AUTOMATIC WATER LEVEL MANAGEMENT SYSTEM

A PROJECT REPORT

in partial fulfillment for the award of the degree
of
BACHELOR OF TECHNOLOGY
IN
ELECTRICAL ENGINEERING

Under

Academy of Skill Development

Submitted By

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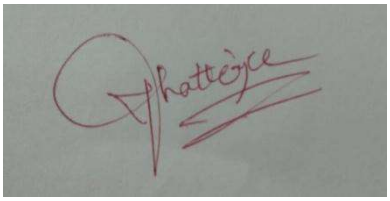
ASD
Skills For Employment

CERTIFICATE FROM THE MENTOR

This is to certify that **DEEPAK KUMAR , PRADYUMAN KUMAR SHARAN, AYUSH , RAJ KUMAR SHIHI** has successfully completed the project titled **"AUTOMATIC WATER LEVEL MANAGEMENT SYSTEM "** under my supervision during the period from February to May which is in partial fulfillment of requirements for the award of the B.Tech and submitted to Department **Electrical Engineering** of **Netaji Subhash Engineering College.**



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Signature of the Mentor

Date: 22nd MAY,2021

Acknowledgement

I take this opportunity to express my deep gratitude and sincerest thanks to my project mentor, **MR. TATHAGATA CHATTERJEE** for giving the most valuable suggestion, helpful guidance and encouragement in the execution of this project work.

I would like to give a special mention to my colleagues. Last but not the least I am grateful to all the faculty members of **Academy of Skill Development** for their support.

PROJECT OBJECTIVE

The main aim of this system is to monitor the water level at rural areas so that it will help in detecting the wastage of water and electricity and measures can be taken to avoid unnecessary overflowing of water and wastage of electricity in the areas where monitoring is a difficult task.

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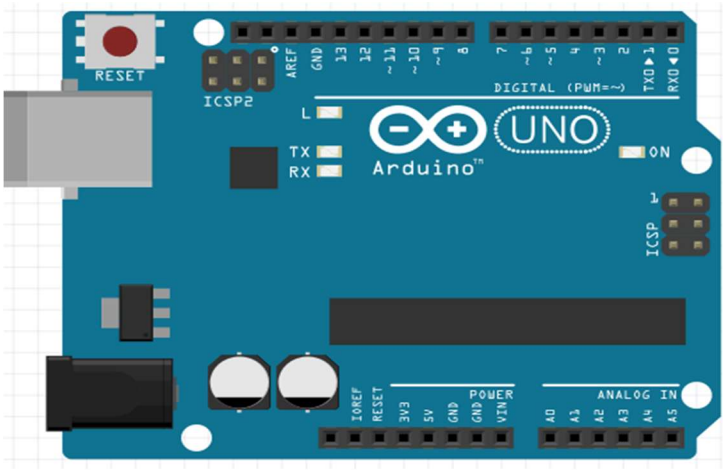
DESCRIPTION OF EACH COMPONENT

❖ ARDUINO UNO R3



The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts.

The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

While the Uno communicates using the original STK500 protocol, it differs from all preceding boards in that it does not

use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Technical specifications

- Microcontroller: Microchip ATmega328P [7]
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 can provide PWM output)
- UART: 1
- I2C: 1
- SPPI: 1
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Width: 53.4 mm
- Weight: 25 g

