A

MINI PROJECT REPORT

ON

"WATER LEVEL CONTROL FOR PURIFIER"

FOR

MINI PROJECT SUBJECT

OF T.E. E&TC – 2019 COURSE, SPPU, PUNE

By

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PUNE – 43

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Department of Electronics and Telecommunication Engineering

Pune Institute of Computer Technology, Pune – 43

CERTIFICATE

This is to certify that the Mini Project Report entitled

WATER LEVEL CONTROL FOR PURIFIER has been successfully completed

by

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Is a bona fide work carried out by them under the supervision of **Prof. S. L. Dhende** and it is approved for the partial fulfillment of the requirements for the Mini Project Subject of T.E. E&TC – 2019 Course of the Savitribai Phule Pune University, Pune.

Prof.S.L.Dhende
Project Guide
of E&TC

Dr. M.V.Munot
HOD, E&TC Dept.

Place: Pune
Date :

ACKNOWLEDGEMENT

It takes immense pleasure in completing and submitting the final project report.
I would like to express my gratitude to our respected, HOD Dr. M.V.Munot and PROF. S.L.Dhende my project guide for their continuous encouragement, valuable guidance and the help for completing the project work.

Last but not the least, I am thankful to all the college staff, friends for helping me directly or indirectly in my project.

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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 utmost importance to preserve water. In many houses there is unnecessary wastage of water due to overflow in Overhead Tanks. Automatic Water Level Controller can provide a solution to this problem" The operation of water level controller works upon the fact that water conducts electricity. So water can be used to open or close a circuit. As the water level rises or falls, different circuits in the controller send different signals. These signals are used to switch ON or switch OFF the motor pump as per our requirements. So, the main objective of this paper is to design and develop an automatic water level controller to maintain the outlet process of the water level at its desired level. The paper also focuses on the need of the people to install automatic water level controller to avoid wastage of water.

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CONTENTS

CHAPTER 1

INTRODUCTION

1.1 Introduction

The total amount of water available on Earth has been estimated at 1.4 billion cubic kilometers, enough to cover the planet with a layer of about 3 km. About 95% of the 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 lo/o constitutes all fresh water found in rivers, streams and lakes which is suitable for our consumption. A study estimated that a person in India consumes an average of 135 litres per day' This consumption would rise by 40%by the year 2025. This signifies the need to preserve our fresh water resources.

1.2 Thesis Objectives

The following objectives are likely to be focused and achieved at the end of the project.

l) To create the most cost-effective and reliable water level controller using as less resources as possible.
2) To study the controller model and observe its characteristics.
3) To compare the controller with the conventional controllers available in market and find the advantages of the former over the latter.
4) To suggest any ideas or improvements that can lead to future development of the controller.

1.3 Thesis Organization

The thesis is organized into seven chapters including the chapter of introduction. Each chapter is different from the other and is described along with the necessary theory required to comprehend it.

Chapter 1 deals with the basic introduction and objectives of thesis
.
Chapter 2 deals with the water level controller components. The block diagram and circuit diagram gives an overview of the whole system. Then the list of components that are used in the circuit. Their purpose in the system is explained along with their ratings and connections. Also we describe the basic operation of the controller. A step-by-step analysis is presented on the actions that would take in the controller beginning from the detection of water by the metallic contacts to the switching ON or switching OFF of the pump accordingly. Finally, we discussed the advantages and disadvantages of the controller.

Chapter 3 deals with complete description of the components used in the circuit individually.

Chapter 4 deals with the results and description of our project.

Chapter5 deals with the possible limitations in proceeding research towards this work are discussed. fire future work that can be done in improving the current.

Chapter 6 concludes the work performed so far.

Chapter 7 discuss the approx. cost estimation circuit layout and the complete hardware setup of the project.

CHAPTER 2

PROJECT DETAILS

2.1 Introduction

The water level controller we propose to make in our project depends on two detection points in the OHT. The water level must be controlled at these two points. To facilitate this, we use sensors. ln our case, these sensors are metallic contacts with space between them present at each detection point. When water reaches a sensor, a proper circuit must be present such that the presence of water is detected and a signal is produced- This signal must pass through IC555 circuits to give the correct output. A similar action must take place when water reaches another sensor. Our circuit essentially uses the high and low states of an IC555 to activate or deactivate the TRIAC.

2.2 Block diagram

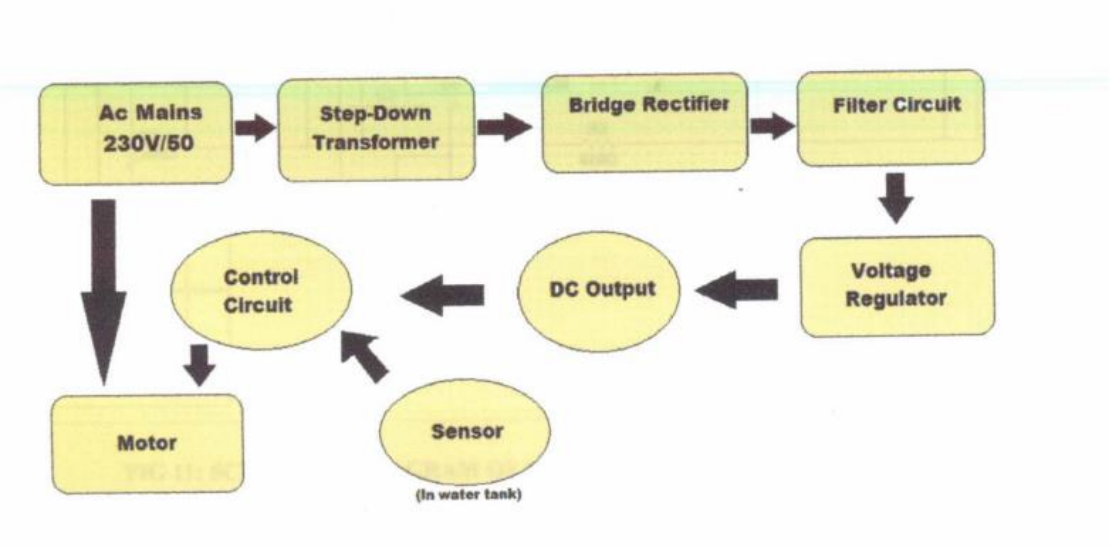


Fig 1: Block Diagram

The Block Diagram consists of-

a) AC Mains - The AC supply of 230v/50Hz connected to main source.

b) Stepdown transformer - It is used to stepdown the voltage which is required for the circuit.

