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Weather Logger for Research and Education

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ABSTRACT: This paper presents a Weather Monitoring System (WMS) that employs IoT and cloud technologies. The WMS captures, records, and displays various weather conditions, such as temperature and humidity, using sensors. Sensor data is transmitted to the cloud for remote access, enabling users to receive real-time updates via a web interface. The system's key components include an Arduino UNO board, sensors, and a WIFI Module for data transmission. WMSs are crucial for monitoring and analyzing weather patterns, offering insights into environmental changes. The system stores data at regular intervals with timestamps for future analysis and provides real-time alerts for monitoring environmental parameters, including temperature, humidity, atmospheric pressure, wind speed, wind direction, air quality, light intensity, rainfall, and geographical coordinates.

I. INTRODUCTION

A weather logger is a device designed to record and store weather data for research and educational purposes, aiding in the study of weather patterns, climate change, and environmental phenomena. These loggers vary in complexity, with basic models recording temperature, humidity, and rainfall, while more advanced versions can capture additional data such as wind speed and direction, barometric pressure, and UV radiation. Weather loggers find utility in various research fields, including meteorology, climatology, and hydrology, enabling the study of weather patterns at different scales and monitoring the impacts of climate change on ecosystems. Additionally, weather loggers serve as valuable educational tools, fostering learning about weather and climate in science classrooms and supporting citizen science projects by collecting data from diverse locations.

II. AIM

To implement a comprehensive weather logging system to enhance meteorological and climatology education and research.

III. PROPOSED SYSTEM



fig.1 block diagram of weather logger with education and research

The primary controller, managed by the Arduino UNO, independently governs each component of the system. An LCD display directly showcases the sensor data, providing real-time updates. The DHT11 sensor, functioning based on Arduino code, measures local temperature (T) and humidity (H). The Wind Speed meter generates power, directed to pin A1 of the Arduino board to calculate Wind Speed using predefined formulas in the Arduino code. The LDR module measures light on the photoresistor, displaying readings based on the Day/Night cycle. The connection scheme of the system illustrates how components are linked. Each component requires a 5V and GND connection from the Arduino board. Initially, the DHT sensor measures temperature (T) in degrees Celsius and humidity (H) in percentage, sending data directly to the display and indirectly to the microcontroller's I/O monitor. Additionally, the Wind Speed meter concurrently measures wind speed.

IV. WORKING PRINCIPLE

A Weather Logger with Education and Research aims to collect weather data for educational purposes and scientific research. The working principle typically involves several components:

1. **Sensors:** Various sensors are employed to measure different weather parameters such as temperature, humidity, air pressure, wind speed, wind direction, precipitation, UV index, etc. These sensors are strategically placed in an outdoor environment to capture accurate data.
2. **Data Collection:** The sensors continuously collect weather data at regular intervals. This data is then transmitted to a central processing unit or data logger.
3. **Data Logging:** The central processing unit or data logger collects the data from the sensors and stores it in a database. The data logging system may also include a real-time clock to timestamp each data point accurately.
4. **Data Analysis and Display:** The collected data can be analysed using software tools to generate various weather metrics, trends, and patterns. Additionally, the data can be displayed in real-time on a digital interface such as a computer monitor, smartphone app, or a dedicated display panel.
5. **Education and Research:** The collected weather data serves as a valuable resource for educational purposes in schools, universities, and research institutions. It can be used to teach students about meteorology, climate science, data analysis, and scientific research methods. Researchers can also utilize the data to study local weather patterns, climate change, and its impacts.
6. **Maintenance and Calibration:** Regular maintenance and calibration of the sensors and data logging system are essential to ensure the accuracy and reliability of the collected data over time. This may involve periodic sensor calibration, battery replacement, software updates, and physical inspection of the equipment.

V. METHODOLOGY

The Weather Logger for education and research utilizes various hardware components, including the Arduino UNO. Arduino is a platform intended for constructing computers capable of sensing and controlling physical elements beyond typical desktop computers' capabilities. It is an open-source platform centered around a simple microcontroller board, complemented by a development environment for programming. Arduino systems can function independently or interact with computer software like Flash, Processing, or Max MSP. The boards can be manually assembled or bought pre-assembled, and the open-source IDE is available for free download. The Arduino Uno, based on the ATmega328 microcontroller, features 14 digital input/output pins (with 6 usable as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains all necessary components to support the microcontroller, requiring only a USB cable for computer connection or an AC-to-DC adapter or battery for power.

