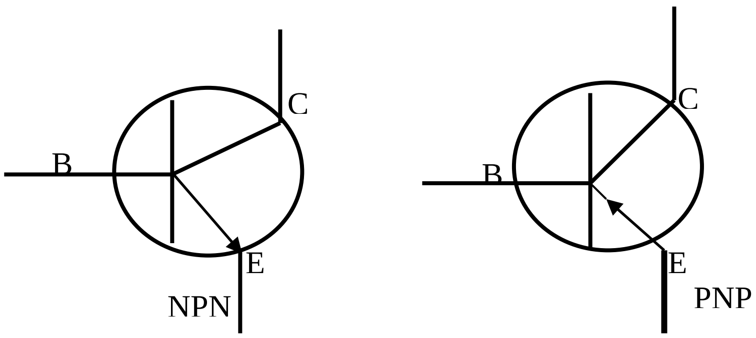


FIG 3.9 TRANSISTOR CIRCUIT SYMBOLS

The letter refers to the layer of semiconductor material used to make the transistor, must transistors used today are NPN because this is the easiest type to make from silicon. This page is mostly about NPN transistors the lead are labeled based (B) collector (C) and emitter (E) these terms refer to the internal operation of a transistor but they are not much in understanding how a transistor is used.

3.11 TRANSISTOR CURRENTS

The diagram below shows the two current palls through a transistor. The small base current controls the larger collector current. When the switch is closed, small current flows into the base (B) of the transistor. It is just enough to make LED B glow dimly. The transistor amplifiers this small current to allow a larger current to flow through from its collector (C) to its emitter (E). This collector current is larger enough to make LED C light brightly

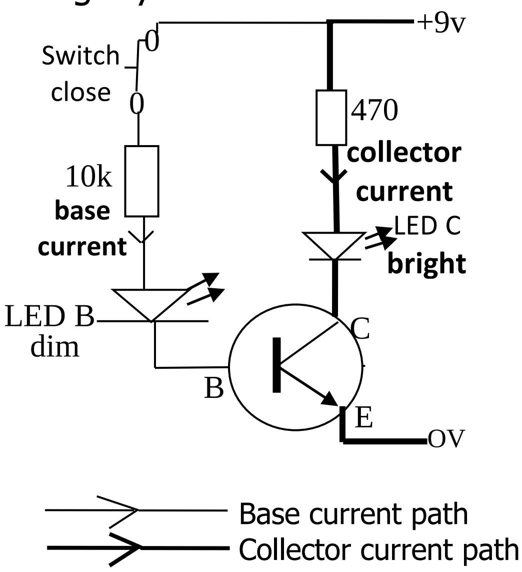


FIG 3.10 CURRENT PATH OF A TRANSISTOR

When the switch is open no base current flows, so the transistor switches off the collector current. Both LED are off. A transistor amplifiers current and can be used as a switch. This arrangement where the emitter (E) is in the controlling circuit (base current) and in the controlled circuit (collector current) is called common emitter mode. It is the most widely use arrangement for transistors.

3.12 CAPACITOR

Capacitor is a passive two-terminal electrical component used to store energy in an electric field. The forms of practical capacitors vary widely, but all contain at least two conductors separated by a non-conductor. Capacitors used as parts of electrical systems, for example consist of metal soils separated by a layer of insulating film. A capacitor is passive electronic component consisting of a pair of conductors separated by a dielectric (insulator) when there is a potential difference (voltage) across the detected on one plate and negative charge on the other plate. Energy is stored in the electrostatic field and is measured in farads.

3.13 RELAY

A relay is an electrically operated switch current flowing through the coil of the relay creates a magnetic field, which attracts a lever and changes the switch contacts. The coil current can be on or off so relay have two switch position and they are double throw (change over) switches. Relays allow one circuit to switch a second circuit, which can be completely separated from the first. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

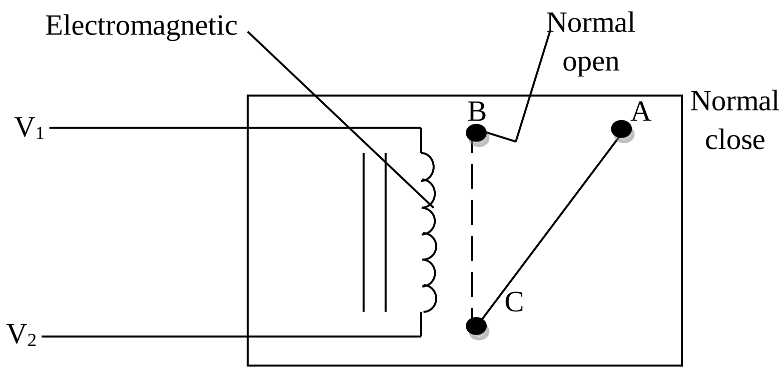


FIG 3.11 DIAGRAM OF A RELAY

The coils of a relay passes a relatively large current. Typically 30mn for a 12v relay but it can be as much as 100mn lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer FC is 200mn so these devices can supply relay coil directly without amplification.