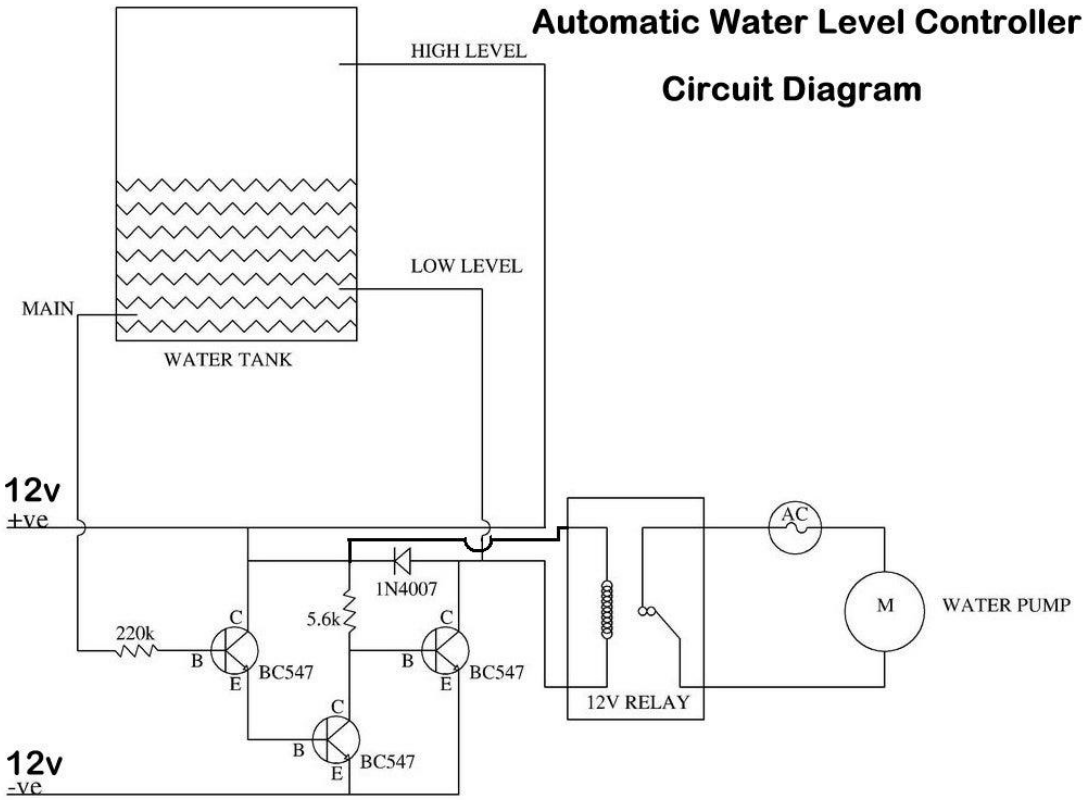
c) Bride Rectifier-The Bridge is consist of four diode which convert the Ac into DC.

d) Filter circuit - This circuit is used to convert the pulsating DC into pure DC.

e) Voltage Regulator - It is used to give regulated supply of 5V DC which is need for Controller circuit,

f) Controller Circuit - This circuit control the motor and Sensor.

2.3 Circuit Diagram:



2.4 COMPONENTS USED IN THE CIRCUIT:

COMPONENT	SPECIFICATION	QUANTITY
Metallic Contacts		2
Transformer	230V,50Hz	1
Diode	1N4007,50V	4
Voltage Regulator IC	MC7805CT	1
Water Pump	5W/230V	1

555 Timer IC	5V(4.5V-16V)	1
LED	3-5V	1
Transistor	BC 547	2
Capacitor	0.01 uF &470 uF	2
Resistor	1M Ω and 1M Ω,1 mΩ	3

Table 1: Component Required Table

2.5 Working Principle

STEP l (operation of Regulated power supply)

- Firstly, 230v AC is given to the input of step-down transformer (230v/9v).
- This 9v AC fed to bridge circuit such as it gives the output 9v Dc.
- Now this Dc gives to the input of voltage regulated IC7805 which Provide 5v as output.

STEP 2 (Operation of control circuit)

- we know the property of 555 timer IC, i.e. its output goes HIGH when voltage at the 2nd pin (trigger pin) is less than l/3ycc
- Also we can reset back the IC by applying a Low voltage at the 4tr pin (Reset pin). O
- Here 3 wires are dipped in water tank. Let us define two water levels- Bottom (Low) level and Top (Up) level. One of the wire or probe is from Vcc.
- The probe from bottom level is connected to the trigger (2nd) pin of 555 IC. So the voltage at 2nd pin is Vcc when it is covered by water.

- When water level goes down, the 2nd pin gets disconnected(untouched) from water i.e. voltage at the trigger pin becomes less than Vcc. Then the output of555becomeshigh.
- The output of IC555 makes the gate Triggered and the TRLAC starts conduction.
- While the water level rises, the top level probe is covered by water and the transistor becomes ON. Its collector voltage goes to Vce=0.2.
- The low voltage at the fourth pin resets the IC. So the output of 555 becomes 0 volt. Hence the motor will turn of automatically.

