Journal of Natural Sciences and Applications
Vol. 1, No. 1, February 2026, pp. 13-20
https://doi.org/10.58421/jnsa.v1i1.1273

Temperature, Humidity and Heat Index Measurement Using Arduino-Based DHT 22 Sensor

Muhammad Daffa Faliha[1], Nevi Sahara[2], Nuri Septrianti[3], Raden Siti Nurul Rachmawati[4], Ariel Dwika Nugraha[5], Udin Asrorudin[6]
[1, 2, 3, 4, 6]Politeknik AKA Bogor, Bogor, Indonesia
[5]Universitas Pendidikan Indonesia, Purwakarta, Indonesia

Article Info

Article history:

Received 2025-11-25
Revised 2026-02-14
Accepted 2026-02-16

Keywords:

Temperature
Humidity
Heat Index
DHT 22 Sensor
Arduino

ABSTRACT

This research aims to develop a temperature and humidity monitoring system using Arduino Uno and DHT22 sensor. Arduino Uno, as an open-source microcontroller, was chosen due to its ease of use and extensive community support. The DHT22 sensor is used to measure temperature and humidity with high accuracy, and has a wide measurement range. This system is designed to read temperature and humidity data periodically, display the results on the LCD, and calculate the heat index based on the data obtained. The research methods include system design, testing and calibration of the sensor, as well as analysis of the measurement data. The measurement results show that the temperature ranges from 29.40°C to 29.90°C, relative humidity between 75.50% to 80.40%, and the heat index between 311.96°C to 345.61°C. The analysis shows that the temperature and humidity increase non-linearly, with humidity slowing down over time. This study concludes that the integration of the DHT22 sensor with Arduino Uno can produce an effective and accurate environmental monitoring system, and provides recommendations for more consistent and accurate measurements in the future..

Corresponding Author:

Udin Asrorudin
Program Studi Analisis Kimia, Politeknik AKA Bogor, Indonesia
Email: udin.asrorudin@gmail.com

1. INTRODUCTION

The Arduino Uno is an open-source microcontroller board based on the ATmega328 chip. It has 14 digital input/output pins and 6 analog input pins, and can be programmed using the Arduino IDE via a USB connection. The Arduino Uno is very popular for electronics and automation projects due to its ease of use, flexibility, and extensive community support [1-3]. With the Arduino Uno, data from the DHT22 sensor can be read periodically, and the results can be processed or displayed as needed.

https://doi.org/10.58421/jnsa.v1i1.1273

The DHT22 is a digital sensor used to measure temperature and humidity. This sensor has high accuracy and a wide measurement range, measuring temperatures from -40°C to 80°C with an accuracy of ±0.5°C, and humidity from 0% to 100% RH with an accuracy of ±2% RH. The DHT22 produces a calibrated digital signal, making it easy to integrate with microcontrollers like the Arduino Uno. This sensor also has a fast response time and good long-term stability, making it suitable for real-time environmental monitoring applications [4, 5].

Temperature is a measure of the degree of hotness or coldness of an object or environment. In the context of measurements using the DHT22, temperature is measured in Celsius (°C) with a resolution of 0.1°C. Temperature measurement is crucial in various fields, such as indoor climate control, agriculture, and healthcare. The temperature values obtained from the DHT22 can be used for further analysis, for example, to calculate the heat index or for automatic control systems [6, 7].

Humidity is a measure of the water vapor content in the air, expressed as a percentage of relative humidity (%RH). The DHT22 measures humidity over a range of 0-100% RH with an accuracy of ±2% RH. Humidity data is crucial for preventing condensation, corrosion, mold growth, and maintaining product quality or environmental comfort. This sensor utilizes the principle of capacitance changes in polymer elements to electronically and accurately detect air humidity [8-10].

The heat index is a parameter that combines the effects of temperature and humidity to assess human thermal comfort [11]. This index helps understand how the temperature perceived by the human body can differ from the actual temperature due to the influence of humidity [12]. Arduino can calculate the heat index using formulas available in the DHT library based on temperature and humidity data obtained from the sensor.

