Automatic Water Level Indicator and Controller by using ARDUINO

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Abstract - *The drinking water crisis in India is reaching alarming proportions. It might very soon attain the nature of global crisis. Hence it is of extreme importance to preserve water. In home based water tank, the one problem is very common to us that the control of water level of overhead tank, as a result the wastage of water is increasing day by day. But we all know water is very precious to us. This problem can be controlled by a simple electronic circuit consists with some cheap electronic components that circuit is called 'water level indicator'. As the water level rises or falls, different circuits in the controller send different signals. The relay operates the water pump. So when the water level is maximum, the relay turns the pump OFF and when the water level is minimum, the relay turns ON the pump.*

This reduces the water wastage due to overflow from tanks and also ensures that water in the tank is always available to use. Also reduces human involvement in turning ON and OFF the pump, as this process is made entirely automatic.

***Key Words*: Relay, LCD,Ultrasonic sensor, Arduino, Bridge Rectifier, Motor, 7- Segment Display, etc.**

1.INTRODUCTION

Water is one of the major resources. It is used for variety of purposes in our households as-well-as in industries for bathing, cleaning, cooking, drinking, gardening, fountains, coolants in industries and many more. In most of the households underground water is pumped to water tank located on the roof top. So generally people will switch on the pump when their tanks go dry and switch off the pump when the tank starts over flowing. As we lead a busy life, we often forget to turn off the water pump even when the tank becomes full. This case of water overflow results in the unnecessary wastage of water and sometimes this may even lead to unavailability of water.

Our paper, Automatic Water Level Indicator and Controller makes this conventional ON and OFF system automatic. It will automatically sense the water level and switch ON the pump when the water level in the overhead tank goes low and it will switch OFF the pump as soon as the water level reaches a pre-determined maximum level.

The drinking water crisis in Asia is reaching alarming proportions. It might very soon attain the nature of global crisis. Hence, it is of utmost importance to preserve water for human beings. Initially rain water was the most accessible source of water for most of the localities, but later water pumps came into existence. These water pumps are allotted for almost every household through which they can be able to get enough water to use. Also in most of the places this water is used as source of drinking. Now the issue is that, while few areas are having abundant supply of water there are still many places where the people are facing difficulty in getting sufficient water supply. This implies that there is a need to monitor and manage water flow. The objective of this paper is to notify the user the amount of water that is present in the overhead water tank. This paper can be further enhanced to control water level by turning the pump ON when the water level is low and turning OFF the pump when the water level is high. Thus the Arduino water level controller helps in preventing wastage of water.

This system provides a unique method that controls lack of water in water tanks and water tank overflow problems. The values of water levels are continuously sent to a microcontroller that triggers the required operation in accordance to the water level. Wheneverthe water level in the tank drops below the prefixed low level, the system switches on the pump that opens the water inlet automatically to allow water to refill the tank and when water level rises above the pre fixed high level, the system again activates the motor that closes the water inlet to stop water from overflowing.

The Automatic Water level controller is a device used to control the water level using a micro controller. Wireless water levelindicator using ultrasonic sensor Arduino is and amazing and very useful paper. This paper is wireless so it is easy to install and it can measure water level up to 100 meters.

In this Arduino based water level indicator and controller paper we are going to measure the water level by placing an ultrasonic sensor on the top of the water tank. When sound waves are transmitted in environment, they return back to origin as ECHO, as soon as the wave strikes any obstacle. The ultrasonic sensor will calculate the delay time that is the taken by the transmitted wave to reflect back as an ECHO. By knowing this delay time we can dump code into the Arduino to calculate the distance between the water level and the sensor. As per therequirement we set the maximum and minimum limit and correspondingly code is dumper into the Arduino to turn ON or OFF the water supply automatically.

The ultrasonic sensor constitutes of two circuits, a transmission circuit and a receiver circuit. The transmitter circuit converts electrical signal into ultrasonic wave

(signal) and receiver circuit converts the ultrasound signal into electrical signal. By using this ultrasonic sensor we can be able to know proximity of any object. In our paper the proximity of water surface can be known by using ultrasonic sensor. The water level will also be displayed on the 16x2 LCD module.

