**ABSTRACT**

Purpose of this project is to control our domestic water pump set with the help of a digital logic circuit. It automatically fill our water tank and we doesn’t bother about to turn *ON* and *OFF* the pump set.

The circuit is build around a simple flip-flop, which automatically set and reset with respect to the water level present in the water tank. Two probes are dipped in the tank (one is on the top side and other is at bottom) to check the presence of water and these probes are the input to the digital logic circuit.

It also contains some protection mechanism in order to protect the motor from *‘Dry-run conditions’*. For this purpose we are dipping a probe in the water source (Well, Ponds, etc.) and the circuit detect the availability of water in the source, when there is no water in the source, the whole system will be shut down otherwise the motor may burn.

Another facility of this system is that it can identify the purity of water. If the content of mud in the tank increases, circuit not only indicates it but also turn OFF the motor.

Also to know the amount of water in the tank, we are using a ‘*Numeric Water Level Display Circuit’* which indicates the amount of water numerically.

**Table of Contents**

|  |  |  |
| --- | --- | --- |
|  | List of figures………………………………………………………. | iv |
|  | List of tables ………………………………………………………. | v |
|  | List of symbols, Abbreviations ……………………………………. | vi |
|  | Chapters |  |
| 1 | Introduction ……………………………………………………….. | 1 |
| 2 | Functional Blocks………………………………………………….. | 2 |
| 3 | Circuit Diagrams …………………………………………………... | 3 |
|  | 3.1 Pump set controlling Circuit …………………………………. | 4 |
|  | 3.2 Numeric Water Level Display circuit………………………… | 8 |
|  | 3.3 Purity Checking Circuit ……………………………………… | 11 |
|  | 3.4 PCB Layout ….……………………………………………….. | 12 |
| 4 | Advantages……………………………………………………….... | 14 |
| 5 | Disadvantages ……………………………………………………... | 15 |
| 6 | Conclusion and Future scope ……………………………………… | 16 |
|  | Bibliography ………………………………………………………. | 17 |
|  | Appendix: Data sheets …………………………………………….. | 18 |

**LIST OF FIGURES**

|  |  |  |
| --- | --- | --- |
| 2.1 | Complete block diagram …………………………………………………… | 2 |
| 3.1 | Pump set controlling circuit ………………………………………………... | 4 |
| 3.2 | Transistor switch …………………………………………………………… | 5 |
| 3.3 | NE 555 Block diagram …………………………………………………….. | 6 |
| 3.4 | Water level display circuit………………………………………………….. | 8 |
| 3.5 | IC 7447 and display………………………………………………………… | 10 |
| 3.6 | Purity checking circuit …………………………………………………...… | 11 |
| 3.7 | PCB layout of pump set controller ………………………………………… | 12 |
| 3.8 | PCB layout of Numeric water level display ……………………………….. | 13 |
| 3.9 | PCB layout of Purity checking circuit ……………………………………... | 13 |

**LIST OF TABLES**

|  |  |  |
| --- | --- | --- |
| 3.1 | Function table of 7411 Triple input AND gate …………………………… | 5 |
| 3.2 | Function table of 74148 Encoder …………………………………………. | 8 |
| 3.3 | Function table of 7447 BCD to 7-segment converter …………………….. | 9 |

**LIST OF SYMBOLS AND ABBREVIATIONS**

µ - Micro

Ω - Ohm

Vcc - Voltage Source

A - Ampere

V - Volt

K - Kilo

AC - Alternating Current

DC - Direct Current

LED - Light Emitting Diode

LDR - Light Depended Resistor

PCB - Printed Circuit Board

IC - Integrated Circuit

**Chapter 1**

**INTRODUCTION**

* 1. Problem Definition

The present project is about providing automation in the switching of water pump set. In additional to this the project also includes the Water level indicating system and purity checking facility. This project will definitely be useful in households.

