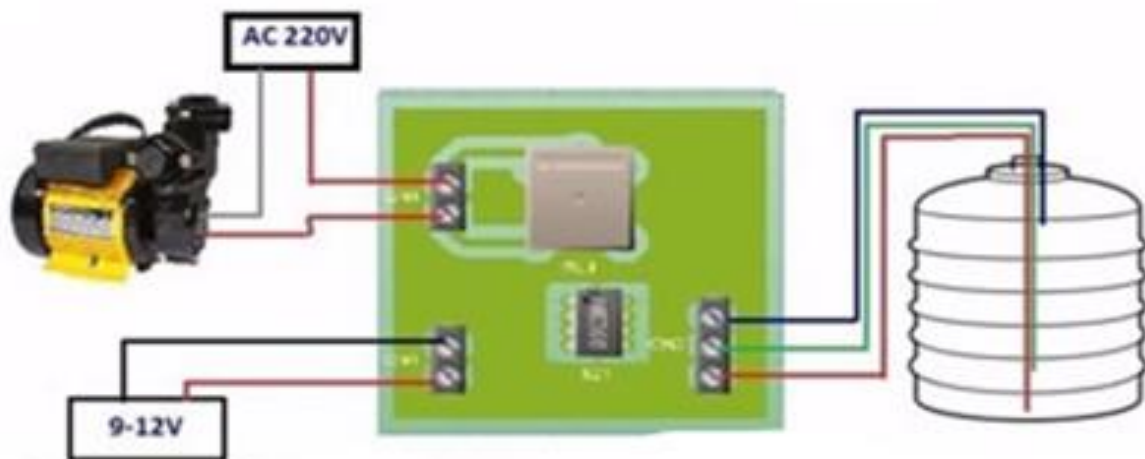




COMSATS UNIVERSITY ISLAMABAD
ATTOCK CAMPUS



Water Pump Controller

PROJECT REPORT

Academic Year 2022

Department: Computer Engineering

Subject: Digital Logic Design

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Abstract

Our understanding of water pump control. Water level controller is a device that manages water levels on a variety of systems such as water tanks, pumps and swimming pools. The basic function of a water level controller is to regulate water flow and optimize system performance. It can save time and energy. Not just electrical energy but also reduce human efforts.

Table of Contents

1.	Introduction	4
2.	Components	4
2.1.	Ne555 timer ic	4
2.1.1.	Block 1	5
2.1.2.	Block 2	5
2.1.3.	Block 3	6
2.1.4.	Block 4	7
2.1.5.	Block 5	7
2.2.	12 v relay	8
2.3.	Bc547 transistor	9
2.4.	Capacitor and diode	10
3	Circuit diagram	
4	Working	
5	Applications of water pump controller	10
6	Problem faced	10
7	Learning experience	10
8	Conclusion	11

1. Introduction

Water level controller is a device that manages water levels on a variety of systems such as water tanks, pumps and swimming pools. The basic function of a water level controller is to regulate water flow and optimize system performance. It can save time and energy. Not just electrical energy but also reduce human efforts .

We have developed water level controller circuit using NE555 Timer The circuit uses 1 transistor, 1 NE555 timer IC, a relay and few passive components. The circuit is completely automatic which starts the pump motor when the water level in the over head tank goes below a preset level and switches OFF the pump when the water level in the over head tank goes above the full level.

Components;

1. Ne555 timer ic
2. Bc 547 transistor
3. Resistors
4. 2 leds
5. 12 v relay
6. 0.1micro farad capacitor
7. Breadboard
8. Connecting wires

2.1. NE555 TIMER IC

- Astable (free-running) mode – The 555 can operate as an electronic oscillator

In this mode, the circuit of the IC 555 timer produces the continuous pulses with exact frequency based on the value of the two resistors and capacitors.