This Automatic Water Level Indicator and Controller indicated the amount of water present in the water tank which enables us to monitor the status od water level in our tanks. This paper also ensures continuous flow of water round the clock eliminating the stress of operating the pump manually thereby saving time, energy and water. This device can automatically detect water level(HIGH/LOW) with high precision.

APPLICATIONS:

- It is used as leveler in storage tanks, boilers to indicate level of water inside.
- Easily indicate when water level is full in tank with beep sound.
- This can also be used to indicate the water level in dams.

2.1 WATER AVAILABILITY:

The total amount of water available on earth has been estimated at 1.4 billion cubic meters, enough to cover the planet with a layer of about 3 km. About 95% of earth's water is in the oceans, which is unfit for human consumption. About 4% is locked in the polar ice caps and the rest 1% constitutes all fresh water founts in rivers, streams and lakes which is suitable for our consumption. A study estimated that a person in India consumes on an average 140 liters per day. This consumption would rise by 40% by the year 2025. This signifies the need to preserve our fresh water resources.

2.2 TYPES OF MONITORING SYSTEMS:

Water level monitoring can be found in many areas since before. The history of water level monitoring and controlling can be explained by the following classification based on:

- Control of System
- Method of Automation

2.2.1 BASED ON THE CONTROL OF SYSTEM:

A control system commands, directs, regulates and manages the behavior of any devices or systems using control loops. The various types of water level monitoring system based on control are as follows:

- Individual Control System
- Large Control System
- Central Control System

2.2.1.1 INDIVIDUAL CONTROL SYSTEM:

This is a very popular type of systems. Here the whole model is implemented on a targeted single source system.

2.2.1.2 LARGE CONTROL SYSTEM:

Here the water level monitoring is implemented on a very large scale basis and huge amounts of sensors are used.

2.2.1.2 CENTRAL CONTROL SYSTEM:

Computerized systems programmed to handle all the functions of multiple utilities like air conditioning system or home entertainment systems, refrigerators all at the same instant regardless of your presence. Control system can be accessed through telephone or internet from any corner of the world.

2.2.2 BASED ON THE METHOD OF AUTOMATION OF SYSTEM:

Automation is the technology by which a task is performed with minimum human assistance. Automation is used for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching on telephone networks, steering and stabilization of ships, aircraft and other applications and vehicles with minimal human intervention. Some processes have been completely automated. The various types ofwater level monitoring are as follows:

- Bluetooth Based Water level Monitoring
- Remote Water level Monitoring
- Automatic Water Level Monitoring

2.2.2.1 BLUETOOTH BASED WATER LEVEL MONITORING:

The system is controlled by the employed control system and Bluetooth plays a major role in alerting the anomalies. Through Bluetooth interface the user will be getting all the information regarding the system.

2.2.2.2 REMOTE WATER LEVEL MONITORING:

In this system the control of the system can be done at remote places, that means we can operate any equipment without actually operating it directly, but it can just be operated with a remote even when we are far away from the equipment.

2.2.2.3 AUTOMATIC WATER LEVEL MONITORING:

This automatic monitoring is something which is recently being implemented in almost every field. This makes the control and monitoring both easier and convenient for the used. Theautomatic system doesn't even need a command every time, it is just programmed once regarding all the possible cases and accordingly it proceeds the operation of

an equipment.

2.3 PREVIOUS EXPERIMENTAL WORKS:

As the water is being wasted from many years, many people implemented many models to overcome this trouble. Some of those previous works are mentioned below:

2.3.1 LIQUID LEVEL CONTROL:

This was an experimental setupby Praseed Kumar, Shamim S Pathan and et al in the year 2014. The controller used is PID controller based on LabVIEW Matlab software. This system consists of a water tank which receives water from a reservoir under a suitable head. A solenoid valve is located at the inlet of the tank. A float sensor located at a suitable height in the tank is used to sense the level of water. The float sensor senses the water level and sends a signal to the NI DAQ 9234 (input module) in the form of voltage. The DAQ card converts this analogue signal into digital signal and sends it to LabVIEW software. The PID controller designed in LabVIEW software will process the data and sends a voltage of 5V as a signal to the output module, i.e. NI DAQ 9263, which will be converting the signal into analogue voltage. This voltage actuates solenoid valve via relay. The author concludes by saying that interfacing of hardware components with LabVIEW software through NI hardware is done successfully. Detection of liquid level by float sensor and corresponding ON/OFF switching of electromagnetic valve is achieved.