3.14 PIEZO ELECTRIC BUZZER

Piezo electric ceramic buzzer element have a simple structure in which piezo ceramic element is glued to vibration plates. When alternating voltage is applied to piezo ceramic element, the element expands or shrinks diametrically. This characteristic is utilized to make vibration plate bend to generate sounds. The acoustic generating method can be roughly divided into self-drive oscillation method and external-drives oscillation method. The former shows the lowest impedance on the acoustic generator, and produces the sound by the positive feedback oscillation circuit to make neconace there by big sound pressure can be obtained by a simple circuit.

3.15 HARDWARE SUBSYSTEM

This project is made up of five modules namely

1. sensor unit
2. display unit
3. control unit
4. power supply unit
5. pump control unit

3.16 POWER SUPPLY UNIT

There are main types of power supply some are designed to convert high voltage AC mains electricity to a suitable low voltage supply for

Electronic circuits and other devices. A power supply can be broken down into a series of blocks, each of them perform a particular function

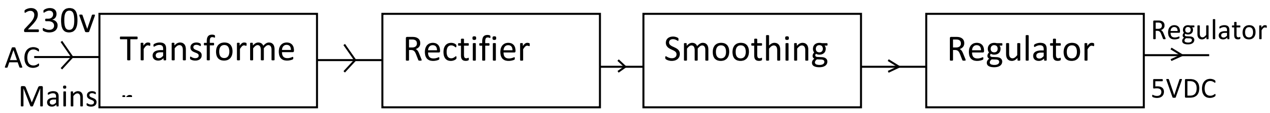


FIG 3.12 BLOCK DIAGRAM OF A REGULATED POWER SUPPLY SYSTEM

Transformer: Steps down high voltage AC mains to low voltage AC

Rectifier: Converts AC to DC but the DC output is varying diode are the main rectifier use.

Smoothing: Smoothers the DC from varying greatly to a small ripple regulator: eliminates ripple by setting DC output to a fixed voltage.

3.17 DISPLAY UNIT

The display unit consists of four seven segment displays, attached to the port or the micro controller. These seven-segment display arrangements show the level of the liquid at any particular point in time.

The seven-segment used in the design is common mode which is a type of seven-segment in which the anodes of all the individual segment are linked together. Therefore for any of the segment to be lighted. OV is supplied to the cathode the choice of common anode seven-segment display in my design because the micro controller sinks TT2 logic better then sourcing it the segment of the display are connected to port 0 of the micro controller and the display is made to display any figure or characters by sending the corresponding hexadecimal valve to port 0.

3.18 COMMON ANODE SEVEN SEGMENT DISPLAY

All the anodes of the seven segments LED are internally connected together and brought out to VCC, which is connected to the emitter of the switching transistor (NPN C945) and its collector to the VCC, and its base is then connected to our terminal of 10kn resistor which in turn is connected from the micro controller.

3.19 LED SEVEN SEGMENT DISPLAY

This type of display comes in a variety of colours, sizes and packaging stiles. While red is still the most favored colour, green, yellow and orange LED readouts are also available. The readout come packaged in standard Dip configuration with clear or modified diffused lens the latter for “full flood” visibility, Its mode of fabrication is based in either a common cathode or common anode arrangement But common-anode arrangement was used in this project for easier configuration. The seven-segment display gets its name from the fact that seven illuminated segment are used to configure the digit 0-9 and a few lower and upper case letters. Its arrangement is in the figure of number eight Its read out and list of segment required for it to illuminates is given below in common cathode all the cathode are internally tied together and brought out to circuit ground through an external current limiting, or pull-down resistor. Turns the LED segment "ON" also in common anode arrangement all anodes are internally connected and brought out to VCC through an external current limiting, or pull-up resistor. A low voltage to any LED cathode turns it on it allows for maximum flexibility due to their sizes and shapes the diagram of the seven-segment display is shown below.

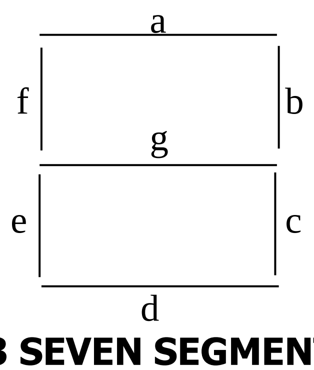


FIG 3.13 SEVEN SEGMENT DISPLAY LAYOUT

3.20 THE INPUT INTERFACE DESIGN

The input unit consists of sensors that monitor the liquid level and effect of "I" to "0" transition on the port of the micro controller. The sensors consist of seven pairs of NPN transistors connected in Darlington pair form. The container is calibrated into different level with each level having sensor attached to it. The sensor consists of a base of a NPN transistor (C945) while connecting the emitter to the transistor to a t5v. The collector of the NPN transistor is attached to the based of another NPN transistor (C945) via a 100n resistor while growing the emitter of the NPN transistor.