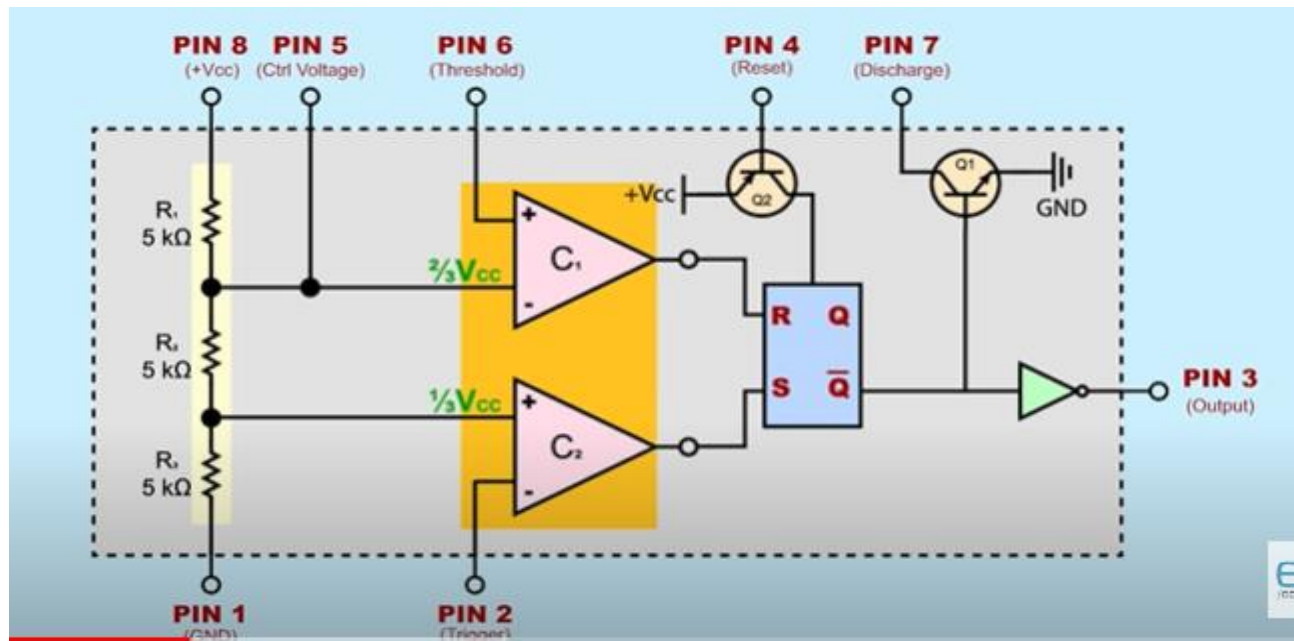
- Monostable (one-shot) mode – In this mode, the 555 functions as a "one-shot" pulse generator.

In this mode, the circuit generates only single pulse when the timer gets an indication from i/p of the trigger button

- Bistable (flip-flop) mode – The 555 operates as an SR flip-flop

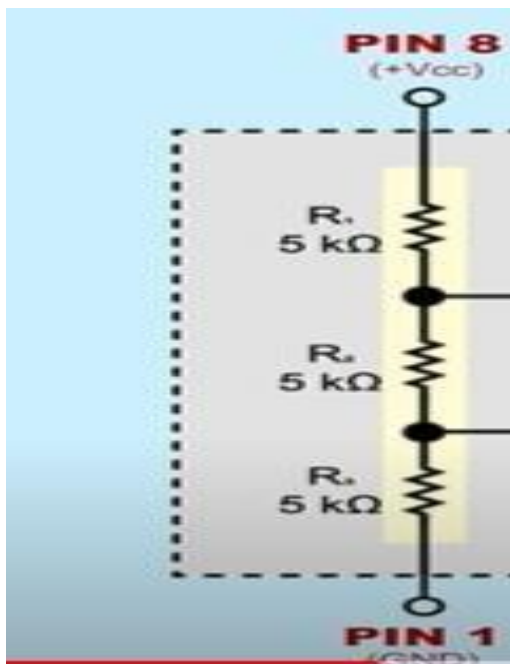
In this mode, the circuit produces 2-stable state signals which are low and states. The output signals of low and high state signals are controlled by reset & activate the input pins, not by the charging & discharging of capacitors.

- By giving vcc(invert to ground) at reset external pin we can use the threshold and trigger pins only for giving inputs.in our circuit requirement was flip flop circuit so that's why we are going to use it in bistable mode



2.1.1. Block 1

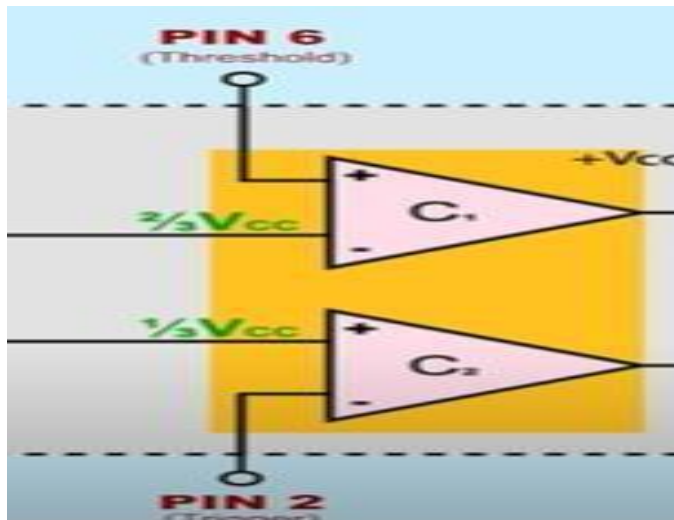
In this block voltage is divided and then given to comparators as an input By using VDR at 1st point we Get $\frac{2}{3} V_{CC}$ and at 2nd point and get $\frac{1}{3} V_{CC}$.