2.3.2LOW COST AUTOMATIC WATER LEVEL CONTROL FOR DOMESTIC PURPOSE:

This was an experimental setup by Ishwar Chanra Murmu, Laloo Kumar Yadav in the year 2013.They have constructed experimental setup which consists of a motor pump which is switched ON when the overhead tank is about to go dry and switched OFF when the overhead tank is about to overflow. Metallic contacts sensors are used. When water comes in contact with these sensors, the circuit gets completed and signal is generated. This signal is fed to logic circuit to get correct actuator signal. The logic gate used is NAND gate. They have concluded by saying that this system is very beneficial in rural as well as urban areas. It helps in the efficient utilization of available water sources. If used on a large scale, it can provide a major contribution in the conservation of water for us and the future generations.

2.3.3ELECTRIC WATER PUMP CONTROLLER AND INDICATOR:

This was an experimental setup by Oghogho Ikponmwosa and Azubuike Charles in the year 2013. They have setup fabricated experimental setup using five metallic contact probes. The lowest probe in the tank is connected to a 5V source to provide a fixed reference voltage which is conveyed upward along the tank as the water level rises while the other four probes were used as inverting inputs to the various comparators. The ADCs, by utilizing the conductivity of water when ionized because of impurities present in it, are used to monitor the presence of water at the probes and give out corresponding digital outputs. The ADC's are comparators whose outputs at any time depend on the voltage difference between their inverting and non-inverting inputs. The non-inverting (positive inputs) of the ADCs are fixed at a voltage higher than that of the inverting (negative inputs) using a potentiometer. This will set the output logic states of all the comparators in the 1 state. When water level rises and touches the conductor connected to any of the comparator inverting input, it raises the voltage at that inputs such that it becomes greater than the voltage at the non-inverting input thus leading to a change in the output logic state of the Comparator from the 1 state to 0 state. The outputs from the ADCs are used by the microprocessor to give out digital signals which turn on visual display LEDs. The author concludes that the system eliminates the cost and inefficiency of human interference associated with monitoring and controlling the pump while maximizing the performance and life span of the electric water pump.

2.3.4MICROCONTROLLER BASED WATER LEVEL CONTROL SYSTEM:

This was an experimental setup by Ejiofor Virginia Ebere and Oladipo Onaolapo Francisca in the year 2013. They have used a microcontroller to automate the process of water pumping in an over-head tank storage system and it has the ability to detect the level of water in a tank. The pump will switch on/off accordingly and display the status on an LCD screen. The automatic water level monitor used in the study consists of the following major units: sensors, microcontroller, display unit, and the pump and the core work of detecting the level of water is done by the comparator. Taking advantage of the electrical conductivity property of water, the copper conductors are used as the water level sensor. When water touches the copper sensor positioned at a particular level in the tank, voltage is transferred to the copper which in turn is transferred to the comparator circuit for further processing. The LM324 comparator is used to compare the inputs from the electrodes in the tank and with a pre-set resistance and output a HIGH or a LOW with respect to the result from the comparison. The author concludes by saying that this research has successfully provided an improvement on existing water level controllers by its use of calibrated circuit to indicate the water level and use of DC instead of AC power thereby eliminating risk of electrocution.

2.3.5 LOGIC GATE BASED WATER LEVEL CONTROLLER:

This was an experimental setup by Md. Moyeed Abrar and Rajendra.R.Patil. The design here is on the basis of electro mechanical system using the digital technology. Here, the

electrical probes are used along with power supply and motor. The probes will be inserted inside the tank and motor will pump as the water goes down. The probes will detect the level of water and ON/OFF the motor. The level controller used here is the water sensor which will sense the low and high level of water in the water tank. If the water is low, the motor will pump the water and after the high level is reached it will stop to pump water. They have concluded by saying that the automatic water level controller has been successfully designed and developed. Most of the researchers have used comparators for comparing the water level in the tank. Also, some have used NAND gate for comparison of water level. The use of resistors has also been noted in places where two level water controllers are needed.