3.21 SENSOR PROCEDURE

A grounding probe is connected at the base of the container so as to ground the liquid content of the container. The ports of microcontroller where the individual sensors would be attached is pulled up to VCC (+5v) putting the port to logic 1. As the liquid level rises, it first touches the first probe placed out level 1, the probe becomes a rounded and since the probe was connected to the base of a NPN transistor (C945) which is active low, the transistor is activated and thus switches. The +5v supply on its emitter to its collector which in turn activates the NPN transistor connected to it. This NPN transistor switches the ground attached to its emitter to its collector and thus the ports of the microcontroller where the collector is connected is now grounded.

Therefore logic 1 to 0 transitions is seen by the microcontroller whenever a particular level is attained by the liquid.

3.22 MICROCONTROLLER UNIT

The at 89552 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 MC5-51 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 AT89552 is a powerful microcomputer, which provides a highly flexible and cost effective solution to many embedded control application.

The AT89552 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.

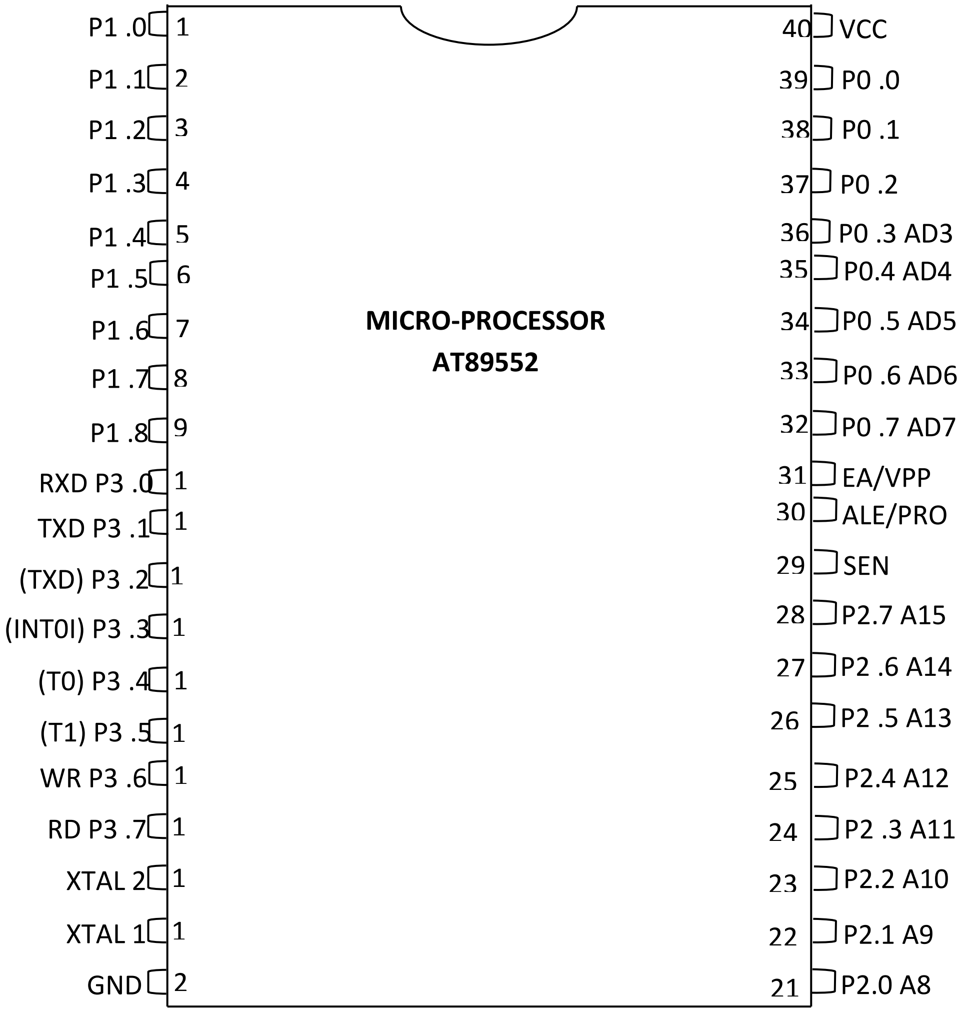


FIG 3.14 PIN CONFIGURATION

3.23 FEATURES

1) Programmable serial channel
2) Compatible with MCS-5ITM product
3) Fully static operation: OHz to 24MHz
4) Three-level program memory lock
5) 128 x 8 –bit internal RAM
6) 32 programmable $^1/_0$ lines
7) two 16-bit timer/counters
8) six interrupt sources

