Thapar Institute of Engineering and Technology

Project Report

Temperature and Humidity Monitoring System

(with LCD Screen and real-time sensors)

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Problem Statement

The real-time measurement of temperature and humidity by software using sensors as the primary source of data. The results and calculations are displayed on an LCD screen.

Identification of the need

The temperature of Earth is increasing day-by-day affiliated to many causes such as burning of fossil fuels; deforestation; farming livestocks; greenhouse gases such as: CFCs, and etc.

NASA, National Aeronautics and Space Administration, an independent agency of the U.S. federal government states that the 'average global temperature' of the Earth has increased by approximately 1.1 degree Celsius since the yea 1880. The current rate at which the Earth is adding the temperature is roughly proved to be 0.15 to 0.20℃ /decade. Hence, it becomes important to address solutions to the cause of temperature increase. The former cannot be done without proper measurements and statistical data. Therefore, temperature sensors are important.

High humidity tends to have a number of adverse effects on human body. It may contribute to feelings of low energy and lethargy. The human body posses some mechanisms which helps to naturally release heat from the body and drop the temperature to neutral: the 'cooling mechanism'. However, higher humidity can cause hyperthermia: over-heating, as a result of the inability to let out heat naturally. Hence, it is essential to measure the humidity present in the atmosphere.

Moreoever, neutral temperature and humidity conditions are vital for human survival. A good care must be taken, and they should be recorded as real-time appropriately and accurately. In addition to this, sensors come-in handy where humans can't reach. Volcanic sites, deep seas, etc. are such habitats where its difficult for humans to conduct manual measurements of certain conditions; as a solution to this: scientists use different types of sensors to gather raw data.

Pre-existing requisites on the problem

Several temperature and humidity measuring sensors are available in the market.

Temperature sensors work on the principle that 'resistance of a substance changes as the temperature is changed'. There are several type of temperature sensors such as:

- **Contact-type temperature sensors**: they measure the degree of hotness/coolness in an object by being in direct contact with it
- **Non-Contact-type temperature sensors**: they are not in direct contact with the object. Instead, they measure the degree of hotness/coolness through the radiation emitted by the heat source.
- **Thermostat**: consists of a bi-metallic strip made up of two dissimilar metals
- **Resistive Temperature Detectors (RTDs)**: they're made up of high-purity conducting metals such as platinum, copper or nickel wound into a coil

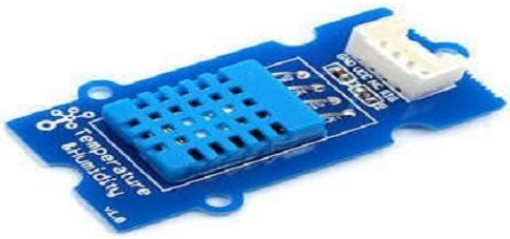
RTD

Thermistor

Humidity sensors are categorized based on the way they measure the change in levels of humidity. For a **capacitive sensor**, the sensing element is a capacitor. The change

in electrical permittivity of the dielectric material is measured to calculate the relative humidity values.

Low resistivity materials are used for the construction of a **resistive**



sensor. In this case, a change in resistivity value is used to measure the change in humidity.

Thermal-conductive sensors measure the **absolute humidity** values.

Examples of humidity sensors:

- **DHT11**
- **DHT 22** - **SHTW2**
- **SHT3X**

Comparing: theoretic vs practical

Several temperature and humidity measuring sensors are available in the market. However, we need a more subtle approach towards technology, and need to use more advanced sensors for the measurement of data.

There exists many places in the world where these sensors haven't made a call, and the traditional methods are still existing, pertaining to the existing already safety-hazards.

Therefore, the latter addresses the problem. Newer, cheaper technologies must be invented so they're affordable by everyone, and the advancement of technology and the use of 'artificial intelligence' benefits scientists and researchers.

In addition to this: 'computers' being the 'smart' devices can help predict solutions and analyze the sites' data instantly and accurately as compared to the duration taken by a human to comprehend the same data.

Requirements

The requirements for this project:

- Arduino
-Connecting wires
-LCD Screen
-Resistor

Software/Hardware Requirements

Software:

-Arduino
-C++/C/Java

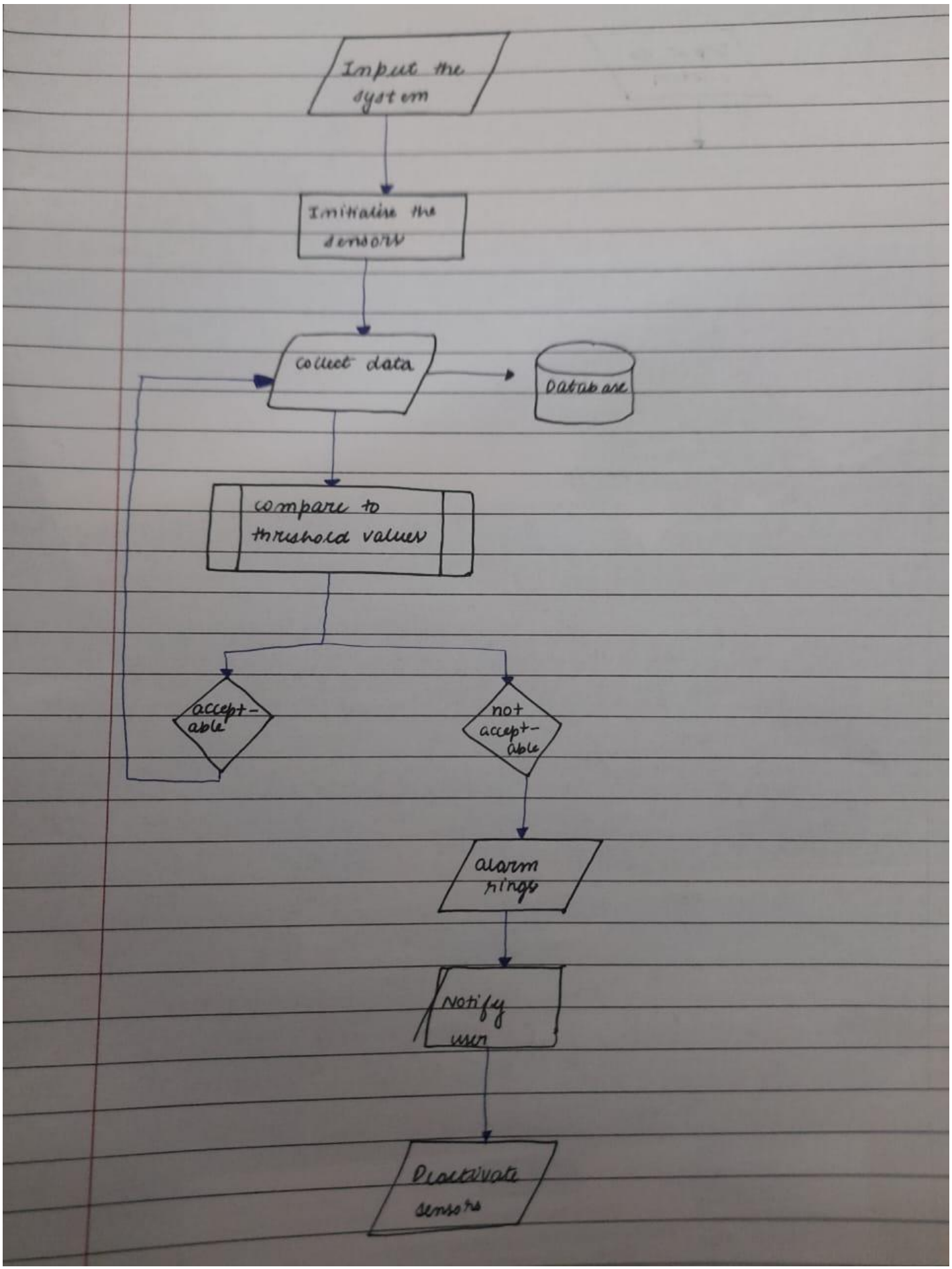
Hardware:

-Laptop
-A proper Wi-Fi connection
-Connecting wires
-Arduino board
-Resistor
-LCD Screen
-DHT22 sensor
-Button
-Alarm

Flowchart

Basic chronology of a sensor system:

