Overflow Detector with Automatic Pump Powered by Solar Panel.

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Introduction:
The number of countries agriculture oriented is large. In the whole world, 85% of the freshwater is used up for agriculture. It also takes up 70-80% of the total volume of used water in arid and semi-arid zones. These areas are the majority in terms of consumption of freshwater. With the help of Technology and Science, initiatives can be taken to resolve this problem.
With the help of an overflow detector which can help people with water consumption, it can also show benefits in terms of economic effects, such as energy and resource. This a project about how a device can be used to resolve problems such as wasting clean water as it is a valuable resource and a scarce one. In different parts of the world, the availability of clean water is a problem and using it without wasting it is very important. Thus, a device such as this overflow water level detector is used to resolve such problems. It is a very budget-friendly, convenient, and efficient device as it can be used by power with a solar panel. Water, more specifically clean water is a valuable resource and using it to its full potential and as efficiently as possible is important.
The operational amplifier is used and has many purposes. It usually is useful for amplification. Its many applications include operating as a comparator circuit, differentiator, integrator and so on. For this specific project, a comparator circuitry is used.

Block Diagram: The Water is filled, and there will be two probes when they conduct among themselves, the


How the circuit is expected to work
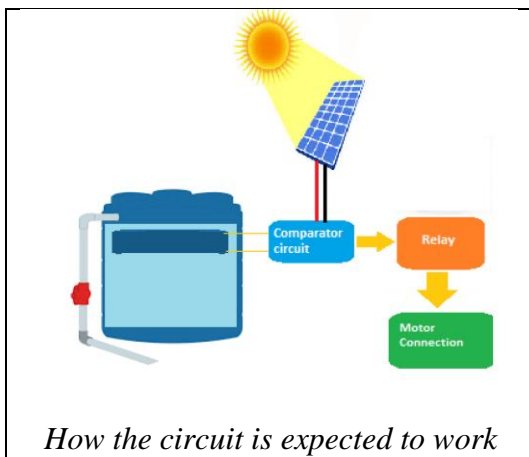
The comparator circuit is triggered, turning the relay switch the other way, which is the ground state, making the motor circuit an open loop. So, the motor is turned off. The whole system is powered by solar panels. So, the diagram requires no extra electrical connection or battery. And it is saving water from getting wasted. There will be a manual switch in the motor which can be used to turn off the motor manually, which let the pump cool in required time intervals. For the demonstration of hardware, a dc motor was used to explain the mechanism of the Overflow detector circuit, which is the comparator circuit with the probe acting as a trigger for the circuit as soon as there is a voltage. This project is also promoting renewable energy; there is no further expense after the circuit. There are multiple simple circuit concepts, and the sum of their use is representing a very helpful and day-to-day use of the system which can be used by every household.

Simulation Diagram:
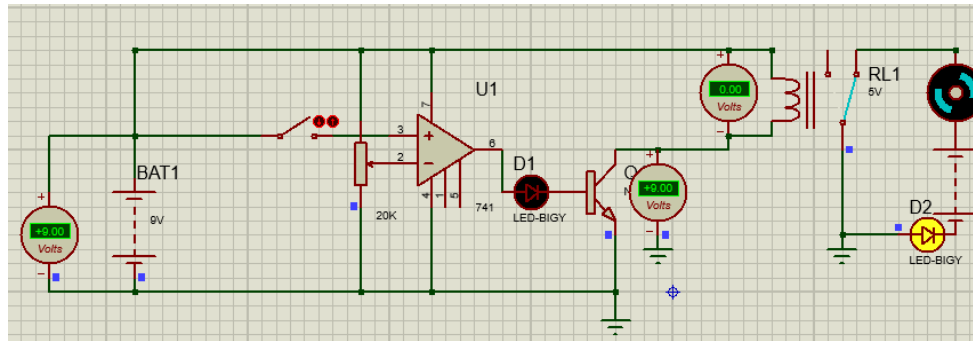
The Tank is not full. (The LED at Motor Circuit is presenting the motor ON/OFF and the switch represents the probe conducting.)
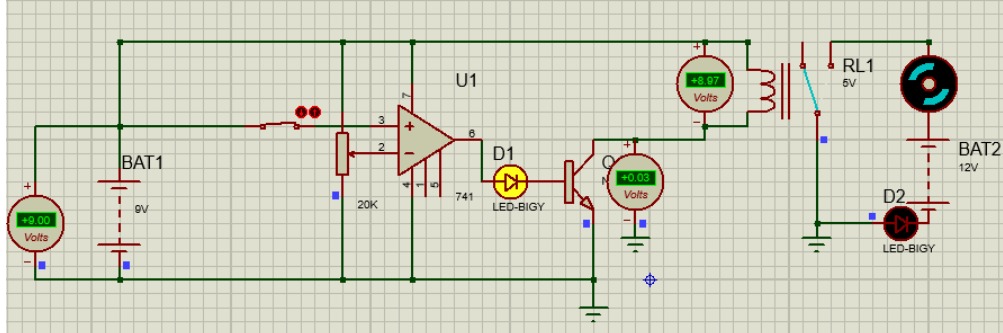

The Tank is full. (The LED at Motor Circuit is presenting the motor ON/OFF and the switch represents the probe conducting.)

