IoT Project Report

ON

"IoT Based Temperature and Humidity Monitoring and Controlling over ThingSpeak using Arduino UNO and ESP8266"

(8th Semester)

Department of Computer Science and Engineering

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Session 2020-2024

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1. Introduction

The Internet of Things (IoT) revolutionizes how we interact with our environment by enabling physical objects to connect and exchange data. This project builds an IoT system for monitoring temperature and humidity, and controlling an LED based on these readings. The system utilizes an Arduino Uno board for processing, an ESP8266 WiFi module for wireless communication, a DHT11 sensor for temperature and humidity measurement, and ThingSpeak for cloud-based data visualization.

2. System Components

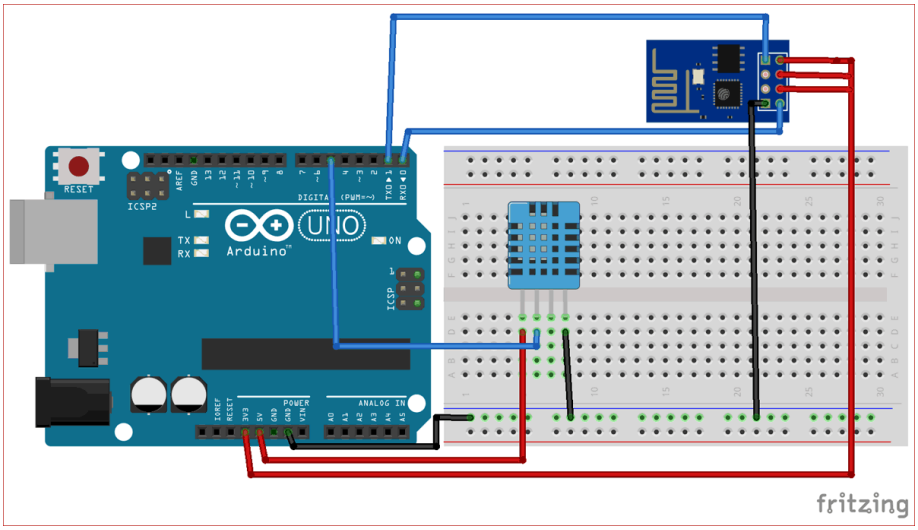
- **Arduino Uno:** A microcontroller board that reads sensor data, processes it, and controls the system.
- **ESP8266 WiFi Module:** Enables the system to connect to a Wi-Fi network and transmit data to the cloud.
- **DHT11 Sensor:** Measures temperature and humidity in the surrounding environment.

- **Jumper Wires:** Used to establish electrical connections between components on the breadboard.
- **LED Bulb:** Controlled based on the temperature readings.

3. System Design

3.1 Hardware Connections

1. Connect the DHT11 sensor's VCC pin to Arduino's 3.5V pin, GND pin to Arduino's GND pin, and data pin to Arduino's digital pin (e.g., pin 2).
2. Connect the ESP8266's RX pin to Arduino's TX (pin 1) and GND pin to Arduino's GND pin.
3. Connect the LED's positive terminal to Arduino's digital pin (e.g., pin 13). Connect the LED's negative terminal to Arduino's GND pin.