9) Low-power idle and power-down modes

3.24 PIN DESCRIPTION

Port 0

Port 0 is an 8 –bit open- drain b1 – directional 10 port. As an output port, each pin can sink eight TT2 inputs. When 1s are written to port 0 pins. The pins can be used as high impedances input. Port 0 may also be configured to be the multiplexed low order. Address/data bus during accesses to external program and data memory in thus mode PO has internal pull-ups and receives the code bytes

PORT 1

Port 1 is an 8-bit-b1-directional $^{1}/_{0}$ port with internal pull-ups. The port 1 output buffers can sink/source four TT2 inputs when 1s are written to port1 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, port 1 pins that are externally being pulled low will source current (112) be cause of the internal pull-ups. Port 1 also receives the low order address bytes during flash programming and verification.

PORT 2

Port 2 is an 8-bit b1-directional $^{1}/_{0}$ port with internal pull-ups. The port 2 output buffers ca sink/source four TT2 inputs. When 1s are written to port 2 pins they are pulled high by the internal pull-ups and can be used as inputs.

As inputs, port 2 pins that are externally being pulled can be used as outputs. As inputs, port 2 pins that are externally being pulled low will source current because of the internal pull-ups. Port 2 emits the high-order address bate during fetches from external program memory and during accesses to external data memory that uses 16-bit addresses

PORT 3

Port 3 is an 8-bit b1-directional $^{1}/_{0}$ port with internal pull-ups. The port 3 output buffers can sink/source four TT2 inputs. When 1s are written to port 3 pins then are pulled high by the internal pull-ups and can be used as outputs. As inputs port 3 pins that are externally being pulled low will source current (112) because of the pull-ups port 3 also serves the function of various speech features of the AT89552 is an listed below.

Port pin	Alternate functions
P3.0	RXD (Serial input port)
P5.1	TXD (Serial output port)
P3.2	INTO external interrupt 0
P3.3	INTI external interrupt 1
P3.4	TO Timer 0 external input
P3.5	T1 timer 1 external input
P3.6	WR external data memory read strobe
P3.7	RD external data memory read strobe

RESET

Reset input: A high on this pin for two machine cycles while the oscillator is turning resets the device.

ALE/PROG

Address latch enable output pulse for latching the low byte of address during accesses to external memory. This is also the program pulse input (PROG) during flash programming. In normal operation ALE is emitted at a constant rate of $^1/_6$ oscillator frequency, and may be used for external timing or clocking purposes. Note however that one ALE pulse is skipped during each access to external data memory.

PSEN

Program store enable is the read strobe to external program memory when the AT89552 is executing code from external program memory. PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

EA/UPP

External access enable. EA must be strapped to GND in order to enable the device to fetch code from external program memory locations starting out 0000H up to FH. Note however that if clock bit 1 is programmed, EA will be internally latched on reset. EA should be strapped to VCC for internal program executions. This pin also receives the 12-volt programming enable voltage (UPP) during flash programming for parts that require 12-volt VPP.

XTAL 1

Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

3.26 PUMP CONTROL SEGMENT

The pump control segment consists of a 10k resistor diode, an NPN transistor and 1 12v relay. The 240vac is attached to the common of the relay while the pump is attached to the normally open pin of the relay. A diode is connected across the energizing coil of the relay to bias the relay while the microcontroller controls the biasing of the relay by sending logic 1 or logic 0 to the base of the NPN transistor, which in turn biases the relay.

