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# An Implementation Iot Weather Station Based On ESP 32

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| Article Info | ABSTRACT |
|---|---|
| Keywords:<br>Weather Station,<br>IoT,<br>Sensors,<br>Blynk,<br>Node MCU | This study discusses the development of an Internet of Things (IoT)-based weather station using NodeMCU ESP32, BMP280 sensor, and DHT11. This weather station is designed to collect real-time temperature, humidity, and atmospheric pressure data, and transmit them to an online platform for further analysis. NodeMCU ESP32 is used as the main microcontroller tasked with controlling and collecting data from both sensors. The BMP280 sensor is used to measure atmospheric pressure and temperature, while the DHT11 sensor is used to measure air humidity. The collected data is sent via a Wi-Fi connection to the Blynk server for storage and analysis. Through the use of IoT technology, this weather station provides the ability to monitor weather conditions in real time and take necessary actions based on the collected data. Integration with an online platform allows remote data access, allowing users to monitor weather conditions from anywhere. Thus, this study not only illustrates the implementation of IoT technology in monitoring weather but also opens up opportunities for broader applications in environmental monitoring and resource management. |
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## INTRODUCTION

Information about current weather conditions is a common need for society because many activities depend on weather conditions. Weather conditions can change rapidly and radically at any time, making people less responsive to the impact. Meteorological factors that must be considered can be used as documents to predict the weather at any time in the future. The most widely used weather information is temperature, humidity, rainfall, wind speed, wind direction and light. It is easier to get information today with a wide internet reach. All internet users can get all information in real time. In addition to being a means of sharing information, the internet can also be used to control or control an object through the Internet of Things (IoT). The Internet of Things is a concept that aims to expand the benefits of permanently connected Internet connectivity [3]. In the increasingly developing digital era, the Internet of Things (IoT) has become a concept that allows objects in everyday life to connect and communicate via the internet network. One interesting implementation of this concept is an IoT-based weather station.

Traditional weather stations generally only provide information about temperature and humidity at a particular location. However, with the integration of advanced sensors such as

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BMP280 and DHT11, IoT-based weather stations can provide more comprehensive and accurate information about weather conditions. The BMP280 sensor is a highly precise atmospheric pressure and temperature sensor. This sensor is capable of measuring changes in atmospheric pressure very accurately, so it can be used to predict weather changes such as rain or sunny weather. In addition, the DHT11 sensor is a temperature and humidity sensor that also has high accuracy. The combination of BMP280 and DHT11 sensors in an IoT weather station allows for the measurement of temperature, humidity, air pressure, and even changes in temperature and humidity over time. In this study, we will discuss in depth the design and implementation of an IoT-based weather station using BMP280 and DHT11 sensors. surement Time: 5.5 mS

**Table 1.** BMP280 Sensor Pin Description

| Pin No. | Pin Name | Pin Description |
|---|---|---|
| 1 | Vcc | This is the power pin. Connect a 3.3 volt dc supply to this pin. |
| 2 | GND | Ground Pin |
| 3 | SCL | Serial Clock pin for I2C interface |
| 4 | Natural Resources | Serial Data Pins for I2C interface |
| 5 | CSB | Chip Select pin for I2C and SPI interfaces when equipped with low and ground signals. When applying a 3.3 volt HIGH signal, this pin will select the I2C interface. |
| 6 | SDO | Serial Data Output pin, which sends output data |

The BMP280 sensor operates on the principle of air pressure changing with altitude. As altitude changes, atmospheric pressure also changes. This sensor uses this principle to measure changes in atmospheric pressure and converts them into interpretable pressure values.

**DHT11 Sensor**

The DHT11 sensor is an economical temperature and humidity sensor that is widely used in various electronic projects, including weather monitoring systems, environmental controls, smart home appliances, and more. Here is a detailed explanation of the DHT11 sensor:


**Figure 2.** DHT11 Sensor

The DHT11 sensor operates based on changes in the resistance of materials that are sensitive to air humidity. This change in resistance is influenced by the level of humidity.

This sensor uses the change in resistance to calculate the temperature and humidity of the air.

**NodeMCU ESP32**

In 2016, Espressif system, a technology company based in Shanghai, China. Released its latest product, ESP32. ESP32 is not here to replace ESP8266, but provides improvements in all lines. Not only does it have support for WLAN connectivity, but also Bluetooth makes it more versatile. The CPU it has is similar to that embedded in the ESP8266 - namely the Xtensa® LX6 32-bit, but with dual core. ESP32 is an open source microcontroller intended for IOT (Internet Of Things) needs, with low prices and energy efficiency. By using TSMC as a core manufacturer with a large 40nm. The ESP32 generation uses the Tensilica Xtensa LX6 microprocessor as the core. Both in single-core and dual-core modes.

**Figure 3.** ESP32 CPU

ESP32 embedded in it Microprocessor LX6 Single or Dual-Core 32-bit with clock frequency up to 240 MHz. And storage SRAM 520 KB, ROM 448 KB, and SRAM RTC 16 KB. In addition, esp32 also supports Wi-Fi connectivity 802.11 b / g / n with speeds up to 150 Mbps and with support for Classic Bluetooth v4.2 and BLE specifications. Plus 34 programmable GPIOs add ease to interface with other devices.