3.2 Software Development

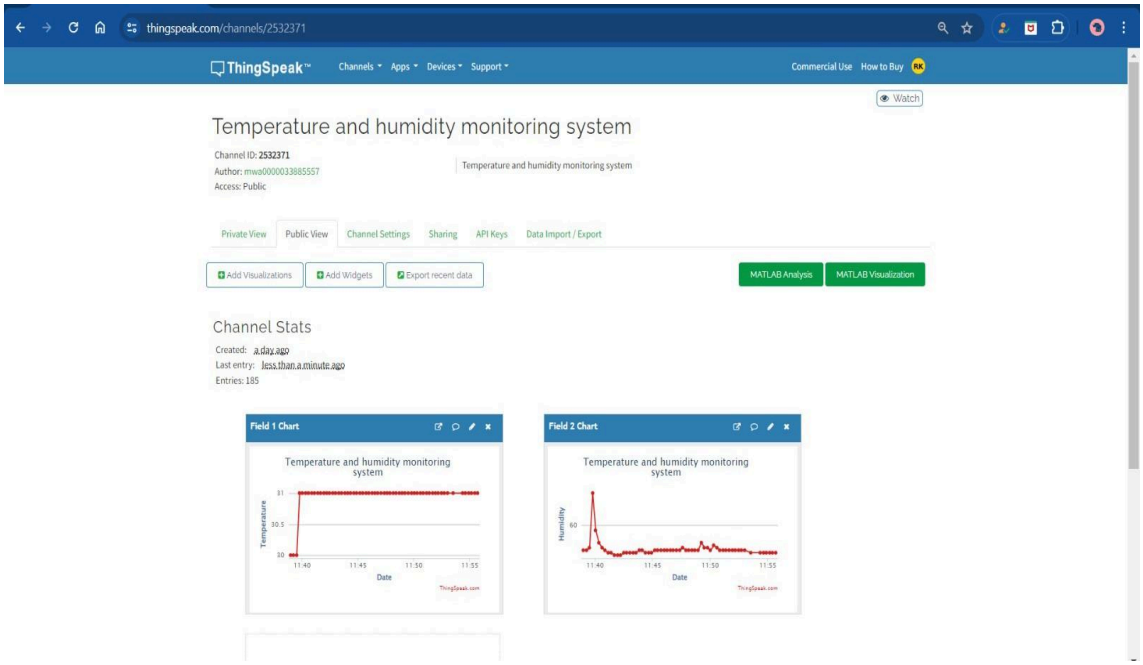
1. **Arduino IDE Setup:** Install Arduino IDE (https://support.arduino.cc/hc/en-us/articles/360019833020-Download-and-install-Arduino-IDE) and select the appropriate board (Arduino Uno) and port.
2. **Include Libraries:** Include necessary libraries like DHT.h, ThingSpeak.h and WiFi.h for sensor and WiFi communication.
3. **Define Variables:** Declare variables for storing sensor readings, ThingSpeak API key and channel ID, WiFi credentials, and LED control pin.
4. **DHT Sensor Initialization:** Create an object of the DHT class, specifying the sensor type (DHT11) and data pin.
5. **WiFi Connection Setup:** Define functions to connect to the WiFi network using your SSID and password.
6. **ThingSpeak Integration:** Obtain your ThingSpeak API key and channel ID from your ThingSpeak account (https://thingspeak.com/).
7. **Data Reading and Transmission:** Write code to read temperature and humidity from the DHT11 sensor at regular intervals (e.g., every 10 seconds).
8. **Condition for LED Control:** Implement logic to control the LED based on a pre-defined temperature threshold (e.g., turn on LED if temperature goes below 35°C).
9. **Data Upload to ThingSpeak:** Construct a formatted HTTP request string with sensor readings and send it to ThingSpeak using WiFi to update your channel with real-time data.

