VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY

ELECTRICAL MEASUREMENT AND INSTRUMENTATION LABORATORY

DEPARTMENT OF ELECTRICAL ENGINEERING

PROJECT BASED REPORT

TOPIC: Water Level Indicator and controller

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ABSTRACT

Water is very precious for the living beings and scarcity of the same is gradually increasing. Most of the cities in the county and that of the world are facing this problem. This is one of the motivations for the current work and to deploy techniques in order to save water and help the environment which in turn ensures water for the future. Hence, it is of utmost importance to preserve and save water. In many houses there exists unnecessary wastage of water due to overflow from overhead tanks etc. Automatic Water Level Controller can provide a solution to this problem. Present work does not use any microcontrollers etc. The operation of water level controller is based on the fact that water conducts electricity. As the water level rises or fall the sensing probes and circuits of the controller detect the same. These signals are used to switch ON or switch OFF the pump motor as per requirements. This system is used to automate the process of water pumping to over-head tank storage and has the facility to select the level of water to pump. The logical situations using electronic circuit manage the system. The required amount or volume of water can be pumped to the over head tank by choosing level selector unlike waiting for the complete filling in the conventional circuits.

INTRODUCTION

Water is very precious and needed for many and every activities. Conservation of water is similarly important and has adverse effects otherwise. The storage of water for the domestic, industrial, agricultural or other such needs is very important. The literature in this regard provides sufficient justification for the use of automatic water level controllers. Many of such circuits make use of microcontroller or PIC ICs to work for the task. To conserve and make effective use of water a controller is needed to manage the required volume or level in underground and overhead tanks of premises. Automatic water level controller circuit is a simple engineering electronic project does the same with suitable logic and components. The pump motor is of single-phase AC and operated using relay from the controller. The present work does not incorporate any Microcontroller instead use JK flip flop and Timer IC555. It will automatically switch ON and OFF the domestic water pump to fill the overhead tank to the set level or volume of water. The main advantage of this water level controller circuit is that it automatically controls the water pump without any user interaction. It is built with simple electronic components. The heart of this pump controller circuit is NE555 IC. Water level controller does help to control the level of water automatically by using sense probe/circuit of the tank. This system not only monitors the water level of the tank, it switches ON the motor automatically whenever overhead tank is empty. The motor is switched OFF when the required level in the overhead tank is reached along with LED indications. Pump motor is not started whenever underground water level is below the pre-set threshold. Using this system, we can avoid the overflow and wastage of the water.

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 LEDs are placed at different level of the water to indicate the level of water and the J-K flip flop is used to control the flow of water to the tank. 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.

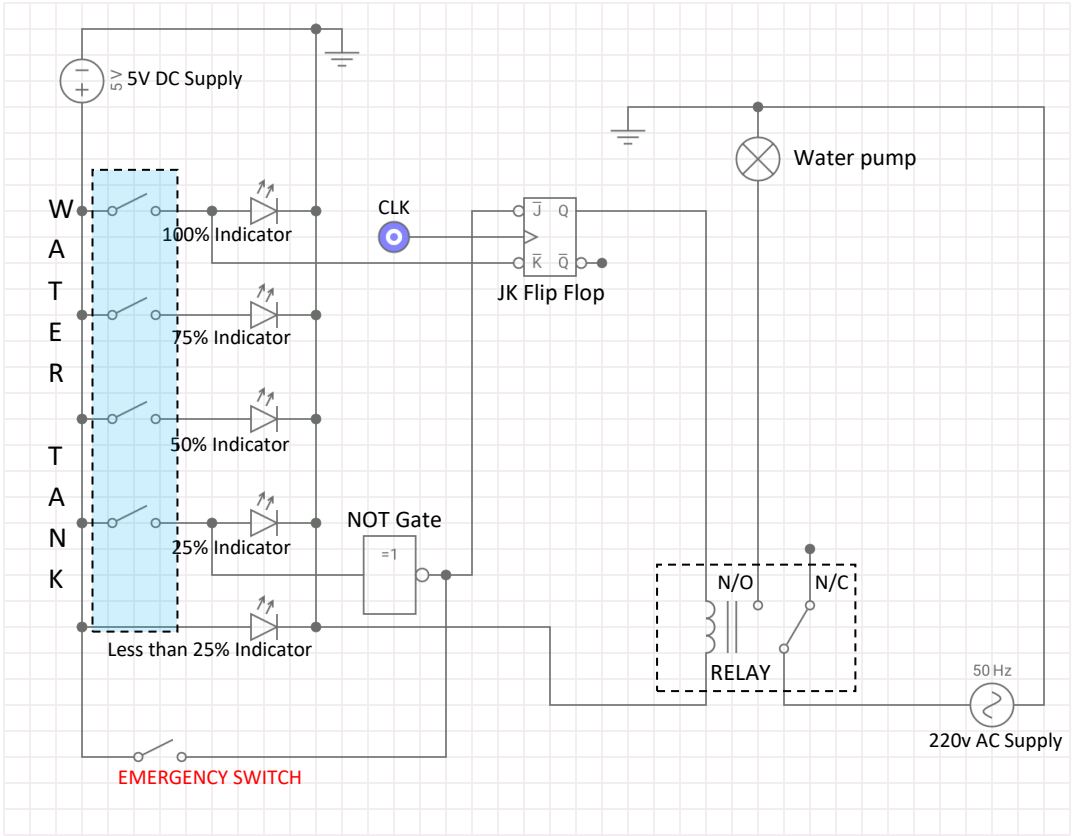
3.To prevent over labour of the pumping machine and prevent it from getting bad.

