

Development of a weather station based on arduino

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Abstract

This paper presents the development of an Arduino-based weather station capable of measuring temperature, humidity and air quality. The operating principles of the device, the components used, and the software are described.

1 Introduction

Recently, Bishkek has been facing significant problems with air quality. Therefore, we constructed a device to monitor the weather transitions.

2 Operating principle

The weather station consists of two main parts: transmitter and receiver. The transmitter is accumulated by the rechargeable battery. The transmitter's sensors collect data, which is read by the Arduino Uno and is transmitted to the receiver via radio module. The receiver, which is connected to the computer, receives the transmitted data and outputs them to the serial monitor for further analysis.

3 Components and assembly

3.1 Components used

- Arduino uno board 2x

- Temperature and humidity sensor (DHT 22)
- Gas sensor for air quality (MQ 135)
- Radio module (NRF24LO1) 2X
- Radio module with antenna (NRF24L01+PA+LNA) 2x
- Adapter for NRF24LO1 2x
- Ultra Lithium 9V rechargeable battery
- Connectors and breadboard

3.2 Scheme

The connection scheme is presented on pic 1 and on pic 2.

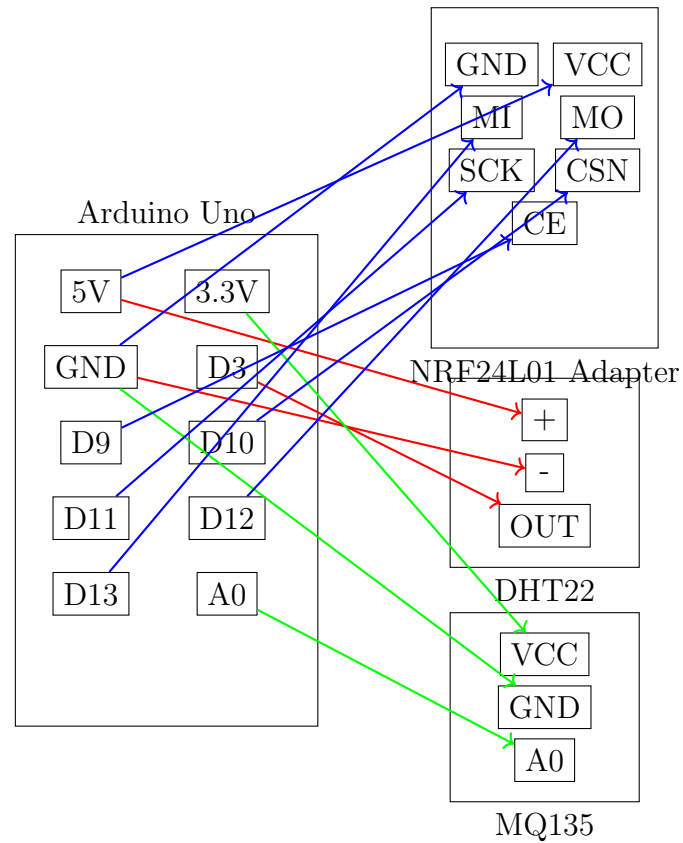


Figure 1: Weather Station Transmitter's wiring scheme

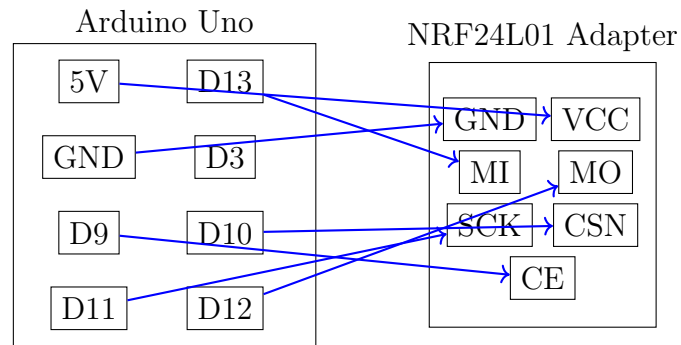


Figure 2: Weather Station Receiver's wiring scheme

4 Software

4.1 Libraries used

- MQ135.h — to work with gas sensor
- DHT.h — to work with temprature and humidity sensor
- SPI.h — to work with radio module
- nRF24L01.h — to work with radio module
- RF24.h — to work with radio module

4.2 Program code

Transmitter's code

Listing 1: Weather meteostation transmitter's code

```

#include <MQ135.h>
#include "DHT.h"
#include <SPI.h>
#include "nRF24L01.h"
#include "RF24.h"

```

```

#define ANALOGPIN A0
#define DHT22_PIN 3

```

```

MQ135 gasSensor = MQ135(ANALOGPIN);
DHT dht22(DHT22_PIN, DHT22);

```

```

RF24 radio(9, 10);

byte address[][6] = {"1Node"};

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

    radio.begin();
    radio.setAutoAck(1);
    radio.setRetries(0, 15);
    radio.enableAckPayload();
    radio.setPayloadSize(32);

    radio.openWritingPipe(address[0]);
    radio.setChannel(0x6e);
    radio.setPALevel(RF24_PA_MAX);
    radio.setDataRate(RF24_250KBPS);

    radio.powerUp();
    radio.stopListening();

    dht22.begin();
    float rzero = gasSensor.getRZero();
    Serial.print("Calibrated RZero: ");
    Serial.println(rzero);
}

void loop() {
    float ppm = gasSensor.getPPM();
    float humi = dht22.readHumidity();
    float tempC = dht22.readTemperature();

    float dataToSend[3] = {ppm, humi, tempC};
    bool ok = radio.write(&dataToSend, sizeof(dataToSend));
    if (ok) {
        Serial.println("Data sent successfully");
    } else {
        Serial.println("Data send failed");
    }
}

```

```

    }

    delay(1000);
}

```

Receiver's code

Listing 2: Weather meteostation receiver's code

```

#include <SPI.h>
#include "nRF24L01.h"
#include "RF24.h"

RF24 radio(9, 10);
//RF24 radio(9, 53);

byte address[][6] = {"1Node", "2Node", "3Node", "4Node", "5Node", "6Node"};

void setup() {
    Serial.begin(9600);
    radio.begin();
    radio.setAutoAck(1);
    radio.setRetries(0, 15);
    radio.enableAckPayload();
    radio.setPayloadSize(32);

    radio.openReadingPipe(1, address[0]);
    radio.setChannel(0x6e);
    radio.setPALevel(RF24_PA_MAX);
    radio.setDataRate(RF24_250KBPS);
    radio.powerUp();
    radio.startListening();
}

void loop() {
    float receivedData[3];
    while (radio.available()) {
        Serial.println("Radio available");
        radio.read(&receivedData, sizeof(receivedData));
        Serial.print("Received PPM: ");
        Serial.print(receivedData[0]);
        Serial.print(" Humidity: ");
        Serial.print(receivedData[1]);
    }
}

```

```
        Serial.print("-Temperature: ");  
        Serial.println(receivedData[2]);  
    }  
}
```

5 Results and conclusions

Constructed weather station successfully works. It is planned to add other sensors, for example atmospheric pressure sensor.