General pin functions

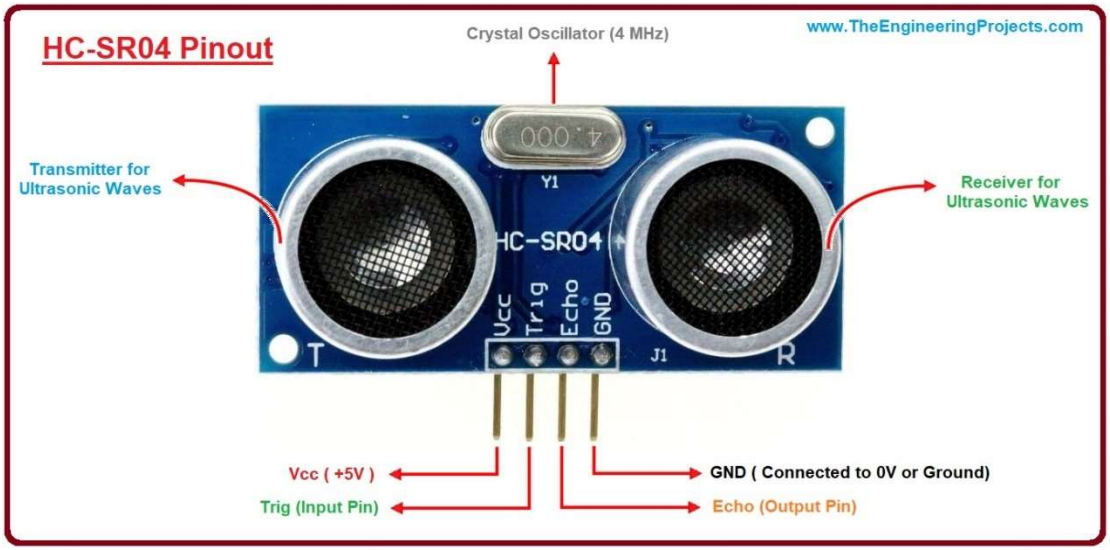
- **LED: There is a built-in LED driven by digital pin 13. When the pin is high value, the LED is on, when the pin is low, it is off.**
- **VIN: The input voltage to the Arduino/Genuino board when it is using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.**
- **5V: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.**
- **3V3: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.**
- **GND: Ground pins.**
- **IOREF: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source, or enable voltage translators on the outputs to work with the 5V or 3.3V.**
- **Reset: Typically used to add a reset button to shields that block the one on the board.[7]**

In addition, some pins have specialized functions:

- **Serial / UART: pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL serial chip.**
- **External interrupts: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.**

- PWM (pulse-width modulation): pins 3, 5, 6, 9, 10, and 11. Can provide 8-bit PWM output with the analogWrite() function.
- SPI (Serial Peripheral Interface): pins 10 (SS), 11 (MOSI), 12 (MISO), and 13 (SCK). These pins support SPI communication using the SPI library.
- TWI (two-wire interface) / I²C: pin SDA (A4) and pin SCL (A5). Support TWI communication using the Wire library.
- AREF (analog reference): Reference voltage for the analog inputs.

❖ ULTRASONIC SENSOR



An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the

emission of the sound by the transmitter to its contact with the receiver. The formula for this calculation is D = ½ T x C (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second). For example, if a scientist set up an ultrasonic sensor aimed at a box and it took 0.025 seconds for the sound to bounce back, the distance between the ultrasonic sensor and the box would be:

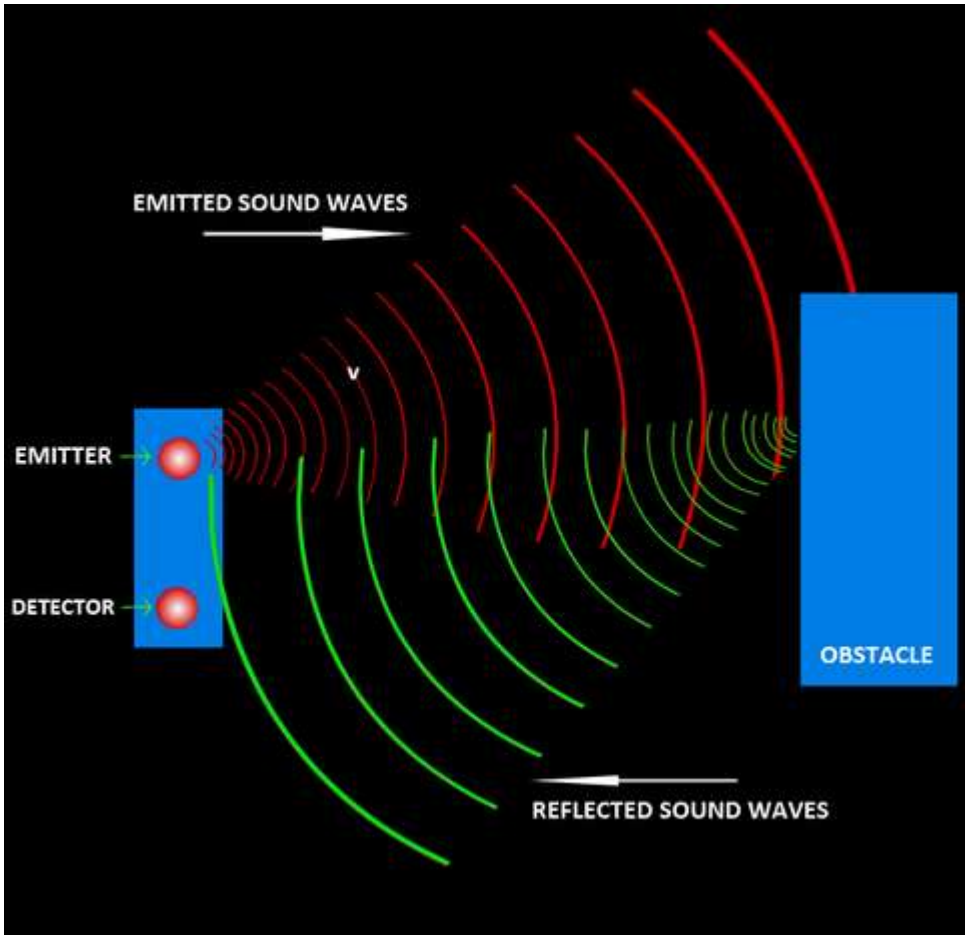
D = 0.5 x 0.025 x 343

or about 4.2875 meters.

Parameter	Value
Main Parts	Transmitter & Receiver
Technology Used	Non-Contact Technology
Operating Voltage	5 V
Operating Frequency	4 MHz
Detection Range	2cm to 400cm
Measuring Angle	30º
Resolution	3mm
Operating Current	<15mA
Sensor Dimensions	45mm x 20mm x 15mm

No.	Pin Name	Pin Description
1	VCC	The power supply pin of the sensor that mainly operates at 5V DC.
2	Trig Pin	It plays a vital role to initialize measurement for sending ultrasonic waves. It should be kept high for 10us for triggering the measurement.

3	Echo Pin	This pin remains high for short period based on the time taken by the ultrasonic waves to bounce back to the receiving end.
4	Ground	This pin is connected to ground.

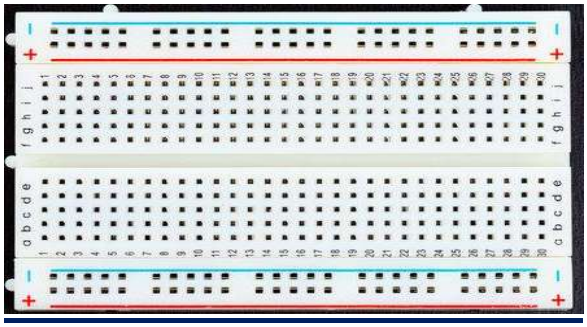


Ultrasonic sensors are used primarily as proximity sensors. They can be found in automobile self-parking technology and anti-collision safety systems. Ultrasonic sensors are also used in robotic obstacle detection systems, as well as manufacturing technology. In comparison to infrared (IR) sensors in proximity sensing applications, ultrasonic sensors are not as susceptible to interference of smoke, gas, and other airborne particles (though the physical components are still affected by variables such as heat).

Ultrasonic sensors are also used as level sensors to detect, monitor, and regulate liquid levels in closed containers (such as vats in chemical factories). Most notably, ultrasonic technology has enabled the medical industry to produce images of internal organs, identify tumors, and ensure the health of babies in the womb.

❖ BREADBOARD

A **breadboard** is a solderless device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate.



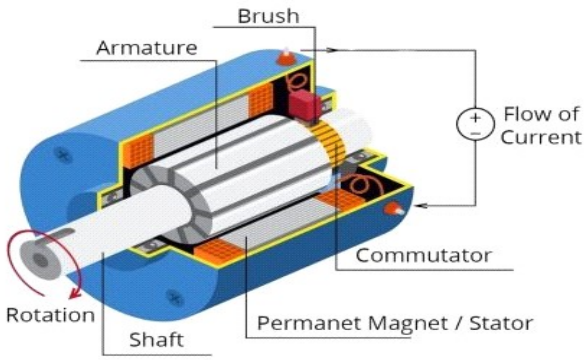
❖ DC MOTOR

An electric motor operated by DC (direct current) is known as a DC motor (unlike an induction motor that operates via an alternating current).DC motor converts electrical energy in the form of Direct Current into mechanical energy in the form of rotational motion of the motor shaft.

