FINAL SEMESTER PROJECT

DIGITAL LOGIC DESIGN

Design Project: Water Level indicator using flip flops

Course: EE 223 Digital Logic Design

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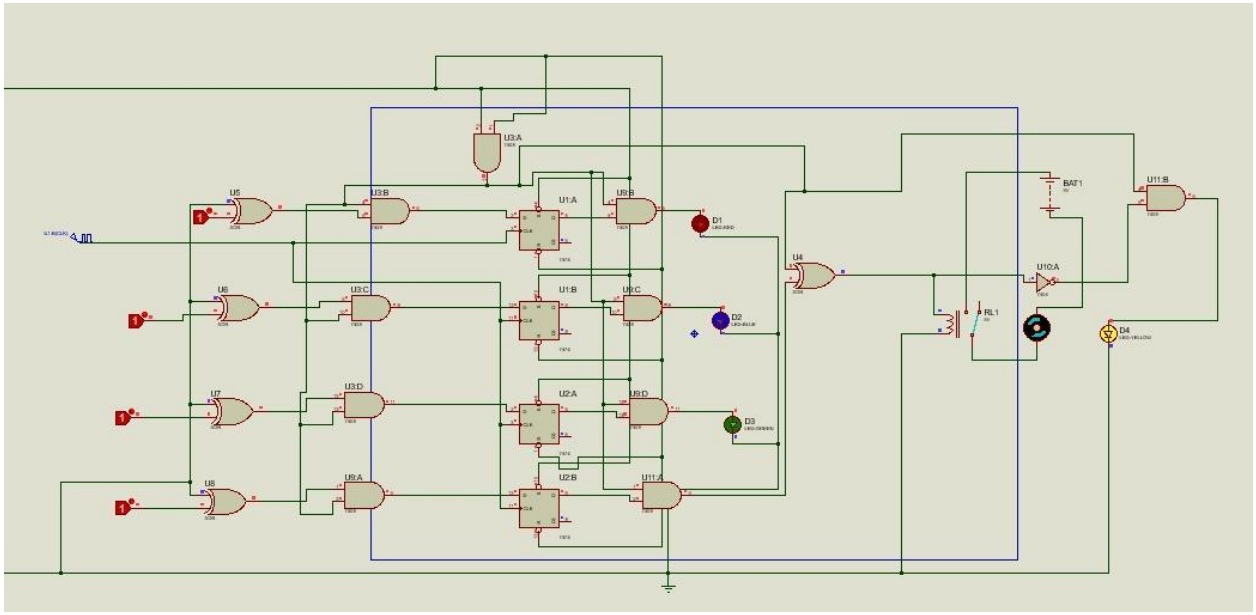
Introduction:

This Project mainly aims at optimizing the use of water. With its help we can detect the level of water so when it reaches the desired level in the specific tank it does not overflow and helps in saving water and electricity. We have used flip flops logic gates and switches to make the water level indicator.

Objective:

I. Learn the working of water level indicators.
II. Indicate the level of water when the motor.
III. Motor off when the water reaches the highest level.

Circuit Diagram:



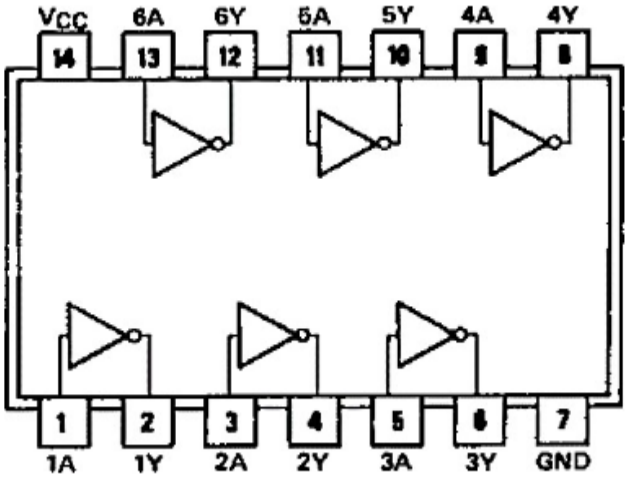
Required Equipment s :

1. IC 7404.
2. IC 7408.
3. IC 7474.
4. IC 7486.
5. Battery.
6. Relay.
7. Motor.
8. LED s.

7404(NOT gate)

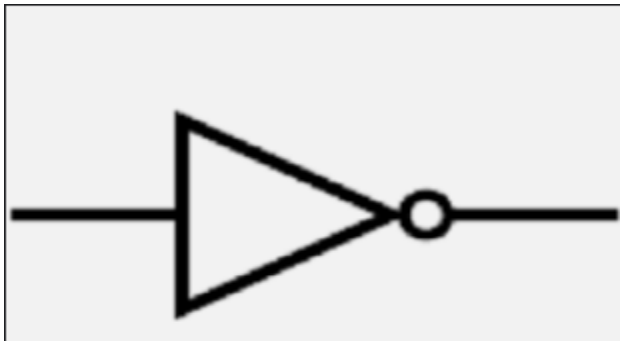
7404 is a NOT gate IC. It consists of six inverters which perform logical invert action. The output of an inverter is the complement of its input logic state, i.e., when input is high its output is low and vice versa.

Pin configuration:



IC 7404:

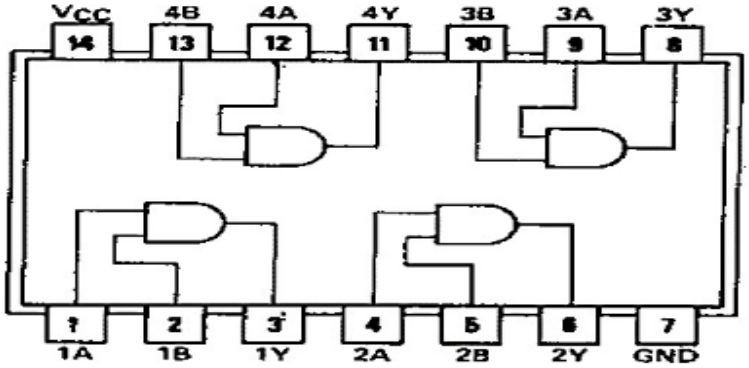
SYMBOL:



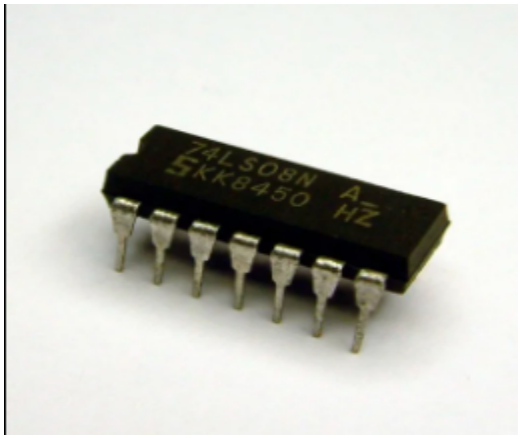
7408(AND gate)

The 7408 is a QUAD 2-Input AND gates and four independent gates each of which performs the logic AND function. It comes in 14-pin DIP package.