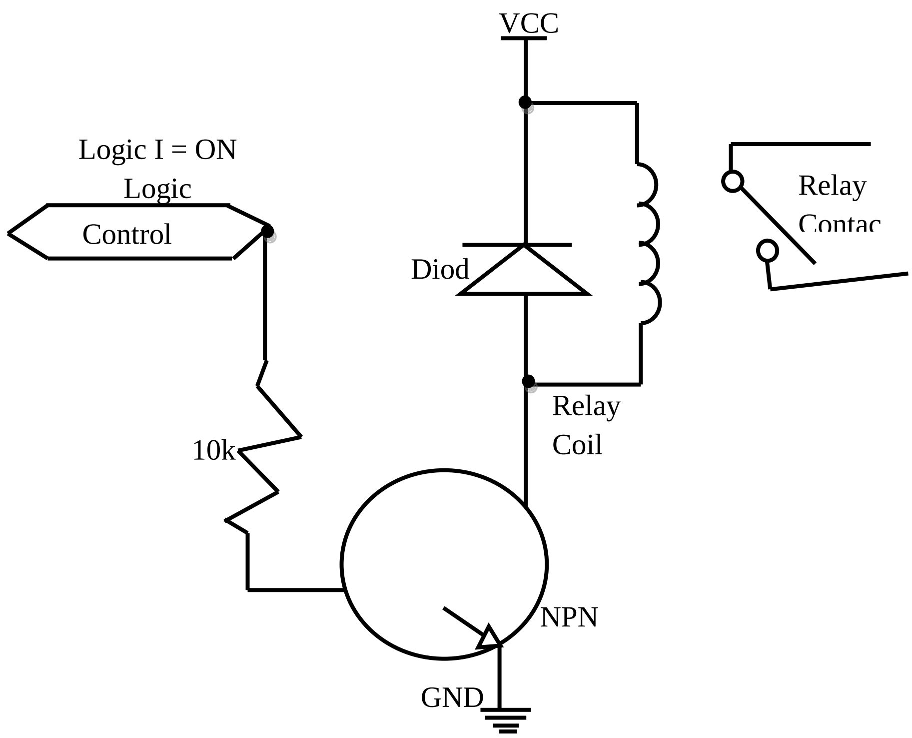


FIG 3.15 pump control segment

CHAPTER FOUR

SYSTEM IMPLEMENTATION

4.0 Overview of the project

As seen in chapter one, the project consist of six blocks. Which depicts the functional parts of the system. In this section, I will like to make conceptual design of the design of the system to have in the detail design of the hardware. The design gives an overview on the function of the major block, how they are integrated and the data flow arrangement. A sensitive automatic detector of water level controller will switching device can the design process characterized by the following

1. Definition of task
2. Requirement
3. Factor that influence choice

In defining a task, every design comes from an idea or a problem that require a solution. Questions may be generated on what exactly that is required to be achieved and the feasibility of the ideas as regards to the implementation. If these questions are analyzed critically with tangible solutions to the problem, a development of this idea into a reality is the next step. Requirement for design process have to be considered once an idea has been establish. The need to determine whether or not the idea require a pc or not depends on complexity of the circuitry, or whether the circuit to be designed needs to make a complex data. The compare these factors with topic with ICS(AND GATE) which two input when high logic changes output preferably, a micro-controller will be the option base on the circuit to be design with less hardware connection and flexibility. In writing a program that performs a desire function accesses the ability of the micro-controller. However it came my though 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 500m amp of current. As a result of this I decided to use 12-voit 1 amps rated transformer for this design after the voltage is step to 12-voit using a transformer, a full wave rectifier circuit was design using four diodes (IN4001). This value of diode is used here because from the specification of voltage/diodes rectifying data books this value is adequate for lower voltage say 0.24 volt current =1 amps therefore 1.27 amps is the maximum load current that can be drawn in the whole system. Also it is known that after rectification, the same voltage (12 volt) continues to flow into the filter. As a result the load voltage 12-volt thus vdc=load voltage =12 volt