- Principle of DC Motor

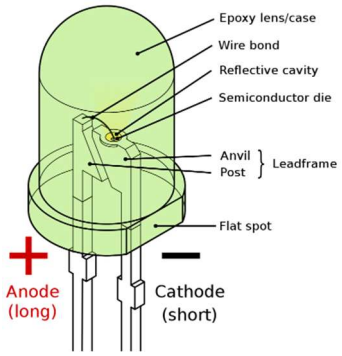
When a current-carrying conductor is placed in a magnetic field, it experiences a torque and has a tendency to move.

The DC motor speed can be controlled by applying varying DC voltage; whereas the direction of rotation of the motor can be changed by reversing the direction of current through it.



Here we used dc motor as water pump.

❖ LED



A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor.

Here we used LED(Light Emitting Diode) to indicate the level of water in the tank.

❖ CONNECTING WIRES

Connecting wires allows an electrical current to travel from one point on a circuit to another, because electricity needs a medium through which to move. In the case of computers, wires are embedded into circuit boards, carrying pulses of electricity that are interpreted as binary signals of zeros and ones.

Most wires in computers and electronic components are made of copper or aluminum. Copper is cheap and electrically conductive. Silver has higher conductivity but is far more expensive.

PROJECT DISCUSSION

Due to exploitation of water resources and speeding of climate change due to human activities, water becoming a luxury these days and keeping tab on water consumption is a necessity now. We know that water conservation starts from a family and a person in a family can easily track their water consumption either by observing day to day activities or checking water level of their overhead tank every day.

But for a municipal government who is concerned about the areas they governing cannot track each and every family's water consumption by physically sending a person every day. Instead they can check level of municipal supply tanks where the level of water is direct reflection of water consumed by the people in the area. Again we have to deploy several people to take readings of tens of municipal overhead tanks several times a day.

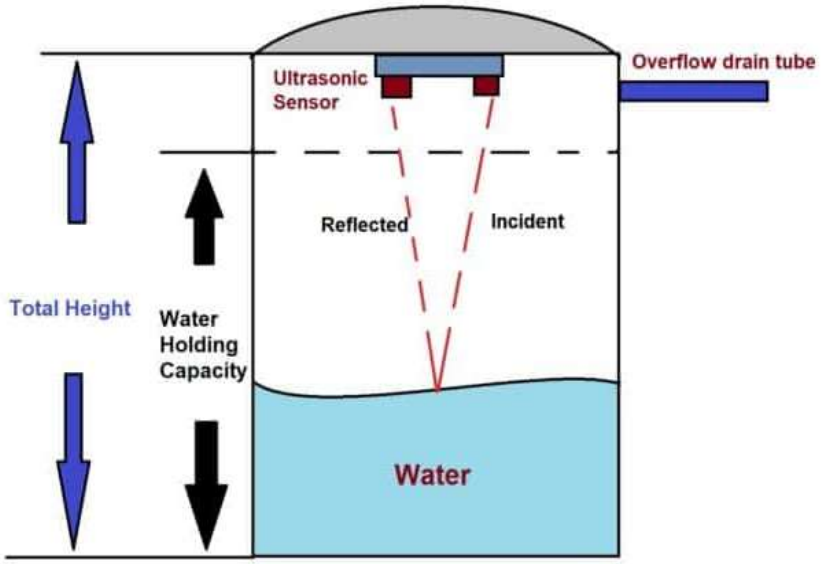
By installing IoT based water level monitoring systems in all the important municipal water tanks the local government can know the level of water in real time and they can fill the tank on time and also can understand the consumption of water in the area. The collected data can be sent to higher level governments where they can draw national level conclusions on water consumption.

IoT based water level monitoring system can also be installed on individual houses / apartments so that one can check water level of their tank in real time from their own comfort and also track their consumption overtime.

How to measure water level using ultrasonic sensor, and why?

Measuring water level is same as measuring distance of solid surfaces, the ultrasonic transducer outputs a train of ultrasonic bursts at 40 KHz which will hit the water surface and reflect back to the sensor. The time taken between sent and received

ultrasonic waves are calculated by a microcontroller such as Arduino.



In ultrasonic measurement, the accuracy of readings is +/- 3mm and can be used to tanks that are up to 4 meter deep.

