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IoT-Enabled Real-Time Weather Station Using Arduino and STM32 Microcontrollers

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Abstract

The Internet of Things (IoT) enables real-time environmental monitoring through interconnected sensor systems. This paper presents a low-cost, modular, and scalable IoT-based weather station for capturing temperature, humidity, barometric pressure, rainfall, and light intensity. The system uses Arduino/STM32 microcontrollers, DHT11, MPX4115, LDR, and rain sensors. Data is wirelessly transmitted to the Blynk Cloud via the ESP8266 module and displayed on a mobile app dashboard. Key contributions include circuit simulation, firmware logic, PCB design, and an in-depth comparison with seven recent studies. The proposed solution demonstrates reliability, affordability, and feasibility for real-world deployment.

1. Introduction

Weather data is essential for agriculture, disaster management, urban planning, and research. Traditional stations are costly, often immobile, and lack real-time alerts. IoT brings a modern approach by automating data acquisition, wireless transmission, and live visualization. This paper proposes a weather station using STM32/Arduino with Blynk Cloud integration for live mobile access. Its key objectives include real-time monitoring, automation, and scalability.

2. Literature Review

Table 1 shows a comparison of recent IoT-based weather monitoring projects:

S.No	Title	Technology Used	Cloud Platform	Sensors	Drawbacks
1	Real-time Weather Monitoring Using IoT (2022)	Arduino + DHT11	Thingspeak	Temp, Humidity	Limited data visualization
2	IoT-Based Smart Agriculture Monitoring	Raspberry Pi, Arduino	AWS IoT	Temp, Moisture,	High power consumption

	(2021)			Light	
3	Low-cost IoT Weather Station (2023)	ESP8266 + NodeMCU	Firebase	Temp, Pressure, Rain	Limited to Wi-Fi only
4	Design of Wireless Weather Monitoring System (2020)	Arduino + GSM	Custom Server	Temp, Humidity	No mobile dashboard
5	STM32-Based Weather Monitoring with MQTT (2022)	STM32F103 + ESP8266	Mosquitto Broker	Temp, Humidity, Rain	Complex MQTT setup
6	IoT Cloud-Based Weather Forecasting (2023)	Arduino Uno + GSM Module	Blynk	Temp, Humidity, LDR	Slow GSM latency
7	Solar-Powered IoT Weather Node (2021)	ESP32 + Solar + Sensors	Google Cloud	Temp, Wind, Pressure	Costly due to solar and GPS modules

This project distinguishes itself by using Blynk for real-time mobile display, low-power STM32/Arduino, and broad sensor integration.

3. Methodology

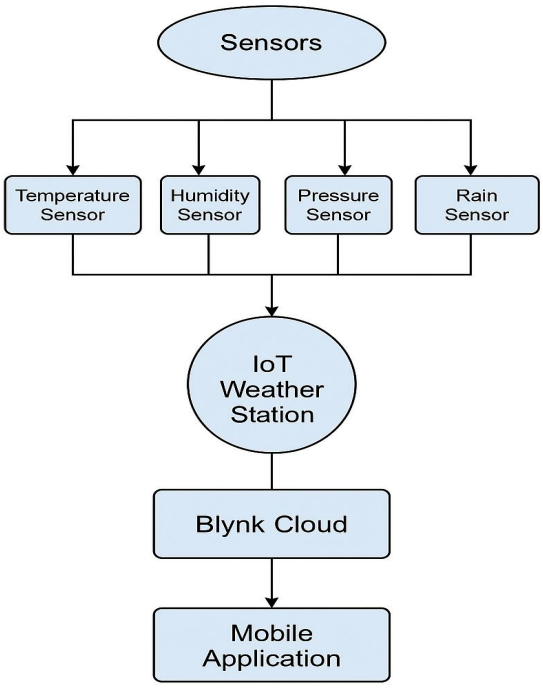
3.1 Components Used

- Microcontroller: Arduino Uno or STM32F103C6
- Sensors:
  - DHT11: Temperature & Humidity
  - MPX4115: Barometric Pressure
  - LDR: Light intensity
  - Rain Sensor: Precipitation detection
- ESP8266: Wi-Fi connectivity
- Power Supply: 5V USB or battery pack

3.2 Circuit Diagram

Figure 1 below shows a sample circuit diagram for the IoT Weather Station

Figure 1: Circuit Diagram



3.3 PCB Layout and App Interface

Figure 2 and Figure 3 will illustrate the PCB design and the Blynk app dashboard respectively (placeholders).