On a final note, the conventional controllers in market mostly use capacitive sensors and microcontrollers. These increase the cost as well as the complexity of the system. We have developed a rather simpler but efficient model of a water level controller

CHAPTER 3

COMPONENTS DESCRIPTION

3.1 Metallic Contracts

These are Aluminium contacts which conduct electricity when the space between them is bridged by water. For our project, two contacts at the bottom part of the tank form the indicator for low level of water. Similarly two contacts at the upper part of the tank indicate that water is about to overflow [2].

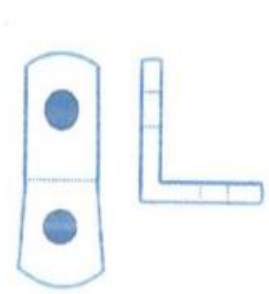


Fig 3 L-Shaped Metallic Contracts

3.2 Transformer

A centre-tapped stepdown transformer is used to provide a suitable voltage to the Bridge rectifier. We specifically selected tris transformer so that the device could be connected directly to the wall outlet. Also the centre tapping helps us to generate a positive polarity voltage required for the circuit. Rating: 230/18 V (9-0-9) AC, 50 Hz[4].

Fig 4 :Centre-Tap Step Down Transformer

3.3 Bridge Rectifier

The full wave rectifier consists of four 1N4007 diodes and two 1000uF capacitors. lt is used to convert the AC supply of the wall outlet to DC supply which will run majority of the circuit elements [3].

It converts an AC voltage into a pulsating dc voltage using both half cycles of the applied ac voltage' For this purpose, it uses two diodes of which one conducts during one half cycle while the other conducts during the other half cycle of the applied ac voltage.

During the positive half cycle of the input voltage, the diode D2 becomes forward biased and D2 becomes reverse biased. Hence D2 conducts and D4 remains OFF. The load current flows through D2 and the voltage drop across the load will be equal to the input voltage. Now during the negative half cycle of the input voltage, diode D2 becomes reverse biased and D4 becomes forward biased. Hence D2 remains OFF and D4 conducts. The load current flows through D4 and the voltage drop across the load will be equal to the input voltage [4].

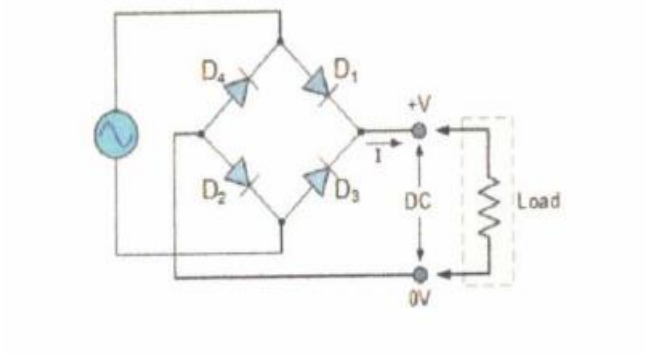


Fig 5 : Bridge Rectifier

3.4 Voltage Regulator IC

Connected to the rectifier outputs are voltage regulators IC 7805. The output of IC 7805 provides Vcc to use to supply the DC voltage to support current flow between the metallic contacts and also used to give Vcc to 555 Timer IC [1].

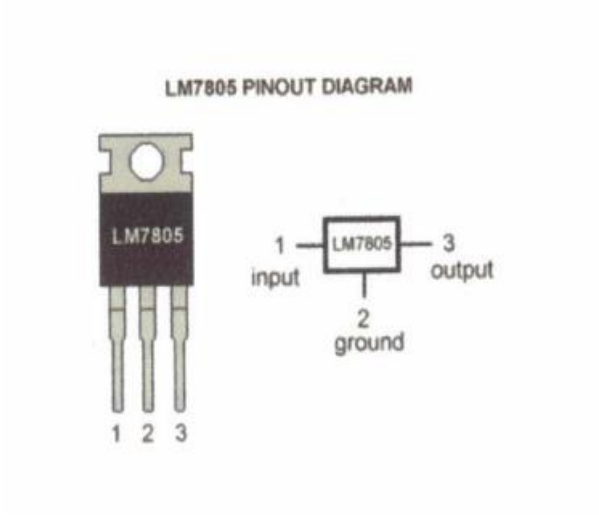


Fig 6 : Regulator Ic 7805

3.5 Water Pump

The centrifugal pump is commonly found inside a submersible fountain pump and some air conditioning units. As the impeller inside it turns,

water is drawn in one side of the pump. It is then expelled out the other end.The power and size of the impeller decide the amount of water flow. More water can be pumped if we have a larger impeller. As the impeller rotates, it moves water from the inlet (which is located near the centre of rotation of the impeller) along the surfaces of the impeller to the outer portions of the volute by means of centrifugal force (thus, its name centrifugal pump). As this water collects in the outer regions of the volute, it is directed to the outlet. The water leaving the outlet causes the water pressure to drop at the inlet. To match the rate with which water is leaving the outlet, the pump sucks in new water at the inlet. These pumps must be primed before starting, which in this case is already done because of its underwater application. Rating: Voltage: 165-240V/50 Hz ; Power: 5W; Output: 400L/hr[6].

Fig 7 : Water Pump

3.6 555 Timer IC

Here, we use the 555 timer as a flipflop element i.e. in bi-stable mode. A Bistable Mod€ or what is sometimes called a Schmitt Trigger, has two stable states, high and low. Taking the Trigger input low makes the output of the circuit go into the high state. Taking the Reset input low makes the output of the circuit go into the low state. This type of circuit is ideal for use in an Automatic Water Level Controller [3].