Overall, integrating the DHT22 sensor with Arduino enables the creation of a low-cost, easy-to-use, and accurate environmental monitoring system [13]. This system can be applied to automatic temperature and humidity control, indoor monitoring, smart agriculture, and small weather stations. Using the DHT22 also simplifies measurement because it requires minimal wiring and provides stable digital data output.

2. METHOD

The method used in this research begins with system design, which involves selecting the main hardware: an Arduino Uno as a microcontroller, a DHT22 sensor for temperature and humidity measurement, a breadboard, jumper cables, and a display module such as a 16x2 LCD to display data in real time. The circuit schematic is designed by connecting the DHT22's VCC pin to the Arduino's 5V, GND to GND, and the data pin to one of the Arduino's digital pins (e.g., pin 8) with an additional 10kΩ pull-up resistor. Next, programming is performed using the Arduino IDE by installing the DHT.h library to read data from the DHT22 sensor. The program is designed so that the Arduino can read temperature and humidity values periodically, for example, every second, and then display the results on the LCD or serial monitor.

https://doi.org/10.58421/jnsa.v1i1.1273

The initial step is to create a system design that includes all components used, including hardware and software. This design is created using applications such as Tingkercad and Wokwi. Using these applications can facilitate the design of a project. The project design that will be carried out is as shown in Figure 1.

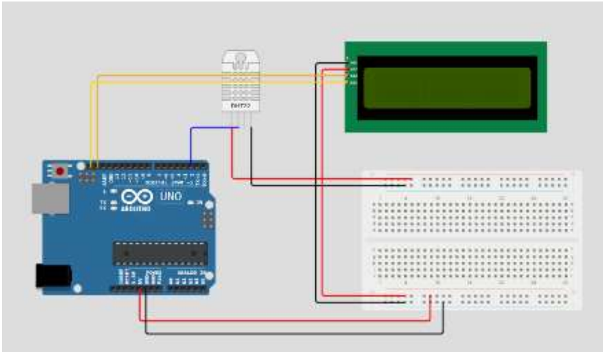

Figure 1. Design of a Temperature, Humidity and Heat Index Measurement Tool Using a DHT 22 Sensor

The project's working system involves determining and assembling the components to be used according to the desired specifications. After creating a design using the desired components, assemble all the necessary components to create a device capable of measuring temperature, humidity, and heat index.

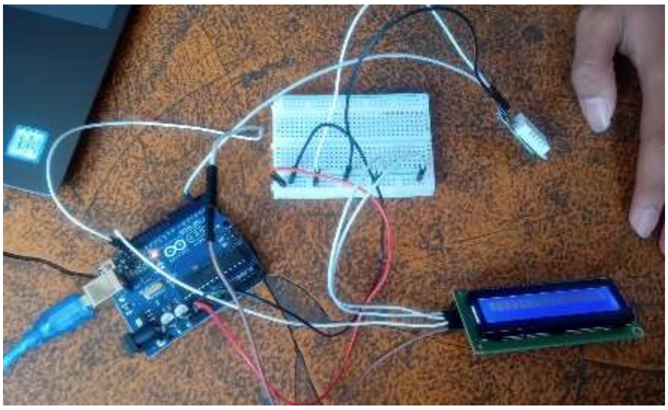

Figure 2. Temperature, Humidity and Heat Index Measurement Tool Circuit Using DHT22 Sensor

The system must meet functional requirements, including must be able to read real-time temperature data from the DHT22 sensor with an accuracy that meets sensor specifications (±0.5°C), must be able to read real-time humidity data from the DHT22 sensor with an accuracy that meets sensor specifications (±2-5% RH). The system must calculate the heat index based on the temperature and humidity data obtained, must display the temperature, humidity, and heat index measurements directly on an output device such as an LCD or serial monitor, must provide a warning (e.g., an alarm or notification) if the temperature or humidity exceeds a predetermined threshold, and must read data periodically at specific time intervals (e.g., every 1-15 seconds). For the device to measure its parameters, coding is required. The resulting coding is combined as follows:

https://doi.org/10.58421/jnsa.v1i1.1273

```
#include <DHT.h>
#include <DHT_U.h>

#include <DHT.h>
#include <Wire.h>
#include <LiquidCrystal.h>

// Gunakan pin 7 untuk DHT22 (karena pin 2 dipakai LCD)
#define DHTPIN 7
#define DHTTYPE DHT22

// Inisialisasi sensor DHT
DHT dht(DHTPIN, DHTTYPE);

// Inisialisasi LCD: (RS, E, D4, D5, D6, D7)
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);  // Jangan ubah ini kalau kabel
LCD sudah sesuai

void setup() {
  Serial.begin(9600);
  Serial.println("DHT22 Temperature and Humidity");

  dht.begin();

  lcd.begin(16, 2);      // LCD 16x2
  lcd.print("DHT22 Sensor");
  delay(2000);
  lcd.clear();
}

void loop() {
  delay(2000);  // Tunggu 2 detik sebelum membaca sensor

  float temperature = dht.readTemperature();  // Celcius
  float humidity = dht.readHumidity();

  if (isnan(temperature) || isnan(humidity)) {
    Serial.println("Gagal baca sensor DHT!");
    lcd.setCursor(0, 0);
    lcd.print("Sensor Error     ");
    return;
  }

  float temperatureF = temperature * 9.0 / 5.0 + 32.0;
  float heatIndexF = dht.computeHeatIndex(temperatureF, humidity,
false);
  float heatIndexC = (heatIndexF - 32.0) * 5.0 / 9.0;
```

https://doi.org/10.58421/jnsa.v1i1.1273

```
  // Tampilkan di Serial Monitor
  Serial.print("Suhu: ");
  Serial.print(temperature);
  Serial.print(" °C  |  Kelembaban: ");
  Serial.print(humidity);
  Serial.print(" %  |  Heat Index: ");
  Serial.print(heatIndexC);
  Serial.println(" °C");

  // Tampilkan di LCD
  lcd.setCursor(0, 0);
  lcd.print("Temp: ");
  lcd.print(temperature);
  lcd.print((char)223);  // Simbol derajat
  lcd.clear();
}

void loop() {
  delay(2000);  // Tunggu 2 detik sebelum membaca sensor

  float temperature = dht.readTemperature();  // Celcius
  float humidity = dht.readHumidity();

  if (isnan(temperature) || isnan(humidity)) {
    Serial.println("Gagal baca sensor DHT!");
    lcd.setCursor(0, 0);
    lcd.print("Sensor Error     ");
    return;
  }

  float temperatureF = temperature * 9.0 / 5.0 + 32.0;
  float heatIndexF = dht.computeHeatIndex(temperatureF, humidity,
false);
  float heatIndexC = (heatIndexF - 32.0) * 5.0 / 9.0;

  // Tampilkan di Serial Monitor
  Serial.print("Suhu: ");
  Serial.print(temperature);
  Serial.print(" °C  |  Kelembaban: ");
  Serial.print(humidity);
  Serial.print(" %  |  Heat Index: ");
  Serial.print(heatIndexC);
  Serial.println(" °C");

  // Tampilkan di LCD
  lcd.setCursor(0, 0);
```

https://doi.org/10.58421/jnsa.v1i1.1273

```
lcd.print("Temp: ");
lcd.print(temperature);
lcd.print((char)223);  // Simbol derajat
```

2.1. Materials

The Arduino Uno, a popular ATmega328P-based microcontroller board for electronics projects. With 32 KB of flash memory, 2 KB of SRAM, and 14 digital input/output pins, it easily connects to a computer via USB and can be programmed using the Arduino IDE. Its flexibility in compatibility with a wide range of modules and sensors makes it a top choice for education, prototyping, and product development. The DHT22, or AM2302, is a digital sensor used to measure temperature and humidity, with a temperature range of -40 to 80 degrees Celsius and a humidity range of 0% to 100%. This sensor provides digital output and uses a single-wire communication protocol, making it easy to connect to microcontrollers such as Arduino. The DHT22 can provide readings every 2 seconds and has low power consumption, making it ideal for applications such as weather stations, HVAC systems, and Internet of Things (IoT) projects.