* 1. scope of study

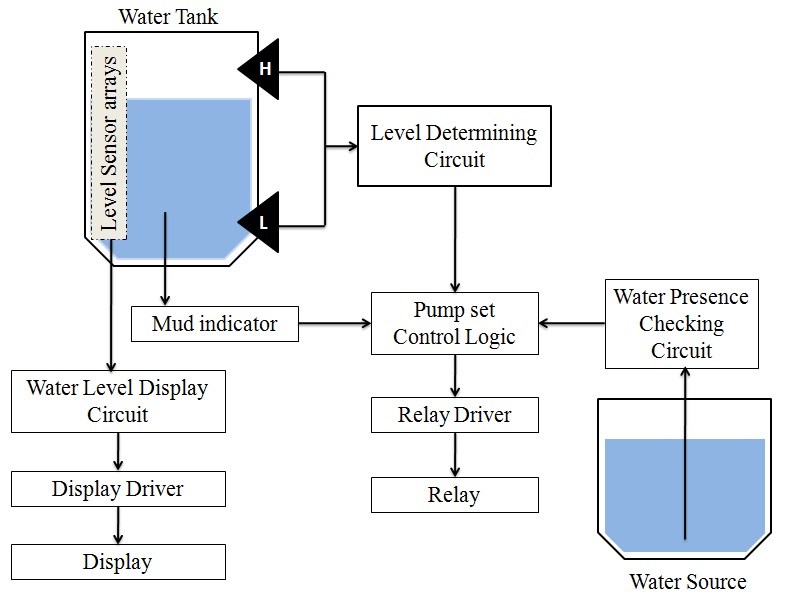
This project is developed in order to provide the existing method in the switching of water pump set much more better this also helps to detect the mud in the water and informs the user accordingly

1.3 Project motivation

This project is developed from the thought of getting automation in filling the water tank this will helps to consume time and also the mud detection enhances the advantages of this project.

**Chapter 2**

**FUNCTIONAL BLOCK DIAGRAM**

****2.1 Water Level Determining Section

*Fig 2.1 Complete Block diagram*

This unit is the input to digital control circuit. We already said that we have two levels top and bottom. Two probes are placed at these levels. It senses the presence or water at the corresponding levels. Inside this block two transistors (BC548) functions as a switch and these probes are connected to the base of transistors.

2.2 Water Presence Checking Section

This section protects our motor from *‘Dry run’* conditions. It checks whether water is present in the water source or not. The source may be well, pond, etc. If the motor runs in the absence of water, may damage the motor (Dry run).So this is a protecting mechanism.

2.3 Pump Set Control Logic

It is the controlling section of the whole system. It energizes the relay according to the different inputs received by it. NE555 IC functions as the controlling unit. Control flip-flop inside the NE555 IC do this job. We are giving some set and reset conditions to the 555 IC.

2.4 Mud indicator

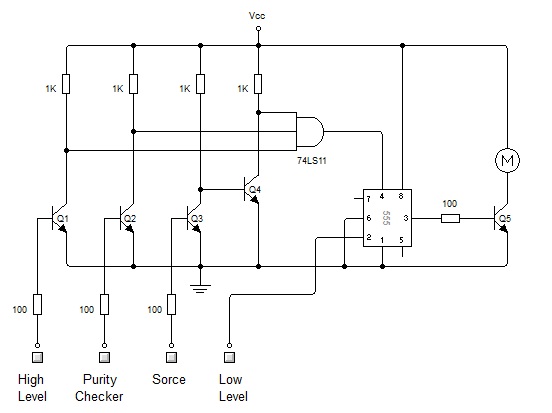
This section indicates the purity of water in the tank. When the content of mud present inside the tank reaches above a particular level, not only it indicates but also the complete system may shut down.

2.5 Numeric Water Level Display

It gives the information about the amount of water present in the tank. It shows the present level in a seven segment display.

**Chapter 3**

**CIRCUIT DIAGRAM**

3.1 Pump set controlling circuit

*Fig 3.1 Pump set controlling circuit*

Above fig shows the controlling circuit. The probe connected to the 2nd pin of 555 is used to switch the output to HIGH when the water level goes below the specified level and it remain in the set state until we reset back the circuit. There are three different conditions for resetting the control flip-flop. These three conditions are fed to the circuit through a triple input AND gate. When anyone of the input to AND gate goes LOW the output will be LOW, a LOW voltage at the 4th pin off 555 (Reset Pin) resets the internal control flip-flop. The transistors decides when the circuit to be reset. These transistors act as a switch operating mode.