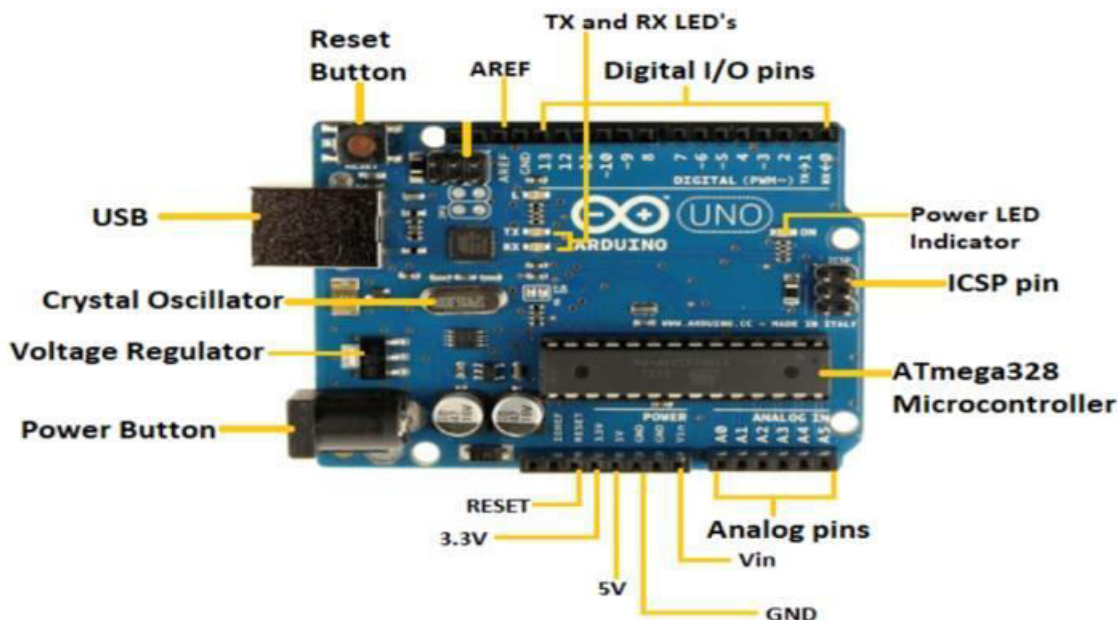


Fig .2 Arduino

Operating Voltage: 5v
 Processor:16MHz ATmega328P
 Input Voltage: 7-12v
 Memory: 32k byte
 Dimensions: 68.6mm x 53.4mm
 USB: 2.0

- The Node MCU is an open-source IoT platform that utilizes firmware running on the ESP8266 Wi-Fi SoC from Expressif Systems, along with hardware based on the ESP12 module. It serves as a development environment for both software and hardware, centered around the cost-effective ESP8266 System-on-a-Chip (SoC).

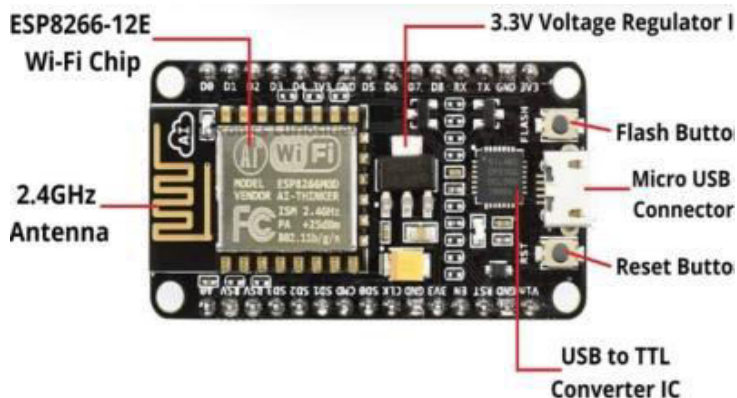


Fig.3 Node

MCU
 Input voltage: 4.5v-10
 Antenna: 2.4GHz
 ADC range: 3.3v
 Memory: 4MB / 64KB
 Temperature Range: -40C- 125C

Dimensions: 49mm x 26mm

- The DHT11 Temperature and Humidity sensor is an affordable digital sensor created for detecting temperature and humidity levels. It can be easily connected to various microcontrollers like Arduino and Raspberry Pi, allowing for real-time measurement of humidity and temperature. This sensor is offered in both standalone and module forms.