16x2 LCD, a liquid crystal display module that can display 16 characters per line and has two lines, a total of 32 characters. Commonly used in electronics projects, this LCD can be connected to a microcontroller such as Arduino to display text, numbers, and symbols. With a parallel interface, 16x2 LCDs are often used in applications such as information displays and navigation menus, thanks to their ease of use and affordability. Jumper cables are short wires used to connect two points in an electronic circuit, such as on a breadboard or microcontroller module. These cables simplify assembly and testing without the need for soldering and are available in various types, including male-to-male, male-to-female, and female-to-female. With their flexible shapes and a variety of colors, jumper cables are very useful in prototyping and electronics learning.

3. RESULTS AND DISCUSSION

After taking measurements on the 1st floor of Building G, temperature, humidity, and heat index data were recorded. The measurement results show that the DHT22 sensor provides temperature values between 29.40 (°C) to 29.90 (°C), relative humidity between 75.50% to 80.40% and heat index between 311.96 (°C) to 345.61 (°C).

Table 1. Temperature, Humidity and Heat Index Measurement Data

Location	Gedung G, 1st Floor		
Parameter	Time 2 (Minutes)	Time 4 (Minutes)	Time 6 (Minutes)
[1] Temperature (°C)	29.40	29.60	29.90
[2] Humidity (%)	75.50	78.80	80.40
[3] Heat Index (°C)	311.96	331.89	345.61

https://doi.org/10.58421/jnsa.v1i1.1273

3.1. Temperature Analysis

Temperature is a measure of the degree of hotness or coldness of an object or environment. Table 1 shows that the temperature values measured at minutes 2, 4, and 6 ranged from approximately 29.40°C to 29.90°C, indicating that the short-term temperature increase is still relatively stable due to environmental factors such as measuring the temperature during the day or the activity of electronic devices that generate heat.

3.2. Humidity Analysis

Humidity is a measure of the amount of water vapor in the air. Relative humidity is the ratio of the amount of water vapor held by the air at a given temperature, expressed as a percentage. Factors influencing relative humidity include air circulation and air temperature. The increase every 2 minutes is not linear. Initially, the increase is quite rapid, but between minutes 4 (78.80%) and 6 (80.40%) it slows down, likely because the air approaches equilibrium, so water vapor no longer increases the relative humidity as much as before.

3.3. Heat Index Analysis

The heat index is a combined measure of air temperature and relative humidity. The heat index increases but slows as the air begins to approach saturation with water vapor, and the rate of heat absorption by the air begins to slow. Table 1 shows that the heat index value is generally 30°C – 55°C. If it is above 65°C, it is unrealistic and can even be considered an extreme condition, possibly due to an error in the equipment or an error in reading the data.

4. CONCLUSION

Based on the results of research on temperature, humidity, and heat index measurements, the temperature values measured at minutes 2, 4, and 6 ranged from 29.40°C to 29.90°C, indicating a relatively stable increase in temperature over a short period. Meanwhile, relative humidity increased nonlinearly, with a rapid increase initially, but slowing between minutes 4 (78.80%) and 6 (80.40%). This is likely due to the air approaching saturation, so water vapor no longer significantly increases relative humidity. The heat index also increased, but at a slower rate as the air becomes saturated with water vapor and heat absorption decreases. Recorded heat index values ranged from 30°C to 55°C, which is still within realistic limits. Values above 65°C are considered unrealistic and may be due to instrument or data reading errors.

Based on the research conducted, the authors recommend that measurements be conducted periodically and under consistent environmental conditions to obtain more accurate and representative data. Double-check the heat index meter to avoid incorrect readings, especially if the values obtained are outside the realistic range. If possible, reduce

https://doi.org/10.58421/jnsa.v1i1.1273

the heat source from the electronic device during the measurement to minimize external influences that can affect the temperature and.