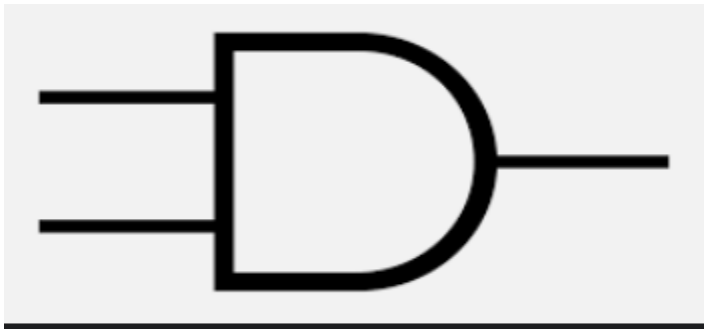
Pin configuration:



IC 7408:



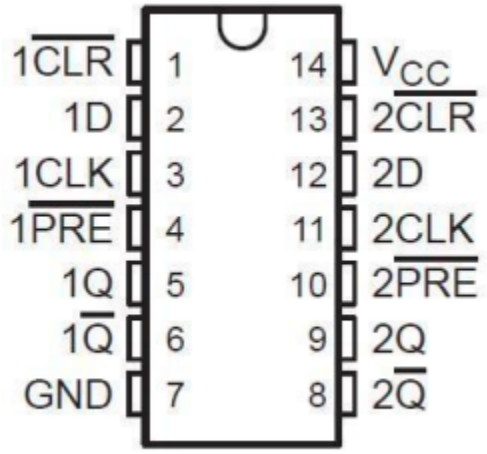
SYMBOL:



7474(D flip flops)

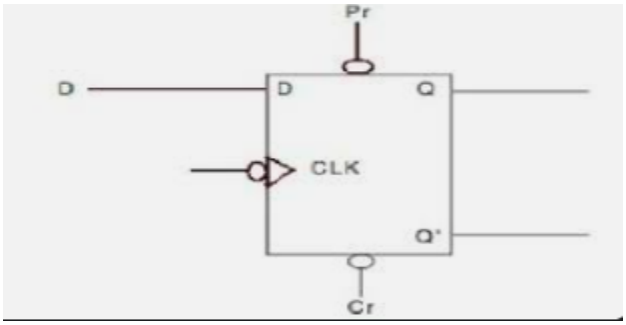
The Integrated-Circuit D Flip-Flop (7474) The 7474 is an edge-triggered device. The Q output will change only on the edge of the input trigger pulse. The small triangle on the clock (Cp) input of the symbol indicates that the device is positive edge-triggered.

Pin configuration:



IC 7474:

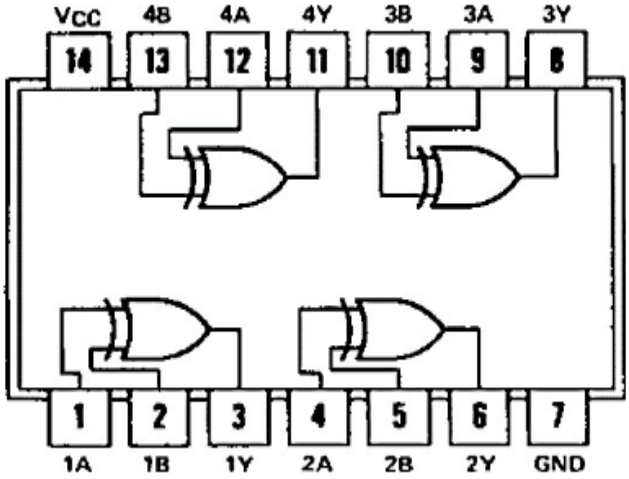
SYMBOL:



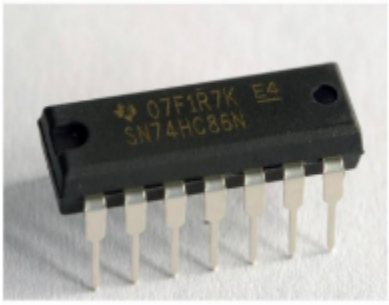
7486(XOR gate)

7486 is a 14 pin IC which is used to perform EXCLUSIVE-OR gate logic function in circuit, 7486 having 1 VCC and 1 GND pin, and 8 input pins and 4 output pins. Input/output pins are placed in pairs of 3 pins(2 pins for input and 1 for result/output), one IC can connect up-to 4 devices.

Pin configuration:



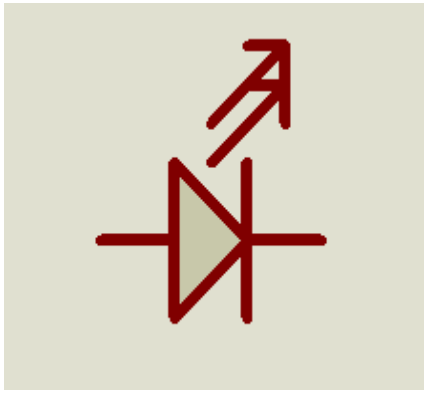
IC 7486:



SYMBOL:

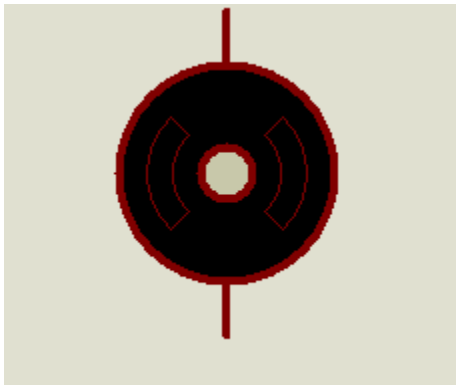
Led

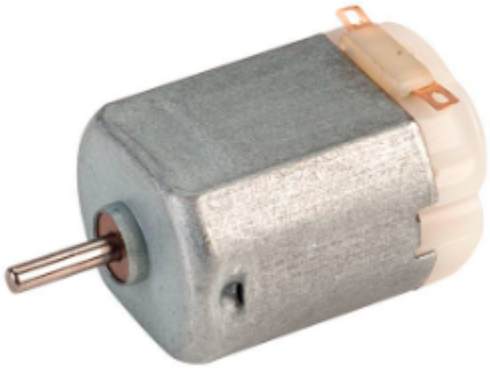
A Light Emitting Diode (LED) is a semiconductor device, which can emit light when an electric current passes through it. To do this, holes from p-type semiconductors recombine with electrons from n-type semiconductors to produce light.