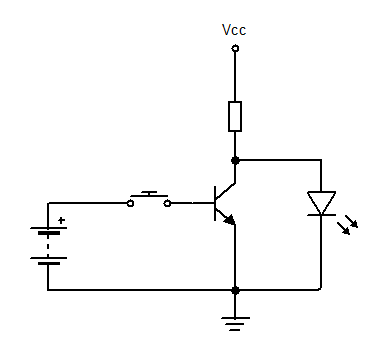
3.1.1 Transistor act as a switch

Fig 3.2 shows how the transistor acts as a switch? If transistor is in off state collector voltage is approximately equal to Vcc and the LED will be glow because transistor act as an open circuit, when the voltage at the base greater than cut in voltage (0.6V) the transistor become turned on. Then its collector voltage falls to Vce (sat) =0.2V and LED will be in off state, now transistor act as a short circuit.

*Fig 3.2 Transistor switch*

3.1.2 IC 74LS11 Triple input AND gate

The AND gate is a digital [logic gate](http://en.wikipedia.org/wiki/Logic_gate) that implements [logical conjunction](http://en.wikipedia.org/wiki/Logical_conjunction) it behaves according to the [truth table](http://en.wikipedia.org/wiki/Truth_table) to the right. A HIGH output (1) results only if both the inputs to the AND gate are HIGH (1).If neither or only one input to the AND gate is HIGH, a LOW output results. In another sense, the function of AND effectively finds the *minimum* between two binary digits

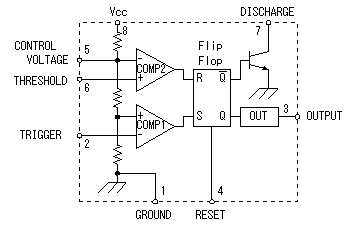
. The 74LS11 IC package contains three independent positive logic 3-input AND GATES. Pins 14 and 7 provide power for all three logic gates. The output for a gate is HIGH only when all three inputs are HIGH, otherwise output is LOW.

A typical 3 input AND gate works according to the function table as shown in figure 3.4. Its output goes LOW when anyone of the input goes LOW. This logic is utilized in our project. Here the three inputs are the ‘reset’ conditions.

*Table 3.1 Function table of 7411*

3.1.3 NE 555 IC

NE555 is an 8 pin IC, used for so many applications to produce square waves, Pulses, Bit storage, etc. NE555 has three different operating modes.

* Astable : Produce continuous square waves
* Mono-stable : Produce a single pulse when triggered
* Bi-stable : a simple memory which can be set and reset

*Fig: 3.3 NE555 Block diagram*

3.1.3.1 Inputs of 555

*Trigger input*: when < 1/3 Vcc ('active low') this makes the output high (+Vcc). It monitors the discharging of the timing capacitor in an astable circuit. It has high input impedance greater than 2 Mega ohm.

*Threshold input*: when greater than 2/3 Vcc ('active high') makes the output low (0V). It monitors the charging of the timing capacitor in astable and monostable circuits. It has high input impedance greater than 10 Mega ohms. Providing the trigger input is > 1/3 Vcc, otherwise the trigger input will override the threshold input and hold the output high (+Vcc).

*Reset input:* when less than about 0.7V ('active low') makes the output low (0V), overriding other inputs. When not required it should be connected to +Vcc. It has an input impedance of about 10 kilo ohm.

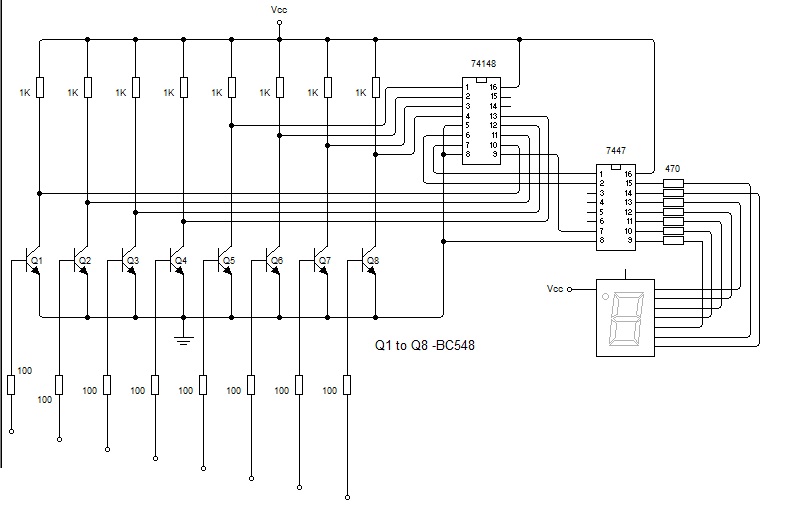
*Control input:* this can be used to adjust the threshold voltage which is set internally to be 2/3 Vcc. Usually this function is not required and the control input is connected to 0V with a 0.01μF capacitor to eliminate electrical noise. It can be left unconnected if noise is not a problem.