REFERENCES

[1] Hakim, F., Supardi, I. W., & Ratini, N. N. (2024). Designing and creating an automatic hydroponic plant watering control system using a TDS sensor based on an ATmega328 microcontroller. Buletin Fisika, 25(1). https://doi.org/10.24843/BF.2024.V25.i01.p01

[2] Silaban, I. W., Sembiring Maha, D. H., & Nainggolan, W. P. (2024). Smart irrigation pump design building range using Arduino ATMEGA328. Journal of Telecommunication and Electrical Scientific. https://doi.org/10.24010/jtels.v1i2.935

[3] Martono, A., Yulianjani, A., & Sudariyanti, A. (2023). Penerapan mikrokontroler pada penutup tempat sampah untuk membuka atau menutup secara otomatis. SENSI. https://doi.org/10.33050/sensi.v9i1.2625

[4] Heryanto, I., Kusuma, S. A., & Hidayat, M. N. (2024). Sistem otomasi suhu dan kelembaban pada greenhouse berbasis sensor DHT22 dan mikrokontroler. Elposys: Jurnal Sistem Kelistrikan. https://doi.org/10.33795/elposys.v12i2.7521

[5] Windy, A., Buaton, R., & Sihombing, M. (2024). Design and build temperature and humidity control equipment in IoT-based rice storage. Journal of Artificial Intelligence and Engineering Applications. https://doi.org/10.59934/jaiea.v4i1.648

[6] Silawarawet, K., Kaewchukul, P., & Saadprai, S. (2025). Heat stroke warning system prototype for athletes: A pilot study. Sensors, 25(2), 294. https://doi.org/10.3390/s25020294

[7] Hadi, C. F., Yasi, R. M., & Prasetyo, A. (2024). Model decision tree forecasting berbasis DHT22 pada smart hydroponic microgreen. Journal of Telecommunication Electronics and Control Engineering. https://doi.org/10.20895/jtece.v6i1.1218

[8] Hikamiah, L. A., Ariyanto, D. P., Widayani, D. A., Nugroho, P. S., Amaratirta, J. C., & Harjunowibowo, D. (2024). IoT-based humidity control system for electrospinning. JANAPATI. https://doi.org/10.23887/janapati.v13i2.75896

[9] Suwandi, I. F. (2023). Perancangan sistem pengukuran suhu dan kelembaban otomatis dengan MD_Parola dan sensor DHT22. Journal of Power Electric and Renewable Energy, 1(2). https://doi.org/10.59811/jper.v1i2.88

[10] Chen, S., Liu, A., Tang, F., Hou, P., Lu, Y., & Zhao, P. (2023). Capacitive polymer sensors: Factors influencing performance and design principles. Sensors and Actuators B: Chemical, 393, 134211. https://doi.org/10.1016/j.snb.2023.134211

[11] Lu, Y.-C., & Romps, D. M. (2023). Predicting fatal heat and humidity using the heat index model. Journal of Applied Physiology, 134(3), 649–656. https://doi.org/10.1152/japplphysiol.00417.2022

[12] Silva, R. B., & Moura, M. S. B. (2024). Atmospheric conditions related to extreme heat and human comfort in the city of Rio de Janeiro. Atmosphere, 15(8), 973. https://doi.org/10.3390/atmos15080973

[13] Mubarok, R., & Syukron, A. A. (2025). Pengembangan Alat Pendingin Otomatis Berbasis Mikrokontroler Arduino Uno Dengan Sensor DHT22. Jurnal Media Informatika, 6(3). https://doi.org/10.55338/jumin.v6i3.5860

[14] Maulia, A., Baihaqi, N., Faiz, N. F., Rizki, M., & Aribowo, D. (2024). Simulasi pengukuran suhu dan kelembaban ruangan menggunakan Arduino Uno dan sensor DHT22 pada Wokwi. Jurnal Teknik Mesin, Industri, Elektro dan Informatika, 3(4). https://doi.org/10.55606/jtmei.v3i4.4544