2.1.2 Block 2

In this block 2 comparators are used. It has two terminals in each comparator (+,-) which of

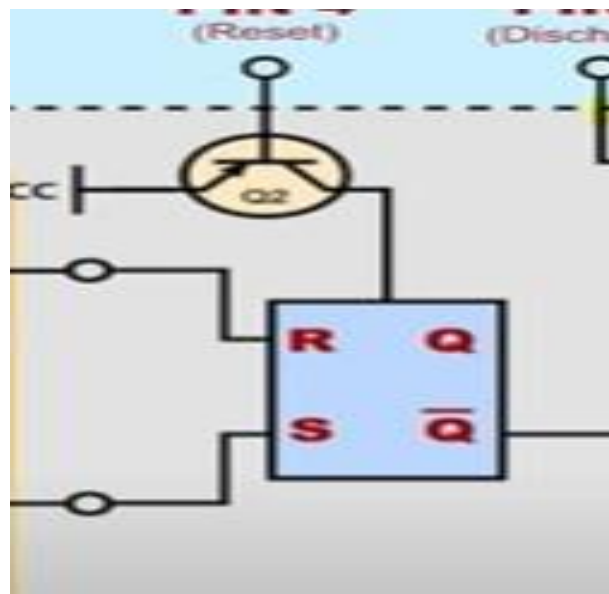
these has high value the output will be as that terminal for example if the value at positive terminal is high then the output is high(1) if the negative terminal has the high value then the output is low (0).



2.1.3 Block 3

It contains RS flip flop circuit .It is considered as one of the basic Sequential circuit and has two inputs one is called set and other is called reset. In this block there is also an external option for

Reset but it depends on the circuit we are dealing with (bistable, nonstable and a stable)

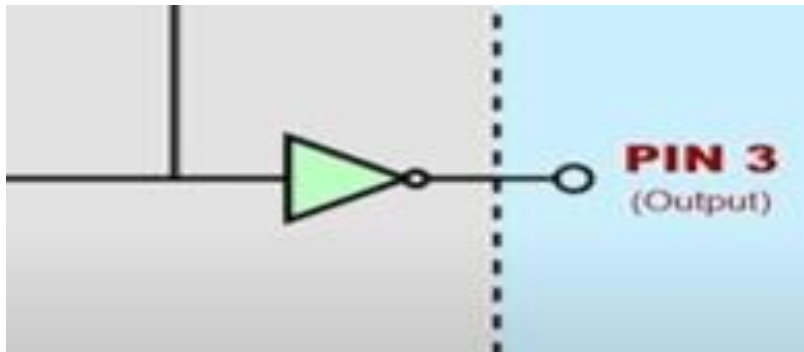


Truth table for RS flipflop;

R	S	Q	Q'
0	1	1	0
0	0	1(no change)	0(no change)
1	0	0	1
1	1	invalid	invalid

2.1.4 Block 4

This block contains an output signal with the help of invert gate.



2.1.5 Block 5

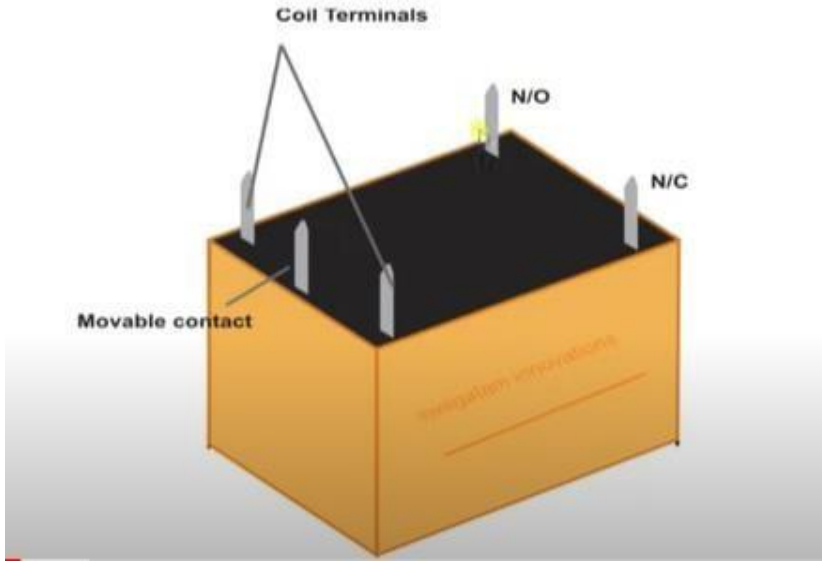
It contains a transistor that works as a discharge option. Discharge pin is used with external capacitors setting duration of the timer. It also depends upon the type of circuit we are required to design (bistable, monostable and astable).