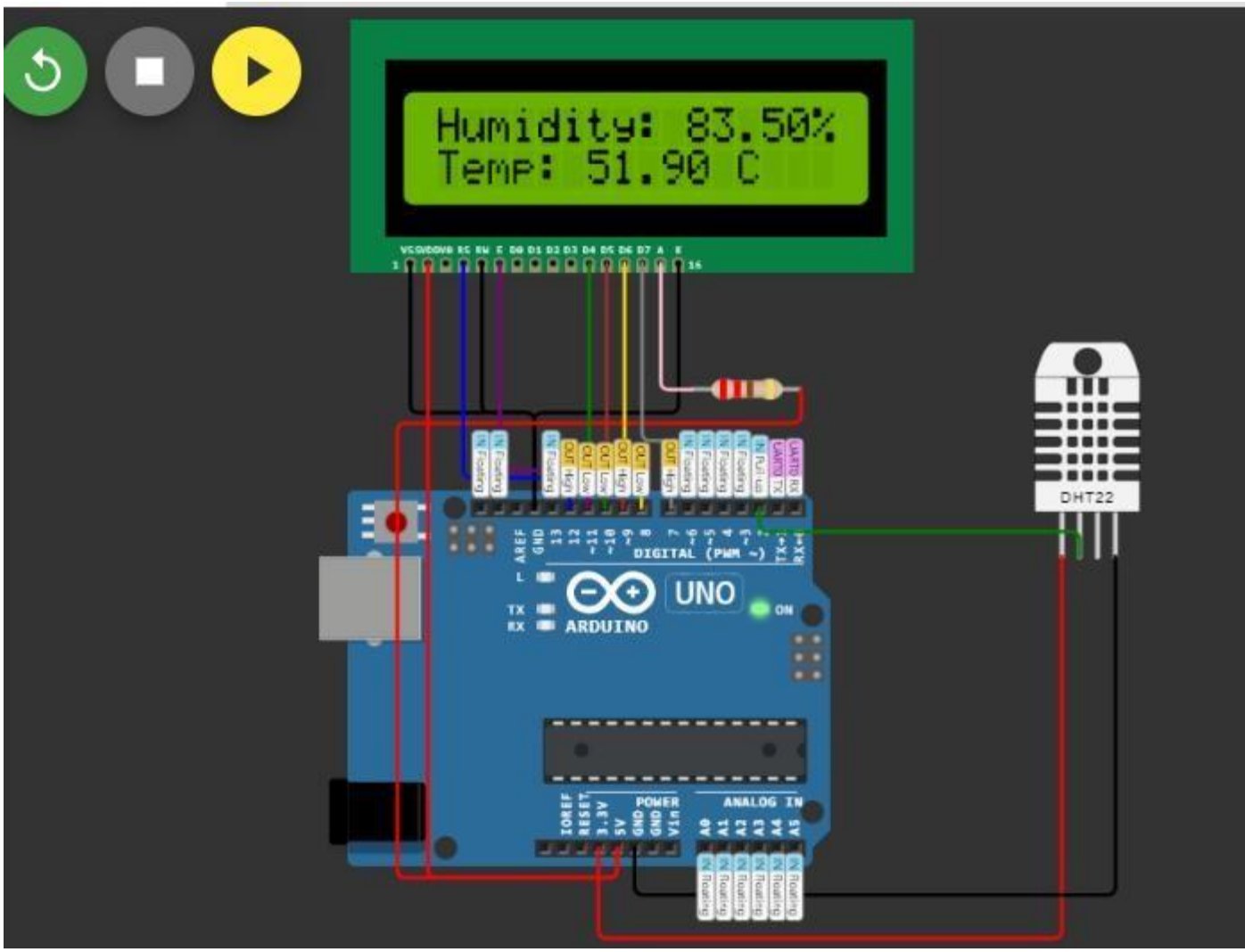
1. Initialize the system
2. Activate sensors
3. Collect data from sensors
4. Process data
5. Analyse data
6. Compare data to set thresholds
7. If details within acceptable range, continue monitoring
8. If data exceeds threshold, trigger alarm
9. Notify user of alarm
10. Deactivate sensors
11. End system


Input the system
Initialize the sensors
collect data
Database
compare to threshold values
accept-able
not accept-able
alarm rings
Notify user
Deactivate sensors

Coding

```
// LCD1602 to Arduino Uno connection example

#include <LiquidCrystal.h> #include "DHT.h"
#define DHTPIN 2
#define DHTTYPE DHT22 // DHT 22    (AM2302), AM2321


DHT dht(DHTPIN, DHTTYPE);
LiquidCrystal lcd(12, 11, 10, 9, 8, 7);
void setup() { lcd.begin(16,
  2);
  // you can now interact with the LCD, e.g.:

  Serial.begin(115200);
  Serial.println(F("DHT22 output on display")); dht.begin();
}
 void loop() {
 float temperature =
 dht.readTemperature();
 float humidity =
 dht.readHumidity();
// Check if any reads failed and exit early (to try again).
if (isnan(temperature) || isnan(humidity)) {
  Serial.println(F("Failed to read from DHT sensor!")); return;
}

Serial.print(F("Humidity: "));
Serial.print(humidity);
Serial.print(F("% Temperature: "));
Serial.print(temperature);
Serial.println(F("°C "));
lcd.clear(); lcd.print(humidity);
lcd.setCursor(0,0);
lcd.print("Humidity: ");
lcd.print(humidity);
lcd.print("%");
lcd.setCursor(0,1);
lcd.print("Temp: ");
lcd.print(temperature);
lcd.println(" C");



  // Wait a few seconds between measurements.
  delay(200);
}
```

Diagram



Output screen:

```
DHT22 output on display
Humidity: 83.50%  Temperature: 51.90°C
Humidity: 83.50%  Temperature: 51.90°C
Humidity: 83.50%  Temperature: 51.90°C
Humidity: 83.50%  Temperature: 51.90°C
Humidity: 83.50%  Temperature: 51.90°C
Humidity: 83.50%  Temperature: 51.90°C
```

Conclusion

Temperature and humidity are vital for human survival hence a constant check must be kept on them. Through this activity we learn the use of ‘sensor-systems’ to measure different physical quantities. The sensors can collect data from sites which otherwise prove to be hazardous for humans. The coding makes it easier to implements. The ‘computers’ which are proven to be ‘smart’ in association with “artificial intelligence” can collect and evaluate data fast, accurately and alert the concerned alarm/system/department likewise. Hence, ‘computers’ and ‘sensors’ can be accurate for data gathering, statistical systems, and data measurement.