*The discharge pin* is not an input, but it is listed here for convenience. It is connected to 0V when the timer output is low and is used to discharge the timing capacitor in astable and monostable circuits.

3.1.3.2Outputs of 555

The output of a standard 555 can sink and source up to 200mA. This is more than other ICs and it is sufficient to supply many output transducers directly, including LEDs (with a resistor in series), low current lamps, piezo transducers, loudspeakers (with a capacitor in series), relay coils (with diode protection) and some motors (with diode protection). The output voltage does not quite reach 0V and +Vcc, especially if a large current is flowing. To switch larger currents you can connect a transistor.

3.2 Numeric Water level display circuit

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*Fig3.4 Water level display circuit*

Input to the encoder is fed through transistors; Vcc is directly dipped in the water. When the water level rises it come in to contact with the base of a particular transistor and then the transistor become on and its collector voltage falls. The encoded output is connected to BCD to 7 Segment converter which converts the encoded values to display characters.

3.2.1 IC74148 Encoder

The 74148 provides three bits of binary coded output representing the position of the highest order active input, along with an output indicating the presence of any active input. It is easily expanded via input and output enables to provide priority encoding over many bits.

*Table 3.2 Function table of 74148 Encoder*

3.2.2 IC 7447 Display Driver (BCD to 7 segment converter)

The DM74LS47 accepts four lines of BCD (8421) input data, generates their complements internally and decodes the data with seven AND/OR gates having open-collector outputs to drive indicator segments directly. Each segment output is guaranteed to sink 24 mA in the ON (LOW) state and withstand 15V in the OFF (HIGH) state with a maximum leakage current of 250 µA. Auxiliary inputs provided blanking, lamp test and cascadable zero-suppression functions.

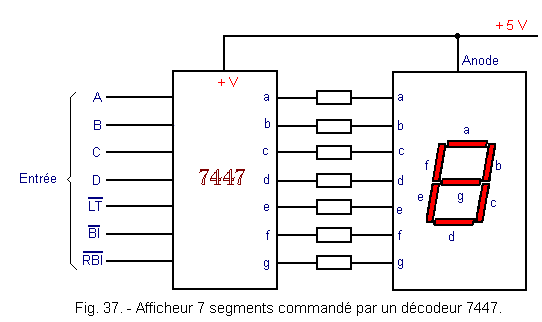
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*Table 3.3 Function table of 7447 BCD to 7 segment converter*

3.2.2.1 Functional Description of 7447

The DM74LS47 decodes the input data in the pattern indicated in the Truth Table and the segment identification illustration. If the input data is decimal zero, a LOW signal applied to the RBI blanks the display and causes a multidigit display. For example, by grounding the RBI of the highest order decoder and connecting its BI/RBO to RBI of the next lowest order decoder, etc., leading zeros will be suppressed. Similarly, by grounding RBI of the lowest order decoder and connecting its BI/RBO to RBI of the next highest order decoder, etc., trailing zeros will be suppressed. Leading and trailing zeros can be suppressed simultaneously by using external gates, i.e.: by driving RBI of a intermediate decoder from an OR gate whose inputs are BI/RBO of the next highest and lowest order decoders. BI/ RBO also serve as an unconditional blanking input. The internal NAND gate that generates the RBO signal has a resistive pull-up, as opposed to a totem pole, and thus BI/RBO can be forced LOW by external means, using wired collector logic. A LOW signal thus applied to BI/RBO turns off all segment outputs. This blanking feature can be used to control display intensity by varying the duty cycle of the blanking signal. A LOW signal applied to LT turns on all segment outputs, provided that BI/RBO is not forced LOW.