Motor

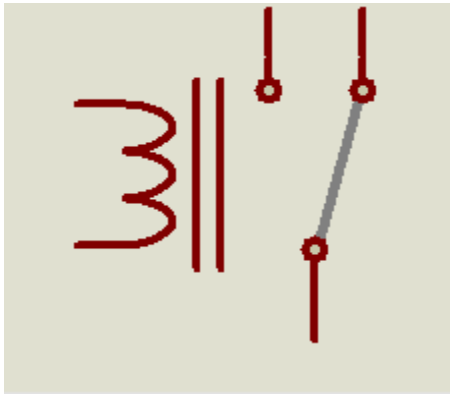
An electric motor is a device for converting electrical energy into mechanical energy in the form of rotation. In an electric motor, the moving part is called the rotor and the stationary part is called the stator.

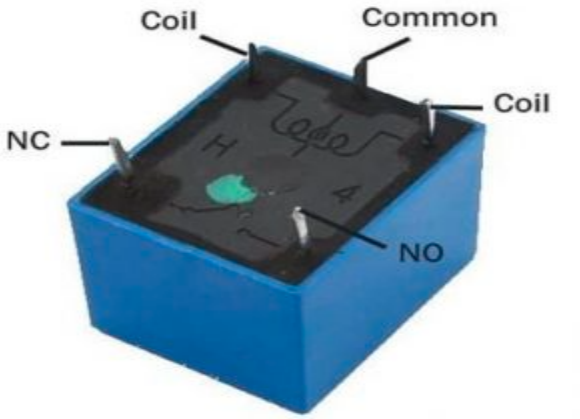


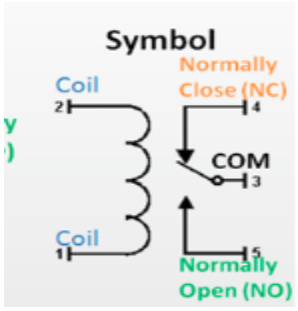


Relay

Relays are electrically operated switches that open and close the circuits by receiving electrical signals from outside sources.

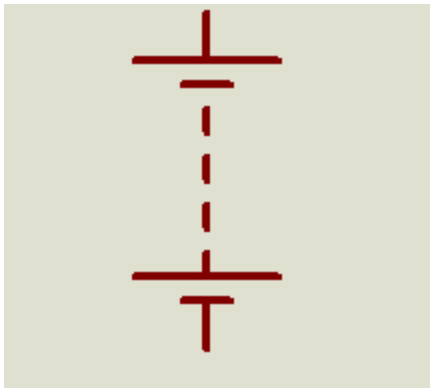






Battery

A battery is a device that stores chemical energy and converts it to electrical energy. The chemical reactions in a battery involve the flow of electrons from one material (electrode) to another, through an external circuit. The flow of electrons provides an electric current that can be used to do work.



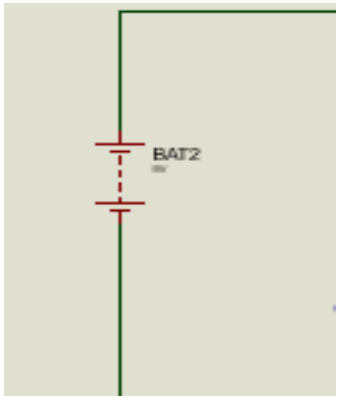
Working principle:

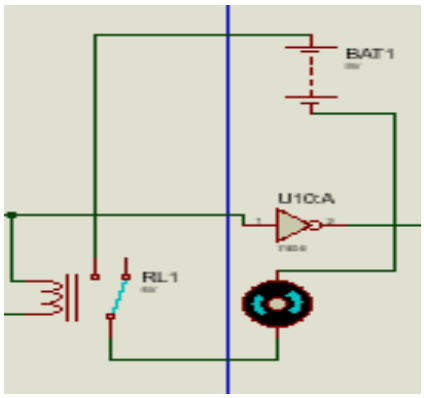
Water level indicator works on the principle of saving water as we have indicated 4 levels in our circuit when water is full and it reaches to the extent of the fourth level the motor will be stopped automatically.we have used leds to indicate that the specific level of the water is reached.
Flip flops will store the inputs of leds until the clock triggers. Also when the level of water decreases, the motor will turn on when the switch is on.

Steps:

Battery:

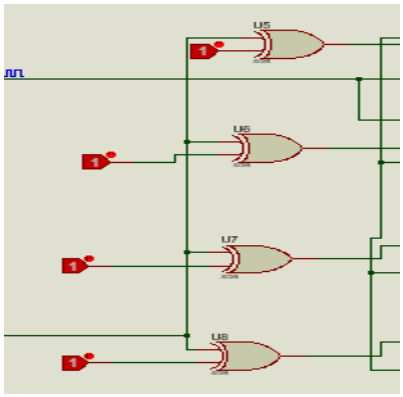
- Two batteries are connected, one is connected to the input and other is connected to the relay.
  - 1st battery positive terminal is given in the tank so that it will give the input when water reaches that level.
  - 2nd battery is used to derive the motor.





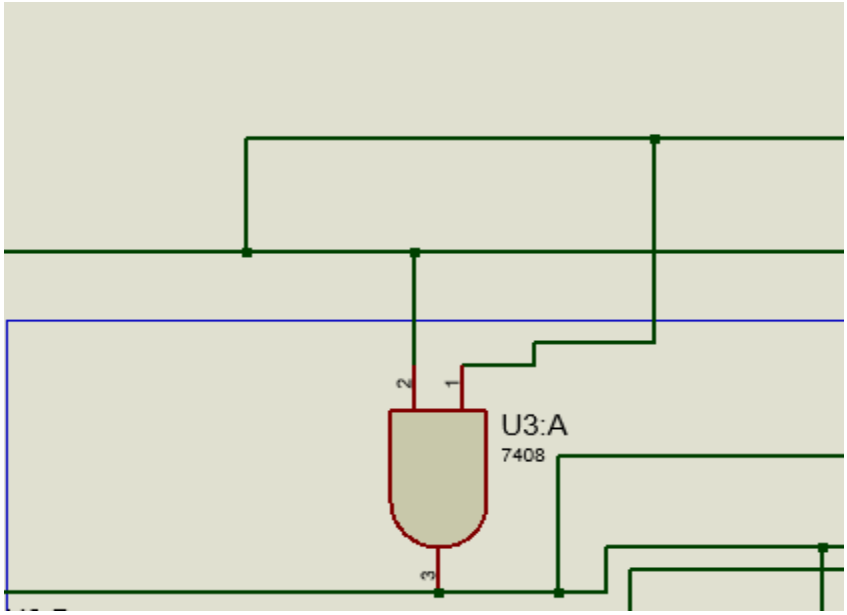
XOR gates:

- We used 4 xor gates to whom we gave input here one will be ground and the other will be in water. In water we have Vcc when water reaches a different level the input will be one and one output will be shown .