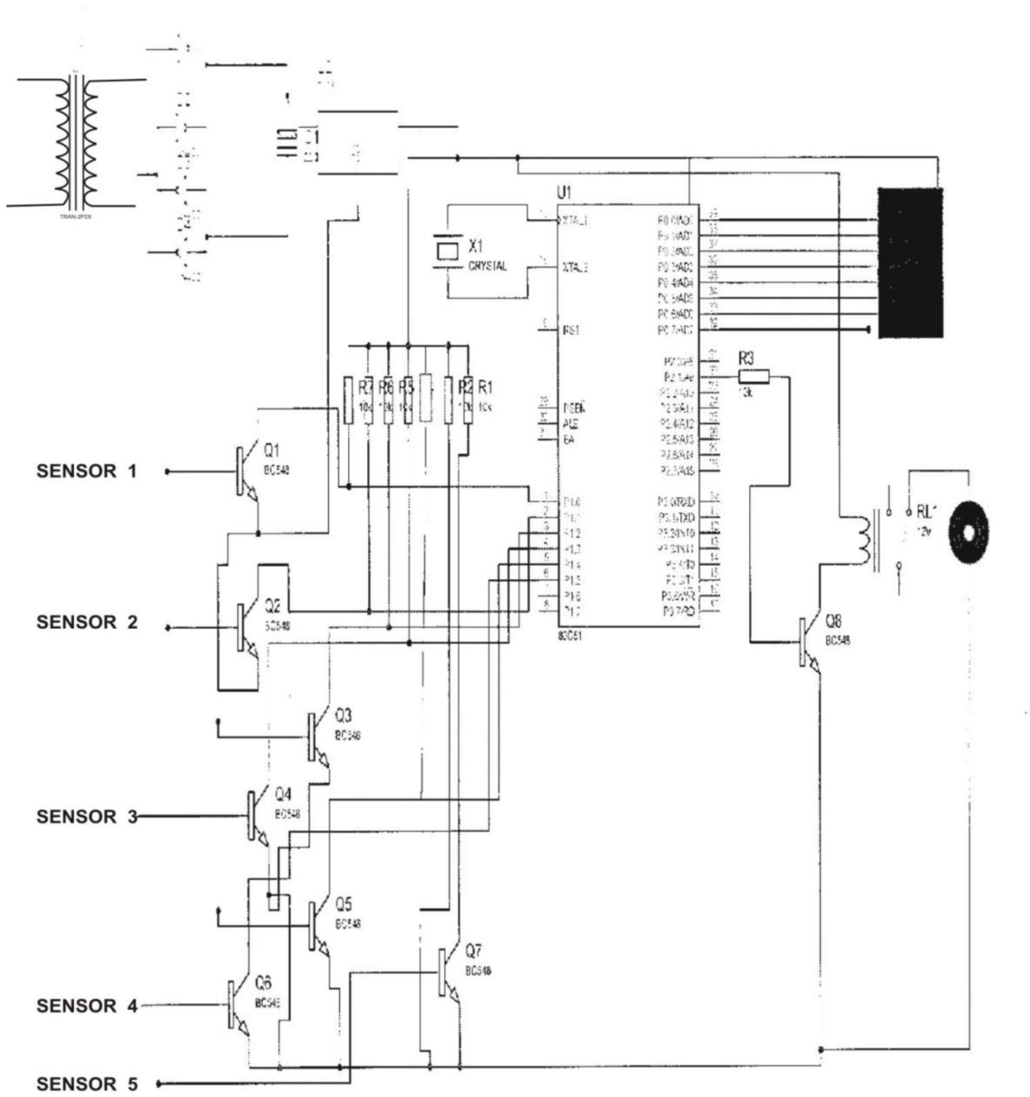


Fig. 5: Circuit Diagram of the Project

4.1 SOFTWARE DESIGN

Software is computer program, instructions that cause the software, the machine to do work. Software as whole can be divided into a number of categories base on the type of work done. The two primary software are operating software (system software), which controls the working of the computer, application software, which addresses the multitude of task for which people use computer. Application software, perform word processing, data base management, and the like. Two additional categories that are either system nor

Application software, and language software, which provide programmers with tools they need to write programs. In addition to these task-based categories, several types of software are described based on their application.

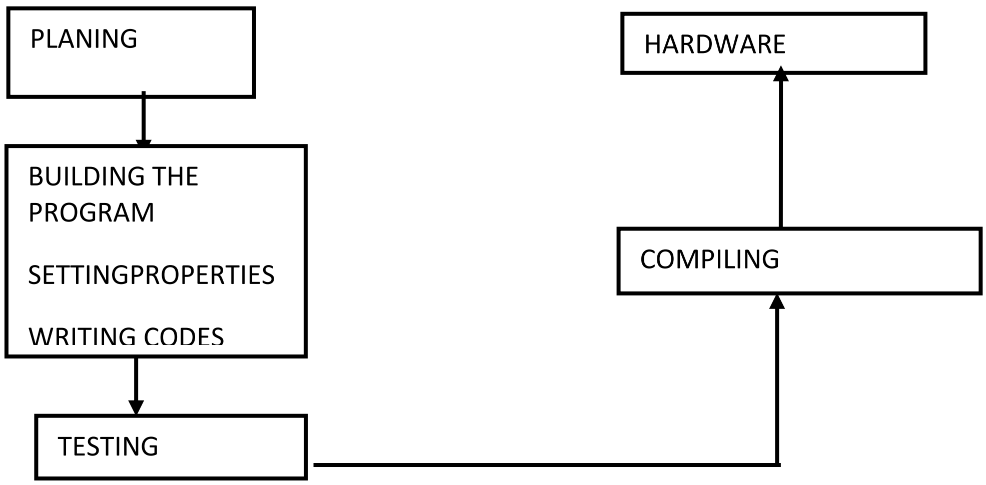


FIG 4.0 SOFTWARE DEVELOPMENT

Software development involves series of steps or is a set of activities that are necessary to be taken for the development of reliable and maintenance software, It is of great importance because hardware design cannot be used with micro-controller base system without depending on software. A typical micro-controller development systems (MDS) include, VDU registers, RAM which serve as a stone for the PROM programmer. Software system is the term use to describe a program that is provide by the manufacturer to aid the development of users (applications) programs. These include programs that convert assembly language into machine code (assembler), or high level language into machine code (interpreter or compiler). It also include programs that facilitate modifications (edition), the computer aided development methodology, which is essential for software development is summarized below

4.3 TEXT EDITOR

This is kind of word processing that is used. After keying in the used in programs code using the input device and the programs is display on the VDU, the text edition can be used to check and correct errors in the programs. In a nutshell, the text edition is used to edit the programs after it has been written.