2.4 PREVIOUS RESEARCH PAPERS:

Few of the previous research papers submitted on the water level monitoring and control system are mentioned below:

2.4.1DESIGN AND DEVELOPMENT OF AUTOMATIC WATER FLOW METER:

This was a research paper by Ria Sood, Manjit Kaur, Hemant Lenka emphases on the need of water level controller in irrigation in agriculture. It says that every crop requires require different amount of water and this can be done by using automatic water level controller which will also help in reducing wastage of water. Here they use a technique to measure flow of rate of water in irrigation pipelines. It uses a Hall Effect Sensor to measure the rate flow. G1/2 Hall Effect water flow sensor is used as a sensing unit with a turbine rotor inside it whose speed of rotation changes with the different rate of flowof water.

2.4.2AUTOMATIC WATER LEVEL CONTROLLER WITH SMS NOTIFICATION:

This was a research paper by Sanam Pudasaini, Anuj Pathak, Sukirti Dhakal, Milan Paudel presents a system of an automatic water level controller with SMS notification. SMS notification was added to automatic controller system so that water can be managed by user during load shedding. Two systems work synergistically; automatic level controller system and SMS system. The program was developed in Arduino program developing environment and uploaded to the Microcontroller. Water level in the system is controlled automatically. The controller operates on a battery power. Whenever the system encounters empty level and the status of load shedding, the SMS notification is sent to the user. The system will automate the process by placing a single sensor unit in the tank that will periodically take measurements of the water level and will control the motor automatically. This system eliminates the efforts of people for daily filling of the tank and checks for overflow.

2.4.3 AUTOMATIC WATER LEVEL CONTROL SYSTEM:

This was a research paper by Asaad Ahmed Mohammed Ahmed Eltaieb, Zhang Jian Min involves designing and development of automatic water level control system had exposed to the better way of software and hardware architecture that blends together for the interfacing purposes. The system employs the use of advance sensing technology to detect the water level. It uses Arduino and uses relay to control motor. Different wires are attached at different Junctions of the Beaker. When we pour water in the beaker, the water comes in contact with the wire and tells the level of water in the tank. Accordingly, they have displayed the level of water on LCD display. And uses relay to turn ON and OFF the motor.

3.1 PROBLEM:

Water scarcity is one of the major problems on the earth. Researchshows that there is only 1% of water on earth that is suitable for usage.Even this low percentage of water is also being contaminated due todifferent chemicals mixed in it. By this we should understand that thereis a need to conserve water.

Unexpected shortage of water supply is common phenomena especiallyin dense population such as in hostels, homes, Industries, hospitals,hotels, learning institutions and in many other places.Also when water pump is started there is always no idea when it getsfilled up and sometimes there are situations where the pump keeps onpumping water to the tank and the water starts spilling out from thetank. This result in seepage of roofs and walls due to overflowing tanks, wastage of energy as well as wastage of water and those pose abiggest threat to the development of an economy. From this it is clear that water is to be conserved in all the available possibilities and make it available for everyone to use.

3.2 DRAWBACKS IN PREVIOUS WORKS:

As mentioned earlier in Literature Survey, there were many implementations to overcome the above mentioned water wastage issue. But the use of transistors, PID controllers, multiple sensing instruments makes those previous systems complex in building. And as they were not made completely automatic, it will be still the user's taskto operate the equipment as per the indication by the sensing unit. In few of the previous works microcontrollers were used, but coding those microcontrollers is a difficult task. Not everyone will be able to code to it or be able to understand it.

3.3 OVERCOMING THE DRAWBACKS:

Our paper can overcome the above mentioned problem as water level will be monitored, indicated and also controlled, thereby conserving water. In this paper entire control is based on Arduino Uno, it controllers every component as

per the code. As we use Arduino board, it is easy to code, as Arduino manufacturers provides Integrated Development Environment(IDE) for easy coding with many features like sample examples, debugging, serial monitor to display the output and many more.