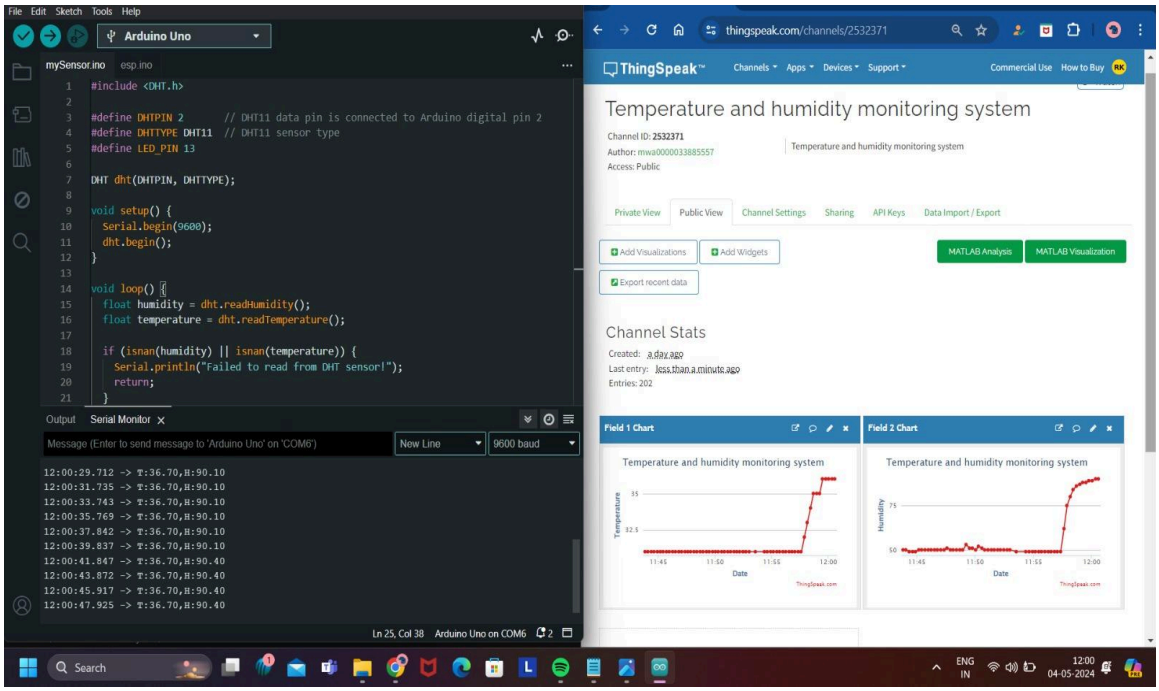
4. Implementation and Testing

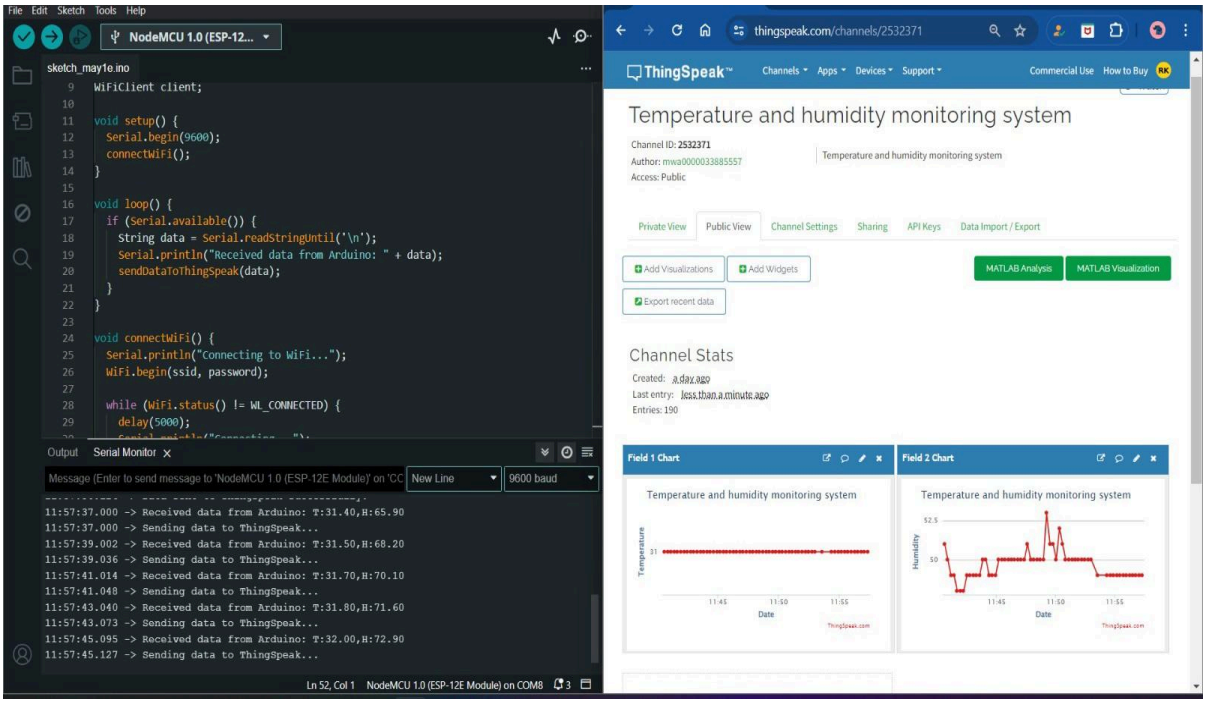
1. Assemble the hardware components on the breadboard following the connection diagram.
2. Upload the developed Arduino code to the Arduino Uno board.
3. Verify that the LED blinks initially, indicating successful code execution.
4. Once connected to WiFi, observe the LED behavior based on the temperature readings. Higher temperatures (above the threshold) should turn on the LED.
5. Access your ThingSpeak channel to view the uploaded data in real-time as graphs.