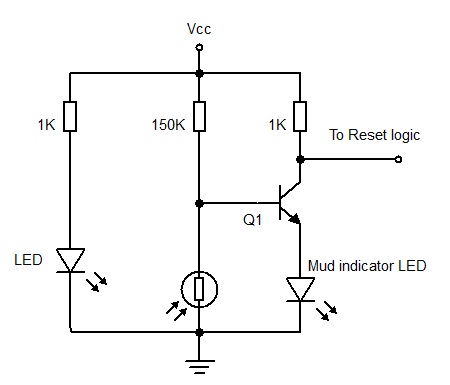
3.2.3 Display driver with display

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*Fig 3.5 IC 7447 and display*

Above fig shows how the display system works. The binary inputs received by the 7447 IC converts it in to appropriate display character. 7447 is a common anode display driver.

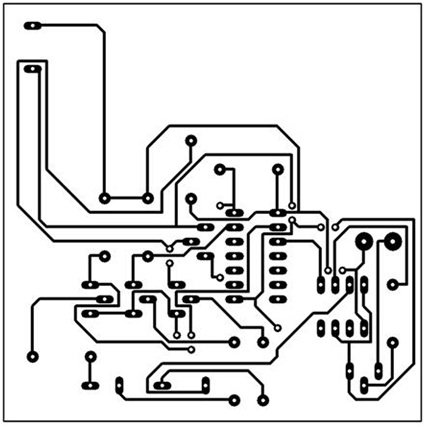
3.3 Purity checking circuit

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*Fig 3.6 Purity checking circuit*

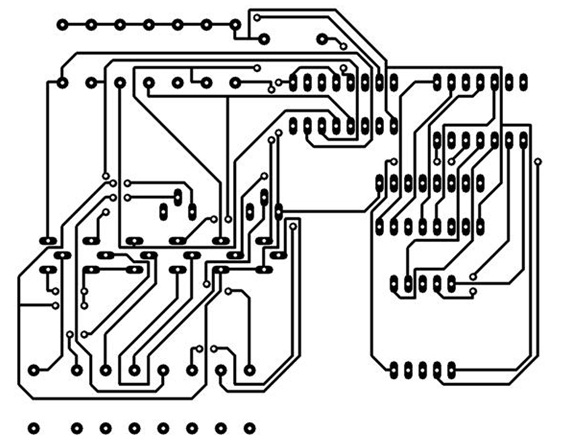
It make use of LDR (Light Depented Resistor). It has very low resistance in presence of light and has very high resistance (MΩ) in absece of light. The LEDand LDR is dipped in the water. If there is pure water the light fron LED reaches the LDR and LDR offer very low resistance hence the voltage drop across the LDR is also very low. So the transisteor become OFF. When the intensity of mud in the tank increases, the light from LED doesn’t reaches the LDR then the voltage drop across the LDR increases and hence the transistor become ON. Then its collector voltage falls to Vce(sat) and the LED will glows.

3.4 PCB Layout (Pump set controlling circuit)

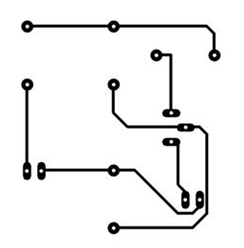
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*Fig 3.7 PCB Layout (Pump set controlling circuit)*

PCB Layout (Numeric Water Level Display Circuit)

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*Fig 3.8 PCB Layout (Numeric Water Level Display Circuit)*

PCB Layout (Purity checking circuit)

*Fig 3.9 PCB Layout (Purity checking circuit)*

**Chapter 4**

**ADVATEGES**

* The main advantage of ‘*Automated Water tank’* is that it provide complete automation for the domestic pump set
* It is inexpensive
* Less man effort
* Awareness about amount of water inside the tank
* Indicates the purity of water
* Limits the usage of electricity
* Less wastage of water

**Chapter 5**

**DISADVATEGES**

* Continuous power supply required for the operation
* Limited sensitivity of Mud indicator

**Chapter 6**

**CONCLUSION & FUTURE SCOPE**

Here we are developed an ‘Automated Water Tank’ circuit which could be used to control the domestic water pump set, it also limit the exceeding electricity bill. The circuit mainly consists of three parts such as Pump set controller, Numeric Water Level display, Mud indicator. Pump set controller controls the motor. Level Display circuit informs the amount of water inside the tank. Mud indicator not only informs the presence of mud but also is shuts down the motor when it detects the mud in the tank

The future scopes are:

* Use of ***Microcontrollers*** for this job so that single chip can do all our needs
* ***pH sensors*** can be used for Purity checking
* Use of ***Solar power*** for continuous DC supply
* Introduction of a ***cleaning arrangement*** in the tank, In order to clean water when its purity less than certain limit

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