CODE :

```
#define echo 6
#define trig 7
void setup()
{
  pinMode(2, OUTPUT)
 pinMode(3, OUTPUT);
  pinMode(4, OUTPUT);
  pinMode(5, OUTPUT);
  pinMode(6, INPUT);
  pinMode(7, OUTPUT);
  pinMode(8, OUTPUT);
}
void loop()
{
  int distance=us();
  Serial.println(distance);
  if(distance<=25)
  { digitalWrite(8,LOW);
   digitalWrite(2,HIGH);
   digitalWrite(3,HIGH);
   digitalWrite(4,HIGH);
   digitalWrite(5,HIGH);
  }
  else if(distance>=25 && distance<150)
  { digitalWrite(8,HIGH);
   digitalWrite(2,HIGH);
   digitalWrite(3,HIGH);
   digitalWrite(4,HIGH);
   digitalWrite(5,LOW);
  }
  else if(distance>=150 && distance<250)
  { digitalWrite(8,HIGH);
   digitalWrite(2,HIGH);
   digitalWrite(3,HIGH);
   digitalWrite(4,LOW);
   digitalWrite(5,LOW);
  }
  else if(distance>=250 && distance<300)
  { digitalWrite(8,HIGH);
   digitalWrite(2,HIGH);
   digitalWrite(3,LOW);
   digitalWrite(4,LOW);
   digitalWrite(5,LOW);
  }
  else if(distance>=300)
  { digitalWrite(8,HIGH);
   digitalWrite(2,LOW);
   digitalWrite(3,LOW);
```

```
   digitalWrite(4,LOW);
   digitalWrite(5,LOW);

  }

}
int us()
{
 digitalWrite(trig,LOW);
 delayMicroseconds(2);
 digitalWrite(trig,HIGH);
 delayMicroseconds(10);
 digitalWrite(trig,LOW);
 long duration=pulseIn(echo,HIGH);
 int distancecm=duration*0.034/2;
 return distancecm;
}
```

PROJECT STEPS

Lets assume the height of the tank is 300 cm and it is empty.

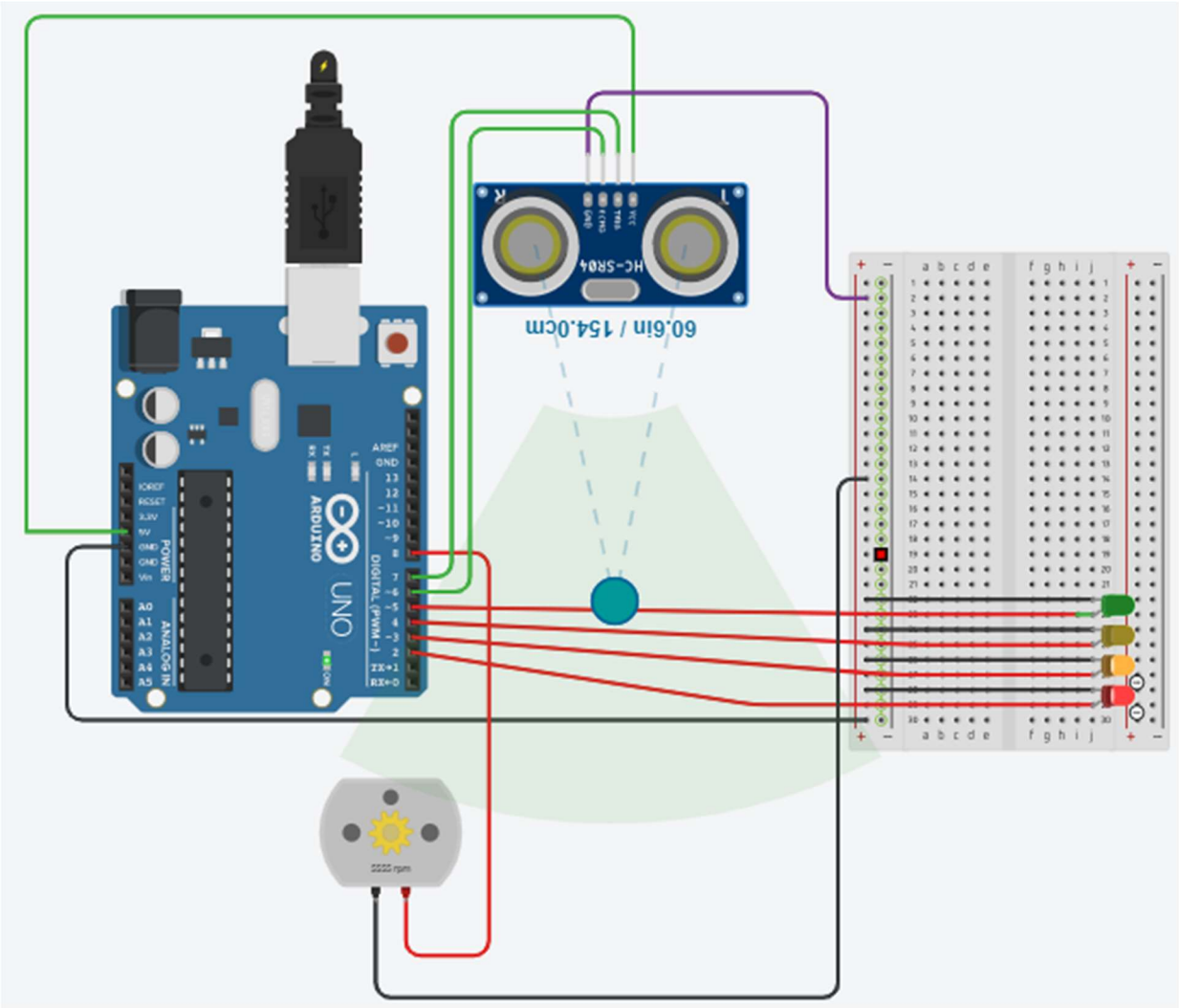
- STEP 1 : Start the setup.

