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AUTOMATED LIQUID VOLUME MEASUREMENT AND FILLING SYSTEM

INTROUCTION

- This project aims to automate liquid volume measurement and filling processes using ultrasonic and flow sensors, ensuring precision, efficiency, and resource optimization.
- Precision Measurement and Filling through Smart Sensor Technology
- It facilitates accurate filling of containers, enhancing industrial processes and promoting automation in liquid management.

IMPORTANCE

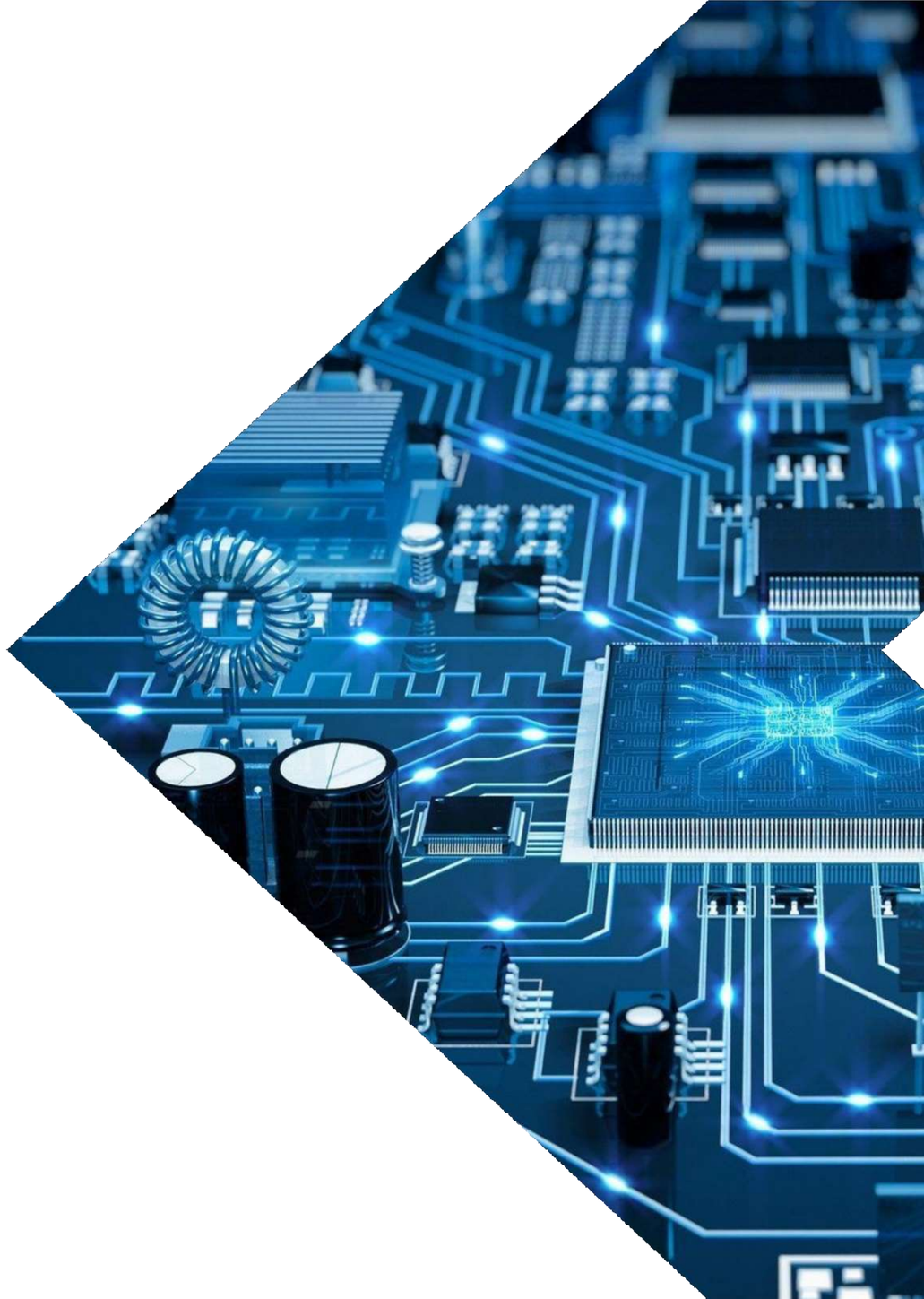
Precision & Efficiency: Ensures precise liquid measurements and automated filling, minimizing wastage and enhancing operational efficiency.

