AUTOMATIC WATER MOTOR CONTROLLER WITH SWITCHING ELEMENTS

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***Abstract*—Water is very much essential for human sustainability every though 75% of the earth surface is covered with water. There is only 2% to 3% water available for utilisation purpose in pure form. But due to laziness & other factor we are not utilising it properly & wasting it without utilising. Many time, where water motors are pumping water up and down we switched on the motor before time which leads to the wastage of electricity. When the water level is full in tank we forget to switch off the electricity which leads to wastage of water. And sometimes motor also get damage. In order to overcome this entire problem, we have studied much electrical circuit with their cost and efficiency. We have made a simple switching electrical circuit where we can control the inflow and overflow of water.**

***Index Terms*—Relay, Transistor, Motor.**

I. INTRODUCTION

The automatic water level controller that we propose to make in our projects depends on two points

a. To detect the inflow of water b. To detect the overflow of water

II. COMPONENTS USED

The Water Level Controller has the following main component:

- Relay
- Transistor
- Light Emitting Diode
- Diode
- Step Down Transformer

RELAY

A relay is usually an electromechanical device that is actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit. Relays are same as remote- control switches and are used in many applications because of their relative simplicity, long life, and proven high reliability. Relays are effectively used in a wide variety of applications throughout industry, such as in telephone exchanges, digital computers and automation systems. Highly sophisticated relays are use to protect electric power systems against trouble and power blackouts as well as to regulate and control the generation and distribution of power. In the home, relays are utilised in refrigerators, washing machines , ,heating and air-conditioning controls. Although relays are associated with electrical circuit, there are many other types, such as hydraulic. Input may be electrical and output directly mechanical, or vice versa.

COIL- This is one end of the coil.

NO- This is Normally Open switch. This is the terminal where the device is connected that we want the relay to activate when the relay is powered. The device connected to NO terminal will be deactivated when the relay has no power and will turn on when the relay receives power. We will use this terminal for powering the pump.

NC- This is the Normally Closed Switch. This is the terminal where we connect the device that we want powered when the relay receives no power. The device connected to NC will be active or start, when the relay has no power and will deactivate when the relay receives power.

Fig.1:- Relay

COM- This is the common terminal of the relay. When the relay is powered and the switch is closed, COM and NO will be shorted. If the relay isn't powered and the switch is open, COM and NC get shorted.
Advantages of Solid State Relays include low EMI/ RFI, long life, no moving parts, no contact bounce, and fast response. The drawback of solid state relay is that it can only accomplish single pole switching. [1][2].

Transistor
Transistor is as semiconductor device which was jointly discovered by John Barden, William Shockley and Walter Brattain of Bell Telephone Laboratory, USA in 1948. This discovery laid down the foundation of modern electronics and extensive research effort started in this direction. These research efforts led to the development of various types of junction transistors and other similar semiconductor devices. The most common junction transistor is Bipolar Junction Transistors (BJT).
A BJT is a terminal semiconductor device which is generally made of Germanium or silicon crystal. It has three alternate layers (regions) of *p*-type and *n*-type semiconductors. The three layers are called Emitter, Base and collector as shown in figure.

Construction of a typical BJT
The doping polarity of base is opposite to the doping polarity of emitter and collector. Emitter and collector have the same doping polarity (*p*-type or *n*-type).

Transistor configurations
a. Common Base (CB) Configuration
b. Common Emitter (CE) Configuration
c. Common Collector (CC) Configuration
But in this project we were discussion only for Common Collector (CC)Configuration for NPN.

Because a transistor's collector current is proportionally limited by its base current, it can be used as a sort of current-controlled switch. A relatively small flow of electrons sent through the base of the transistor has the ability to exert control over a much larger flow of electrons through the collector.

Suppose we had a lamp that we wanted to turn on and off with a switch. Such a circuit would be extremely simple as in Figure below (a).

For the sake of reference, let's insert a transistor in place of the switch to show how it can control the flow of electrons through the lamp. Remember that the controlled current through a transistor must go between collector and emitter. Since it is the current through the lamp that we want to control, we must position the collector and emitter of our transistor where the two contacts of the switch were. We must also make sure that the lamp's current will move *against* the direction of the emitter arrow symbol to ensure that the transistor's junction bias will be correct as in Figure below (b).