- STEP 2 : When the tank is empty (distance=300),the red LED will glow and indicates the tank is empty then the water pump turns on automatically.

- STEP 3 : while the pump is running the orange(distance=250 cm),yellow(distance=150 cm) and green(distance=25 cm) light will glow successively which indicates that water level in the tank is rising.

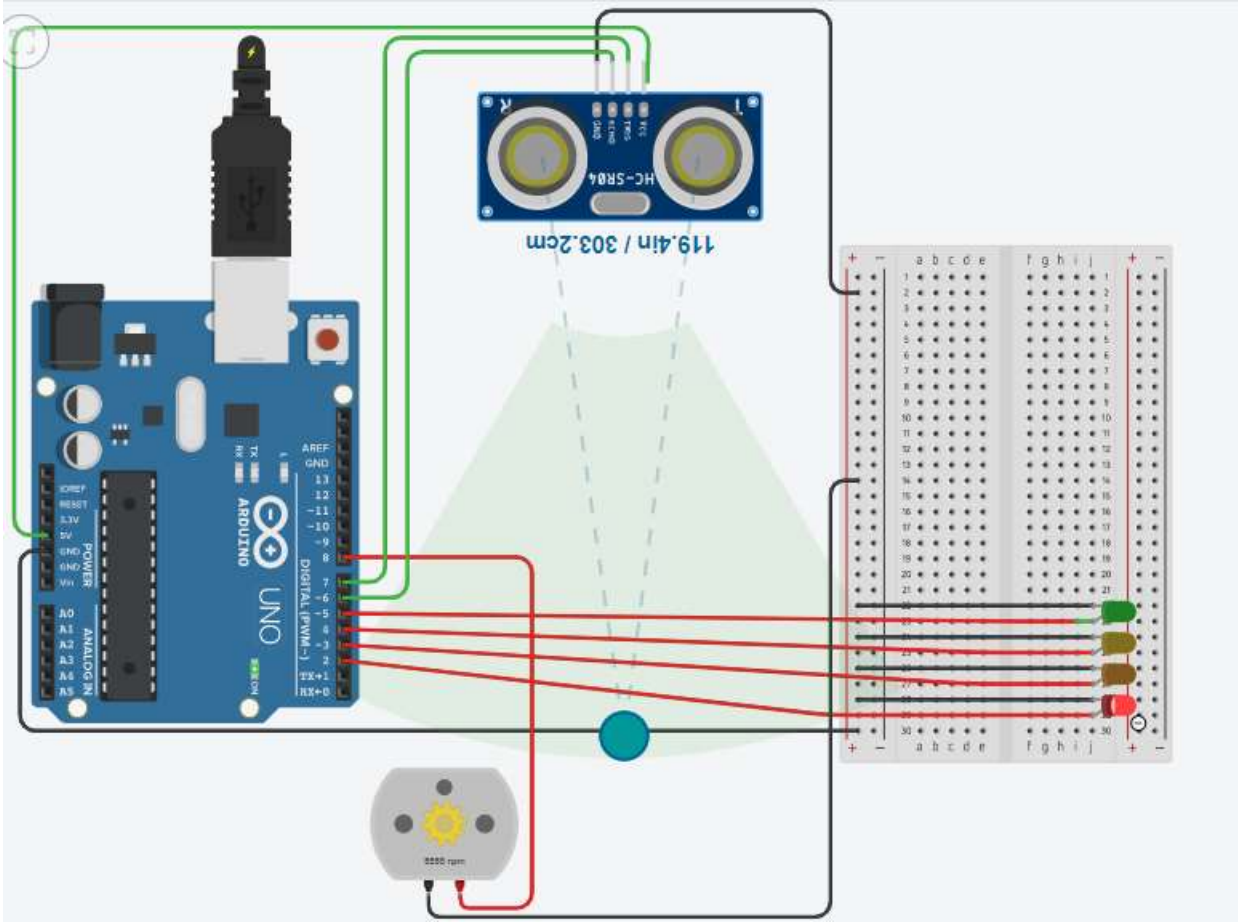
- STEP 4 : when the tank becomes full(distance=25 cm) the green LED will start glowing and the water pump turn off automatically.

