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ANALYSIS OF AUTOMATION THROUGH SENSORS OF HEAT AND HUMIDITY OF DIFFERENT DIRECTIONS

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Abstract: The analysis of automation through sensors of heat and humidity in different directions is a process that involves the use of sensors to measure and monitor temperature and humidity levels in various directions. These sensors are typically placed strategically in different locations to gather data on the environmental conditions. By incorporating automation into the analysis process, the gathered data can be efficiently processed, and actions can be triggered based on predefined thresholds. For example, if the humidity exceeds a certain level, the automation system may initiate actions like turning on dehumidifiers or activating ventilation systems.

Keywords: DHT11,DHT22, temperature, humidity, algorithm, robotics, sensor

Introduction. The automation of heat and humidity control involves utilizing advanced technology and systems to regulate and maintain optimal temperature and moisture levels in indoor environments. This automation process is achieved through the integration of various sensors, controllers, and smart devices. The advantages of automating heat and humidity control are numerous and significant.

Firstly, it greatly enhances comfort and well-being by creating a more pleasant and consistent indoor environment. With the ability to automatically adjust heating, ventilation, and air conditioning systems, occupants can enjoy optimal temperatures and humidity levels throughout the day, regardless of external weather conditions. This eliminates the need for manual adjustments or relying on fluctuating external factors.

Moreover, automation offers improved energy efficiency by optimizing the use of heating and cooling systems. The automated control systems can analyze data from sensors and make real-time adjustments to minimize energy consumption while maintaining optimal conditions. This results in reduced energy costs and a more sustainable approach to managing indoor environments.

In addition to comfort and energy efficiency, automation simplifies the management and maintenance of heat and humidity control. With centralized control systems, facility managers can easily monitor and adjust settings in multiple areas or zones. Real-time data and analytics provide valuable insights into system performance and enable proactive maintenance to prevent issues before they occur. This not only saves time and effort but also ensures the longevity and reliability of the systems.

Automating heat and humidity control is particularly advantageous in commercial buildings, such as offices, retail spaces, and healthcare facilities. These environments often have varying occupancy levels and specific requirements for temperature and humidity regulation. With automation, these demands can be effortlessly met, creating a comfortable and safe environment for employees, customers, and patients.

In conclusion, the automation of heat and humidity control through the integration of advanced technology and systems offers numerous benefits. It enhances comfort and well-being, improves energy efficiency, simplifies management and maintenance, and ensures optimal conditions in indoor environments. Embracing automation in heat and humidity control is a wise investment that can significantly improve the quality of life and the sustainability of various indoor spaces.

Literature analysis and methods. The automation of heat and humidity control has been an important area of research, particularly in the fields of building automation and environmental control systems. Various literature and methods have been proposed to address this topic. Here are some common approaches:

– Sensor-based control: This method involves using various sensors to measure temperature and humidity levels in the environment. These sensors provide feedback to the control system, enabling it to adjust heating, ventilation, and air conditioning (HVAC) settings accordingly.
– Feedback control systems: These systems continuously monitor and adjust heat and humidity levels based on predefined setpoints. They utilize feedback loops to maintain desired conditions by adjusting actuators such as dampers, valves, or fans.
– Model-based control: This approach involves developing mathematical models that represent the dynamics of heat and humidity systems. These models can be used to predict and control the behavior of these systems, enabling efficient and optimized control strategies.
– Machine learning techniques: With the advancements in machine learning, researchers have explored the use of algorithms and models to automate heat and humidity control. By analyzing historical data, machine learning methods can learn patterns and make predictions to optimize control strategies.
– Internet of Things (IoT) integration: IoT devices, such as smart thermostats and environmental sensors, can be integrated into automation systems. These interconnected devices can communicate with each other and cloud-based platforms to enable intelligent and automated control of heat and humidity.

Many research papers, journals, and books have extensively covered these methods and their implementations in different contexts, such as smart homes, industrial automation, and agriculture. It is recommended to explore academic databases, conferences, and online platforms like IEEE Xplore, ACM Digital Library, ScienceDirect, and Google Scholar for a comprehensive literature analysis on the automation of heat and humidity control.

Discussion. Temperature is a measure of hotness and coldness. It is measured using a device called a thermometer. Temperature is measured in three units: Celsius, Fahrenheit, and Kelvin. Thus, there are three different scales for measuring temperature. Each unit can be converted to another unit using the conversion formula we will learn in this topic.

Temperature measurement. Temperature measurement describes the process of measuring the temperature of an object or body.