Working Principle: To being with PIN 2, is connected to the potentiometer which can be tuned to a preferred value of reference voltage needed as it is a required criterion for a comparator circuit. Then comes pin 3, to which the sensors are connected, which would indicate if the reserve tank overflowed or not. One of the sensors is placed at the bottom while the other is at the top which would eventually cause a closed loop circuit once the water reaches to the level of the later part of the sensor. Once it is a closed loop circuit when the water reaches the sensor, since the op-amp is operating on an open loop configuration, when the voltage at pin 3 exceeds the reference provided by pin 2, it reaches V saturation as it comes out of pin 6 after the open loop gain is applied. Therefore, a current is allowed to reach the LED which is there as an indicator. And passes through the transistor acting as a switch. This allows the collector current to reach the relay switch. The magnet inside the relay switch is magnetized and allows the switch to flick to the left opening the circuit connected to the motor and operating it. This turns off the motor. Preventing any water to be transferred to the reserve tank any further.

Components:

- OP-AMP (LM 471)
- 20k Ohms Potentiometer
- DC Pump 6-12V
- Jumper wires
- 5V Relay
- 2N222 (NPN Transistor)
- DC Battery Clip Connectors
- LED Light (as a diode)
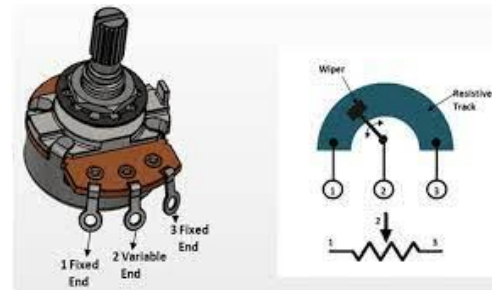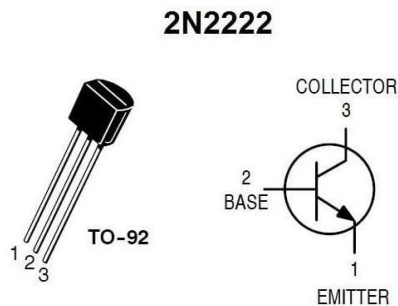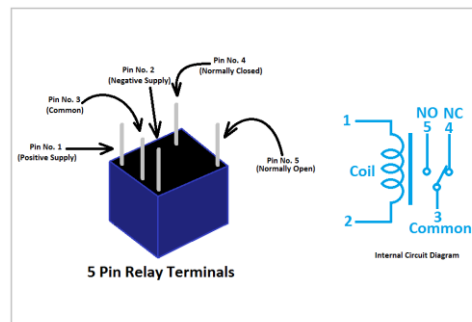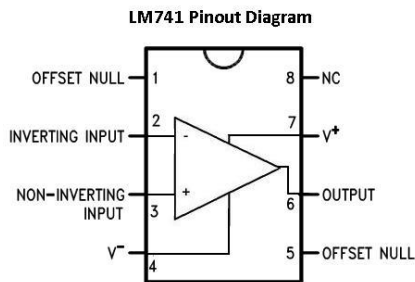- 9V Battery