4.To avoid wastage of water.

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

CIRCUIT DIAGRAM:

The circuit for this project can be referred from the Fig. 1 which gives an overview of how the connections of the necessary components are made so as to achieve the automated system to indicate and control water level & avoid its wastage.



CIRCUIT DIAGRAM OF AUTOMATIC WATER LEVEL CONTROLLER AND INDICATOR

COMPONENTS REQUIRED:

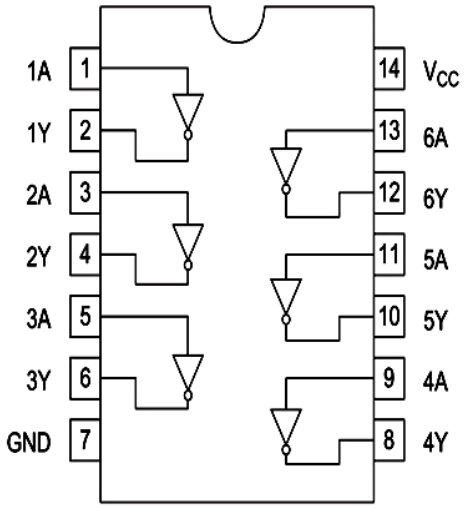
1. 5V LED bulb
2. IC 7404 (NOT gate)
3. IC 7400 (NAND gate)
4. Pulse Switch
5. Water Pump
6. 5V Relay
7. IC 555
8. 5v DC power supply

Component Description:

1. 5V LED bulb:

It is an electric light for use in light fixtures that produces light using one or more light – emitting diodes(LEDs). LED lamps have a lifespan many times longer than equivalent incandescent lamps, and are significantly more efficient. LEDs come to full brightness immediately with no warm-up delay. Frequent switching on and off does not reduce life expectancy.LED lamps are used for both general and special-purpose lighting. Where colored light is needed, LEDs that inherently emit light of a single color require no energy-absorbing filters. In our project LED bulb is used to indicate water level.

2. IC 7404 (NOT Gate)



Input	Output
A	Y
0	1
1	0

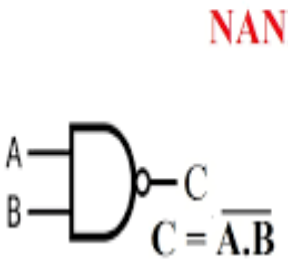
NOT gate or an inverter is a logic gate which implements logic negation. These are single input device which have an output level that is normally at logic level ‘1’ and goes “LOW” to a logic level ‘0’ when its single input is at logic level ‘1’ and vice-versa.

In our project we have used NOT gate for inverting INPUT of j-k flip flop i.e inverting L.

J	K	OUTPUT
1	0	1
0	0	1
0	1	0
0	0	0
1	0	1

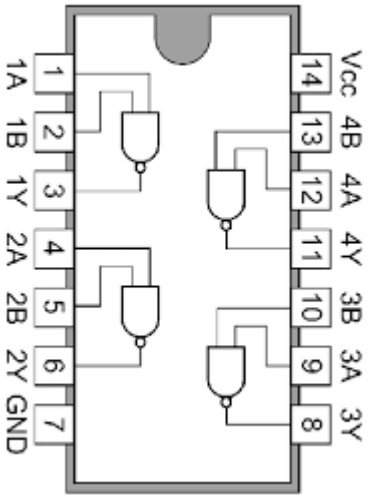
L	U	OUTPUT
0	0	1
1	0	1
1	1	0
1	0	0
0	0	1

3. IC 7400 (NAND GATE):



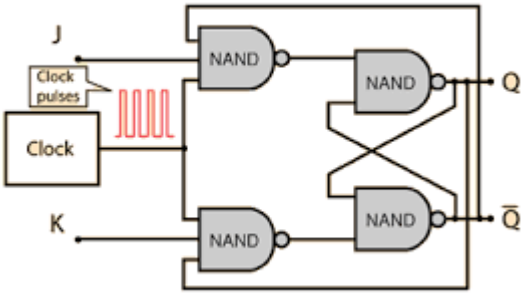
Truth Table

INPUT		OUTPUT
A	B	A NAND B
0	0	1
0	1	1
1	0	1
1	1	0



A NAND gate is a logic gate which produces an output which is false only if all its inputs are true.

In our project NAND gate IC is used to design the J-K flip flop.



The JK flip flop is basically a gated SR flip flop with the addition of a clock input circuitry that prevents the illegal or invalid output condition that can occur when both inputs S and R are equal to logic level “1”.Due to this additional clocked input a JK flip-flop has four possible input combinations, “logic 1”, ”logic 0”, ”no change” and “toggle”.

4. Pulse Switch:

A Switch is a device that **makes** or **breaks** a circuit or a contact. As well, it can convert an analog data into digital data. The main requirements of a switch to be efficient are to be quick and to switch without sparking. The essential parts are a switch and its associated circuitry.

In our project it is used to handle the emergency situation i.e like for today there is sufficient water in the tank and it will refill itself tomorrow but suddenly you got the news that there will be a power cut tomorrow, so you need to restart the motor again to refill it, for this situation there is the pulse switch which switches the motor again even if there is water more than 25% and refill the tank upto 100% and then stops.