5. Results and Discussion

The project successfully demonstrates an IoT system for temperature and humidity monitoring with cloud-based data visualization and LED control. Real-time data sent to ThingSpeak allows for remote monitoring and analysis of the environment. The LED provides a visual indication of temperature exceeding the threshold, enabling quick identification of potential concerns.


thingspeak.com/channels/2532371
ThingSpeak™
Channels
Apps
Devices
Support
Commercial Use
How to Buy
Watch
Temperature and humidity monitoring system
Channel ID: 2532371
Author: mwa0000033885557
Access: Public
Temperature and humidity monitoring system
Private View
Public View
Channel Settings
Sharing
API Keys
Data Import / Export
Add Visualizations
Add Widgets
Export recent data
MATLAB Analysis
MATLAB Visualization
Channel Stats
Created: a day ago
Last entry: less than a minute ago
Entries: 185
Field 1 Chart
Temperature and humidity monitoring system
Temperature
Date
Field 2 Chart
Temperature and humidity monitoring system
Humidity
Date


File Edit Sketch Tools Help
Arduino Uno
mySensor.ino
esp.ino
#include <DHT.h>
#define DHTPIN 2 // DHT11 data pin is connected to Arduino digital pin 2
#define DHTTYPE DHT11 // DHT11 sensor type
#define LED_PIN 13
DHT dht(DHTPIN, DHTTYPE);
void setup() {
Serial.begin(9600);
dht.begin();
}
void loop() {
float humidity = dht.readHumidity();
float temperature = dht.readTemperature();
if (isnan(humidity) || isnan(temperature)) {
Serial.println("Failed to read from DHT sensor!");
return;
}
Output
Serial Monitor
Message (Enter to send message to 'Arduino Uno' on 'COM6')
New Line
9600 baud
12:00:29.712 -> T:36.70,H:90.10
12:00:31.735 -> T:36.70,H:90.10
12:00:33.743 -> T:36.70,H:90.10
12:00:35.769 -> T:36.70,H:90.10
12:00:37.842 -> T:36.70,H:90.10
12:00:39.837 -> T:36.70,H:90.10
12:00:41.847 -> T:36.70,H:90.40
12:00:43.872 -> T:36.70,H:90.40
12:00:45.917 -> T:36.70,H:90.40
12:00:47.925 -> T:36.70,H:90.40
Ln 25, Col 38 Arduino Uno on COM6
thingspeak.com/channels/2532371
ThingSpeak™
Temperature and humidity monitoring system
Channel ID: 2532371
Author: mwa0000033885557
Access: Public
Private View
Public View
Channel Settings
Sharing
API Keys
Data Import / Export
Add Visualizations
Add Widgets
Export recent data
MATLAB Analysis
MATLAB Visualization
Channel Stats
Created: a day ago
Last entry: less than a minute ago
Entries: 202
Field 1 Chart
Temperature and humidity monitoring system
Field 2 Chart
Temperature and humidity monitoring system
Search
ENG
IN
12:00
04-05-2024



6. Conclusion

This project showcases the capabilities of IoT technology in monitoring environmental conditions. The combination of Arduino, ESP8266, and ThingSpeak provides a robust and user-friendly platform for data acquisition, control, and visualization.

7. Reference

- https://www.elprocus.com/a-brief-on-dht11-sensor/
- https://www.nabto.com/esp8266-for-iot-complete-guide/
- https://www.instructables.com/IoT-Temperature-Sensor-With-ESP8266/
- https://iotdesignpro.com/projects/temperature-humidity-monitoring-over-thingspeak-using-arduino-esp8266