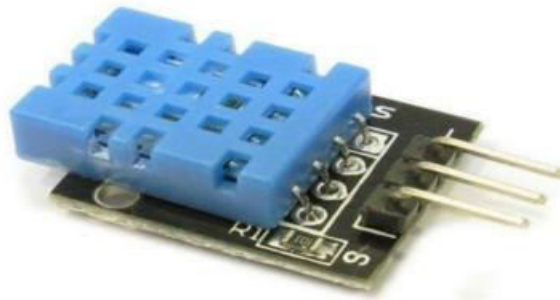


Fig.4 Temperature and Humidity sensor

- LCD Display:

The Liquid Crystal Display (LCD) is widely used for user interfaces and debugging in various devices. Character-based LCDs, which rely on controllers like Hitachi's HD44780 or compatible ones like HD44580, are particularly popular. These LCDs come in 1-line, 2-line, or 4-line variants with a single controller, supporting up to 80 characters. LCDs that exceed 80 characters typically employ two HD44780 controllers.

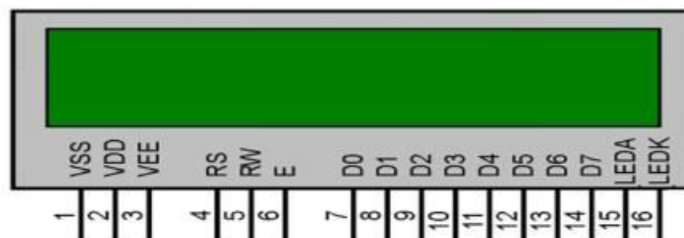


Fig.5LCD

Minimum logic voltage: 4.5 V

Maximum logic voltage: 5.5 V

Typical LED backlight voltage drop: 4.2 V.

Typical LED backlight current: 120 mA

Supply current: 2 mA

- Wi-Fi Module:

For this setup, a small wireless transmitter or hub is necessary. It retrieves data from the internet via your home broadband connection and transforms it into radio waves, which it then broadcasts to establish a local area around itself. Commonly referred to as a Wireless Access Point (WAP), this transmitter allows devices with the compatible wireless adapter to receive these radio signals, creating a Wireless Local Area Network (WLAN). However, the range of the Wi-Fi signal is limited because of its relatively weak radio signals, typically covering an average home and extending to the street directly outside, but not much farther.



Fig.6 Wi-Fi Module

Power supply: 3.3 Volts
Consumption: 100 m Amps
Input/Output voltage: 3.6 Volts
Range: 50 meters
Dimensions: 30 x 20 x 3

REFERENCES

- [1] Stipanicev D, Marasovic J. (2022). Network embedded greenhouse monitoring and control. Proceedings of 2022 IEEE Conference on Control Applications.
- [2] Real Time Paddy Crop Field Monitoring Using Zigbee Network”, by K. Nirmal Kumar Ranjith R. Prabakaran 978-1-4244-7926-9/11/\$26.00 ©2021 IEEE.
- [4] Review of Sensors for Greenhouse Climate Monitoring” by Vu Minh Quan, Gourab Sen Gupta, Subhas Mukhopadhyay 978-1-4244-8064-7/11/\$26.00 ©2022 IEEE.
- [5] Weimei Zhang, “Study about IOT”s Application in “Digital Agriculture” Construction,” ICECE, pp. 2578-2581, 2021.
- [6] M. Haefke, S. C. Mukhopadhyay, and H. Ewald, “A Zigbee Based Smart Sensing Platform for Monitoring Environmental Parameters,” Instrumentation and Measurement Technology Conference (I2MIC), pp. 1-8, 2021.
- [7] Zheng Qiang, Peng Lin, Zou Qiuxia, Gao Lutao, The Design of Remote Greenhouse Monitoring System Based on the Embedded Web Server, Agricultural Mechanism.
- [8] Ouohong Li, Zhang, Yi Zhang A Design of the IOT Gateway for Agricultural greenhouse Sensors HB & Transducers, Vol. 172, Issue 6, June 2014, pp.75-80. Stipanicev D., Marasovic J. (2003). Network embedded greenhouse monitoring and control. Proceedings of 2003 IEEE Conference on Control Applications. Real Time Paddy Crop Field Monitoring Using Zigbee Network" by K. Niram [2] Stipanicev D., Marasovic J. (2003). Network embedded greenhouse monitoring and control. Proceedings of 2003 IEEE Conference on Control Applications.
- [9] H. Theseus, S. Kolb, M. Eberl, and R. Schiller, Miniaturized photoacoustic gas sensor for CO₂, in Sensor Systems Simulations: From Concept to Solution, W. van Driel, O. Pyper, and C. Schumann, eds. Cham, Germany: Springer International Publishing, 2020, pp. 73–92
- [10] D. Lazik, D. Vetterlein, S. K. Salas, P. Sood, B. Apelt, and H. J. Vogel, New sensor technology for field scale quantification of carbon dioxide in soil, Vadose Zone Journal, vol. 18, no. 1, pp. 1–14, 201



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