5. Water Pump: (230v AC)

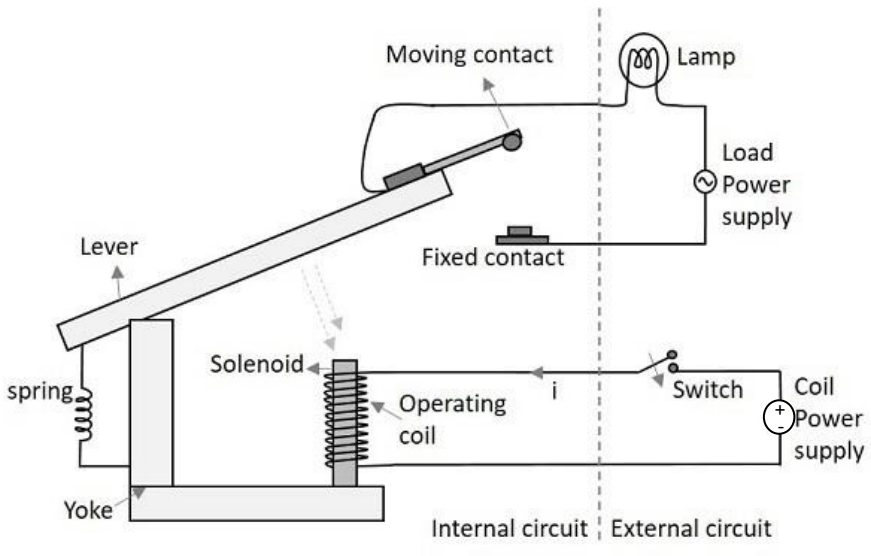
It is a mechanical device used to transfer liquid of various type. it relies on the principle of centrifugal force. As the name implies, waterpump pumps water. They are generally centrifugal pump consist of a rotating impeller inside a stationary volute (casing). Liquid enters the pump through the suction inlet into the eye of impeller. The speed of rotating impeller then forces the liquid out through the discharge nozzle. In our project the water pump is used for the purpose of filling the water in the tank.

6. 5v RELAY:

Electromechanical switches are also called as **Relays**. These switches are partially mechanical and partially electronic or electrical. These are greater in size than electronic switches and lesser in size than mechanical switches.

Construction of a Relay

A Relay is made such that the making of contact supplies power to the load. In the external circuit, we have load power supply for the load and coil power supply for controlling the relay operation. Internally, a lever is connected to the iron yoke with a hard spring to hold the lever up. A Solenoid is connected to the yoke with an operating coil wounded around it. This coil is connected with the coil power supply as mentioned.

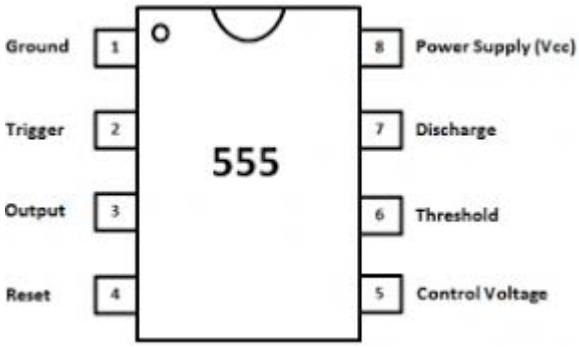


Working of a Relay

When the Switch is closed, an electrical path is established which energizes the solenoid. The lever is connected by a heavy spring which pulls up the lever and holds. The solenoid when gets energized, pulls the lever towards it, against the pulling force of the spring. When the lever gets pulled, the moving contact meets the fixed contact in order to connect the circuit. Thus the circuit connection is ON or established and the lamp glows indicating this.

When the switch is made OFF, the solenoid doesn't get any current and gets de-energized. This leaves the lever without any attraction towards the solenoid. The spring pulls the lever up, which breaks the contact. Thus the circuit connection gets switched OFF.

7. IC 555:



The 555 timer IC is an integrated circuit(chip) used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip flop element.