TRANSLATOR

There are two types of translators, assembler, interpreter and compiler. An assembler translate assembly language in the form of ammonic (memory aids) into machine code. A good feature of assembler is creating a list that shows the machine code and the assembly language of the programs side by side. A compiler on the other hand translates a high-level language into machine code. An interpreter reads the source code of our programs one line at a time and performs the specification instructions contained in that line

4.4 LINKER/LOCATOR

This is used to join the different modules that make up the programs together in the correct sequence and this is to be bound to addresses. The linker/locator pair works together to co-ordinate between the separate modules for smooth programs execution.

4.5 LOADER

The loader aids in loading an object code into RAM

4.6 TESTING

After the programs is written ,it was tested, this involve executing the programs with selected input called test cases, the result whether or not the program is functioning as desired.

4.7 DEBUGGING

This involves detecting out and removing errors in the program.

4.8 DEVELOPMENT PROCESS

In writing the software for this project, a modular approach was employed. This made it easier to check for errors and debug the program. Three major tools were used in the development process; the C51 compiler was used to translate from the source code into the object code. The SDCPP was employed to link the program while the PACKIHX did the conversion from binary to hexadecimal.

4.9 CHOICE OF PROGRAMMING LANGUAGE

My implementation programming for this project is C programming language reasons being the fact that C combines the element of high-level language with functionalism of assembly language. C allows the manipulation of bits, bytes and addresses. Also C codes are portable which means that it is possible to adapt software written for one type of computer to another. Nevertheless, a special feature of C is that it allows the direct manipulation of bite, byte, word and pointers. This suite it to system level programming where these operation are common. C has only 32 key word as compare with Q-basic for IBM pc which contain 159 key word

4.10 PROGRAM ENTRY AND EDITING

After the design of the software, a text editor is employed to enter the source into the disk file. As noted earlier, the text editor also functions as error correcting in the program. The text editor use is the CRIMSON text editor.

4.11 COMPILING AND LINKING

The small device C "compiler" comes with a lot of modules. It dose the task of compilation, linking binary to hexadecimal conversion once the compilation command is issued an object file, a hexadecimal and a binary file.

4.12 SYSTEM CONTROL PROGRAM STEPS

The operation of the micro-controller based water level control system is summarized as follows;

1. The display unite display the present level of the water for example "3"
2. The micro-controller monitor the sensor and open the pump once the water level has gone too low, and the display system shows "L" which means low

3. The micro-controller closes the pump when it shows “F” which means full in it display

4.13 PROGRAM

```
Include < at 89552. H >
Void pump (void)
If (P1 – 0)
P2 – 1 = 1
3
If (! P1 – 5) Є
P2 – 1 = 0
3
Void display (void) Є
// level 2
If (CP1 – 0) 88 (P1 -1)88 (P1 -3) 88 (P1- 4)) Є
Po = o x 47
3
// level 1
If ((! P1 – 0) 88 (P1 -1) 88 (p1 -2) 88 (P1 – 3) 88 (P1 - 4)
Po = OX79
3
// display level 3
If ((!P1 – 0) 88 (!P1 – 1) 88 (P1 – 2) 88 (P1 – 3) 88 (P1 – 4) Є
Po = OX24
3
// display level 3
If ((! P1 – 0) 88 (! P1 – 1) 88 (P1 -2) 88 (P1 – 3) 88 (P1 – 4)) Є
Po = OX30
3
// display level 4
If ((! P1 – 0) 88 (! P1 – 1) 88 (! P1 3) 88 (P1 – 4)) Є
PO = OX19
// display level 5
If ((! P1 – 0) 88 (! P1 – 1) 88 (! P1 – 2) 88 (!P1 – 4) 88 (1 – 5))
PO = OX12;
3
```

```
// display level 6
If ((! P1 – 0) 88 (! P1 -1) 88 (! P1 – 2) 88 (P1 – 3) 88 (P1 – 4))
88 (P1 – 5)) Є
P0 = OXOe;
3
Void main (void) Є
While (1) Є
//P2 = 0
Pump ( )
Display (  )
3
3
```

CHAPTER FIVE

5.0 SYSTEM TESTING AND INTEGRATION

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 AT78LS05 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.

5.2 TEST PLANE AND TEST DATA

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 there by enabling one or even intended users 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 .however, 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.

5.3 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 colour 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.

5.4 TEST FOR TRANSISTORS

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

5.5 SYSTEM TEST

The system was powered and operated upon using several possibilities they include making sure that the pump only start when the water level has gone below the mark, and stops when the water level has reach maximum. The seven segment display was also tested to make sure correct level was display on the seven segment display screen. The sensors were also tested.

5.7 TRANSFORMER TEST (step down)

Expectedly the transformer was rated 220v/12v, 1000mA. from the mains power supply, the primary coil receives 220v input, the output was measure to be 16.75v using a DMM. Test data on transformer has it that the resistance of the primary windings for step down transformer is higher than that of the secondary side this was ascertained.