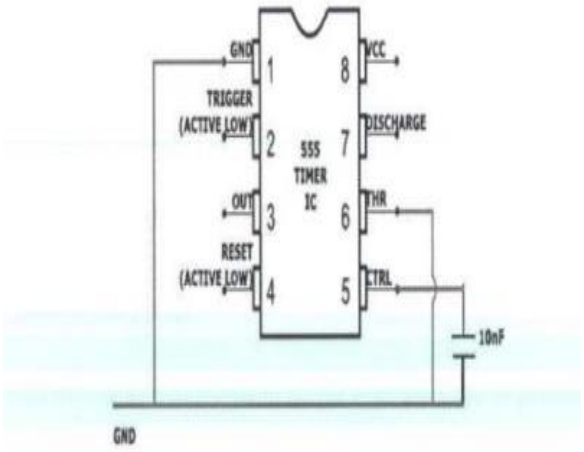


Fig 8 : 555 Timer in Bi-stable mode

FIGURE 8: 555 TIMER IN BI-STABLE MODE

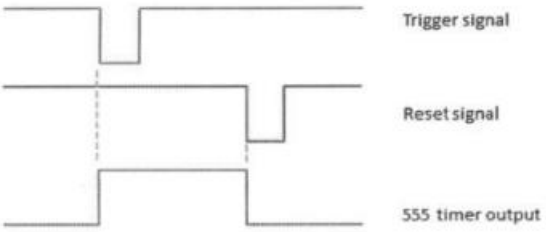


Fig 9 : 555 Timer WaveForms

3.7 LED (Light Emitting Diode)

Three LEDs are used to indicate-

- The high state of 555 timer IC.

- The low state of 555 timer IC.
- The ON/OFF state of the Pump.

A resistance of I KQ should be connected in series with the LED to protect it from high voltages [3].

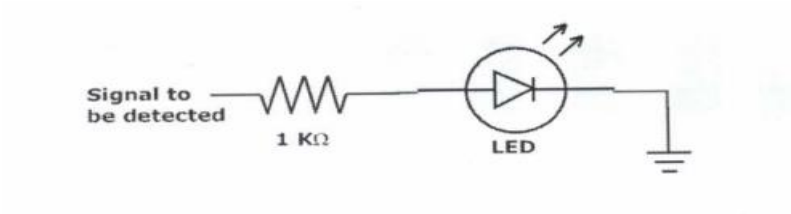


Fig 11 : Light Emitting Diode

3.8 Transistor

Transistors are semiconductor devices used to amplify and switch electronic signals and electrical power. At least three terminals for connection to external circuit are present. By applying voltage or current to one pair of the transistor the current through other pair of terminal changes. Because the controlled (output) power can be higher than the controlling (input) power, transistors can amplify a signal. In our circuit, we used transistor 8C548 to amplify it. IC 7805 provided the 5 volts Vcc to the BJT which was connected in common base configuration [4]

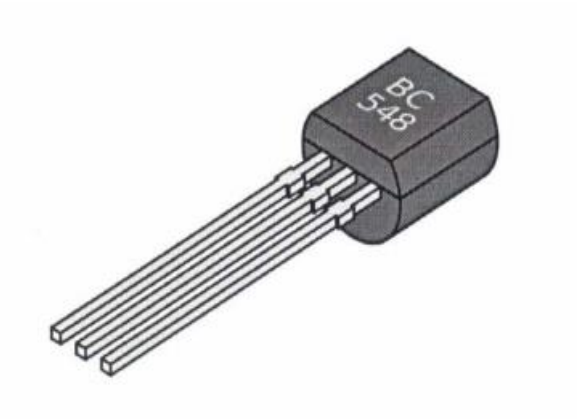


Figure 12 : BC 548 Transistor

3.9 Capacitor

A capacitor (originally known as a condenser) is a passive two-terminal electrical component used to store energy electrostatically in an electric field. The forms of practical capacitors vary widely, but all contain at last two electrical conductors (plates) separated by a dielectric (i.e. insulator).

An ideal capacitor is characterized by a single constant value for its capacitance. Capacitance is expressed as the ratio of the electric charge Q on each conductor to the potential difference V between them. The SI unit of capacitance is the farad (F), which is equal to one coulomb per volt (1 C/V).Typical capacitance values range from about 1 pF (10^-12 F) to about I mF (10^-3 F) [5].

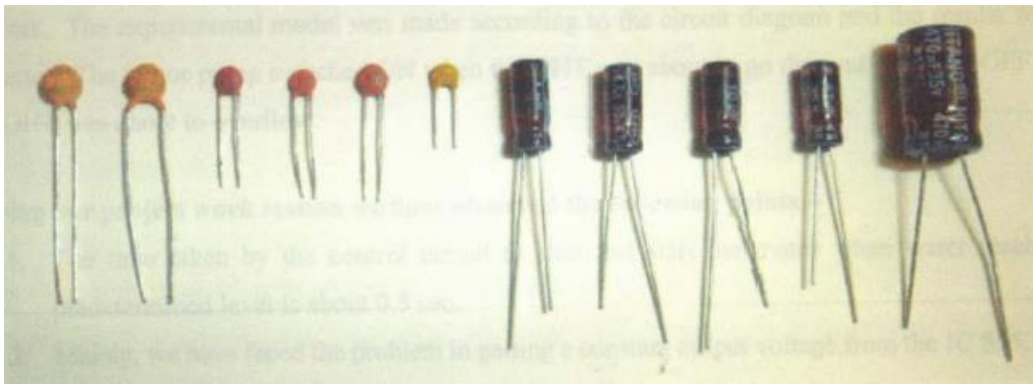


Figure 13: Capacitor

3.10 Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and" at the same time, act to lower voltage levels within circuits. ln electronic circuits resistors are used to limit current flow, to adjust signal levels, bias active elements, terminate transmission lines among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sesnsing devices for heat, light, humidity' force, or chemical activity [3]

Figure 14 : Resistor

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Results

The automatic water level controller has been successfully designed and developed. The submersible pump is turned off and on according to the water levels. Compared to other conventional methods, the automatic water level controller shows excellent performance with its reliable technology and it is cheaper and durable. The automatic water level controller is a promising controller in terms of system response in water level control with respect to the non-linearity introduced by pumps and sensors. The experimental model was made according to the circuit diagram and the results were as expected. The motor pump switched ON when the OHT was about to go dry and switched OFF when the OHT was about to overflow.

During our project work session we have observed the following points –

1. The time taken by the control circuit to stop and start the motor when water reaches its predetermined level is about 0.5 sec.