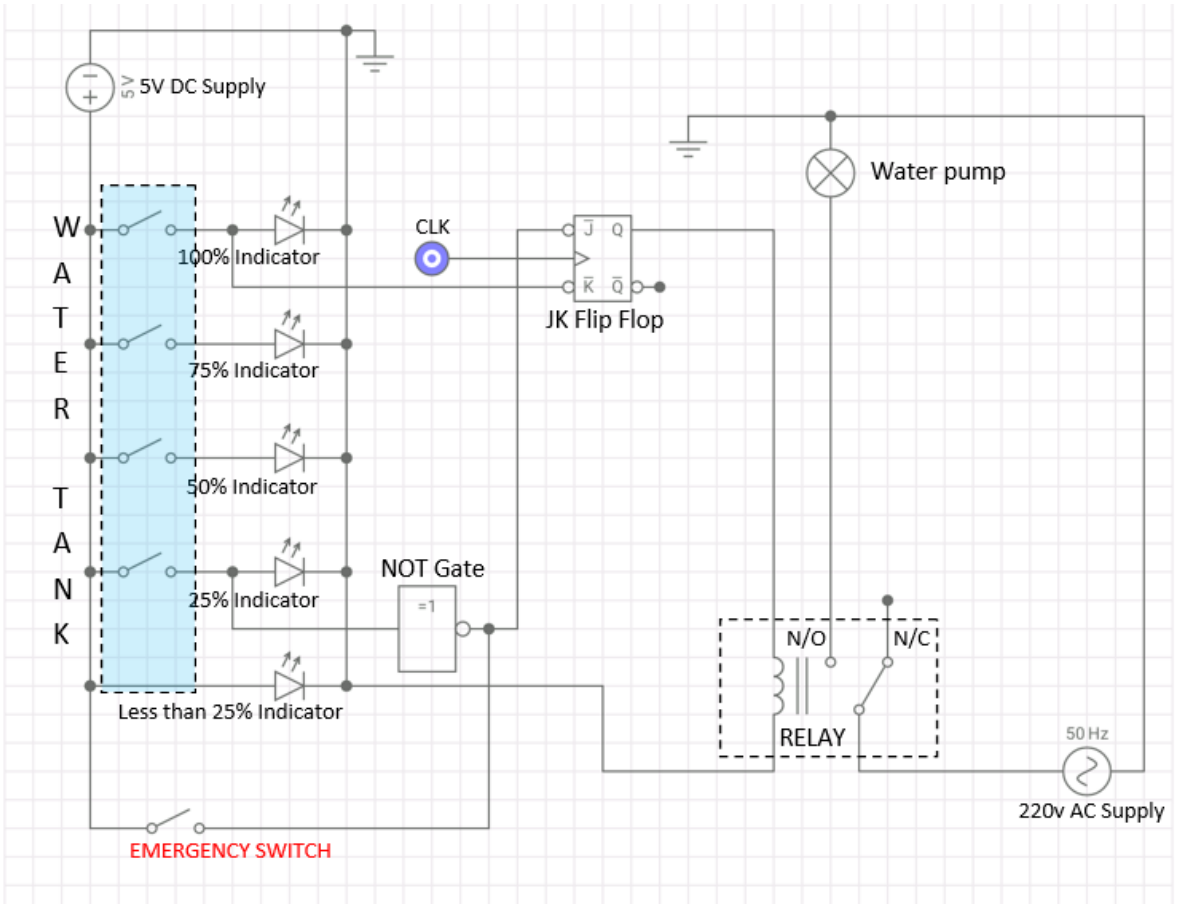
In our project IC 555 is used to generate clock pulse for JK flip flop.

8. 5v DC Power Supply:

A 5V DC battery/bench power supply is used to power up the entire circuit.

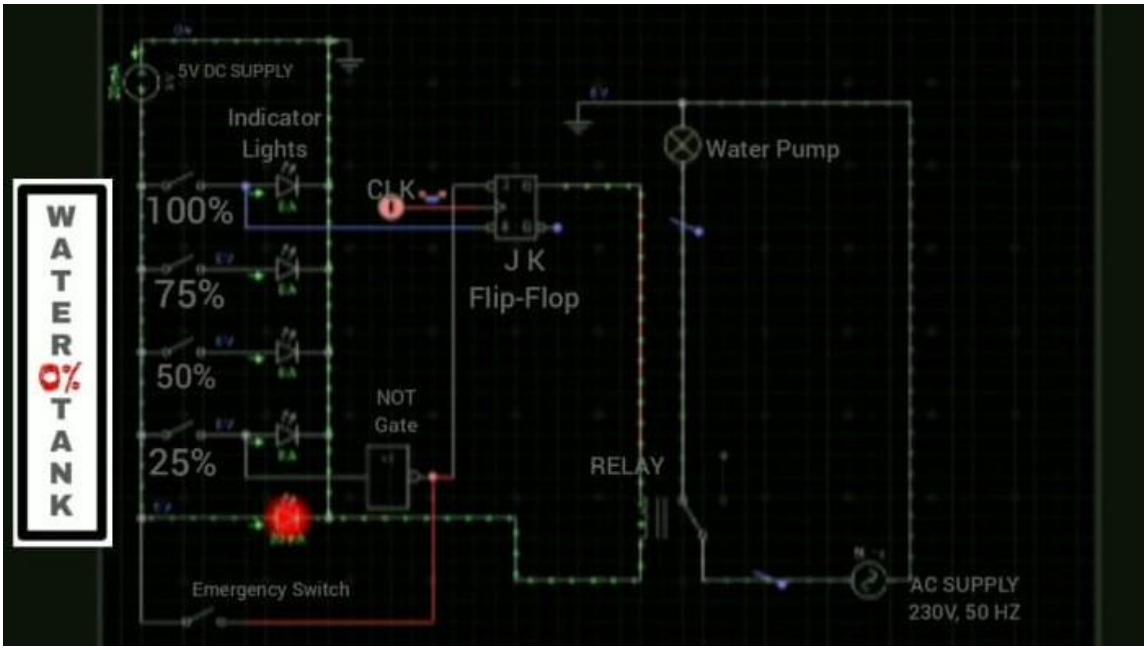
METHODOLOGY:

The water tank and its inside and outside circuit is as shown below.