Hardware Implementation:
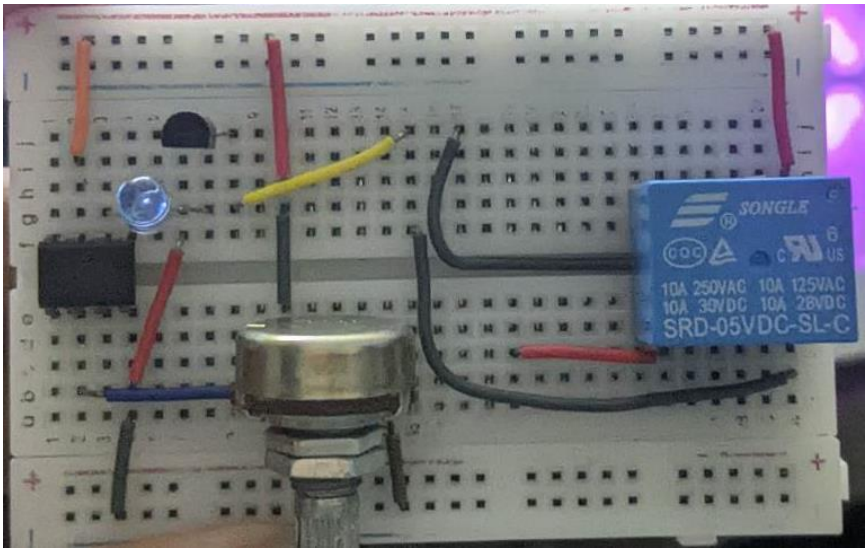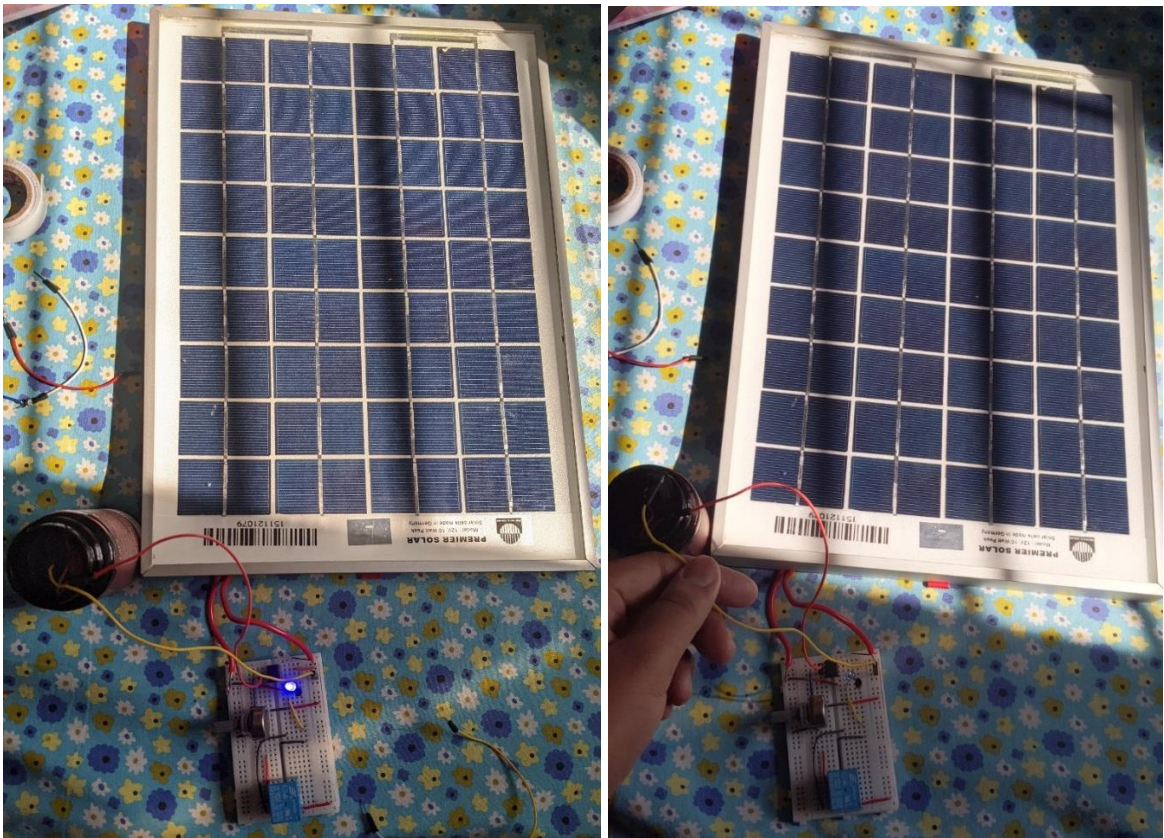
Components	Data Table	
LED	4V	10mA
2N222	19.4mA	
LED(Yellow)	2.2V	19.7
Relay OFF	0.2V	
Relay On	7.4V	
Resistor	7.38kΩ	

Discussion: As there is a voltage across the noninverting terminal. There is approximate 0V across the relay. And the voltage drop across the relay is 5.4 when it is on which is greater than the required. Switching the relay from the motor circuit connection to the grounded connection. Creating an open loop and closing the circuit. The Required resistance for the circuit to work is 7.38kΩ. As per the calculations, the resistance value is about 3.5V.

Conclusion: This project is very simple. Commonly found components. And it is a very helpful concept with it is instantaneous. As soon as the motor starts the sensor triggers the relay closing the circuit. Relay is a more convenient choice as it can work under 250VAC and 10A current. And The Alternative solution is a transistor, but it cannot work under very high voltage. This project can be converted into a "Smart Water Pump System" which will require a microcontroller which will set a delay to the circuit, such as 2-3 hours. We can add more probes which will give different levels of water levels in a LED screen, and it will be a completely automatic system. It is not consuming any additional power from the grid. It can be powered by rechargeable batteries. The solar panel has its flaws and advantages. It is a sustainable energy with a very small efficiency. To Power the whole system it might require a backup power supply. The system's main purpose is to save water and electricity bills presented by the small-scale prototype. This is one major problem of most Bangladeshi buildings it is manually controlled, and people can be busy from time to time making it hard to turn off the tank at the exact time. Taking help of the technology and science to save ourselves time and having the environment is something people need. Technology is Hope, for a future, with an eco-friendly system and easier lifestyle for human beings.

Appendix:

| UA741 | Relay 5V | Battery | DC Water Pump | 2N222 PNP | LED |

References:

1. https://www.youtube.com/watch?v=7MO1mx9ROAs&t=342s&ab_channel=ABTabi
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