This paper is made automatic, that meansall the tasks will be performed by the respective components and gives required output correspondingly. Arduino sends commands to the components as per the code and accordingly the components gets operated and required task will be performed, reducing human involvement.

3.4 BLOCK DIAGRAM:

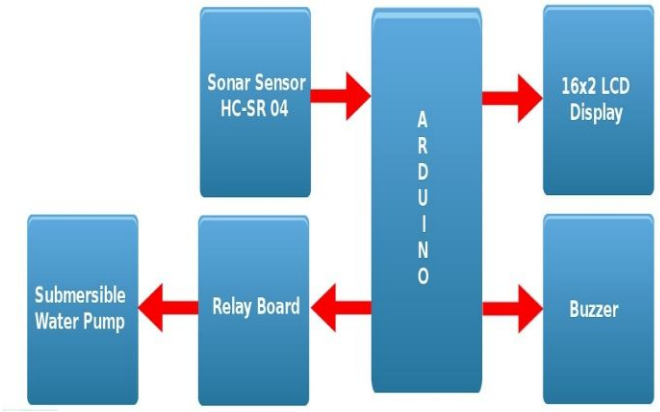


Fig. 3.1 Block Diagram

The above shown figure is the block diagram of our paper. The ultrasonic sensor sends ultrasonic waves, these waves gets reflected back as soon as this wave hits to any obstacle. This reflected wave is called ECHO. The ultrasonic sensor calculates the delay time and this information is sent to the Arduino Uno, then the Arduino calculates the distance from the sensor and water level. As per code the Arduino Uno operates relay and buzzer. Also time to time status of water level is displayed on LCD. All this operation is done according to the code dumped into Arduino.

3.5 WORKING:

The Automatic Water Level Indicator and Controller is an equipment which automatically turns ON and OFF the water pump based on the water level in the tank without human interference. This equipment also enables the user to monitor the status of water in the tank at any time.

The ultrasonic sensor will send an ultrasonic wave, this wave is reflected back as it hits the water surface in tank. Then this sensor calculates the delay time (i.e., the time taken by transmitted wave to reflect back as an echo). With this delay time Arduino calculates the distance between sensor and water level by the formula

Distance= (travel time/2) x(speed of sound)

The speed of sound is approximately 340m per second.

The working of the paper can is mainly based on the Arduino control. The working can be explained based on the distance between the sensor and water level as follow:

CASE 1: IF THE DISTANCE IS LESS THAN 10 cm:

In this case the distance displayed on the LCD is less than 10 cm. That means the water level in the tank is almost full. So if the pump is ON at that time, the relay gets operated by the Arduino, which turns OFF the pump. This controls the overflow of water through the tank.

CASE 2: IF THE DISTANCE IS LESS THAN 10 cm AND GREATER THAN 100 cm:

In this case the distance displayed on the LCD is less than 10 cm and greater than 100 cm. This means the water level in the tank is medium. So if the pump is ON at that time, it remains ON till the relay gets next command. And if the pump is OFF at that time, it remains OFF till the relay gets next command. That means in this case no operation is performed specifically, but remains to be in the same state as before.

CASE 3: IF THE DISTANCE IS GREATER THAN 100 cm:

In this case the distance displayed on the LCD is greater than 100cm. This means the water level in the tank is almost empty. So if the pump is OFF at that time, the relay gets operated by the Arduino, which turns ON the pump. This ensures that the pump turns ON when the tank is about to remain empty.