Measuring Temperature: Since temperature is a relative measurement, it is measured with thermometers that can be adjusted to different temperature scales. There are three main scales for measuring temperature:

– Fahrenheit scale, its symbol (°F).
– Celsius scale, its symbol (°C).
– Kelvin scale, its symbol (K).

Each of these scales has different reference points and uses a different set of divisions based on them. The Celsius scale is usually used to measure temperature.

A device for measuring temperature. A glass thermometer is one of the most common devices for measuring temperature. A glass thermometer is a glass tube filled with mercury or another liquid, in which mercury acts as the working fluid. An increase in temperature causes the liquid to expand, and mercury changes its properties with respect to temperature. As the temperature increases, the volume of mercury also increases. Thus, temperature can be determined by measuring the volume of a liquid, and temperature can be read by observing the liquid level on a thermometer. Usually, we use a mercury glass thermometer.[1-2]

Figure 1. Temperature measuring devices.

Similarly, there are several other instruments used to measure temperature:

– Thermocouples;
– Thermistors;

- Infrared thermometer;
- Resistance temperature detector (RTD);
- Pyrometer;
- Langmuir probes (to measure the electron temperature of the plasma);

Temperature and heat. In thermodynamics, heat and temperature are closely related concepts with precise definitions. Heat should not be confused with temperature, but they can be directly related.

Temperature	Heat
Temperature is a measure of how hot or cold it is.	Heat is the transfer of thermal energy between molecules and is measured in Joules.
Temperature describes the average kinetic energy of molecules.	Heat measures how energy moves or flows.
The unit is Kelvin	The unit is Joule
Temperature unit: Fahrenheit ºF , Celsius ºC, Kelvin K	Unit of heat: joule (J) and calorie (cal)
Temperature symbol “T”	Heat symbol “Q”

Table 1. The table shows how temperature and heat differ from each other.

Temperature scales. Thermometers measure how hot and cold the body is, using three temperature scales—Celsius, Fahrenheit, and Kelvin. According to the Kelvin scale, the freezing and boiling points of water are 273.15 K and 373.15 K, respectively. On the Fahrenheit scale, the freezing and boiling points of water are 32°F and 212°F, respectively. On the Celsius scale, the freezing and boiling points of water are 0°C and 100°C, respectively.

Conversion of temperature scales. Temperature can be converted from one scale to another using conversion formulas. In temperature conversion, the value of temperature changes from one unit to another. The three main temperature conversions are:

- Between Celsius and Kelvin.
- Between Fahrenheit and Kelvin.
- Between Celsius and Fahrenheit.

Temperature conversion	Formulas
Celsius to Kelvin	K = C +273.15 K = C +273.15
Kelvin to Celsius	C = K −273.15C = K −273.15
Fahrenheit to Celsius	C = (F−32)59C = (F−32)59
Celsius to Fahrenheit	F = C95+32F = C95+32
Fahrenheit to Kelvin	K = (F−32)59+273.15 K = (F−32)59+273.15
Kelvin to Fahrenheit	F = (K−273.15)95+32

Table 2. The table shows formulas for converting different units of temperature

We can also measure the temperature using DHT11 and DHT22 sensors.

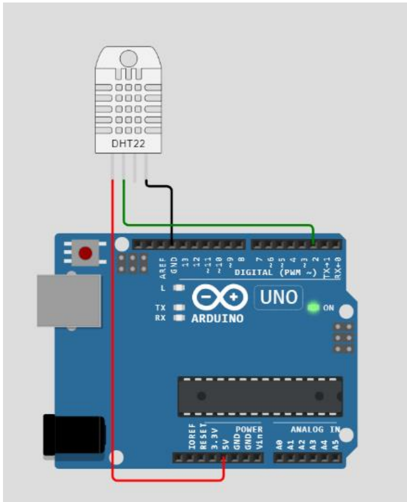

Figure 2. Connecting the DHT22 sensor to the Arduino.

Also known as DHT22 or RHT03, it is a capacitive humidity sensor and high precision temperature sensor. The DHT22 also has a capacitive sensing element and a high-precision temperature measuring element connected to a high-performance 8-bit microcontroller. Thus, it has the advantages of excellent quality, ultra-fast response, strong anti-noise ability and high cost performance.

Features:

- Ultra-small size
- Humidity sensor from 0 to 99.9% RH with ±2% accuracy, temperature sensor from -40 to 80℃ with ±0.5℃ accuracy.

Humidity is the amount of water vapor in the air.

Absolute Humidity: The actual amount of water vapor in the air regardless of the air temperature is called absolute humidity. Humidity is measured as grams of water vapor per cubic meter of air. The higher the amount of water vapor in the air, the higher the absolute humidity.