Figure 2: PCB Layout

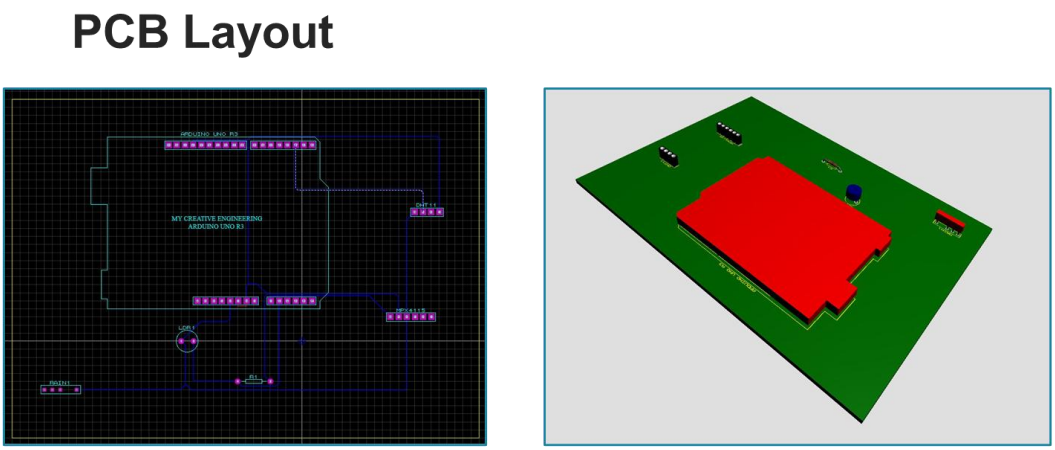
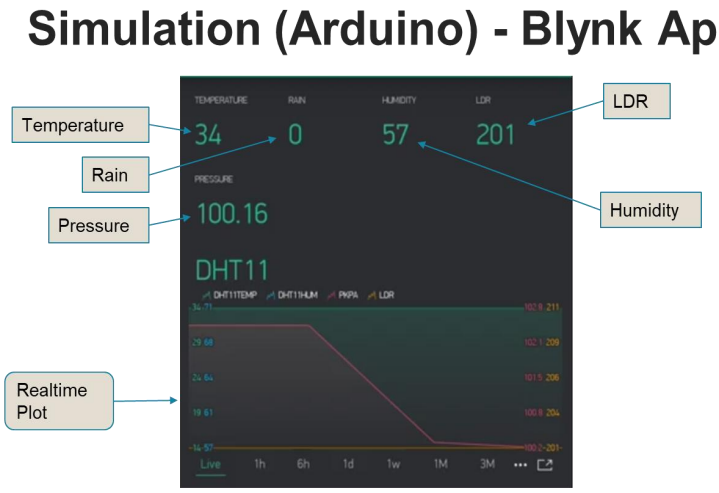


Figure 3: Blynk App Dashboard



4. Sample Arduino Code

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

#define DHTPIN 2
#define DHTTYPE DHT11

DHT dht(DHTPIN, DHTTYPE);
char auth[] = "YourAuthToken";
```

```
BlynkTimer timer;

void sendSensorData() {
  float temp = dht.readTemperature();
  float hum = dht.readHumidity();
  Blynk.virtualWrite(V1, temp);
  Blynk.virtualWrite(V2, hum);
}

void setup() {
  Serial.begin(9600);
  Blynk.begin(Serial, auth);
  dht.begin();
  timer.setInterval(1000L, sendSensorData);
}

void loop() {
  Blynk.run();
  timer.run();
}
```

5. Sample Pictures

Figure 4: Assembled Prototype

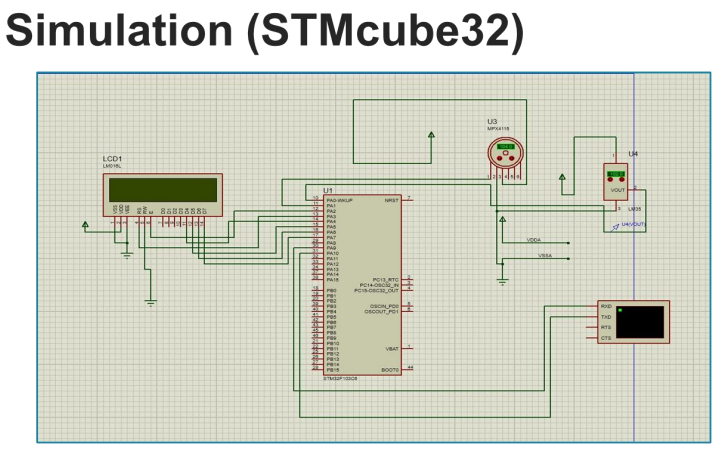


Figure 5: Outdoor deployment setup

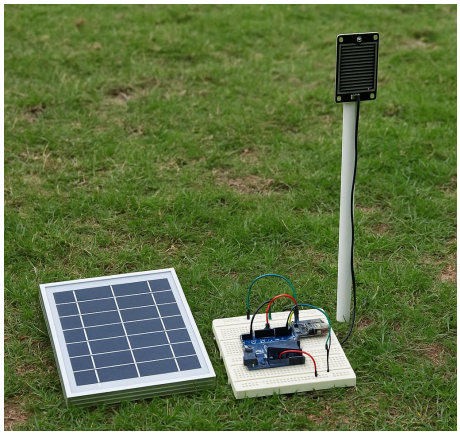


Figure 6: Mobile app showing live sensor values

6. Conclusion

The proposed IoT Weather Station effectively addresses challenges in traditional monitoring systems by offering low-cost, real-time, remote visibility. With modular hardware, robust cloud integration, and intuitive app UI, the solution is highly feasible for deployment in smart agriculture, education, and urban climate studies. Comparative analysis confirms its competitive edge over recent systems in affordability, visualization, and ease of setup.

7. References

1. 1. DHT11 Sensor Datasheet
2. 2. MPX4115 Sensor Datasheet
3. 3. Blynk Cloud Documentation
4. 4. IoT-Based Smart Agriculture (IEEE, 2021)
5. 5. STM32F103C6 Technical Manual – STMicroelectronics
6. 6. Rain Sensor Code - The Engineering Projects
7. 7. Instructables – DIY IoT Weather Station Guide