4.1 SCHEMATIC DIAGRAM:

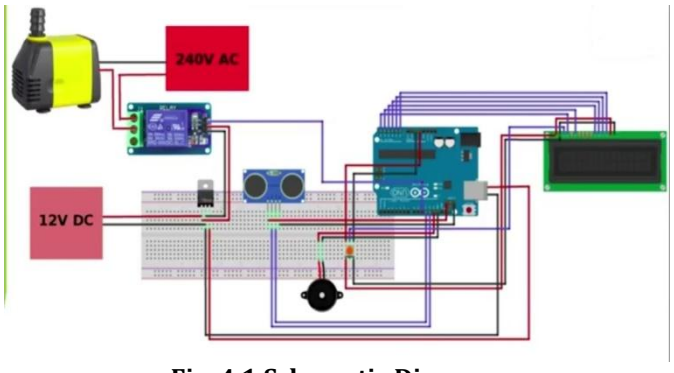


Fig. 4.1 Schematic Diagram

The above shown figure is the schematic diagram of our paper. Each component shown in the above figure is explained below in detail.

4.2 COMPONENTS:

The components that are used for the hardware implementation of our paper are

- Arduino UNO
- Ultrasonic Sensor
- Buzzer
- Liquid Crystal Display
- IC 7805 Voltage Regulator
- Relay Module
- Submersible Water Pump
- Battery
- Breadboard
- Connecting wires

4.2.1 ARDUINO UNO:

Fig. 4.2 Arduino Uno Board

Arduino Uno is a microcontroller board based on the ATmega328P. Its Operating voltage is 5V. It has 14 digital input/output pins (of which 6 can be used as PWM outputs)6 analog inputs. It has a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. We simply need to connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

4.2.2ULTRASONIC SENSOR:

An Ultrasonic sensor is a device that can measure the distance by using sound waves. It measures distance by sending out a sound wave at a specific frequency which transducers have

Fig. 4.3 Ultrasonic Sensor

piezoelectric crystals which resonate to a desired frequency and convert electric power into acoustic power. And then transmitted inside the shape of a cone, are think about something from a goal again to the transducer. An output signal is produced to perform a few sort of indicating or manipulate function. A small distance from the sensor is needed to offer a delay so that the “echoes” can be interpreted. The targets would have any kind of reflective shape – even round objects. Which are a noncontact type water level measurement sensor and the measurement ranges from 2cm-4m. The transmitter transmits ultrasonic wave when the wave hits the obstacle it get reflected back and received at receiver and they are convert to electric wave. Output of sensor is in term of centimeter or inches. Operating voltage is 5V with 40Hz frequency.

4.2.3 BUZZER:

Fig.4.4 Buzzer

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows.The word “buzzer” comes from the rasping noise that buzzers made when they wereelectromechanical devices, operated from stepped-down AC line voltage at 50 or 60cycles. Other sounds commonly used to indicate that a button has been pressed are a ringor a beep. It most commonly consists of a number of switches or sensors connected to acontrol unit that determines if and which button was pushed or a pre-set time has lapsed,and usually illuminates a light on the appropriate button or control panel, and sounds awarning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electricbell without the metal gong (which makes the ringing noise) Often these units wereanchored to a wall or ceiling and used the ceiling or wall as a sounding board. Anotherimplementation with some AC-connected devic.es was to implement a circuit to makethe AC current into a

noise loud enough to drive a loudspeaker and hook this circuit up toa cheap 8-ohm speaker. Nowadays, it is more popular to use a ceramic-basedpiezoelectric sounder like a Sonalert which makes a high-pitched tone. Usually thesewere hooked up to "driver" circuits which varied the pitch of the sound or pulsed thesound on and off.

4.2.4 LIQUID CRYSTAL DISPLAY(LCD):

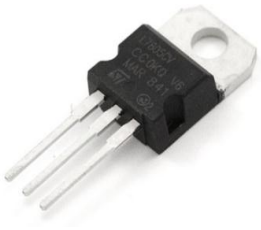
LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD is very basic module and isvery commonly used in various devices and circuits. These modules are preferred overseven segments and other multi segment LEDs. The reasons being:

1. LCDs are economical

2. Ease of programming for characters and graphics.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. Inthis LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers,namely, Command and Data. The command register stores the command instructionsgiven to the LCD. A command is an instruction given to LCD to do a predefined tasklike initializing it, clearing its screen, setting the cursor position, controlling displayetc. The data register stores the data to be displayed on the LCD. The data is theASCII value of the character to be displayed on the LCD.