PROJECT CIRCUIT DIAGRAM

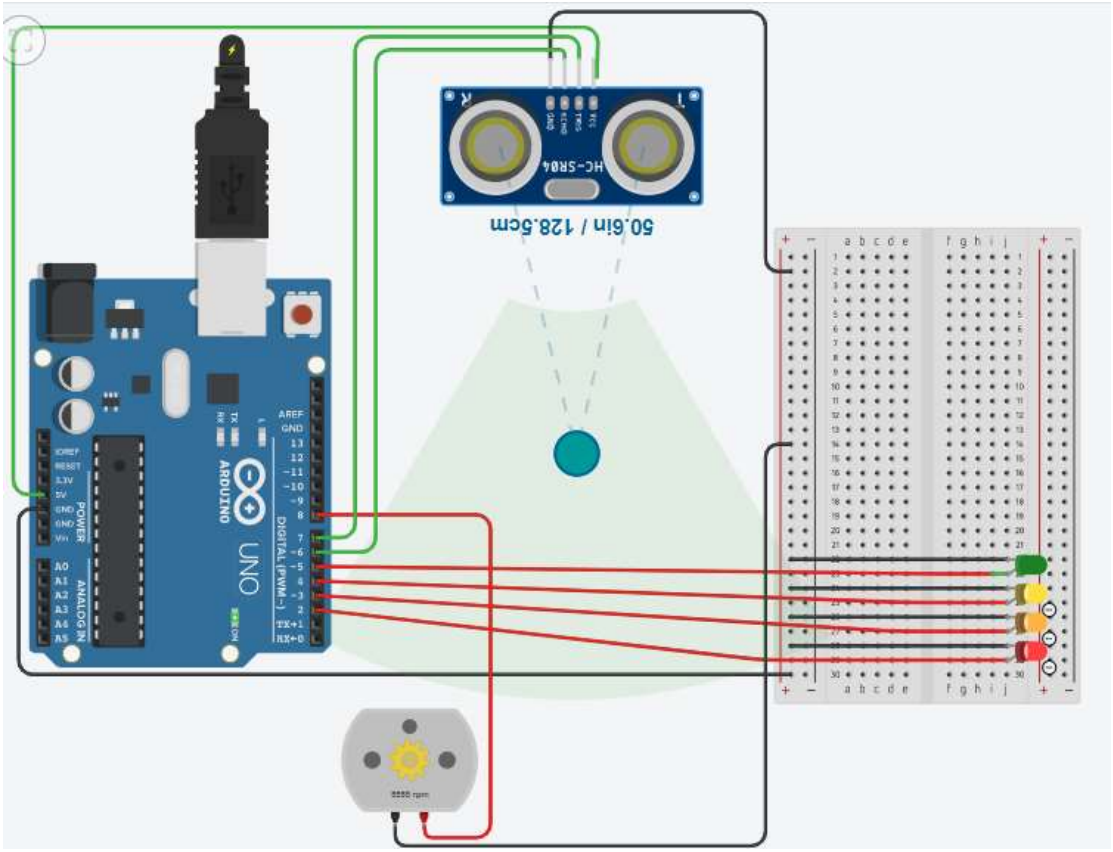


RESULT

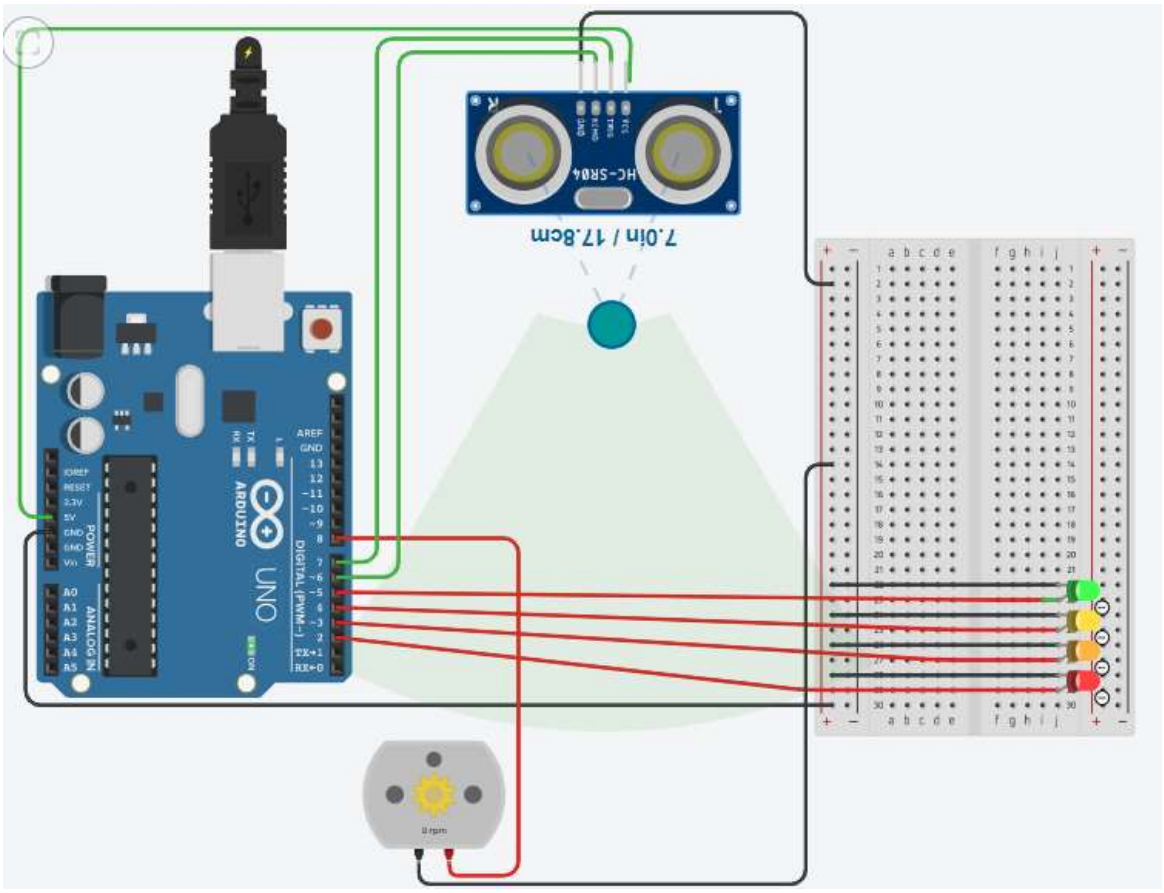
❖ When the tank is empty water pump is running



❖ Water level is rising



❖ When tank becomes full water pump turns off



CONCLUSION

After observing the results we can conclude that the system is working as intended .This project helps in reducing the wastage of water resource and electricity.

REFERENCE—

MR. TATHAGATA CHATTERJEE(PROJECT GUIDE)

www.tinkercad.com(FOR SIMULATION)

en.wikipedia.org (FOR COMPONENTS DISCRIPTION)