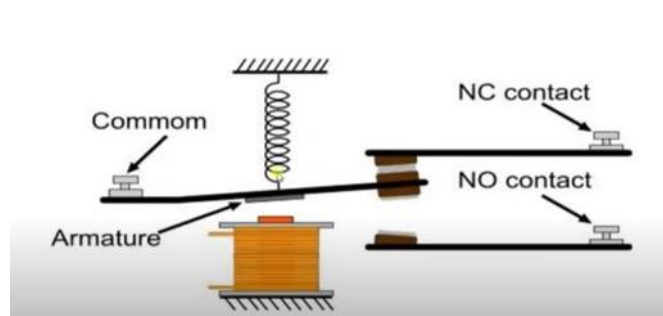
2.2 12 V RELAY

A relay is the device that opens or closes the contacts to cause the operation of the other electric control. Relays control one electrical circuit by opening and closing contacts in another circuit. it contains 5 pins

There is coil between pin 1 and 2 Pin 3 is common pin also known as movable contact Pin 4 is normally open and Pin 5 is normally close.



It works on a principle of electromagnetic attraction coil acts as a magnet then it attracts the movable connection (common) for switching purpose.



2.3 Bc547 transistor

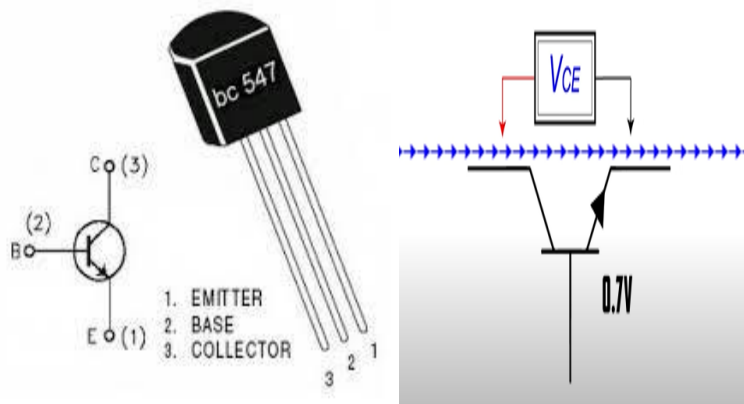
The BC547 transistor is an NPN transistor(2 diodes). Rather than using a mechanical switch a transistor can work as an electronic switch,also it can be used to amplify currents but in this circuit it is used as an electronic switch.

Main current flow through collector and emitter .Signal current flows from base to collector,this current also control the switch .Current from base to emitter can open the current flow from collector to emitter.

As we know from diode that at least 0.7v is required to start functioning so in this case when 0.7v is applied at base the transistor start functioning.

In our circuit if there is high voltage at base then it allows current to flow from collector to emitter.

Connectivity of collector is such that it is connected to positive terminal and emitter is grounded (V_{ce}).base can be connected to positive terminal aswell with respect to emitter at negative (V_{be}).