4.2.5 IC 7805 VOLTAGE REGULATOR:



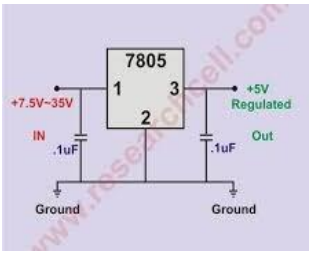


Fig. 4.6.1 IC 7805 Voltage Regulator Fig. 4.6.2 Schematic of IC 7805

This IC 7805 is a three terminal device with the three pins being 1. INPUT2.GROUND and 3.OUTPUT.

The Fig. 4.6.2 shows the pins on a typical 7805 IC.

Pin 1 is the INPUT Pin. A positive unregulated voltage is given as input to this pin.

Pin 2 is the GROUND Pin. It is common to both Input and Output.

Pin 3 is the OUTPUT Pin. The output regulated 5V is taken at this pin of the IC.

As I have previously talked about regulated power supply as a device that works on DC voltages and it can uphold its output accurately at a fixed voltage all the time even if there is a significant alteration in the DC input voltage.As per the datasheets of 7805 IC, the basic circuit required for 7805 to work as a complete regulator is very simple. In fact, if the input supply is an unregulated DC Voltage, then all you need are two capacitor (even those are not mandatory depending on the implementation).

The above schematic shows all the components required for a 7805 IC to work properly. The 0.22µF Capacitor near the input is required only if the distance between the regulator IC and the power supply filter is high. Also, the 0.1µF Capacitor near the output is optional and if used, it helps in the transient response. In this circuit, VIN is the input voltage to the 7805 IC and the source can be from either a battery of an unregulated DC. VOUT is the output of the 7805 IC, which is a Regulated 5V.

4.2.6 RELAY MODULE:

Fig. 4.7 Relay Module

This is a small and easy to use 1 channel relay board that operates on 5V. Use it to control one 240V power appliance lights, fans, etc. directly from microcontrollers or low voltage circuits. The relay can handle a maximum of 7A/240 V AC or 7A/24V DC. Relay has all three connections - Common(COM), Normally Open(NO), Normally Closed(NC) brought out to 3 pin screw terminals which makes it easy to make and remove connections. The board has a power indication (RED) and a relay status (GREEN) LED to ease debugging. The board can accept inputs within a wide range of voltages from 3V to 5V. Power input and relay control signals are brought to 3 pin header pins on the board. Hence, the board can be easily interface with our development boards using our female to female jumper wires.

A relay is an electrically operated device. It has a control system and (also called input circuit or input contactor) and controlled system(also called output circuit or output cont actor). It is frequently used in automatic control circuit. To put it simply, it is an automatic switch to controlling a high-current circuit with a low-current signal.

The advantages of a relay lie in its lower inertia of the moving, stability, long-term reliability and small volume. It is widely adopted in devices of power protection, automation technology, sport, remote control, reconnaissance and communication, as well as in devices of electro-mechanics and power electronics. Generally speaking, a relay contains an induction part which can reflect input variable like current, voltage, power, resistance, frequency, temperature, pressure, speed and light etc. It also contains an actuator module (output) which can energize or de-energize the connection of controlled circuit. There is an intermediary part between input part and output part that is used to coupling and isolate input current, as well as actuate the output. When the rated value of input (voltage, current and temperature etc.) is above the critical value, the controlled output circuit of relay will be energized or de-energized.

4.2.7 SUBMERSIBLE WATER PUMP:

Fig. 4.8 Submersible Water Pump

A submersible pump, also called an electric submersible pump, is a pump that can be fully submerged in water. The motor is hermetically sealed and close-coupled to the body of the pump.A submersible pump pushes water to the surface by converting rotary energy into kinetic energy into pressure energy. This is done by the water being pulled into the pump: first in the intake, where the rotation of the impeller pushes the water through the diffuser.

From there, it goes to the surface.

The major advantage to a submersible pump is that it never has to be primed, because it is already submerged in the fluid. Submersible pumps are also very efficient because they don't really have to spend a lot of energy moving water into the pump. Water pressure pushes the water into a submersible pump, thus "saving" a lot of the pump's energy.