Relative humidity: A measure of the amount of water vapor that air can hold compared to the amount it can hold at a given temperature is called relative humidity. Relative humidity is expressed as a percentage. Relative humidity depends on temperature.

Specific humidity: The weight of water vapor per unit volume of air is called specific humidity. Specific humidity is expressed in grams of water vapor per kilogram of air.

Dew Point: The temperature at which air is saturated with water and condensation begins is called dew point. The higher the dew point, the higher the moisture content.

Humidity refers to the presence of water in the air. It strongly affects the various production processes of the industry. For example, in the semiconductor industry, humidity or moisture levels must be properly regulated to ensure perfect wafer processing. Humidity control is also important for incubators, respiratory equipment, sterilizers, and biological products. Moisture levels can also affect chemical, biological and physical processes.[3]

Below are the moisture meters used to measure moisture. There are different ways to measure humidity:

1. Psychometric method. The psychometric method is the oldest method of moisture measurement. The psychometric method is also known as the wet and dry bulb method. The psychrometric sensor does not directly sense humidity; instead, it senses temperature and indirectly detects humidity. The sensing elements that can be used are thermometers and thermistors.

The psychometric method uses two sensory elements; the first is a "dry bulb" that measures the ambient temperature. The second is a "wet bulb" wrapped around a stick saturated with distilled water. Air across the wet bulb causes evaporation. Therefore, the temperature is cooled below the ambient temperature.

The amount of cooling depends on the vapor pressure of the air. Relative humidity can be visualized on a psychrometric chart using wet and dry bulb temperatures. Psychrometric charts and dew point equations can be stored in the microprocessor. It then converts the relative humidity and dew point into a direct sensing method.

2. Hygrometric method. A hygrometer is a humidity measuring device designed to measure relative humidity in open or closed spaces. It measures moisture indirectly by sensing changes in physical or electrical properties of materials.

– Laminate hygrometer. A laminate hygrometer is made by attaching thin strips of wood to thin strips of metal, thus forming a laminate. The laminate hygrometer is designed in the form of a spiral. When the humidity changes, the helix changes. This is because there is a change in the length of the wood due to moisture. The end of the spiral is attached to the pointer and therefore gives a deflection. The indicator scale is rated in percent moisture.
– Hair hygrometer. Hair hygrometer is the simplest and oldest type of hygrometer. It uses human hair. When humidity changes from 0 to 100%, human hair tends to stretch by 3%. It has an accuracy of ± 5% for humidity from 20 to 90% in the temperature range from 5 to 40 ° C.
– Capacitive hygrometer. Some thin polymer films have the property of changing the dielectric constant with changes in humidity. This principle is the basis of capacitive hygrometers. The capacitance between the two plates created by using the polymer as a dielectric is directly proportional to the humidity. The operating range of capacitive hygrometers is from 0 to 100 °C. They can also be temperature compensated to give an accuracy of ±0.5% over the full humidity range. We can also measure the humidity using the Soil moisture sensor. This sensor measures soil moisture.[4]

Results. Program code:

```
#include "DHT.h"
#define DHTPIN 2
#define DHTTYPE DHT22
DHT dht(DHTPIN, DHTTYPE);

void setup() {
  Serial.begin(9600);
```

```
  Serial.println(F("Temperature, Humidity testing!"));

  dht.begin();
}
void loop() {
  delay(2000);
  float h = dht.readHumidity();
  float t = dht.readTemperature();
  float f = dht.readTemperature(true);
  Serial.print(F("Temperature: "));
  Serial.print(h);
  Serial.print(F("%  Humidity: "));
  Serial.print(t);
  Serial.println(F("°C "));
}
```