**Weather Station Circuit Schematic With NodeMCU ESP32**

The schematic of the weather station circuit that will be built is as shown in the image below.

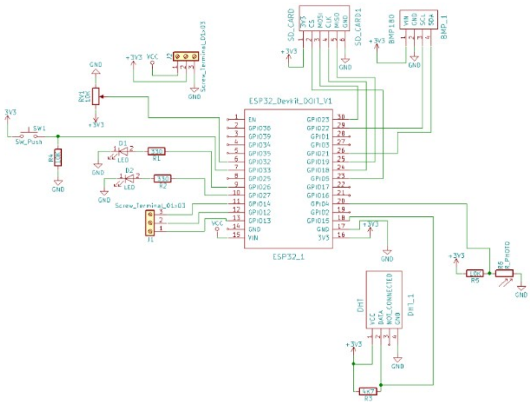

**Figure 4.** Complete set of weather station systems

## RESEARCH METHODS

The method used in this research is a combination of experimental and quantitative research. With this approach, it is hoped that the IoT weather station system developed can provide a significant contribution to monitoring weather and environmental conditions in real-time.

Data Analysis Methods

1. Data collection:
   a. The NodeMCU ESP32 will collect data from weather sensors such as temperature, humidity, air pressure, and possibly wind speed and direction.
   b. This data will then be sent via a WiFi connection to a server or data storage platform.
2. Data Storage:
   a. Data can be stored in the cloud using services like AWS, Google Cloud, or Azure, or you can store it locally on your own servers.
   b. Make sure to store data in a format that is easy to access and process, such as CSV or JSON.
3. Data Visualization:
   a. Create a user interface or dashboard to visualize the collected weather data. You can use tools like Grafana, Plotly, or Matplotlib to create attractive and informative graphs and charts.
   b. Useful graphs might include daily trends in temperature, relative humidity, and air pressure, as well as perhaps wind.
4. Data analysis:
   a. Perform simple statistical analysis such as mean, median, and standard deviation to see trends and patterns in weather data.
   b. It is also possible to use advanced analysis techniques such as regression to predict future weather patterns based on historical data.
5. Notifications or Automatic Actions (Optional):
   a. If you want to take action based on certain weather conditions, you can create a notification system or automated actions.
   b. For example, if the temperature reaches extreme levels, the system can send a notification or activate cooling or heating devices.
6. Data Security:
   Make sure to secure your weather data, especially if you store it in the cloud. Use strong encryption and authentication protocols to protect your data from unauthorized access.
7. System Maintenance and Monitoring:
   Finally, make sure to perform regular maintenance on our system and monitor its performance. Check the sensors regularly to make sure they are working properly and make sure the data delivery system is running smoothly.

By following these steps, we will have a powerful data analysis method for your IoT Weather Station system with Node MCU ESP32.

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## RESULTS

**System Result.**

This system consists of two main parts, namely hardware and software. After being assembled, the circuit is as in Figure 5 below. The hardware circuit consists of 3 parts, namely, the node-mcu board, the BMP 280 and DHT11 sensor boards and the LCD board equipped with an I2C interface.

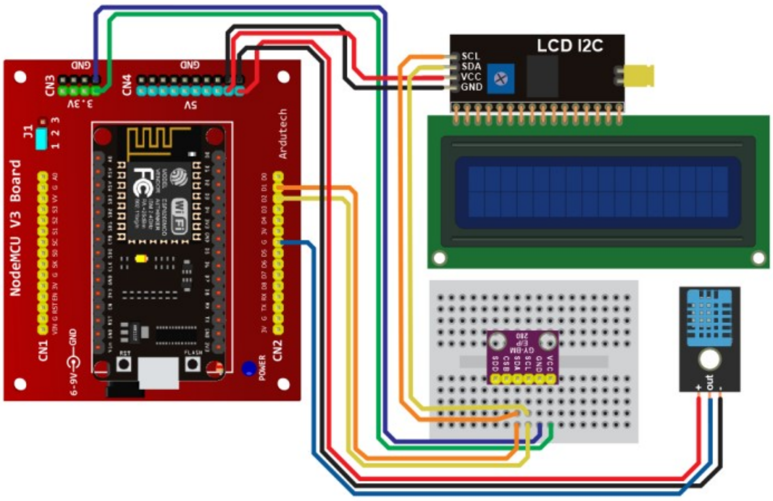


Figure 5. Complete IoT Weather Station Circuit

How the system works is as follows:

When first turned on, the system will initialize the device. It checks what devices are connected to it. Then the system tries to make a connection to wifi, according to the SSID and password that have been set. If it is appropriate, the system will connect to wifi. Then each sensor reads the environmental conditions and sends the results to Blynk. Blynk then sends the results to the Android Smartphone.