Resource Optimization: Significantly reduces material wastage, conserves resources, and promotes sustainable practices in industries relying on accurate liquid management

Cost-Efficiency: Streamlines processes, reducing labor costs and enhancing product quality, making it economically advantageous for industries.

COMPONENTS USED

- ARDUINO UNO
- ULTRASONIC SENSOR - HC-SR04
- RELAY MODULE
- FLOW SENSOR & DC PUMP



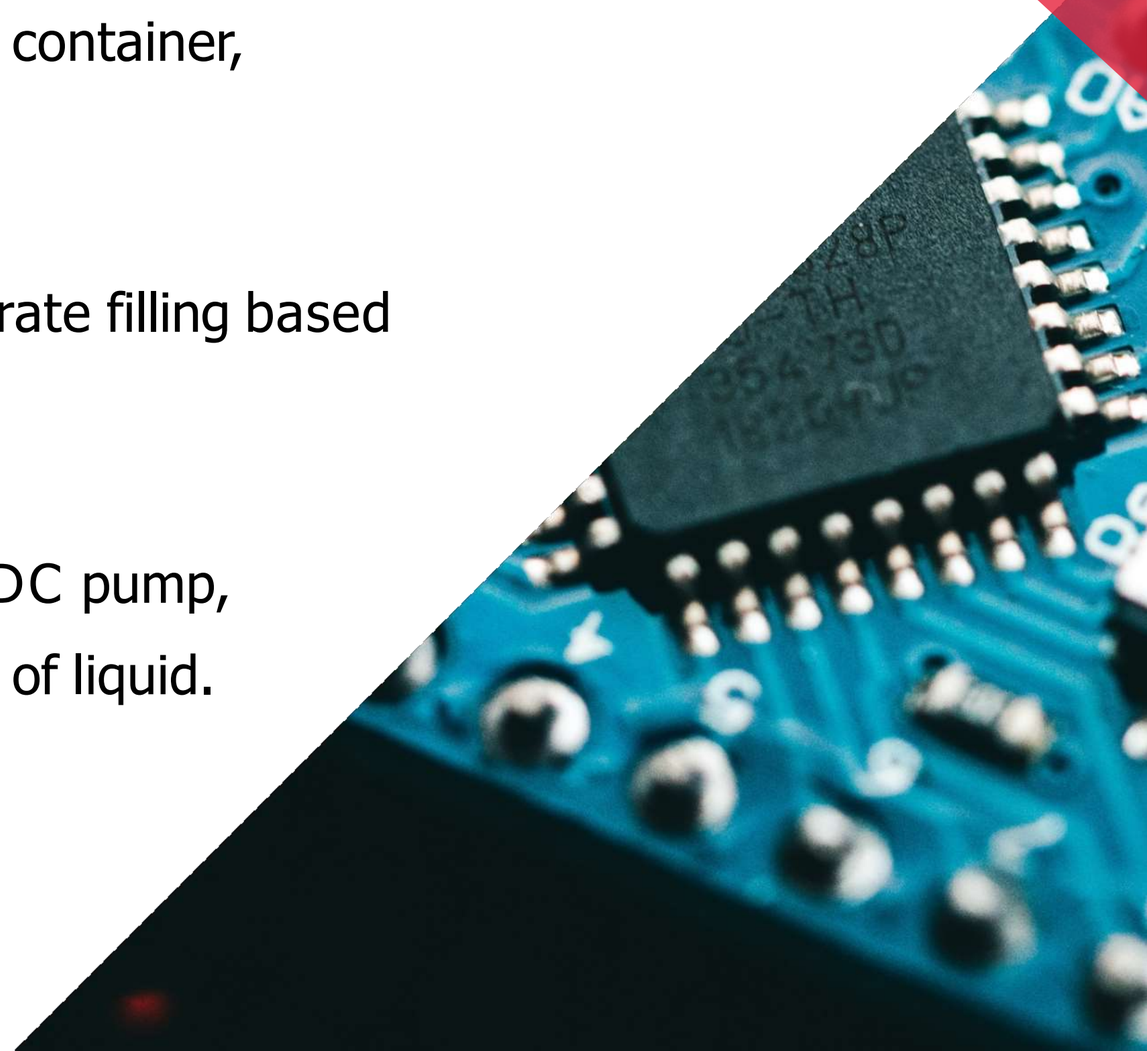
WORKING PRINCIPLE

- **Ultrasonic Sensors**: Measure height and radius of the container, providing precise dimensions for volume calculation.