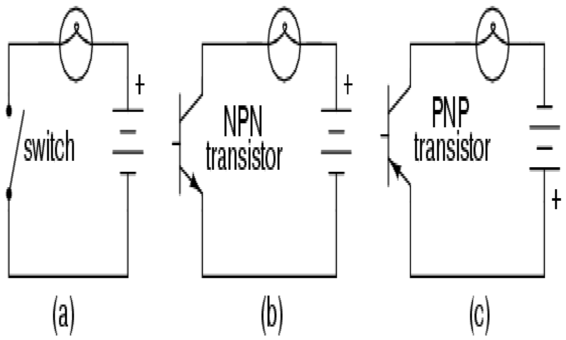

Fig.2. (a) mechanical switch, (b) NPN transistor switch, (c) PNP transistor switch.

A PNP transistor could also have been chosen for the job. Its application is shown in Figure above (c).

The choice between NPN and PNP is really arbitrary. All that matters is that the proper current directions are maintained for the sake of correct junction biasing

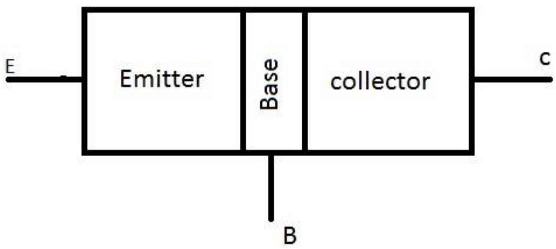

Fig.3. Pin Diagram of Transistor

Going back to the NPN transistor in our example circuit, we are faced with the need to add something more so that we can have base current. Without a connection to the base wire of the transistor, base current will be zero, and the transistor cannot turn on, resulting in a lamp that is always off. Remember that for an NPN transistor, base current must consist of electrons flowing from emitter to base (against the emitter arrow symbol, just like the lamp current). Perhaps the simplest thing to do would be to connect a switch between the base and collector wires of the transistor as in Figure below (a).

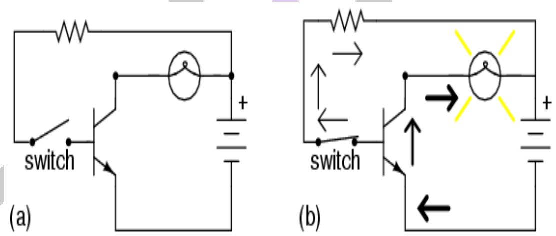

Fig.4. Transistor: (a) cutoff, lamp off; (b) saturated, lamp on.

If the switch is open as in Figure above (a), the base wire of the transistor will be left "floating" (not connected to anything) and there will be no current through it. In this state, the transistors said to be cutoff. If the switch is closed as in Figure above (b), electrons will be able to flow from the emitter through to the base of the transistor, through the switch, up to the left side of the lamp, back to the positive side of the battery. This base current will enable a much larger flow of electrons from the emitter through to the collector, thus lighting up the lamp. In this state of maximum circuit current, the transistor is said to be saturated. Of course, it may seem pointless to use a transistor in this capacity to control the lamp. After all, we're still using a switch in the circuit, aren't we? If we're still using a switch to control the lamp—if only indirectly—then what's the point of having a transistor to control the current? Why not just go back to our original circuit and use the switch directly to control the lamp current? [3][4]

Light emitting diode

A light-emitting diode (LED) is a semiconductor device that emits visible light when an electric current passes through it. The light is not particularly bright, but in most LEDs it is monochromatic, occurring at a single wavelength. The output from an LED can range from red (at a wavelength of approximately 700 nanometers) to blue-violet (about 400 nanometers). Some LEDs emit infrared (IR) energy (830 nanometers or longer); such a device is known as an *infrared-emitting diode* (IRED).
An LED or IRED consists of two elements of processed material called *P-type semiconductors* and *N-type semiconductors.* These two elements are placed in direct contact, forming a region called the *P-N junction.* In this respect, the LED or IRED resembles most other diode types, but there are important differences. The LED or IRED has a transparent package, allowing visible or IR energy to pass through. Also, the LED or IRED has a large PN-junction area whose shape is tailored to the application.

