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# Arduino-based temperature and humidity monitoring for smart agriculture

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## Abstract

Smart agriculture is becoming increasingly important to optimize resource use and increase crop yield. Monitoring environmental parameters such as temperature and humidity is critical for maintaining optimal growing conditions. This research presents a simple, low-cost Arduino-based system for real-time temperature and humidity monitoring. The system utilizes the DHT11 sensor to collect data and displays the results on an LCD screen. The collected data can also be used to trigger alerts or automate irrigation systems in future developments.

**Keywords:** Smart Agriculture; Arduino, Temperature Monitoring; Humidity Monitoring; DHT11 Sensor; Real-time Data; Environmental Monitoring

## 1. Introduction

Agriculture plays a vital role in global food security. However, climatic variations can impact crop productivity. Modern farming requires precise monitoring of environmental conditions to optimize growth. Temperature and humidity are two crucial factors affecting plant health. Traditional manual monitoring is time-consuming and prone to errors. Hence, automated systems using microcontrollers like Arduino offer a cost-effective solution for real-time monitoring.

### *Objectives*

- Design and implement a simple Arduino-based temperature and humidity monitoring system.
- Display the readings on an LCD screen for real-time observation.
- Provide a basis for further development towards automated smart agriculture.

## 2. Materials and Methods

### 2.1. Components Use

**Table 1** Table of the components

| Component | Quantity | Description |
|---|---|---|
| Arduino Uno | 1 | Microcontroller board |
| DHT11 Sensor | 1 | Temperature and humidity sensor |
| 16x2 LCD Display | 1 | For displaying sensor data |
| 10k Potentiometer | 1 | For LCD contrast adjustment |
| Breadboard and Wires | As needed | For circuit connections |

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| | | |
|---|---|---|
| USB Cable | 1 | To power and program Arduino |

### 2.2. Circuit Diagram

Refer to the following wiring instructions:

- Connect VCC of DHT11 to 5V on Arduino.
- Connect GND of DHT11 to GND on Arduino.
- Connect Data pin of DHT11 to Digital pin 2 on Arduino.
- Connect LCD as per standard 16x2 LCD wiring:
- RS to pin 12
- E to pin 11
- D4-D7 to pins 5,4,3,2 respectively
- Potentiometer connected to V0 for contrast.
- Power the Arduino via USB.

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## 3. Arduino Code

```
#include <DHT.h>

#include <LiquidCrystal.h>

#define DHTPIN 2     // DHT11 data pin connected to Arduino pin 2

#define DHTTYPE DHT11

DHT dht(DHTPIN, DHTTYPE);

LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

void setup() {

 lcd.begin(16, 2);

 dht.begin();
 lcd.print("Smart Agriculture");

 delay(2000);
 lcd.clear();
}

void loop() {

 float humidity = dht.readHumidity();

 float temperature = dht.readTemperature(); // Celsius


 if (isnan(humidity) || isnan(temperature)) {

  lcd.clear();
  lcd.print("Sensor error");

  delay(2000);
  return;
 }
```

```
  lcd.clear();
  lcd.setCursor(0, 0);

  lcd.print("Temp: ");

  lcd.print(temperature);
  lcd.print(" C");


  lcd.setCursor(0, 1);

  lcd.print("Humidity: ");

  lcd.print(humidity);
  lcd.print(" %");

  delay(2000);
}
```

## 4. Results and Discussion

The system successfully measures and displays the temperature and humidity in real-time. The use of the DHT11 sensor provides acceptable accuracy for smart agriculture purposes, especially for small-scale farms or research applications. The LCD display allows farmers to quickly see the current environmental conditions. This simple setup can be extended to trigger alarms or automated watering systems when parameters fall outside optimal ranges.

## 5. Conclusion

This study demonstrates a low-cost and simple Arduino-based temperature and humidity monitoring system suitable for smart agriculture. The system provides real-time environmental data which is essential for optimizing crop growth conditions. Future improvements can integrate wireless communication and automated control for enhanced functionality.

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