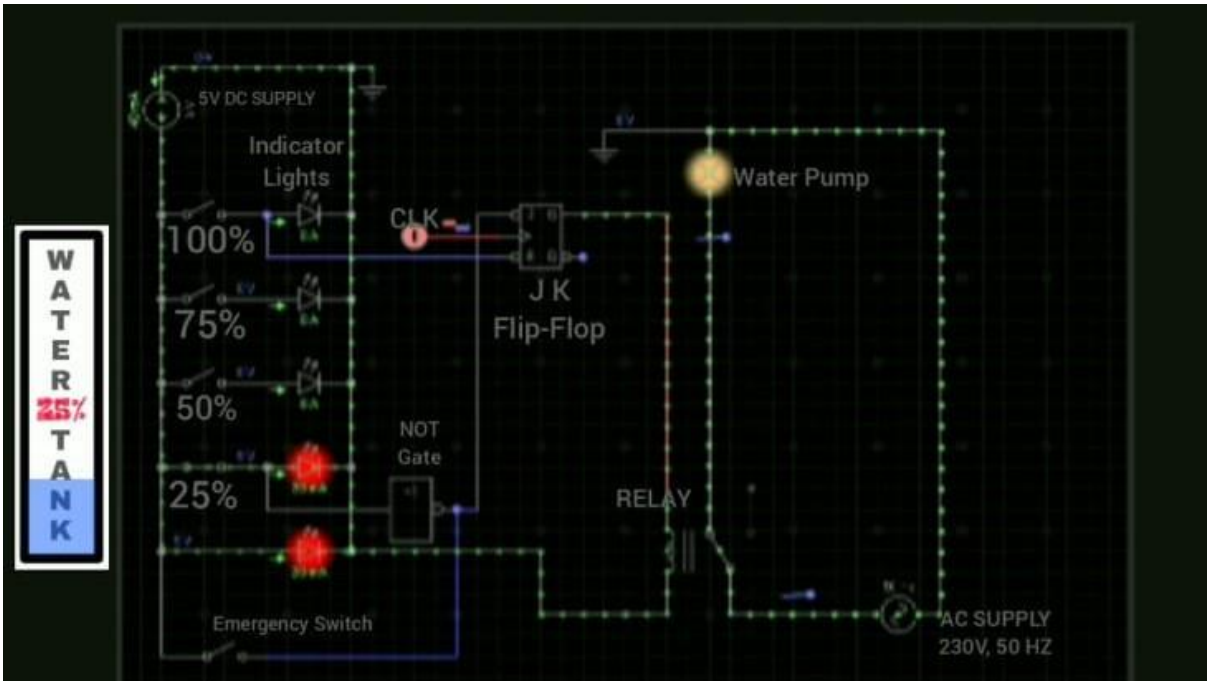


A 5V dc supply is used for both the indicator and controller circuit. In the circuit 5 LED lamps and and a lamp is used for indications. LEDs are used to indicate the percentage of water filled in the tank and the water pump is indicated by a lamp. A J-K flip flop is used in the circuit to control the relay. A NOT GATE is connected through the lower level of the tank to the J input of the flip flop and the upper level of the tank is connected to the K input of the flip flop. A clock pulse is given through the 555 timer IC to the J-K flip flop which controls its output. A relay is used to switch the motor ON/OFF position. There is also an **emergency switch** to be operated manually.

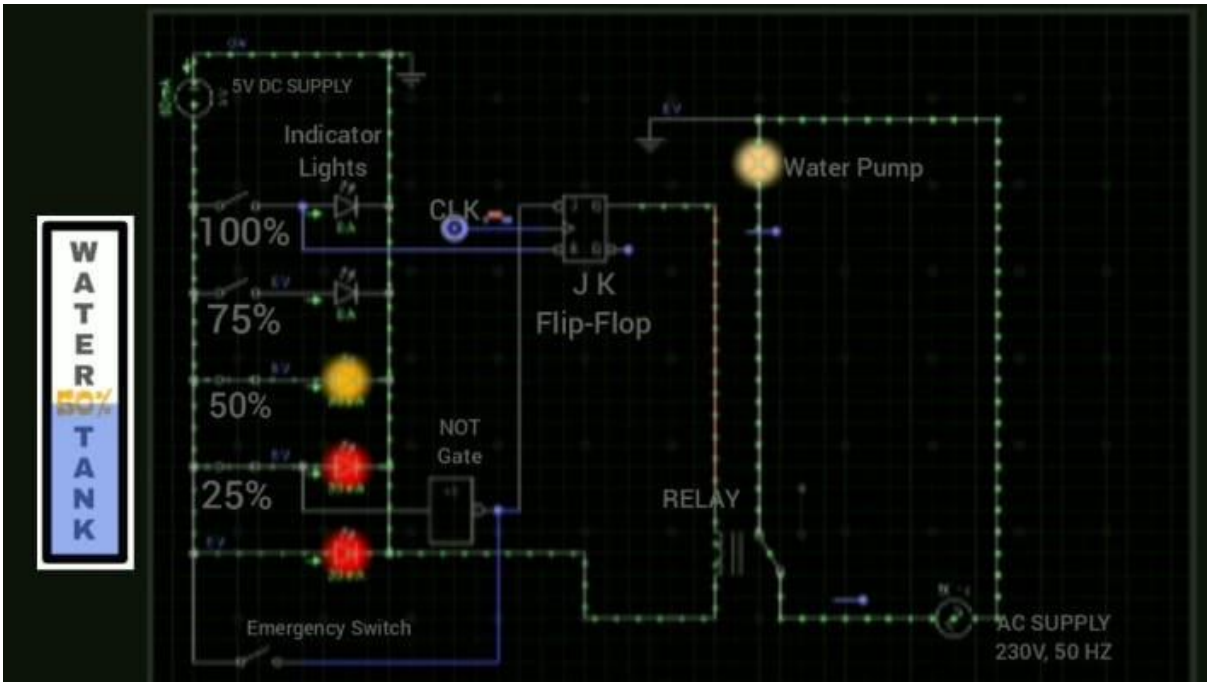
At the initial stage the water availability in the water tank is 0%. So according to our circuit connections, the water pump starts automatically. The water pump is made automated by the help of relay connected in series with the pump. The relay is an electromagnetic switch which is used to turn off or turn on using low power operating system. Here we have used JK flipflop and a NOT GATE connected to J terminal input. The initial condition needed to turn ON the water pump is obtained by connecting circuit as given below:



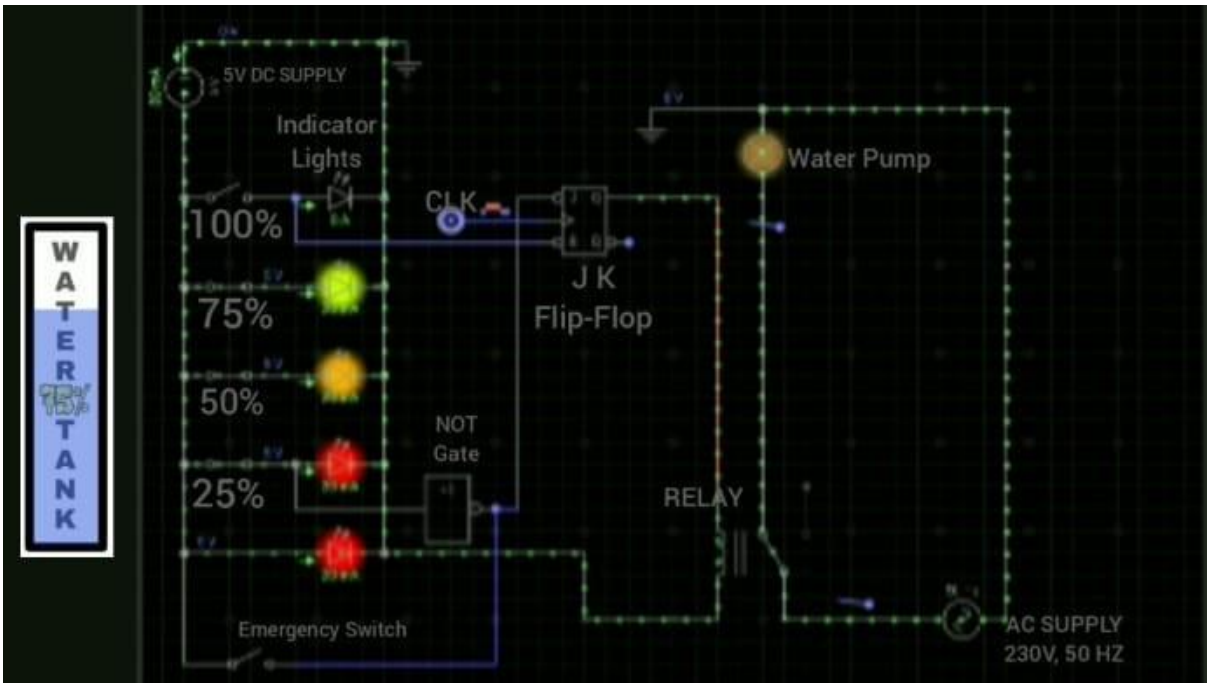
Then the water pump runs and the water gets filled up in the tank. When the water reaches upto 25% of the tank, then the water helps in turning on low level switch and the LED glows, thus indicating water content of the tank is 25%.



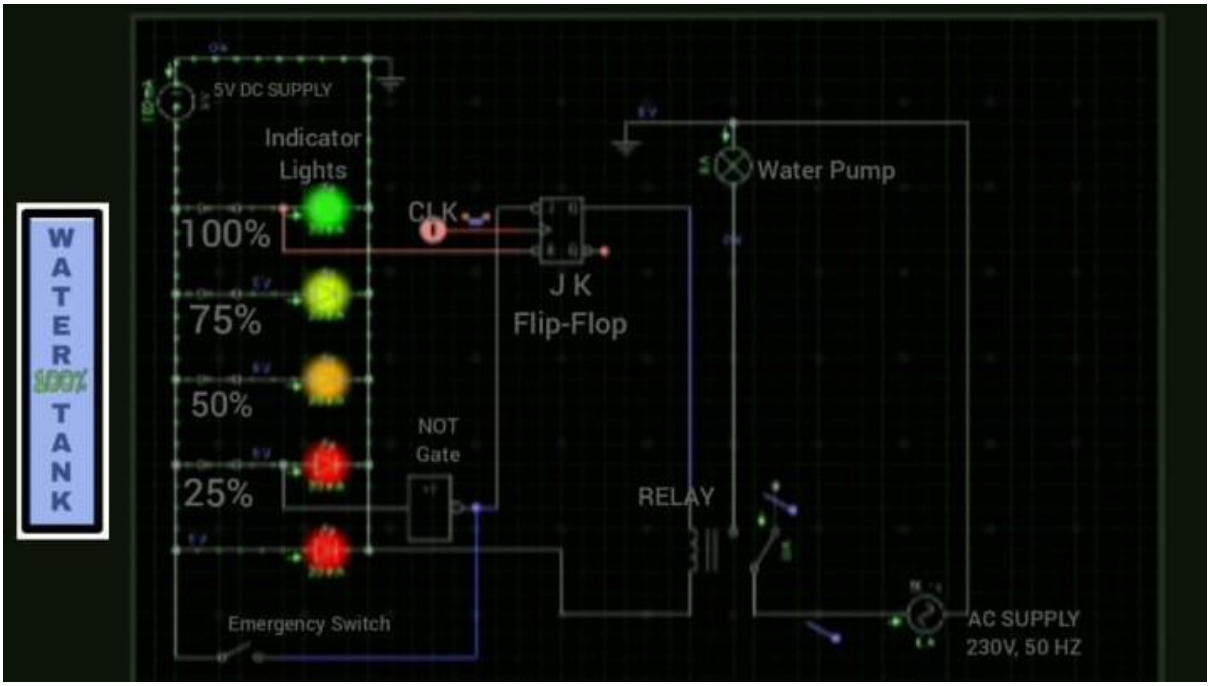
Still the water pump is running and eventually the water level in the tank rises slowly. When the water level reaches upto 50%, then it switches on 50% water level indicator.