Benefits of LEDs and IREDs, compared with incandescent and fluorescent illuminating devices, include:

Diode

A diode is a specialized electronic component with two electrodes called the anode and the cathode. Most diodes are made with semiconductor materials such as silicon, germanium, or selenium. Some diodes are comprised of metal electrodes in a chamber evacuated or filled with a pure elemental gas at low pressure. Diodes can be used as rectifiers, signal limiters, voltage regulators, switches, signal modulators, signal mixers, signal demodulators, and oscillators.

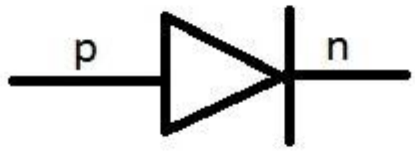

Fig.5. Diode

The fundamental property of a diode is its tendency to conduct electric current in only one direction. When the cathode is negatively charged relative to the anode at a voltage greater than a certain minimum called forward break over, then current flows through the diode. If the cathode is positive with respect to the anode, is at the same voltage as the anode, or is negative by an amount less than the forward break over voltage, then the diode does not conduct current. This is a simplistic view, but is true for diodes operating as rectifiers, switches, and limiters. The forward break over voltage is approximately six tenths of a volt (0.6 V) for silicon devices, 0.3 V for germanium devices, and 1 V for selenium devices.

The above general rule notwithstanding, if the cathode voltage is positive relative to the anode voltage by a great enough amount, the diode will conduct current. The voltage required to produce this phenomenon, known as the avalanche *voltage*, varies greatly depending on the nature of the semiconductor material from which the device is fabricated. The avalanche voltage can range from a few volts up to several hundred volts.

Transformer

In this project we were use step down transformer. If the first coil has more turns that the second coil, the secondary voltage is smaller than the primary voltage: This is called a step-down transformer. If the second coil has half as many turns as the first coil, the secondary voltage will be half the size of the primary voltage; if the second coil has one tenth as many turns it has one tenth the voltage.[5]

Fig.6. Transformer

III. Operation:-

1. STEP-BY-STEP OPERATION:-

- ➢ We have taken a npn transistor with common collector configuration.
- ➢ In this circuit we use relay as a switch in forward bias.
- ➢ The connection of the reverse bias is connected to the liked in pipe. And the first circuit of inflow of water is complete.
- ➢ Then the motor is start.
- ➢ Second circuit the biasing is same and the connection of relay is revers.
- ➢ Which control the overflow of water
- ➢ The motor is off state.

IV. Advantages of the proposed water level controller

a. Cost:-The main advantage of the water level controller is it has very low cost than the conventional one available in markets and it is a very simple controller. For example, some commercial water motor use microcontrollers which alone costs around Rs.600. Some controllers even have a price range of Rs.2000-Rs. 4000. But for our system, the components used are less in number and easily available. Hence losses will be less leading to a better efficiency. Our project cost is less than Rs.100.

b. Construction:-The construction of a water motor controller is very easy and simple as it requires only a few electronics components. The circuit involved is also relatively simpler. And easy made in house.

c. Skill Required:-Since the system of water motor controller is simpler than the ones conventionally available, it can be easily made at house. The controller can also be easily operated by anyone. And easily connected with water motor.

Table No.1: Water Level Controller

Case.	Input	Motor	Water tank
1.	Water is coming in pipe	Starts	Running water in tank
2.	Water is not coming in pipe	Off condition	Not running
3.	Water is coming in pipe	Off condition	Tank is full

Table No.2. Cost Estimation of Water Level Controller:

S.No.	Particulars	Quantity	Cost(Rs.)
1.	L.E.D	1	2
2.	Transistor	2	3
3.	Diode	4	5
4.	Relay	2	15
5.	Transformer	1	40

V. RESULTS

The experimental model was made according to the circuit & the result was as expected. The motor pump switched on when the motor detect the incoming of water & switched off as the detection of overflow level. We have gone through a comparative study with the other projects. We have reduced the cost of model to 98 rupees.

Table No. 3 Comparative for my project to other project.

S.No.	Parameter	Other projects	My project
1.	Cost	440Rs.	98Rs.
2.	Size	Large	Small
3.	Complexity	Hard	Smiple

Conclusion

In this paper, our aim was to design a circuit which controls the motor .So with the help of switching elements like transistor and relay. We designed a circuit, which holds our desired result.

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