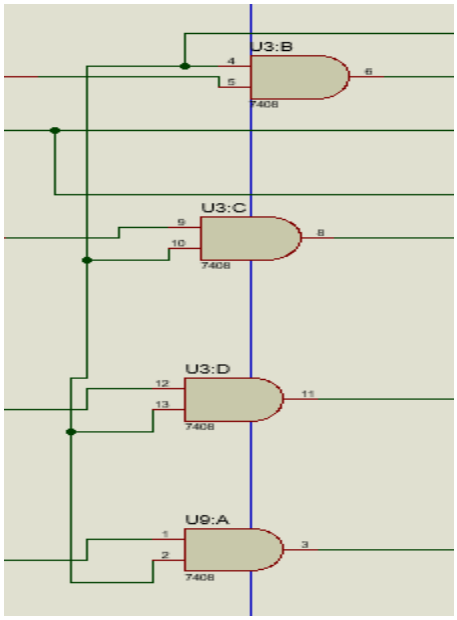
1 AND gate:

- Both set and reset is connected to 1 AND gate and this AND gate output is connected to the 8 further and gate this is done due to this reason if these both are on then the circuit will work otherwise it will be closed.



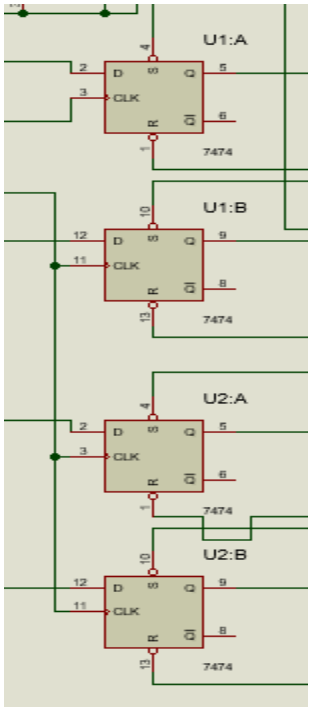
4 AND gates:

- These inputs are the output of the XOR gates at different levels; each gate has one different input and one input is the output of set and reset and. This is done so that the next input will be only one when the set is reset.



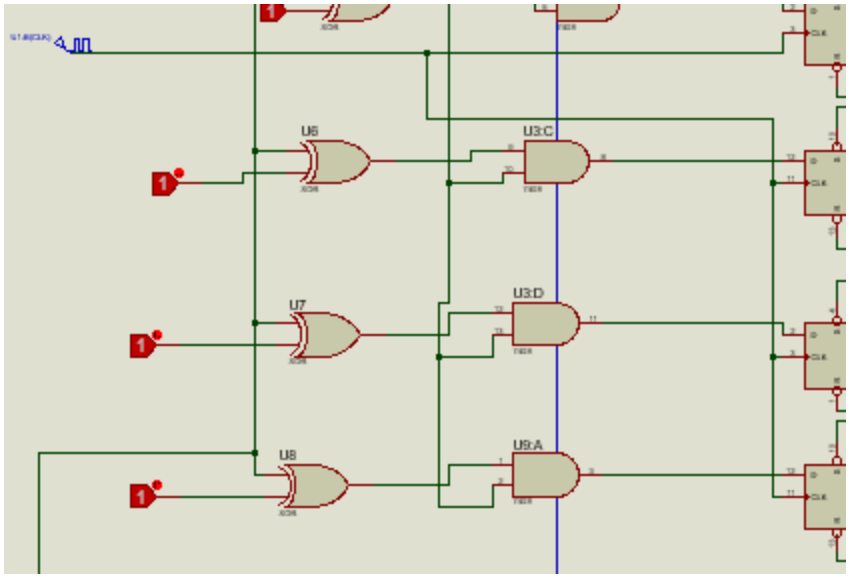
4 D-FLIP FLOPS:

- We used 4 D-flip flops whose inputs were the outputs of the AND gates in d and set and reset are connected to the Vcc so that they will always be one .



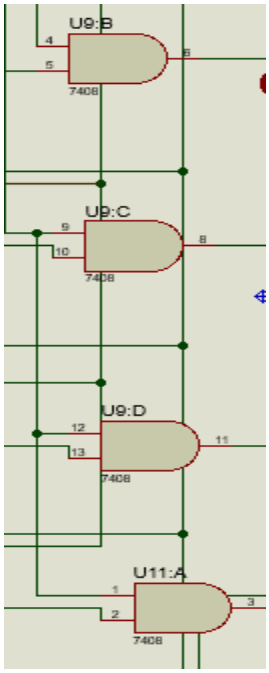
Clock signal:

Clock signal is given as in AC form and flip flop stores the signal till the clock triggers from 0 to 1.