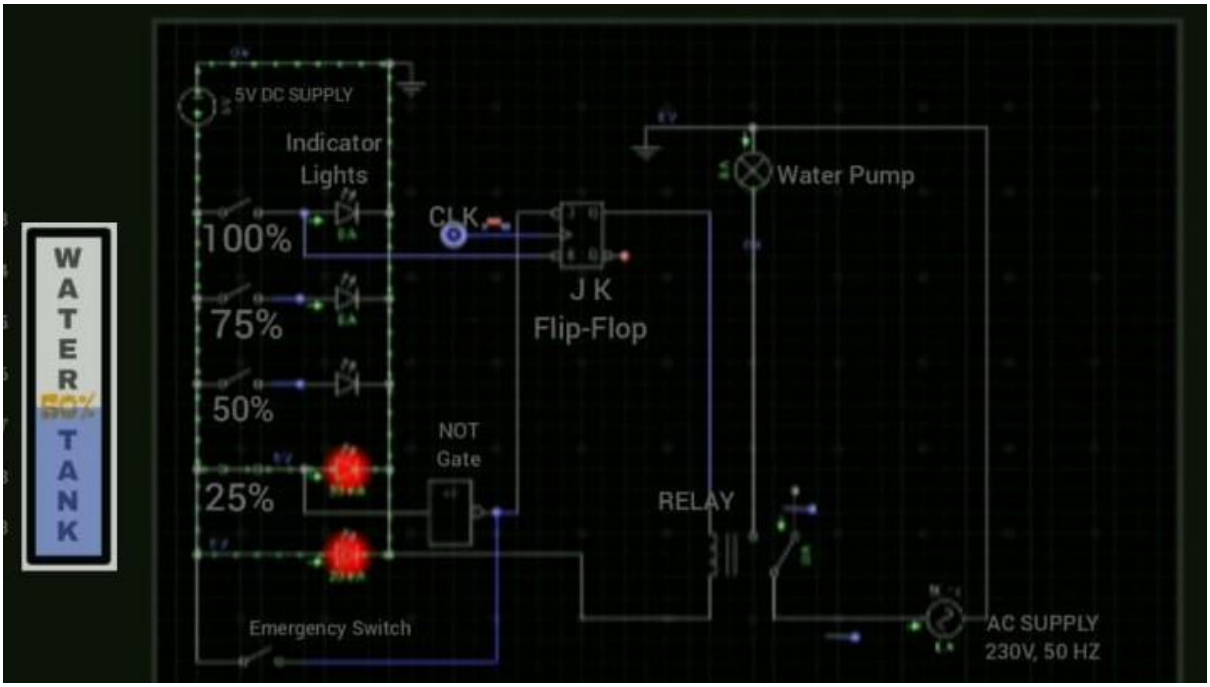
Still the water pump is running and eventually the water level in the tank rises slowly. When the water level reaches upto 75%, then it switches on 75% water level indicator.



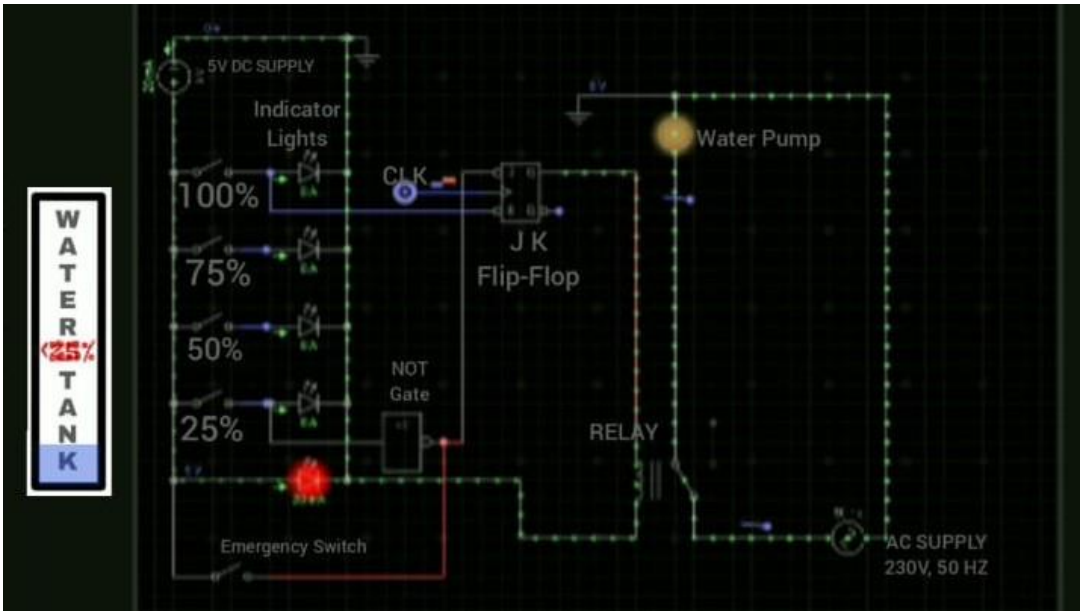
While the water pump is running, the water level rises slowly and reaches upto 100%, thus it turns on the 100% indicator and switches OFF the water pump. Because now the J terminal gets low and the K terminal gets high for which the output is always low voltage. So, the water pump stops running, thus the water flow to the tank.