Also, while the pumps themselves aren't versatile, the selection certainly is. Some submersible pumps can easily handle solids, while some are better for liquids only. Submersible pumps are quiet, because they are under water, and cavitation is never an issue, because there is no "spike" in pressure as the water flows through the pump.

There are a few disadvantages with submersible pumps, and two have to do with the seal. The seals can become corroded with time. When that happens, water seeps into the motor, rendering it useless until it is repaired. Also, that seal makes the submersible pump a bit difficult to get into for repairs.The other main disadvantage is that one pump does not fit all uses. Single stage pumps are used for most home and light industrial pumping. This includes aquarium filters, sewage pumping, or sump pumps for drainage. Multiple stage pumps are used for anything underground, such as water wells or oil wells. Also, pumps are made to work with thin liquids like water, or thick ones like sewage. Caution must be used with submersible pumps; they must be fully submerged. The water around a submersible pump actually helps to cool the motor. If it is used out of water, it can overheat.

4.2.8 BATTERY:

A battery source of 12V is used in this paper.

Fig.4.9 Battery

4.2.9BREADBOARD:

Fig. 4.10 Breadboard

Breadboards usually are plugged in to a standard power supply that either connects to a wall outlet or a battery. Certain holes in the breadboard are connected to positive or negative voltage so that when a circuit is correctly wired and the breadboard is plugged in, current flows through the circuit. Usually, they're used with low levels of voltage and current so that components are safe to touch even while the breadboard is plugged in, but it's a good idea to keep the breadboard unplugged and, if it has a power switch, turned off until a circuit is complete to avoid shocks or damaged components.

It's easier and faster to work with breadboards to lay out

circuits than it would be to try to wire components without one, so they're useful for quickly testing and prototyping electronics ideas. Breadboards can also be used without soldering, which makes it easy to remove components and reuse them when you're done with an experiment. If you're building a simple electronic paper for home use, you may be able to leave it on the breadboard while it's in use, but a commercial paper would need to be remade on a permanent platform.

4.2.10 CONNECTING WIRES:

Fig. 4.11Connecting Wires

Connecting wires will be required to connect all the above components with Arduino and breadboard.

The below picture is the "Automatic Water Level Indicator and Controller" setup.

As mentioned the working of the paper, all the cases are successfully indicated and controlled accordingly.

Case 1: Motor turn on

Case 2: Motor turn off

5. RESULTS

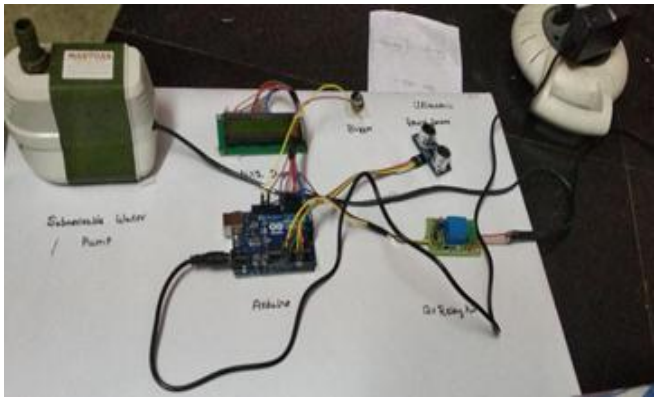


Fig. 5.1 Paper kit

Case 1:

When the supply is given to the pump the below figure shows the result of the case. When the water level is below or equal to the minimum level the motor gets turned on and the display shows "PUMP ON W DISTANCE IS ___". So the water is transferred to the tank by the Submersible Water Pump.

Fig. 5.2 Output: Pump On

Case 2:

When the supply is given to the pump the below figure shows the result of the case. When the water level is high or equal to the maximum level the motor gets turned off and the display shows "PUMP OFF W DISTANCE IS ___". So the water stops transferring to the tank by the Submersible Water Pump.

Fig. 5.3 Output: Pump Off

CONCLUSION

Therefore with this equipment, the pump can automatically turn ON and OFF based on the water level. Also time to time monitoring of water level can be done and displays the result on LCD.

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