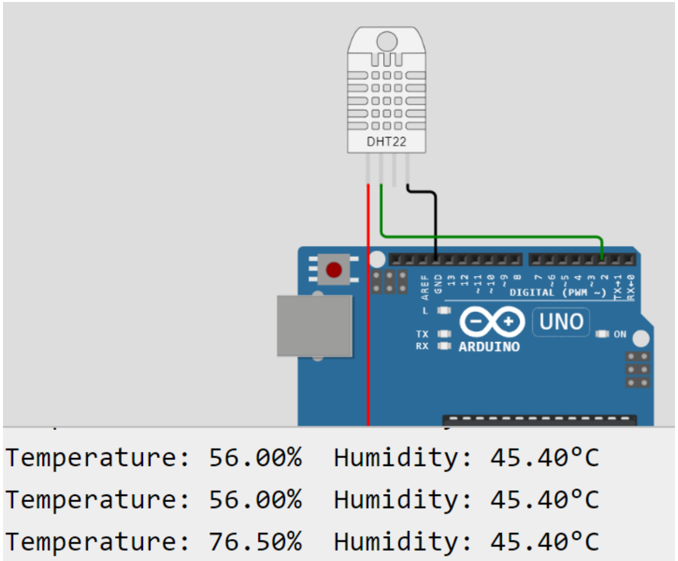

Figure 3. The result obtained during the measurement of the DHT22 sensor.

```
diagram.json
{
  "version": 1,
  "author": "Uri Shaked",
  "editor": "wokwi",
  "parts": [
   { "type": "wokwi-arduino-uno", "id": "uno", "top": 163.8, "left": 28.2, "attrs": {} },
   {
    "type": "wokwi-dht22",
    "id": "dht",
    "top": 0.3,
    "left": 71.4,
    "attrs": { "humidity": "76.5", "temperature": "72.6" }
   }
  ],
  "connections": [
   [ "uno:GND.1", "dht:GND", "black", [ "v-20", "*", "v5" ] ],
   [ "uno:2", "dht:SDA", "green", [ "v-16", "*", "h0" ] ],
   [ "uno:5V", "dht:VCC", "red", [ "v20", "*", "h0" ] ]
  ],
  "dependencies": {}
}
```

DHT11 and DHT22 sensors provide an effective means of measuring temperature and humidity. These sensors open up numerous possibilities for the development of automated systems in various fields such as greenhouses, incubators, cooling rooms, and agriculture, among others. By incorporating these sensors into a well-designed system, it becomes possible to monitor and control the temperature and humidity levels with precision. The results of the analysis are given below.[5]

	DHT11	DHT22
Temperature Range	0 to 50°C	-40 to 80°C
Temperature Accuracy	±2%	±0.5%
Humidity Range	5 to 95% RH	0 to 100%RH
Humidity Accuracy	±5%	±2%

Table 3. Analysis results on dht11 and dht22 sensors.

Conclusion. One of the key advantages of using DHT11 and DHT22 sensors is their compatibility with microcontrollers. By programming the microcontroller in the C++ language, it is possible to implement a robust and reliable solution for temperature and humidity monitoring. The microcontroller serves as the brain of the system, enabling the sensors to collect data and process it according to the programmed instructions.

The collected data can then be analyzed to gain valuable insights into the environmental conditions of the monitored area. This analysis can provide crucial information for optimizing the growth of plants in a greenhouse, ensuring the proper conditions for eggs in an incubator, maintaining ideal storage conditions in cooling rooms, and improving overall agricultural practices. By understanding the temperature and humidity patterns, informed decisions can be made to enhance productivity, reduce costs, and promote sustainability.

In conclusion, the utilization of DHT11 and DHT22 sensors, combined with the power of microcontrollers and C++ programming language, opens up exciting possibilities for creating automated systems in various fields. The ability to measure temperature and humidity accurately and reliably allows for better control and optimization of environmental conditions. The resulting analysis can lead to improved practices and increased efficiency, benefiting industries such as agriculture, horticulture, and storage management.

References.

1. Кочеткова О.А., Пудовкина Ю.Н., Родионов М.А., Егина В.А. РОБОТОТЕХНИКА КАК СРЕДСТВО ОБУЧЕНИЯ УЧАЩИХСЯ ПРОГРАММИРОВАНИЮ И АЛГОРИТМИЗАЦИИ // Современные проблемы науки и образования. - 2020. - № 6.; URL: https://scienceeducation.ru/ru/article/view?id=30287 (дата обращения: 06.11.2022).

2. Nijssen S.R.R., Muller B.C.N., Baaren R.B.v., Paulus M. Saving the Robot or the Human? Robots Who Feel Deserve Moral Care // Social Cognition. 2019. Vol. 37. No. 1. P. 41-62.

3. Морхат П.М. Искусственный интеллект: правовой взгляд. М.: Буки Веди. 2017. 257 с.

4. Гульшод Юнусова Назиховна. "ПРОГРАММИРОВАНИЕ И РОБОТОТЕХНИКА НА ОСНОВЕ STEAM LEARNING". Американский журнал междисциплинарных исследований и разработок, том 2, март 2022, стр. 58-87.

5. Rayimdjonova O.S., Muhammadjonov A.G'. "Avtomatlashtirish va algoritimlash jarayonida issiqlik, namlik sensorlaridan aniq natijalar olish yechimlari". MUHAMMAD AL-XORAZMIY AVLODLARI, 2023, 12-14.