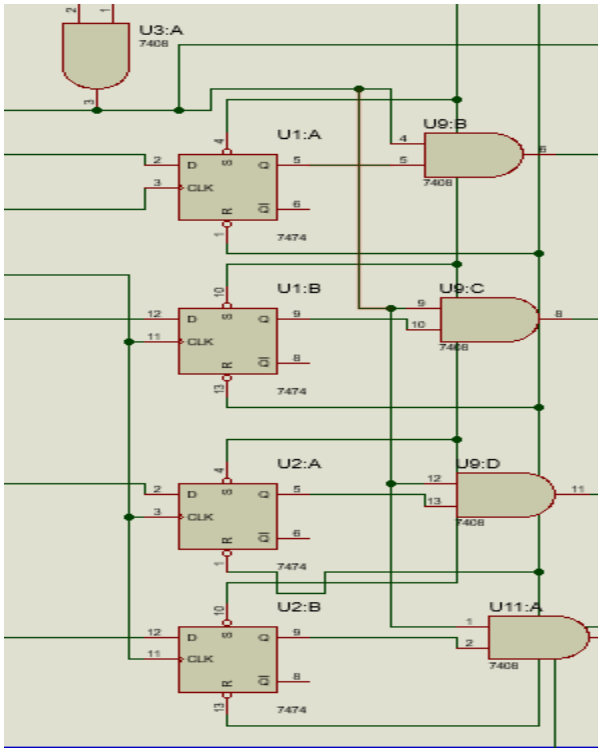


4 AND gates:

4 AND gates are used so that it will give the output to the led s.

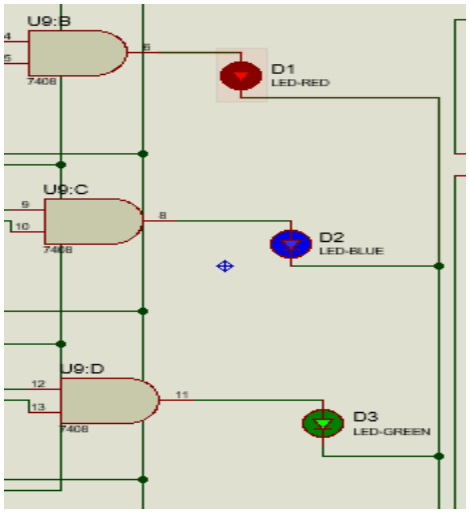


These 4 gates have input one from the output Q coming from flip flop and one from the AND of set and reset.



LED S:

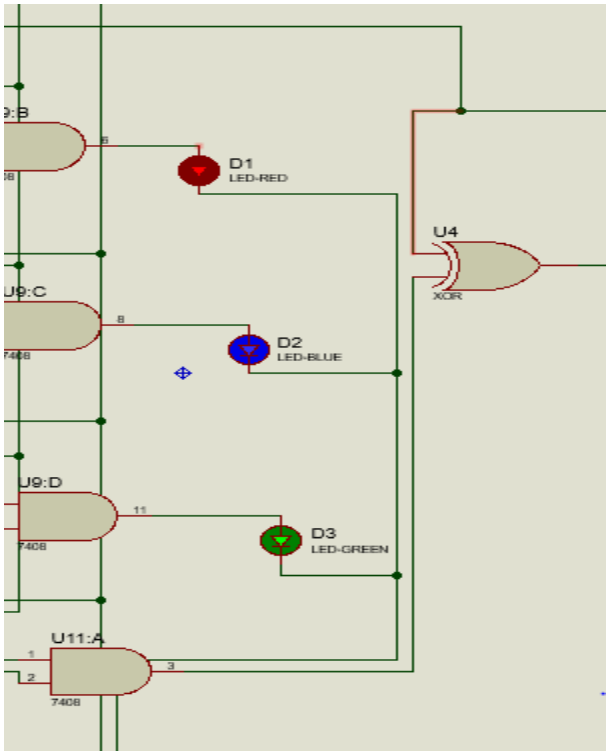
Led s are connected to the output of the last or gate and other terminal is connected to the ground first three levels are directly connected to the led s of different colors.



These led s shows that the water reaches to this level .because as the water reaches to the wire and water have Vcc that gives one input and the led glows .

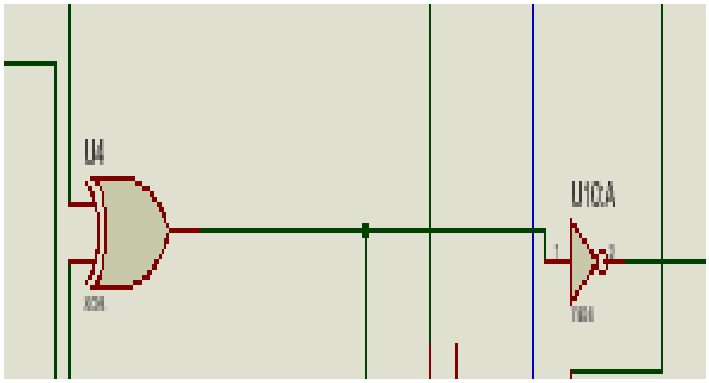
XOR gates:

One XOR gate is connected having on input coming from the set and reset AND and other is the output coming from AND gate of highest level.



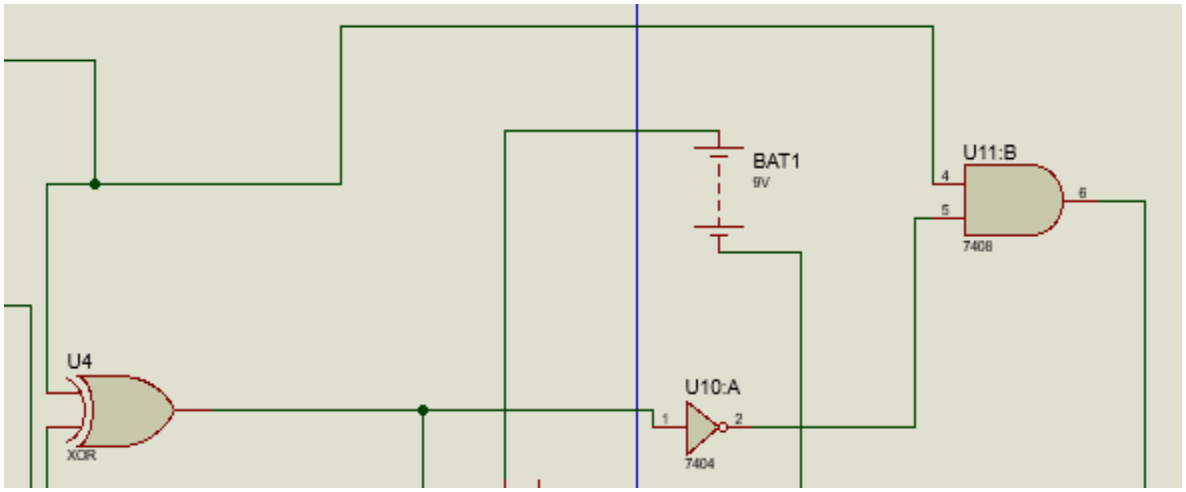
NOT gate:

One NOT gate use which input is the output of the latest XOR gate

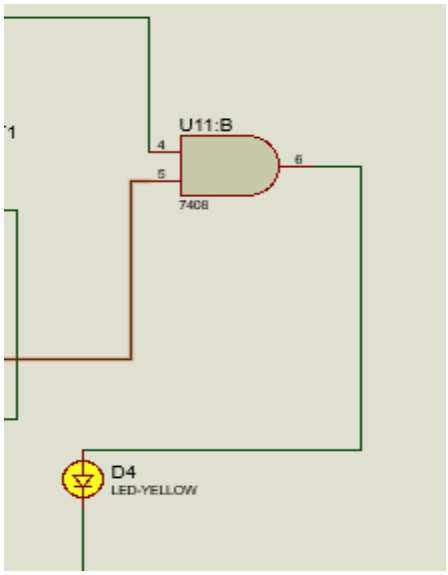


AND gates:

Last and gate is used which has the one input coming from NOT gate and other is and of set and reset.

