MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

Wireless Weather Station

PROJECT

CSE 306

MICROPROCESSOR, MICROCONTROLLER AND ASSEMBLY LANGUAGE SESSIONAL

GROUP 03

SEC A

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INTRODUCTION:

This Arduino Weather Station displays the current date, time, interior and exterior weather conditions in real time. It is a device which collects data related to the weather and environment using many different sensors. Wireless weather stations are commonly used by homeowners, farmers, schools and business to monitor local weather. It can measure many things like:

- Temperature
- Humidity

The outdoor temperature and humidity are measured using the DHT22 sensor and this data is wirelessly sent to the indoor unit using the WIFI ESP8266 NodeMCU . At the indoor unit, there is also another DHT22 sensor for measuring the indoor temperature and humidity, as well as a DS3231 Real Time Clock module which can keep track of the time even if the Arduino loses power. All of these data are printed on a 1.3-inch OLED SPI display.

METHODOLOGY:

The methodology of a wireless weather station involves several components and processes that work together to measure and transmit weather data wirelessly. Here is an overview of the typical methodology:

1. Sensors: Wireless weather stations consist of various sensors that measure different weather parameters. These sensors may include:

- Temperature sensor: Measures the ambient temperature.

- Humidity sensor: Measures the moisture content in the air.

- Barometric pressure sensor: Measures atmospheric pressure.

- Anemometer: Measures wind speed and direction.

- Rain gauge: Measures rainfall.

- Solar radiation sensor: Measures solar radiation intensity.

- UV sensor: Measures ultraviolet (UV) radiation levels.

These sensors are usually located in an outdoor unit or sensor array.

2. Data Acquisition: The sensors continuously measure the respective weather parameters. The collected data is then processed and converted into electrical signals or digital format suitable for transmission.

3. Wireless Transmission: The weather data is transmitted wirelessly from the sensor array to a display console or a central receiver. The transmission can be accomplished using various wireless technologies such as radio frequency (RF), Bluetooth, Wi-Fi, or other proprietary wireless protocols.

4. Receiver and Display: The receiver or display console is located indoors and receives the transmitted data from the outdoor sensors. It decodes and interprets the received signals to retrieve the weather data. The console typically includes a screen or display where the weather information is presented in a user-friendly format.

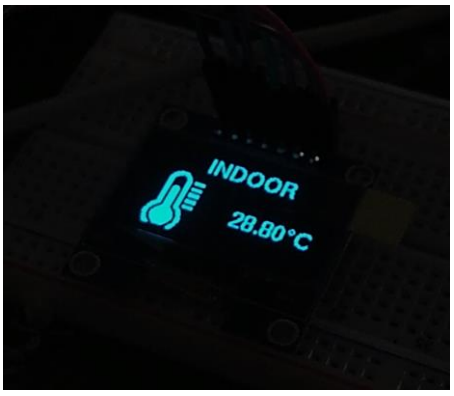
5. Data Logging and Storage: Many wireless weather stations offer data logging capabilities. They can store the received weather data in onboard memory or external storage devices, allowing for long-term data collection and analysis. This enables users to track and analyze weather patterns over time.

6. Remote Monitoring and Connectivity: Wireless weather stations often have the capability to connect to external devices or networks for remote monitoring and access. This can include connecting to computers, mobile devices, or the internet. Remote connectivity enables users to monitor weather conditions and access real-time or historical data from anywhere.

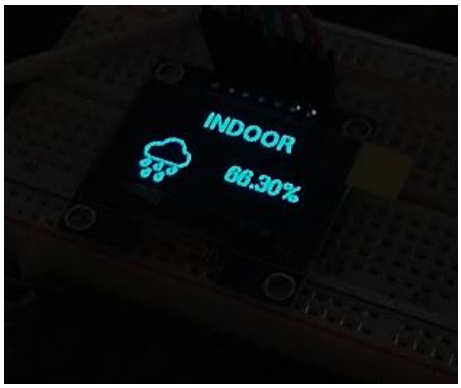
7. Power Source: Wireless weather stations typically require a power source to operate. They can be battery-powered, solar-powered, or a combination of both. Some models also come with an option for AC power connection.

8. Calibration and Maintenance: To ensure accurate and reliable measurements, wireless weather stations may require periodic calibration and maintenance. This can involve recalibrating sensors, checking for sensor drift or malfunctions, and keeping the station clean and free from obstructions.