- **Flow Sensor**: Monitors liquid flow rates, ensuring accurate filling based on calculated volume requirements.

- **Arduino Control**: Utilizes sensor data to regulate the DC pump, precisely filling the container with the calculated volume of liquid.

- **DC MOTOR PUMP** : Used to fill the object with liquid



APPLICATIONS

Manufacturing: Precise filling of raw materials, enhancing product quality, and reducing production costs.

Pharmaceuticals: Accurate drug formulation, ensuring medication safety and effectiveness.

Agriculture: Optimal irrigation control, conserving water resources and promoting sustainable farming.

Water Treatment: Efficient chemical dosing, ensuring high-quality water supply for communities.

Research Labs: Accurate handling of reagents, supporting precise experiments and scientific research.

Beverage Industry: Consistent filling of bottles, maintaining uniformity in beverage production.

CODE OVERVIEW

```
//Define pins for ultrasonic sensors
const int trigPinHeight = 2; //Trig pin of the height sensor
const int echoPinHeight =3; //Echo pin of the height sensor
const int trigPinRadius =4; //Trig pin of the radius sensor
const int echoPinRadius =5; //Echo pin of the radius sensor
const int flowSensorPin =6; //Pin connected to the output of the flow sensor
const int pumpPin =7; //Pin connected to the relay module controlling the DC pump

//Constants for flow sensor
const float calibrationFactor =4.5; //Modify this value based on your flow sensor's calibration

void setup() {
 pinMode(trigPinHeight, OUTPUT);
 pinMode(echoPinHeight, INPUT);
 pinMode(trigPinRadius, OUTPUT);
 pinMode(echoPinRadius, INPUT);
 pinMode(flowSensorPin, INPUT);
 pinMode(pumpPin, OUTPUT);
 Serial.begin(9600);
}

void loop() {
 //Measure height
 float height =measureDistance(trigPinHeight, echoPinHeight);

 //Measure radius
 float radius =measureDistance(trigPinRadius, echoPinRadius);

 //Calculate volume (assuming object is a cylinder)
 float volume = PI *radius *radius *height;
```

```
 //Print volume to serial monitor
 Serial.print("Volume: ");
 Serial.println(volume);

 //Water filling using flow sensor and pump
 float totalVolume = 0;
 while (totalVolume < volume) {
  int sensorValue = pulseIn(flowSensorPin, HIGH);
  float flowRate = sensorValue / calibrationFactor;
  float deltaTime =millis() / 1000.0; //Convert milliseconds to seconds
  float totalFlow =(flowRate *deltaTime) / 1000; //Convert from mL to L
  totalVolume += totalFlow;
  digitalWrite(pumpPin, HIGH); //Turn on the pump
 }

 //Turn off the pump after filling the object
 digitalWrite(pumpPin, LOW);
}

//Function to measure distance using ultrasonic sensor
float measureDistance(int trigPin, int echoPin) {
digitalWrite(trigPin, LOW);
 delayMicroseconds(2);
 digitalWrite(trigPin, HIGH);
 delayMicroseconds(10);
 digitalWrite(trigPin, LOW);

 float duration = pulseIn(echoPin, HIGH);
 //Speed of sound in air =343 m/s =0.0343 cm/microsecond
 float distance =(duration *0.0343) / 2; //Divide by 2 to get one-way distance
 return distance;
}
```

FUTURE ENHANCEMENT

01 **Integration with IoT:** Connect the system to the Internet of Things (IoT) for remote monitoring and control, enabling real-time data analysis and predictive maintenance.

02 **Machine Learning Algorithms**: Implement machine learning algorithms to optimize liquid distribution, learning patterns for efficient usage over time, and adapting to changing demands.

03 **Sensor Fusion:** Integrate multiple sensor types (e.g., optical sensors for liquid quality analysis) for comprehensive monitoring, enhancing the system's analytical capabilities.

PURPOSE *OF THIS PROJECT*

Optimizing Industrial Processes: Automate liquid volume measurement and filling, ensuring precision, reducing human error, and enhancing operational efficiency in various industries.

Resource Conservation: Minimize wastage, optimize material usage, and promote sustainable practices, contributing to resource conservation and environmental responsibility.

Promoting Technological Innovation: Showcase the potential of smart sensor technology, fostering innovation in automation, and inspiring future advancements in industrial processes.


Thank
you!