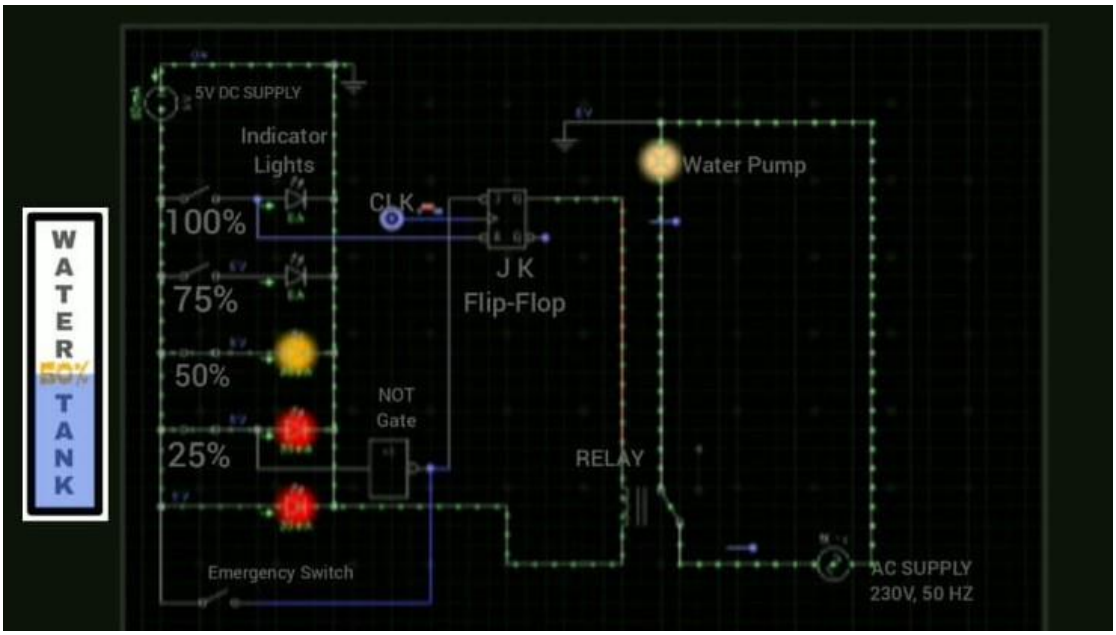
The water in the tank decreases slowly as we use the water frequently to meet various needs. Eventually with the decrease in water level, the level indicators turns OFF one by one. Even though the water level in the tank is not 100%, the water pump remains off because of NO CHANGE condition in J-K flipflop, which helps in getting desired output.



Slowly the water level reaches to 25% and then less than 25%, the 25% level indicator gets turns OFF. The water pump switch is turned ON and the water continues to flow in the tank and the above process again continues till the water in the tank is 100%.



Now let's assume a special case when we have a condition like the water in the tank is sufficient for today and it will refill itself tomorrow. But you got the news that there will be electric power cut tomorrow. So, you need to restart the motor again to refill it. So, for this situation there is an emergency switch, which is a pulse switch. It switches ON the motor again even if there is water more than 25% available and refill the tank upto 100% and then stops.



ADVANTAGES AND APPLICATIONS:

The Flexible water level controller and indicator is very useful gadget for house hold and industrial applications. It can be used for various fluid level controls in industries etc. Following are the few advantages and applications listed.

Advantages

 Easy installation.

 Low maintenance.

 Compact and elegant design

 Users can control the required level of water in over head tank.

 Avoids wastage of water from tanks.

 It can maintain exact preset water levels.

 The system is very versatile, a numbers of tailor made variations like control of multiple tanks or multiple pumps are possible.

 Being automatic saves man power.

Applications

 Used in buildings where the manual monitoring is difficult.

 Used in industries to control the water level and in chemical mixing etc.

 It can be installed in metro cities where the drinking water is the only water used for all purposes which keeps the drinking water from being wasted.

FUTURESCOPE

Main intension of this project is to establish a flexible, economical and easy configurable system which can solve water losing problems. In the near future as home automation web based water level monitoring and controlling system can be designed, through which the system can be controlled from any place via internet through mobile phone. A GSM module can be integrated so as to receive the current status via SMS in registered cell-phones. It can be modified and put to great use like taking preventive steps when some natural calamities like floods, drainage overflows etc are detected and for avoiding highly in-toxic liquid overflows in chemical plants etc. This could save precious lives of number of living beings. Also the assets purchased from hard earned money could be refrained from getting damaged with the prior information from such automated indicators and controllers.

CONCLUSION:

This paper was intended to design a simple and low cost automatic water level indicator and controller. This is not only for water tank but also can be used for various liquids & oil level in industries and chemical labs too. To design this system, we used transistor as a platform connected to relay along with local materials for low cost. We tried to design a system in such a way that its components will be available easily and when connected together, will be able to prevent the wastage of water. The whole system operates automatically. So it does not need any expert person to operate it. It is not at all very expensive. This design has much more scope for future research and development. Though it is a project, we hope some modification in this project will lead to a reasonable diversity of usage.

ACKNOWLEDGEMENT

This project opportunity that we got during Electrical Measurement and Instrumentation Lab was a great chance of learning and development in practical aspect. Therefore we as a team consider ourselves lucky as we developed team aspects like being and working as a team together. We perceive this opportunity as a big milestone in our career development and we will strive to use this acquired skills and knowledgement in the best possible way in future.

We express our sincere gratitude to Mr. Jatin Kumar Pradhan for giving this opportunity and inspiring us to do better.