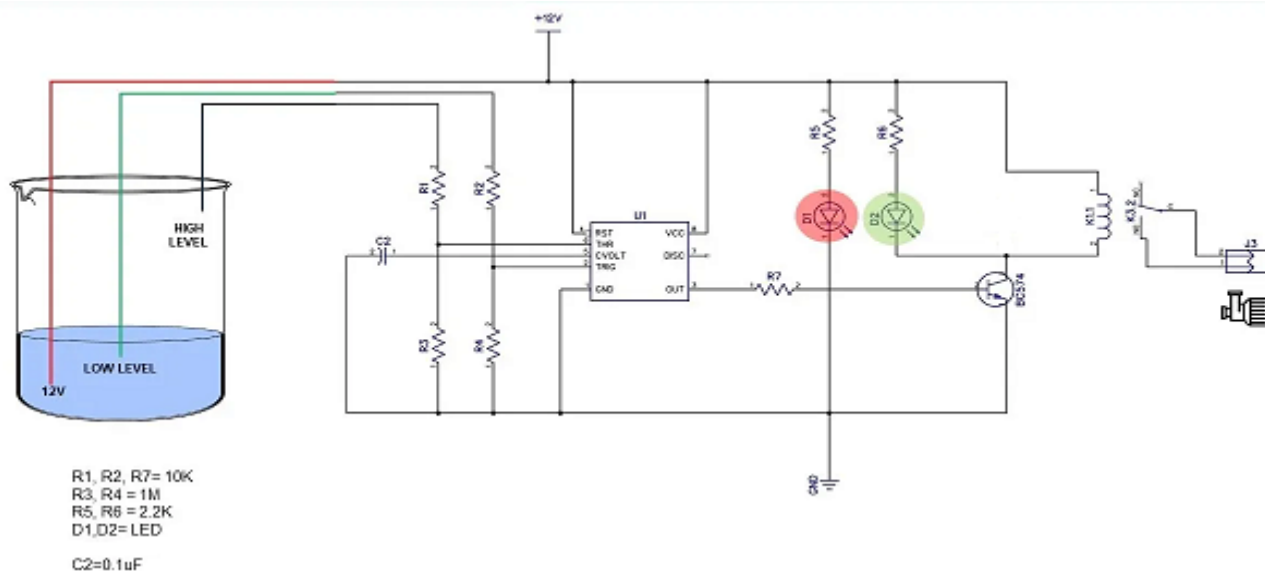
2.4 Capacitor ;

0.1 micro farad capacitor is used due to the following reason

When used in a direct current or DC circuit, DC has zero frequency, a capacitor charges up to its supply voltage but blocks the flow of current through it because the dielectric of a capacitor is non-conductive and basically an insulator.

Normally control terminal (pin 5) of timer is connected to ground through a 0.01μF bypass capacitor so as to prevent noise coupled onto this pin from causing false triggering

3 Circuit Diagram:



Truth Table for circuit;

Pin 6 (Highlevel)	Pin 2 (low level)	R	S	Q'	(Q')'	pump
low	low	low	high	low	high	on
low	high	low	low	low	high	on
high	high	high	low	high	low	off
high	low	high	high	invalid	invalid	invalid

4 Working;

In NE555 Timer the output will increase when the power of the second pin (trigger pin) is not more than $\frac{1}{3} V_{DC}$. We can also reset the IC using low voltage to 4th pinout (reset pins). For this particular project you will find 3 wires attached to a water tank. We will specify two levels – Low (Low) and High (High) Water Levels. One of the anchors for the investigation or for V_{cc} .

The Lower level is connected to NE555 trigger pin 2. Therefore, the Voltage across the second pin is V_{cc} while in the water. As the water level decreases, a second probe is drawn from the water force, and the trigger pin will become below the V_{cc} . Then the output of 555 goes up.

The output of 555 is connected on a BC547 transistor, activating the transmission coil and water pump will be turned on. When the water level rises, a high-level probe is placed in the water and the transistor shuts down. The collecting power is $V_{CE(sat)} = 0.2$. Low power in 4th pinout resets IC. Therefore, the output of 555 turns off. So the Motor is turned off. In the basic demo of this project, you can use a DC Motor connected directly across the 555 output ground rather than the transmission. For practical purposes, you must use a transfer. The transfer rate is preferred depending on the load.

5 Applications of water pump controller

- Automatically turn ON/OFF pumps
- Can be used in factories, commercial complexes, apartments, home,
- Fuel tank level gauging
- Oil tank level control
- High & low-level alarms
- Pool water level control
- water level control

- Pump controller
- Stream level monitoring
- Tsunami warning and sea level monitoring

6 Problem faced

These were some of the major problems faced while making this project .Faulty components initially we designed a proper circuit but due to faulty Components it was not working and Understanding connectivity and Working of ne555 IC and relays .

7 Learning experience

Overall it was very interesting experience we got to learn so many thing in this project like

- Working of relays
- Use of ne555 timer ic
- Checking for the components are they functional or not?
- Developing some engineering mindset
- Troubleshooting the problems
- Developing logics and much more

8 Conclusion

To conclude this whole project it was really fun and interesting project to work on we know that it is not something unique but still at our level we learned a lot of new concepts . We think that such activities should be promoted and supported as it helps student to have practice understanding of their engineering knowledge and also it helps boosting student's confidence. At the end we would like to thank sir abbas Ali shah for giving us this opportunity.