2. Mainly, we have faced the problem in getting a constant output voltage from the IC 555, which sometimes alternates at range of 1.5-2 V as a result the motor doesn't start properly.

CHAPTER 5

CONCLUSIONS

In these days, when Earth's reserve of consumable water is decreasing every moment, every drop has its value. Water level controller is a simple yet effective way to prevent wastage of water. Its simplicity in design and low cost components make it an ideal piece of technology for the common man.

Thus the automatic water level controller is a big boon as concerned with the house hold applications as well as other water saving purposes including agricultural sector and industries. Based on the survey result, it is found that the automatic water level controller has a rising demand and it is a good asset from the electronics perspective.

Hence we conclude 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.

5.1 Advantages & Disadvantages

Advantages –

- Automatic water level controller is used to automatically fill the overhead tank as and when it gets empty and monitor the water level in it.
- Automatic water level controller is simple and easy to install.

- Automatic water level controller has low maintenance.
- Automatic water level controller has compact and elegant design.
- Automatic water level controller is fully automatic.
- Automatic water level controller with its precise working saves water and the motor energy.
- Automatic water level controller avoids the seepage of walls and roofs when the tank overflows.
- Automatic water level controller is ideal as it is difficult to access overhead tanks.
- Automatic water level controller has safe operation of motor/pump within permissible voltage limits.

Disadvantages –

- It is a passive electrical system and hence it requires continuous power supply.

CHAPTER 6

FUTURE PROSPECTS

The water level controller designed in this project can be used to control water flow. However, there is no way of knowing whether the source of water, which in this case is the UGT, actually has water or not. If no water source is present, then the submersible pump would start running unnecessarily and overheat itself. This could be taken care by implementing another sensor. Also, the rate of water input must always be equal to or greater than the rate of water output. To make this happen we could use a speed regulator. If these issues are taken care of then a more efficient and reliable performance can be achieved.

CHAPTER 7

APPENDIX

7.1 Cost Analysis of Project:

Sr.No	Particulars	Quantity	Cost in INR (approx.)
1	Transformer	1	80
2	Diode	4	30
3	Capacitor	1	20
4	IC 7805	1	20
5	Transistor	1	5
6	555 Timer	1	10
7	Triac BT134	1	10
8	LED	1	5
9	Water Pump	1	300
10	Metallic contact	2	20
11	Miscellaneous	------	300
	Total		800

Table 2: Cost Analysis of Project

Water pump and is the auxiliary components of the system [l]. They are not considered as a part of the control circuit. Their cost and ratings of the pump vary according to load connected to the system' An increase in load will lead to selection of a larger pump. Likewise, the current flowing through the circuit will also increase. Therefore, we would require a higher rated triac. For our project,

we had to pump a small volume of water for demonstration purpose so we used a low rated pump.

7.2 Circuit Layout:

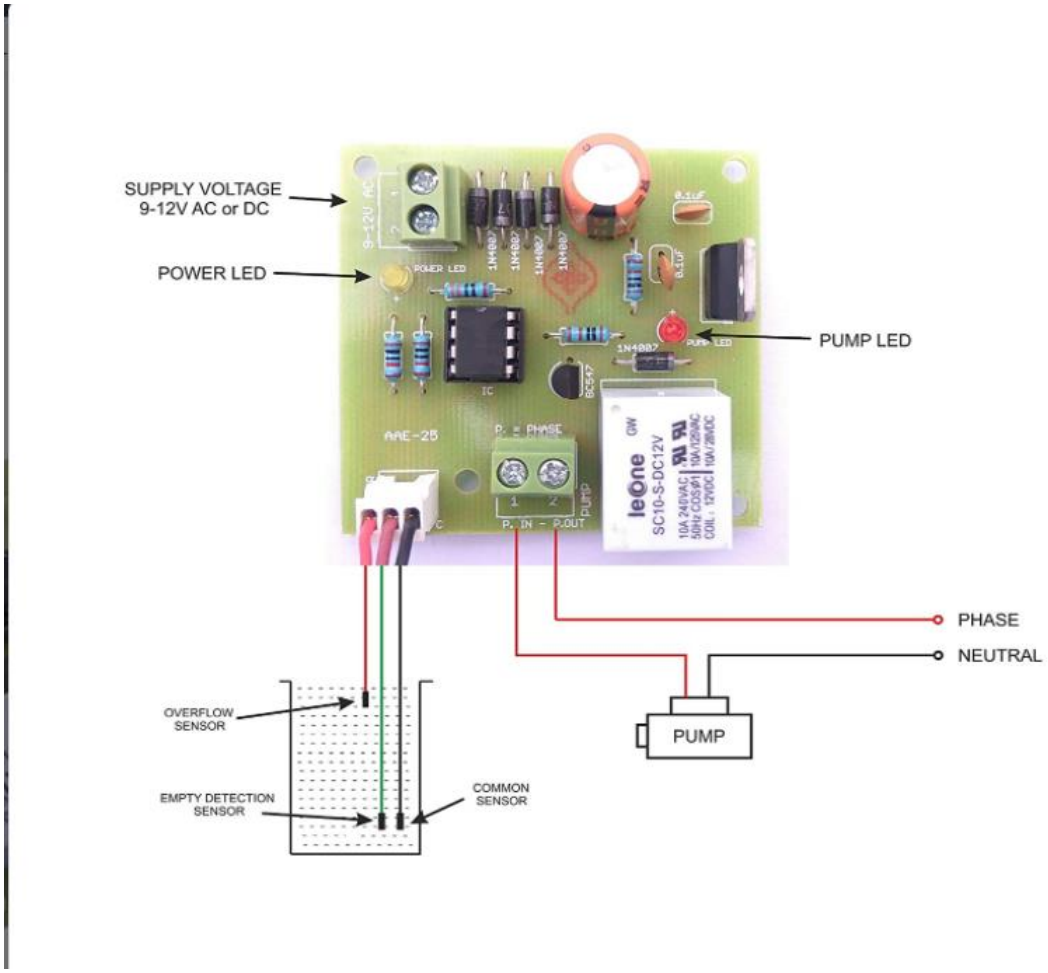
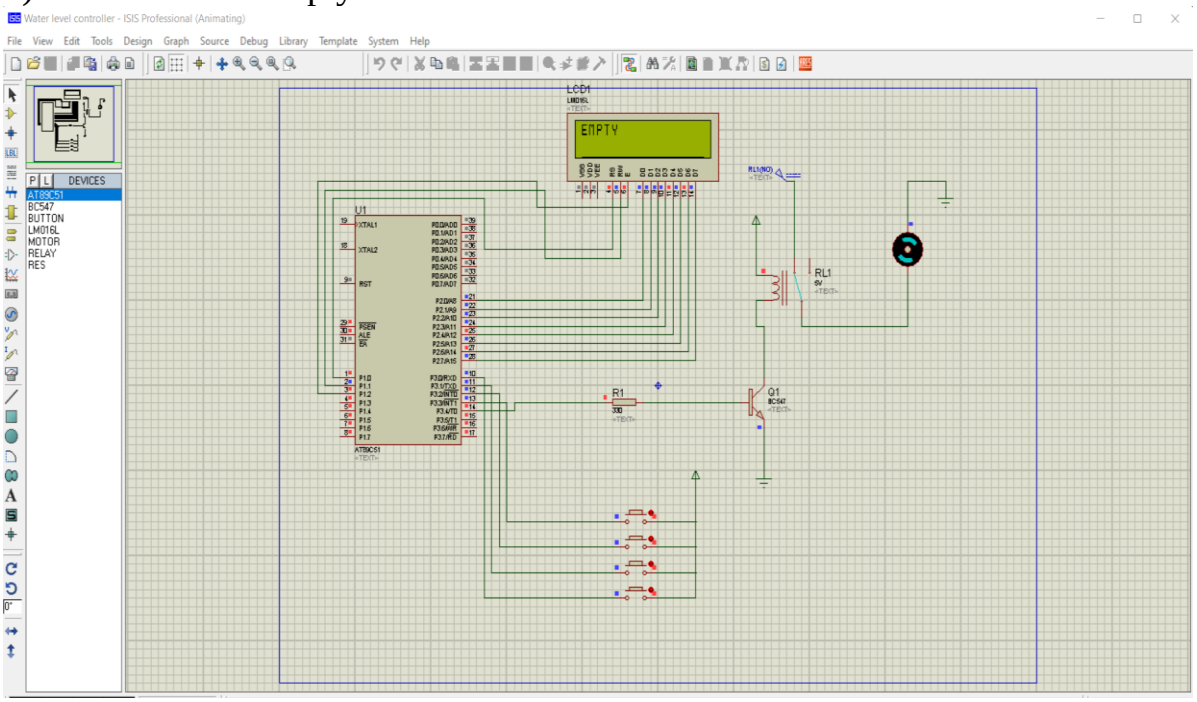