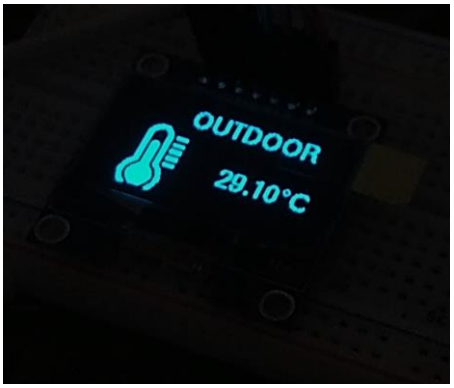
DATE-TIME



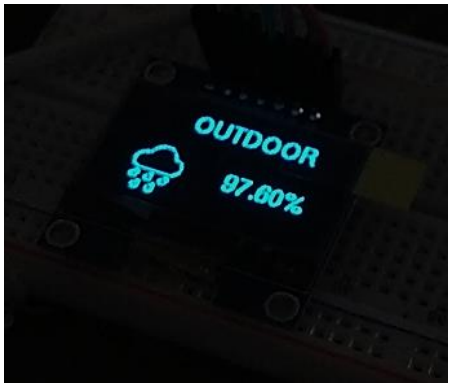
INDOOR TEMP



INDOOR HUMIDITY



OUTDOOR TEMP



OUTDOOR HUMIDITY

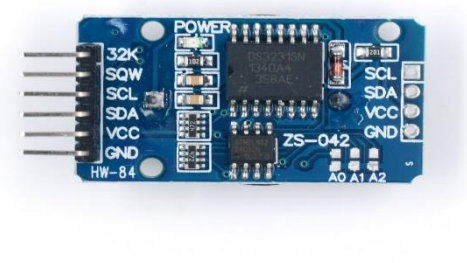
COMPONENTS DETAILS:

The DHT sensors are made of two parts, a capacitive humidity sensor and a thermistor. There is also a chip inside that does some analog to digital conversion and outputs a digital signal with the temperature and humidity. The digital signal is fairly easy to read using any microcontroller.

Characteristics of the DHT22

- 3 to 5V power and I/O
- 2.5mA max current use during conversion
- 0-100% humidity readings with 2-5% accuracy
- -40 to 125°C temperature readings ±0.5°C accuracy

DHT22



DS3231

The DS3231 is a low-cost, extremely accurate I2C real-time clock (RTC) with an integrated temperature compensated crystal oscillator (TCXO) and crystal. The device incorporates a battery input, and maintains accurate timekeeping when main power to the device is interrupted. The integration of the crystal resonator enhances the long-term accuracy of the device as well as reduces the piece-part count in a manufacturing line.The RTC maintains seconds, minutes, hours, day, date, month, and year information.

ESP8266

The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

For the transmitter we use:

- An Arduino NANO
- A DHT22 sensor
- ESP8266 WiFi Module
- A breadboard
- Jumper wires

In order to build the receiver, we need the following parts:

- An Arduino UNO
- A DS3231 Real Time Clock module
- A DHT22 Temperature and Humidity Sensor
- A ESP8266 WiFi Module
- A 1.3-inch OLED SPI Display
- A breadboard
- Jumper wires

OUTCOME

This wireless weather station can measure indoor humidity, temperature using sensor and transmit through Wi-Fi system. It also measures real time date and clock data using sensor and display it in active 1.3inch oled display. This project is based on Wi-Fi system, so the information can be shown from any mobile or laptop device by connecting with same Wi-Fi network.

COMPONENTS & EXPENSE:

SL NO	COMPONENT NAME	QUANTITY	PRICE
1	ARDUINO UNO	1	900/-
2	ARDUINO NANO	1	700/-
3	DS3231 RTC	1	300/-
4	DHT22	2	500/-
5	NODEMCU WIFI ESP8266	2	800/-
6	1.3INCH OLED SPI DISPLAY	1	600/-
7	3.7V DC BATTERY	2	200/-
8	JUMPER WIRES	2 SETS	100/-

9	BREADBOARD	2	200/-
10	POWER JACK	2	200/-
		TOTAL	**4500/-**

APPLICATION:

1. Real-time Weather Monitoring: A wireless weather station allows you to monitor current weather conditions in real-time, including temperature, humidity and more. This data can be displayed on the weather station's console or transmitted wirelessly to a computer or mobile device for easy access.

2. Weather Forecasting: Many wireless weather stations provide weather forecasting capabilities based on collected data. They use algorithms to analyze weather patterns and predict future conditions, helping you plan your activities and make informed decisions.

3. Historical Data Analysis: Wireless weather stations often store historical weather data, allowing you to analyze trends, track weather patterns over time, and identify seasonal variations. This information can be valuable for various purposes, such as agriculture, research, or personal interest.

4. Integration with Smart Home Systems: Many modern wireless weather stations can integrate with smart home systems or online platforms. This enables you to access weather data remotely, automate home devices based on weather conditions (e.g., adjusting thermostats, irrigation systems), or even contribute your weather data to online weather networks.

5. Educational and Hobbyist Use: Wireless weather stations are popular among weather enthusiasts, students, and hobbyists. They provide a hands-on learning experience about weather

phenomena and meteorology, allowing users to deepen their understanding of the natural environment.

CONTRIBUTION:

ID	NAME	CONTRIBUTION
202114006	Afra Anan	• Outdoor unit measurement code and physical connection • Collecting all materials of the project
202114036	Maisha Tabassum	• Indoor unit measurement code and physical connection • Report writing as per instruction
202114061	Md. Imran-Ul-Huq	• Wireless transmit and receive and physical connection • Collecting information about the components • Designing and testing the diagram