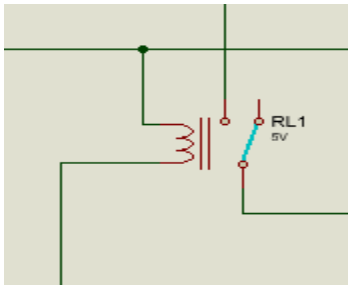


This AND gate is connected to the positive terminal of led and other is connected to the when the input is from tank is 1 the led will glow.



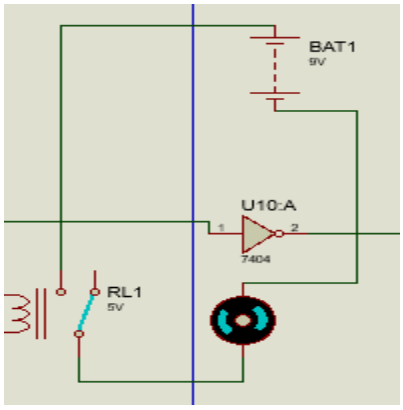
Relay:

One 5v relay is used which is used to drive the motor its input is coming from the XOR gate and battery is connected to it because the motor should be off when the led is on of highest level.



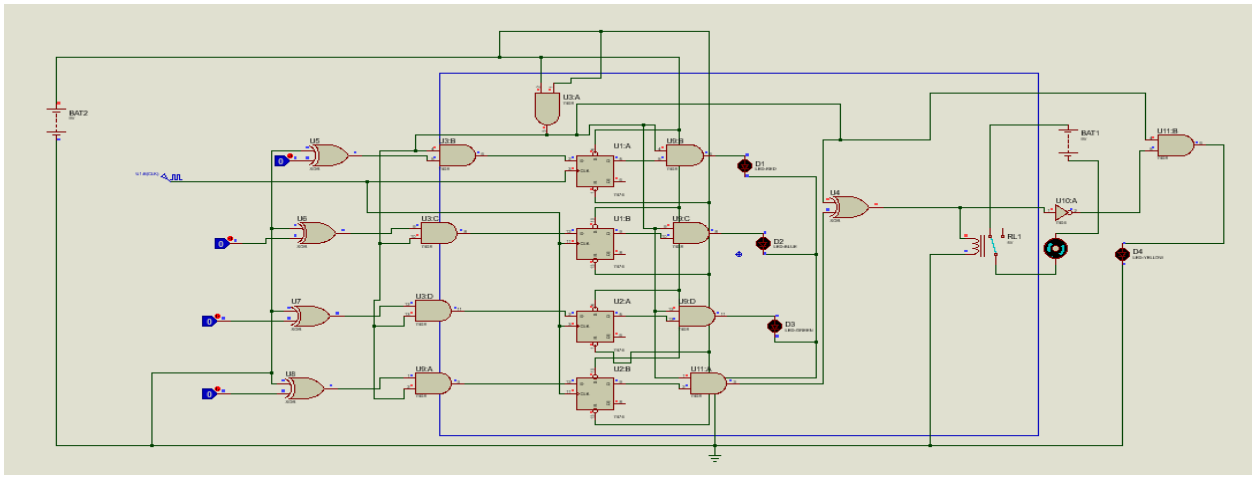
Motor:

One motor is connected to the relay and battery it shows us the water pump that is used to fill the tank.