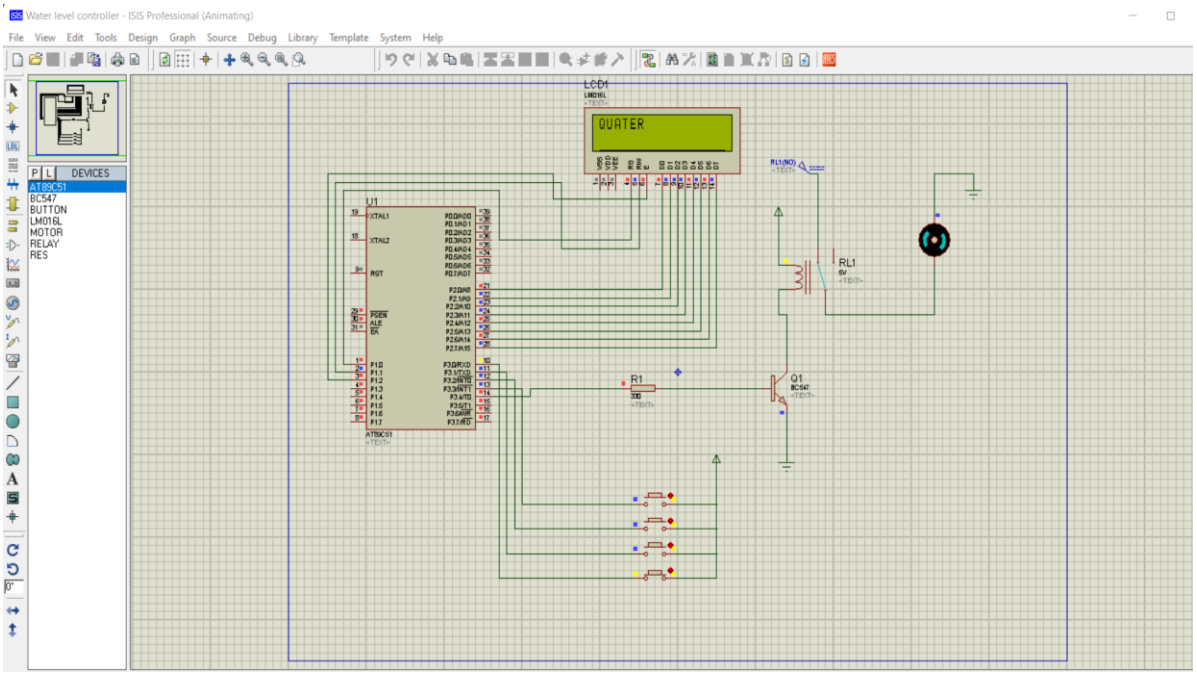
Fig 15 : Circuit Layout

7.3Complete Software Setup:

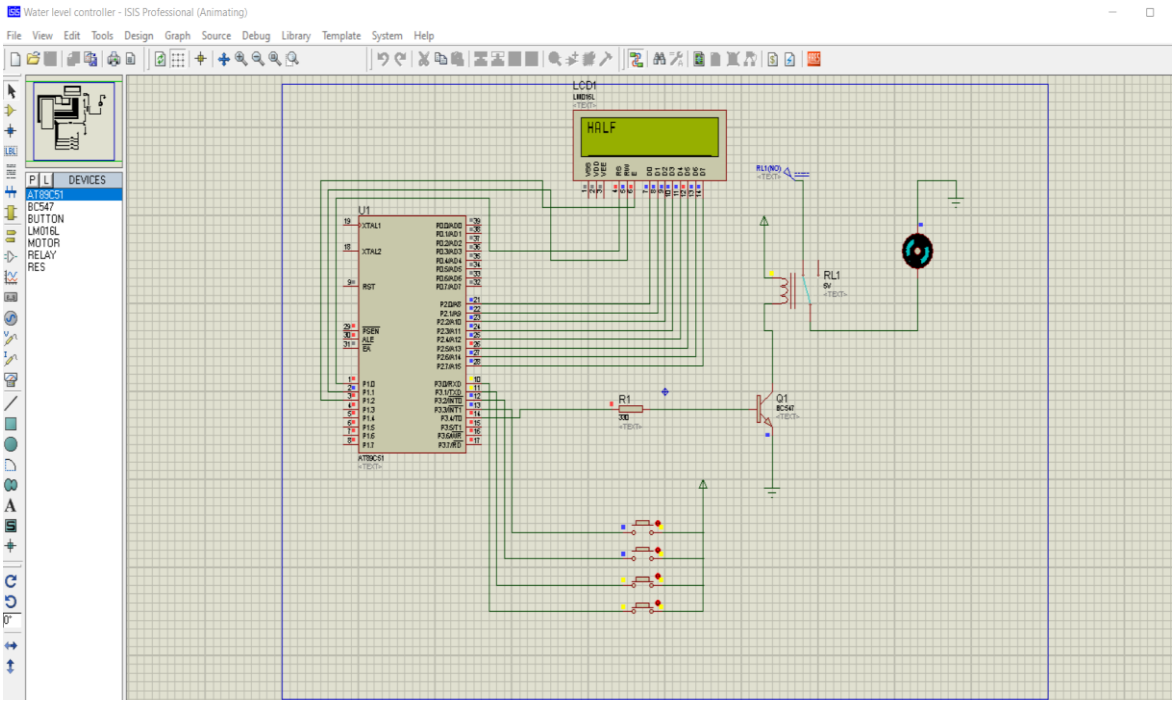
1)When Tank Is Empty:



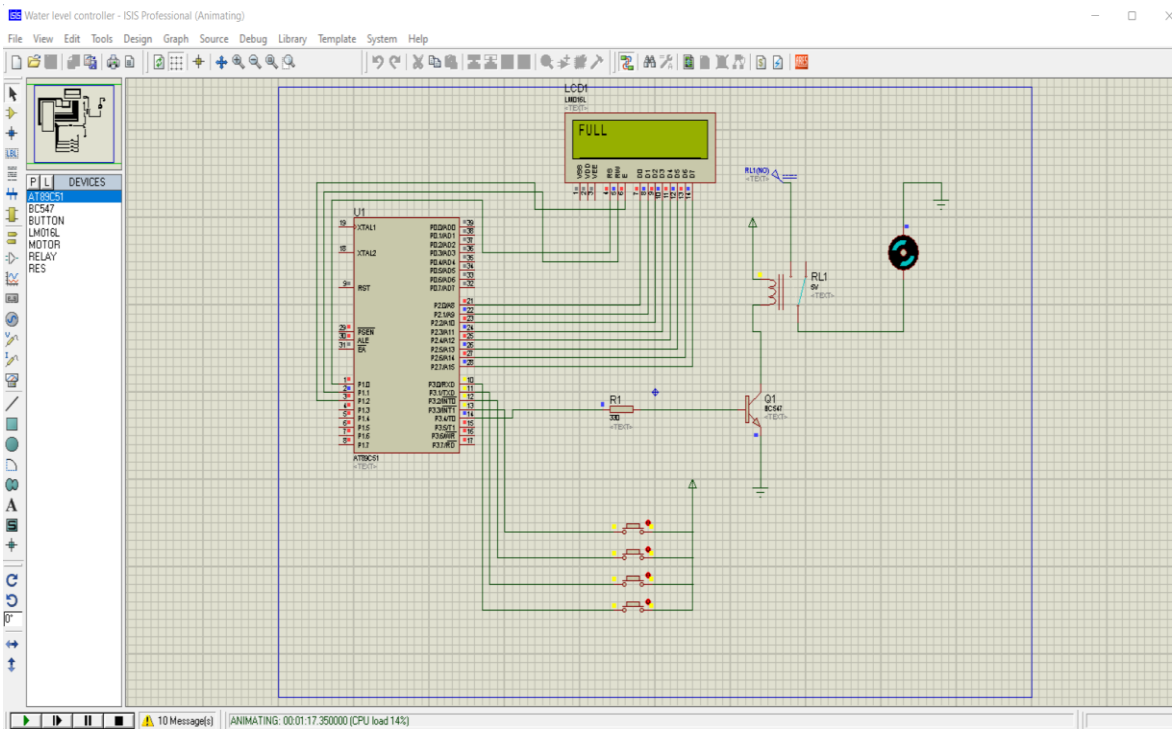
2) When Tank Is Quarter:

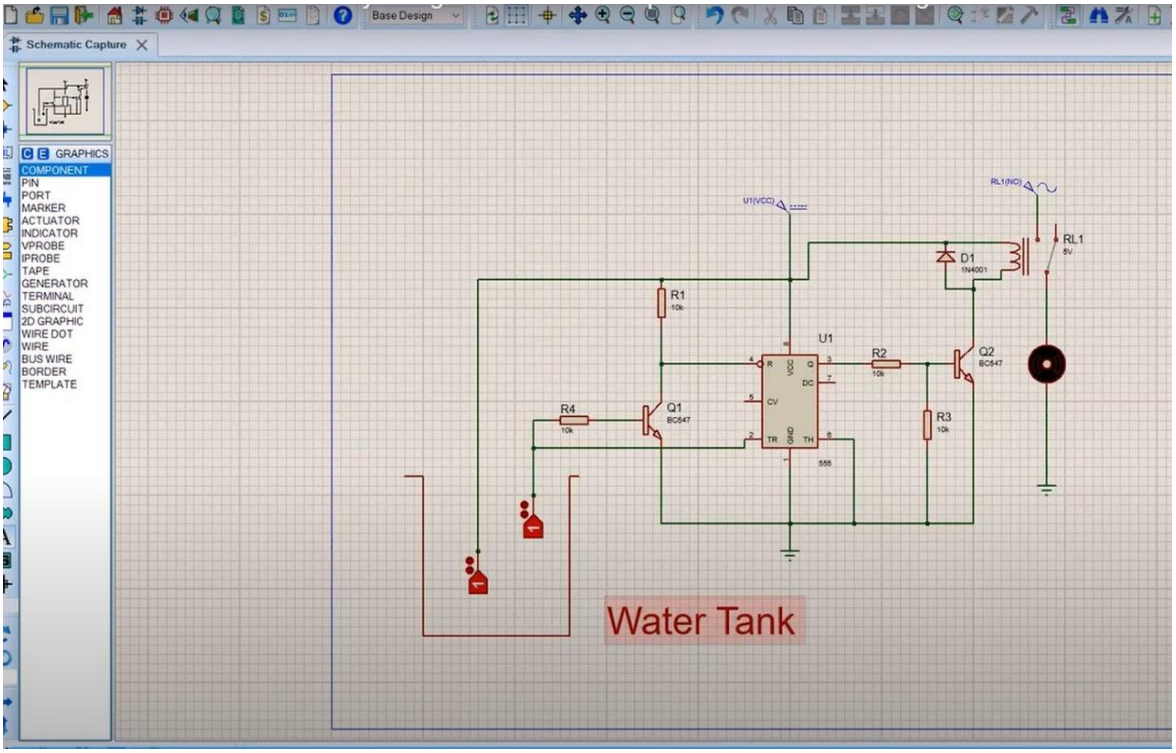


3) When Tank Is Half :



4) When Tank Is Full :




Schematic Capture
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VPROBE
IPROBE
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GENERATOR
TERMINAL
SUBCIRCUIT
2D GRAPHIC
WIRE DOT
WIRE
BUS WIRE
BORDER
TEMPLATE
U1(VCC)
RL1(NO)
RL1
5V
D1
1N4001
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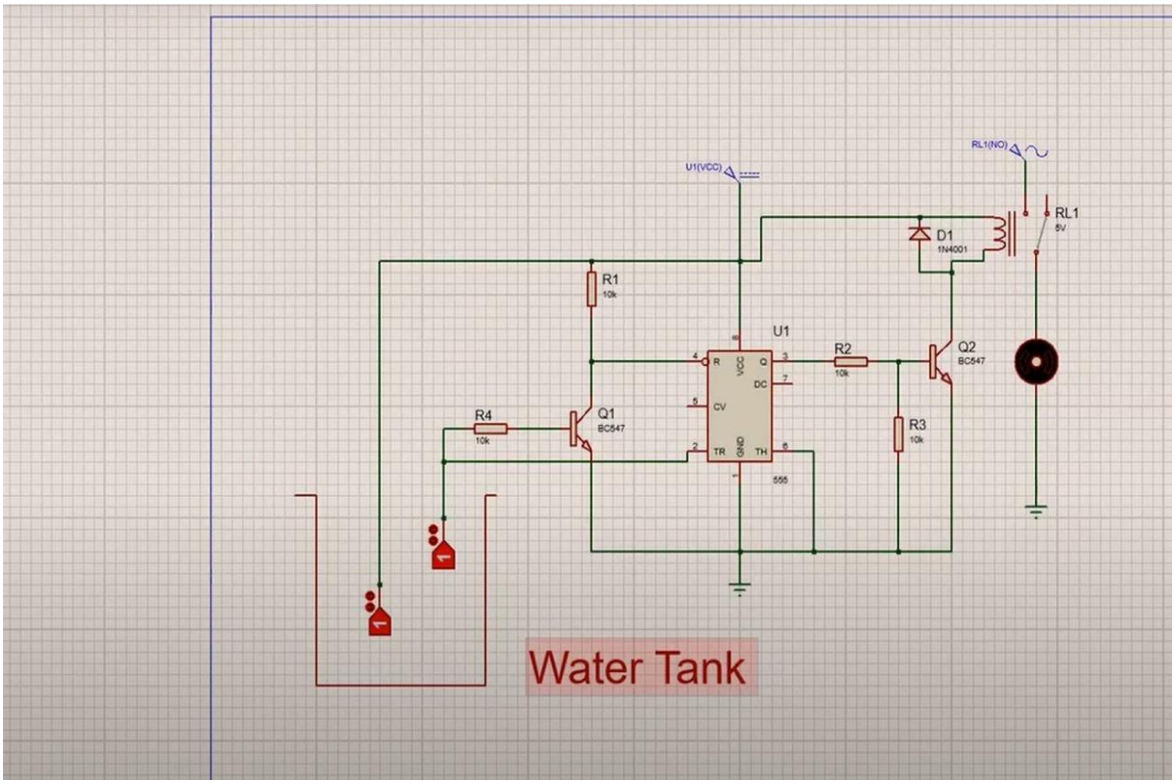
10k
Q1
BC547
R3
10k
555
Water Tank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RL1(NO)
RL1
5V
D1
1N4001
R1
10k
U1
R2
10k
Q2
BC547
R4
10k
Q1
BC547
R3
10k
555
Water Tank

7.4 Reference

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