University of Asia Pacific

Department of Computer Science and Engineering

CSE 316: Microprocessor and Microcontroller Lab

LAB REPORT

Experiment Number: 04

Experiment Title: Water Level based Automatic Pump Control

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1.Experiment Name:

Water Level based Automatic Pump Control

2.Objective:

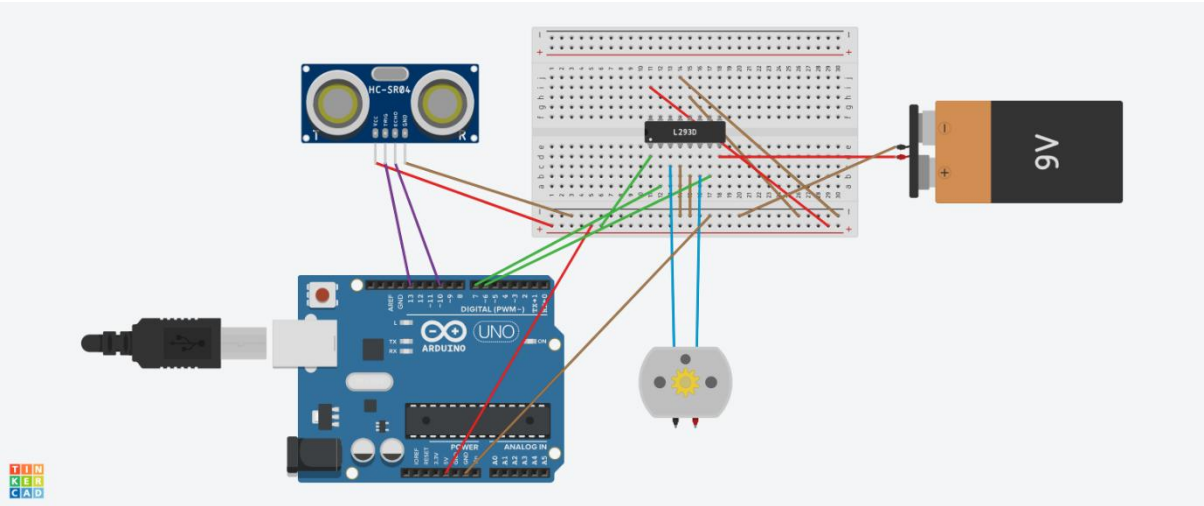
The objectives of this experiment are:

I. To design and implement an automatic water pump control system using Arduino and an ultrasonic sensor.
II. To monitor the water level of a tank in real-time.
III. To automatically switch ON the pump when the water level is low.
IV. To automatically switch OFF the pump when the tank is full.
V. To prevent water overflow and avoid pump dry run.
VI. To save energy and ensure efficient pump operation.
VII. To provide a low-cost and reliable water level management system without manual supervision.

3.Apparatus:

i. Tinker CAD
ii. Arduino IDE
iii. Bread board
iv. Connecting wires
v. Arduino
vi. Ultrasonic Sensor HC-SR04
vii. L293D H bridge motor driver
viii. 9V Power Source
ix. DC motor/pump

4.Circuit Diagram:



5.Code/ Assembly Program:

```
// Pin configuration
const int TRIG = 13;
const int ECHO = 10;
const int IN1  = 7;
const int IN2  = 6;
long duration;
int distance;
// Distance thresholds
const int minDistance = 40;   // Tank full -> Pump OFF
const int maxDistance = 70;   // Tank empty -> Pump ON

void setup() {
  pinMode(TRIG, OUTPUT);
  pinMode(ECHO, INPUT);

  pinMode(IN1, OUTPUT);
  pinMode(IN2, OUTPUT);
  Serial.begin(9600);
}
void loop() {
  // --- Ultrasonic trigger pulse ---
  digitalWrite(TRIG, LOW);
  delayMicroseconds(2);
  digitalWrite(TRIG, HIGH);
  delayMicroseconds(10);
  digitalWrite(TRIG, LOW);
  // --- Measure echo time ---
  duration = pulseIn(ECHO, HIGH);
  // --- Convert to cm ---
  distance = duration * 0.034 / 2;
```

```
  // --- Print distance ---
  Serial.print("Water Level Distance: ");
  Serial.print(distance);
  Serial.println(" cm");

  // --- Pump Control Logic ---
  if (distance > maxDistance) {
    // Tank empty -> Pump ON
    digitalWrite(IN1, HIGH);
    digitalWrite(IN2, LOW);
    Serial.println("Pump ON");
  }
  else if (distance < minDistance) {
    // Tank full -> Pump OFF
    digitalWrite(IN1, LOW);
    digitalWrite(IN2, LOW);
    Serial.println("Pump OFF");
  }
  // --- Small delay before next reading ---
  delay(500);
}
```

6. Output / Observations:

The system automatically controls a water pump using an ultrasonic sensor and Arduino. The HC-SR04 sensor, with TRIG pin 13 and ECHO pin 10, measures the distance between the water surface and the sensor at the top of the tank. When the TRIG pin sends out an ultrasonic pulse, it bounces off the water surface and comes back to the ECHO pin. The Arduino calculates the time it takes for the pulse to return and converts it into distance in centimetres. Depending on this distance, the Arduino controls the pump using motor driver pins IN1 and IN2. If the distance is more than 70 cm, meaning the tank is almost empty, the Arduino sets IN1 HIGH and IN2 LOW to turn the pump ON. If the distance is less than 40 cm, meaning the tank is full, both IN1 and IN2 are set LOW to turn the pump OFF. If the distance is between 40 cm and 70 cm, the pump keeps running until the water is full. Observations from the serial monitor showed the system works correctly: when the water level was 75 cm, the pump turned ON; at 55 cm, it kept running; and at 35 cm, it turned OFF. This shows that the system keeps water at the right level, prevents overflow, avoids running the pump when the tank is empty, and reduces the need for manual checking.

7.Result:

The automated water pump system worked as expected. The ultrasonic sensor accurately measured the water level, and the Arduino controlled the pump correctly. When the tank was nearly empty (distance > 70 cm), the pump turned ON, and when the tank was full (distance < 40 cm), the pump turned OFF. For water levels in between, the pump continued running until the tank was full. The system successfully maintained proper water levels, prevented overflow, avoided dry running, and reduced the need for manual supervision.

8.Conclusion:

The automatic water pump system successfully controls the water level in the tank using an ultrasonic sensor and Arduino. It accurately measures the water level and turns the pump ON when the tank is nearly empty and OFF when it is full, preventing both overflow and dry running. The system works reliably for all intermediate water levels, ensuring the pump runs only when needed. This automation reduces the need for manual supervision, saves energy, and provides an efficient and safe way to maintain proper water levels in the tank.