5.8 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.

5.9 PERIMENTED RESULT VS ACTUA L RESULT

COMPONENT	EXPERIMENTED VALUE	ACTUAL VALUE	UNIT	TOLERANCES
REGULATOR	5.00	5.02		
TRANSFORMER	12Vac @ 240Vac	13.2	V	
TRANSISTOR	Rbe 520 Rbc 510	550 548		
CAPACITOR	10 10 30	10.20 10.15 29.82		
RESISTOR	1000 2000 220 1000	1000 2000 218 9980		5%

5.10 PERFORMANCE EVALUATION

From the table above, it shows that range between the expected value and the actual can be tolerated. As a result of this the drift in expected value has no critical effect on the system design since the result current range was also exceeded, also the operational voltage was not exceeded.

5.11 PACKAGING

After the completion of the work, the circuitry was enclosed in a case to avoid damage. This is very vitally to the packaging of any electronic equipment, the enclosure provides protection as well as attraction that is, it add aesthetic value to the work. The sizes of tank to be used for packaging was first of all determined after considering the following factors

1. easy input and removal of water from the tanks
2. positions of the tanks
3. space for future modifications, easy accessibility to circuit board
4. Easy mobility of the tanks.

5.12 BILL OF ENGINEERING MEASURMENT AND EVALUATION

To carry out this project, some things were put into considerations. Among those things include the cost of component used for the construction was the priority. The table below shows the component that are used in the project construction, the quantity and also the price of ach components

S/N	COMPONENT	VALUE	QUANTITY	UNIT	BUIK PRICE
1	TRANSFORMER	220V/12V	1	120	120
2	DIODES	IN4001			
3	CAPACITORS	2200 35V	1	50	50
		10 16v	1	50	50
4	TRANSISTORS	C945			
5	INTEGRATED CIRCUITS	7805	1	80	80
		AT89552	1	450	450
6	RELAY	6v:10amp	1	80	80
7	SEVEN SEGMENT DISPLAY		1	120	120

8	POWER SWITCH		1	40	40
9	VEROBOARD		1	100	100
10	RESISTORS	10KΩ	6	5	60
		150Ω	1	5	50
		4.7KΩ	5	5	50
		10K variable	5	5	50
11	AC CABLE		3	80	240
12	CASING	Knock out box	1	500	500
13	D.C WATERTR PUMP	12v	1	1200	1200
14	BUCKETS		2	150	300
	LEAD		9	30	270
	WATER PIPE		2	80	160
TOTAL					**3890**

5.13 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

5.14 PROBLEMS ENCOUNTERED

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 require re-designing and the software debugging also created a bit of the 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.

5.15 RECOMMENDATIONS

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

REFERENCES

Aye, T. S., & Lwin, Z. M. (2006). Microcontroller Based Electric Expansion Valve Controller for Air Conditioning System, *World Academy of Science, Engineering and Technology.* Vol. 2864.

Belone, S., & Graw, H. W. (2004). *Electronic Circuit Discrete & Integration,* (23rd Edition). New Delhi, India: S, Chand & Company.

Byrne, L., Lau, K. T., & Diamond, D. (2002). Monitoring of Headspace Total Volatile Basic Nitrogen from Selected fish Species using Reflectance Spectrosc opic Measurements of pH Sensitive filmsî, The *Analyst,* vol. 127,

Dietz, P., Yerazunis W., & Leigh, D. (2003). *Very Low-Cost Sensing Devices.* India: Chand & Company.

Javanmard, M., Abbas, K. A., & Arvin, F. (2009). A Microcontroller-Based Monitoring System for Batch Tea Dryer, *CCSE Journal of Agricultural Science, Vol. 1, No. 2.*

Lau, U., & Dermot, D. (2005). *Sensors Operation*. London: Chand & Company.

Milenkovic, A., Milenkovic, M., Jovanov. E., Hite, D., & Raskovic. (2005). An *Environment for Runtime power monitoring of wireless Sensor Network Platforms*, Proc. *Vol. 1, No. 8*.

Paul, H., & Windfied, R. (2008). The Art of Electronic, (2nd Edition). London: Chand & company

Ronald, J., (2005). *Digital Systems.* U.S.A: Prentice Hall Inc.

Tharaja, B. L., & Tharaja, A. K. (2006). *A Text Book On Electrical Technology, (*23rd Edition). New Delhi, India: S, Chand & Company

www.microchip.com

APPENDIX A : SYSTEM COMPONENT LIST

1. Dc water pump
2. Lm7805 voltage regulator
3. Vero board
4. Connecting wire
5. Seven segment display
6. 240/12v, 1000ma transformer
7. Soldering iron
8. 30ph capacitor
9. 10uf 16v capacitor
10. Rectifier diodes
11. 2200uf/25v capacitor