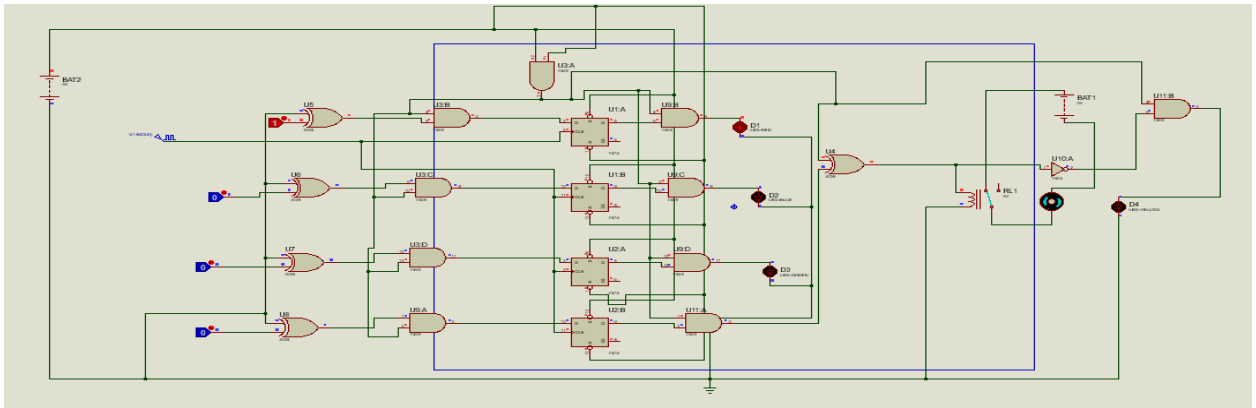


Software Proteus

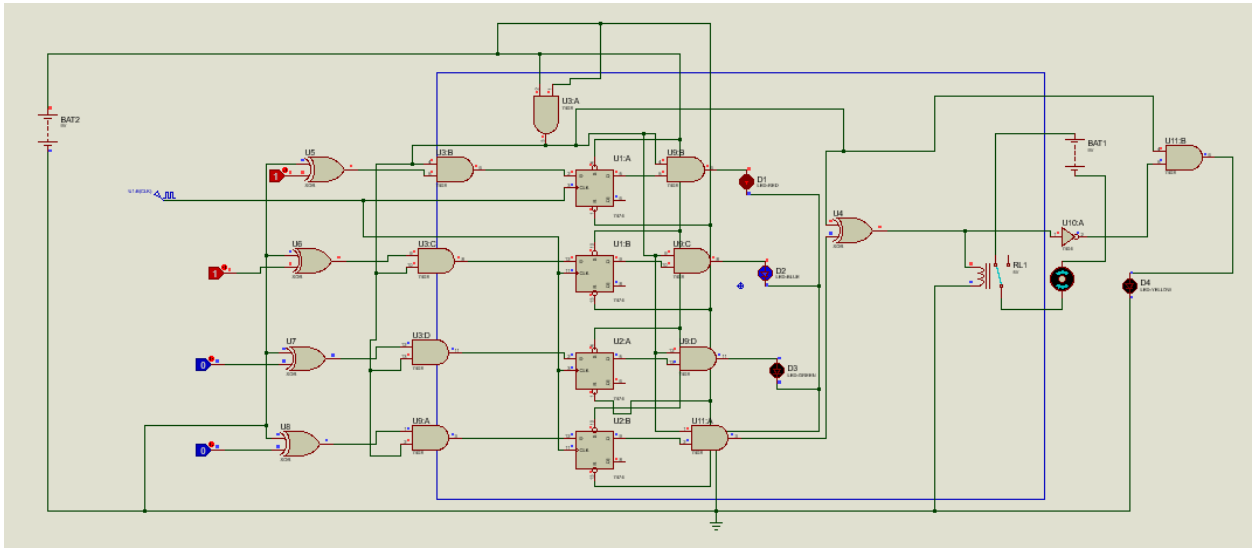
No water:



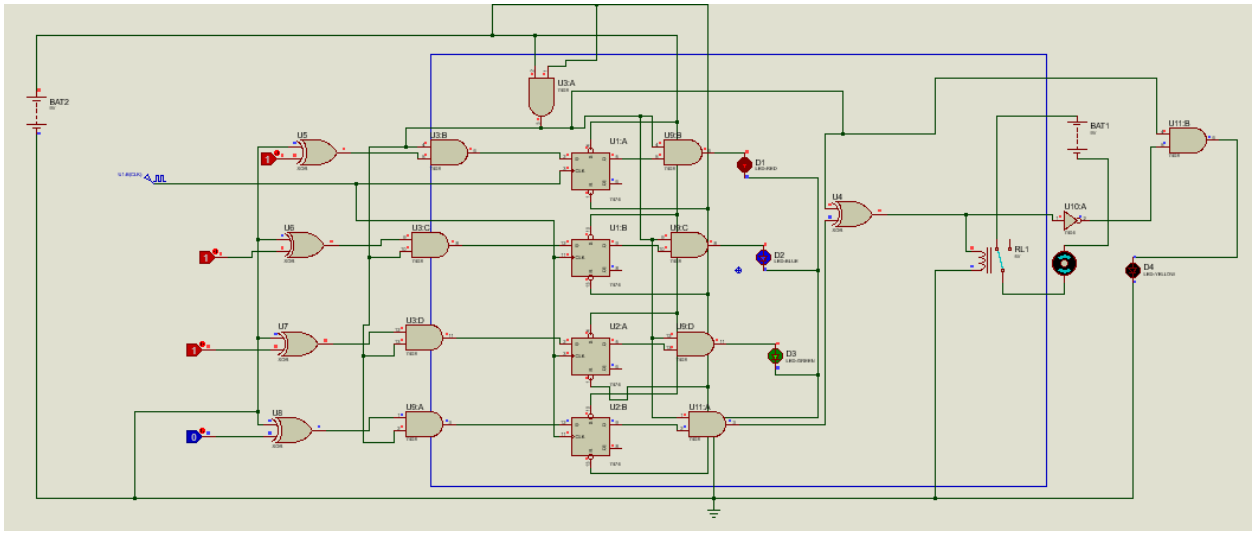
1st level:



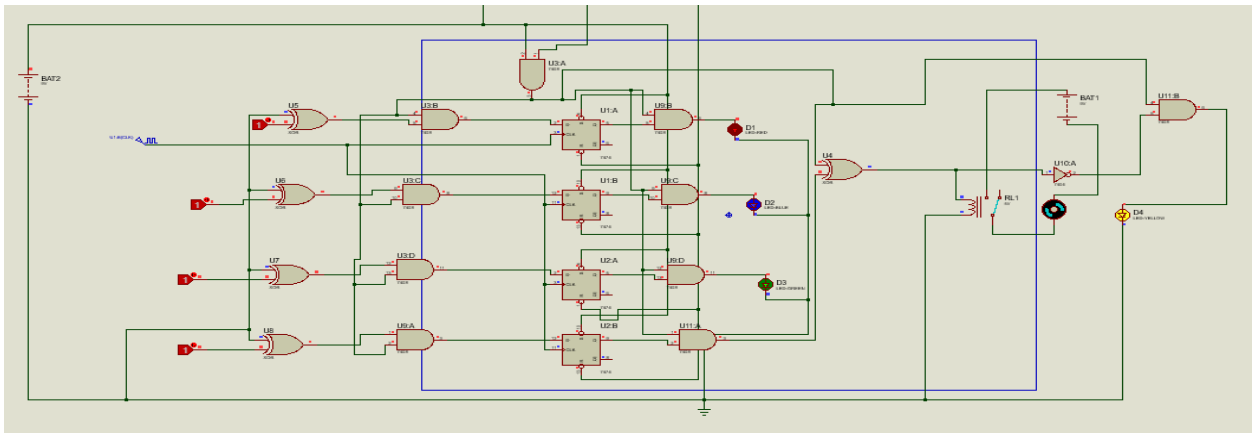
2nd level:



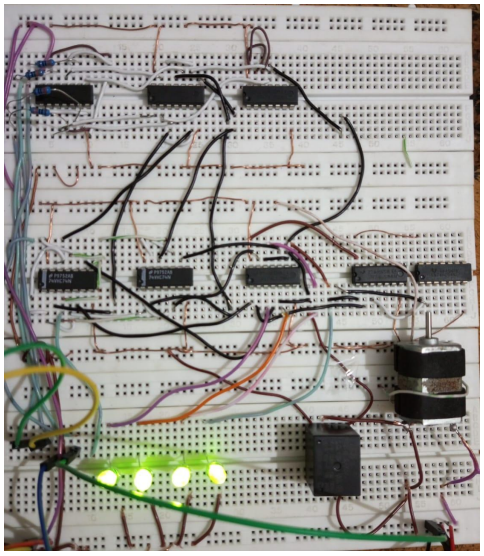
3rd level:

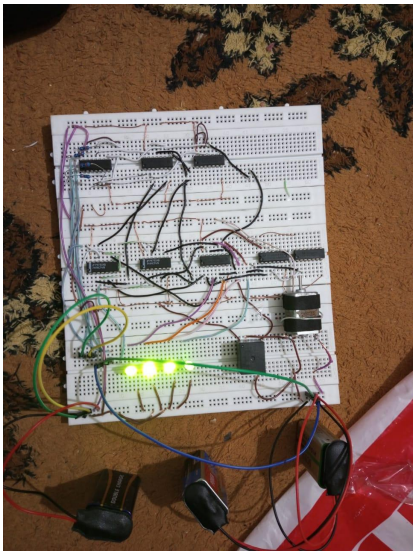


Highest level:



Hardware:





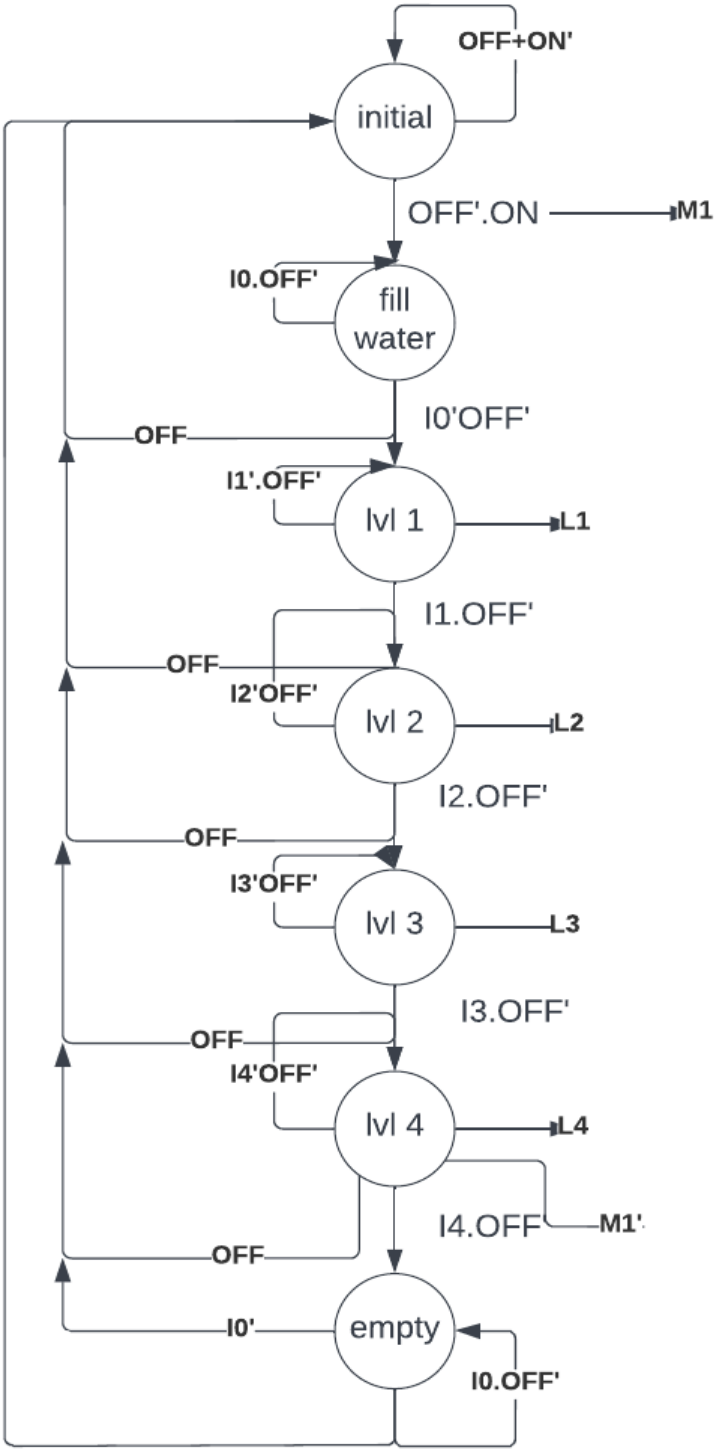
Transaction state:

INPUT SYMBOL	1	0	NAME
ON	START WORKING	No action	Switch
OFF	Stop working	No action	switch
I0	Empty	Not empty	Tank
I1	Filled to level 1	Not filled to level 1	Level one input
I2	Filled to level 2	Not filled to level 2	Level two input
I3	Filled to level 3	Not filled to level 3	Level three input
I4	Filled to level 4	Not filled to level 4	Level four input

Output:

OUTPUT SYMBOL	1	0	NAME
L1	LED ON FOR LEVEL 1	OFF	Red led
L2	LED ON FOR LEVEL 2	OFF	Blue led
L3	LED ON FOR LEVEL 3	OFF	Green led
L4	LED ON FOR LEVEL 4	OFF	Yellow led
M1	MOTOR ON	MOTOR OFF	Water driver motor

State diagram:



STATE TABLE:

PRESENT STATE	TRANSECTION STATE	NEXT STATE	OUTPUT
1000000	OFF+ON' OFF'.ON	1000000 0100000	 M1
0100000	OFF I0.OFF' I0'OFF'	1000000 0100000 0010000	 L1
0010000	OFF I1'.OFF' I1.OFF'	1000000 0010000 0001000	 L1 L2
0001000	OFF I2'.OFF' I2.OFF'	1000000 0001000 0000100	 L2 L3
0000100	OFF I3'.OFF' I3.OFF'	1000000 0000100 0000010	 L3 L4,M1'
0000010	OFF I4'.OFF' I4.OFF'	1000000 0000010 0000010	
0000001	I0.OFF I0+OFF I0'.OFF'	0000001 1000000 0100000	

SIGNIFICANCE:

The significance of water level indicator are as follows.

i. Indicates the level of water.
ii. Saves water.
iii. Saves electricity.
iv. Used in large tanks factories, chemical plants, electrical substation .
v. Can be used in homes.
vi. Rain fall detection ,leakage detection
vii. Can help avoid seepage of walls and roofs due to tanks overflowing
viii. cooling towers use water level indicators to monitor water levels in a tank and make corrective actions based on the level of water. Without water level indicators in a water tank, you would have to manually check whether enough water is in the tank, and should your tank ever go empty,

CONCLUSIONS:

This project was intended to design a simple and low cost water level indicator. This is not only for water tank but also used for oil level and chemical level for home and industries To design this system,we used flipflops,logic gates, relay and batteries .We tried to design a system in such a way that its components will be able to prevent the wastage of water. The whole system operates auto-matically. So it does not need any expert person to operate it. It is not so 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