Then so that the system can be monitored via a smartphone, we must connect the system to Blynk. Then install Blynk IoT from the Play Store. Install until finished then Login with the same account as the account that was created on the web earlier. After the Blynk display appears, then we follow the procedure as on the Blynk web. After the configuration is complete on the cell-phone and has appeared, the LCD displays the BMP280 sensor reading value and humidity from the DHT11 sensor.

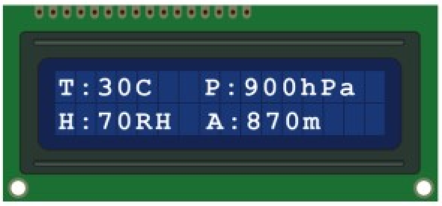


Figure 6. Sensor Reading Values Also Appear In The Blynk Android Application.


Figure 7. Sensor Reading Values Displayed on Android Smart Phone

## Discussion

The results of monitoring the average air temperature during the day in Medan city for 21 days can be seen in the table below. Measurements were taken from 10:00 WIB and 15:00 WIB.

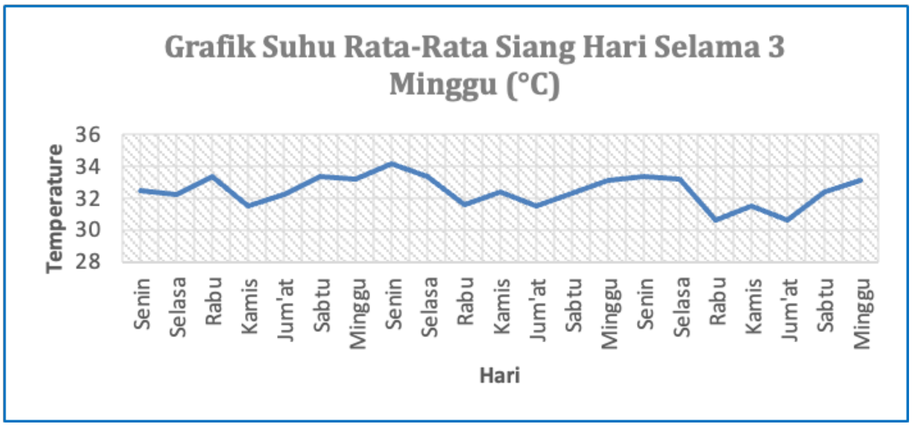


Figure 8. Average Daytime Temperature Graph for 3 Weeks

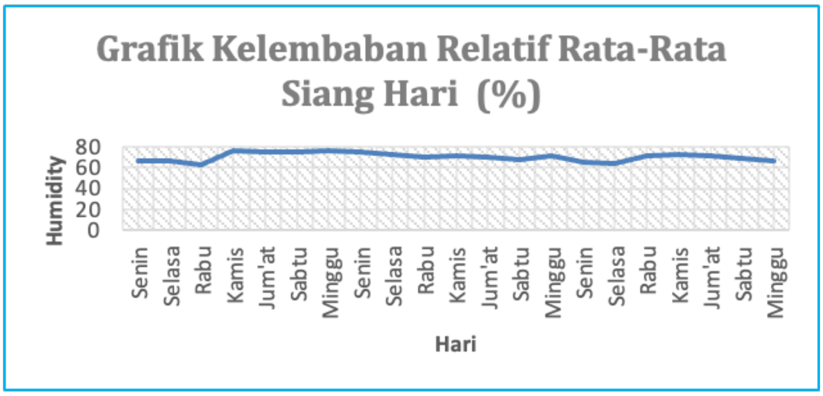


Figure 9. Average Relative Humidity Chart During the Day

The graph shows the average daytime temperature for three weeks in degrees Celsius (°C). Here are some points to discuss from the graph:

1. Temperature Movement:
   a. The average temperature ranges from 29°C to 34°C.
   b. There are significant temperature fluctuations from day to day, indicating climate variations that may be caused by factors such as weather, rainfall, and humidity levels.
2. Weekly Trends:
   a. In the first week, average temperatures were seen to be stable with a slight increase on Wednesday.
   b. The second week showed a higher increase in temperatures compared to the first week, with the highest temperature peaks occurring on Thursday and Friday.
   c. The third week shows greater temperature variation with a significant drop on Wednesday, but then increasing again towards the end of the week.
3. Certain Day:
   a. Monday of the second week showed one of the highest temperatures on the chart.
   b. The lowest temperature occurred on Wednesday in the third week.
   c. There was a consistent increase in temperature towards the end of the third week.
4. Further Analysis:
   For further analysis, it is important to consider external factors that may affect temperature, such as seasonal weather patterns, natural events such as rain or storms, and human activities that may affect local temperatures.

This graph provides a clear picture of how the average daytime temperature varies over a three-week period and can be used for more in-depth analysis of climate trends in a particular region.

## CONCLUSION

From the discussion above, the results of this study can be concluded as follows: The designed system has been in accordance with expectations, namely being able to monitor surrounding weather conditions such as temperature, relative humidity, air pressure and altitude. The accuracy of the measurement is approximately 5%, so it can be said to be quite accurate. The connection to the Blynk cloud is also fast and the results depend on the internet provider used. Can monitor weather conditions via Android and iOS smartphones.

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