Monitoring temperature and humidity of server room using Lattepanda and ThingSpeak

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Abstract. To keep the server running properly, the temperature and humidity in the server room need to be considered because if the temperature or humidity in the server room is not suitable with standards it will disturb or damage the existing server. For this reason, the condition of the server room must be monitored and the temperature and humidity in the room are maintained. In this work we design a temperature and humidity remote monitoring system and server room using Lattepanda and ThingSpeak to data cloud of monitoring result. The system design process consists of two parts, the first is the design of hardware reading data on the sensor. The second is sending data to ThingSpeak capable to be resuscitated which is can be accessed via internet using a browser. From the results of the test, it can be seen that Lattepanda can be used to monitor temperature and humidity in the server room. The temperature and humidity can be monitored in real time (every 30 seconds) through the channels provided by ThingSpeak.

1. Introduction
Companies or other institutions are in growing up process usually have server space as a place to store digital data, various digital data such as data letters, photos and other data stored in the server hard drive. To keep the server running properly, the temperature and humidity in the server room need to be considered because if the temperature or humidity in the server room is not suitable with standards it will disturb or damage the existing server [1]. Generally, the server room has been prepared with an air conditioner cooling with the standard needed for the server room. However, the condition of the server room must be monitored and the temperature and humidity in the room are maintained.

Monitoring of temperature and humidity done by installing a temperature and humidity measuring instrument in the server room. However, if monitoring is done by entering the server room, it will be bother because the temperature in the server room is cold. In addition, direct monitoring in the server room will be difficult if we want to monitor continuously. To handle this problem, we design a remote monitoring system to monitor the temperature and server room. Along with the development of Internet of Things (IoT) remote monitoring has been developed [2–4].

Previously there has been studies designed remote monitoring systems for server rooms. Hartoni Anwar et al has designed a web-based temperature and humidity remote monitoring system for PoP (Point of Presence) rooms [5]. They use Arduino as a microcontroller to get data from the sensor and send it to the server using the ESP module. In addition, there are also several studies use ZigBee as a communication protocol for monitoring in server rooms [6,7]. Unlike some previous
studies we designed a temperature and humidity remote monitoring system and server room using Lattepanda and ThingSpeak to data cloud of monitoring result.

2. Materials and method

2.1. Lattepanda

Lattepanda is a super small computer with the first Windows 10 operating system in the world which have a mini size, but its ability cannot be doubted, and arguably this miniPC (Personal Computer) board is capable of carrying out activities normally done on a PC on generally [8]. Not only as a substitute for PC, Lattepanda also can be used as a controller board because it is designed to be compatible with Arduino, so Lattepanda is one of the options for inexpensive controller boards [9,10]. Arduino is an open source micro single board controller, as an open hardware platform, Arduino can be used to create prototypes of interactive electronic equipment based on flexible and easy to use hardware and software.

Lattepanda has the following specifications:

- Processor: Intel Cherry Trail Z8300 Quad Core 1.8GHz
- Operation System: Pre-installed pre-activated full edition of Windows 10
- Ram: 2GB DDR3L
- Storage Capability: 32GB
- USB 3.0*1, USB 2.0*2, WiFi and Bluetooth 4.0
- 2 GPIOs for Intel chip, 20 GPIOs for Arduino
- Power: 5v/2A

Figure of Lattepanda structure can be seen at figure 1.

![Lattepanda structure](image)

**Figure 1. Lattepanda structure**

20 GPIOs Arduino has the following function:

- **Analog Inputs**: A0 - A5, A6 - A11 (on D4, D6, D8, D9, D10, and D12). The Lattepanda has 12 analog inputs, labeled A0 through A11, all of which can also be used as digital I/O. Each pin has a 10-bit resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts.
- **Serial**: D0 (RX) and D1 (TX). Used to receive (RX) and transmit (TX) TTL serial data.
- **External Interrupts**: D3 (interrupt 0), D2 (interrupt 1), D0 (interrupt 2), D1 (interrupt 3) and D7 (interrupt 4). These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
• **PWM:** D3, D5, D6, D9, D10, and D13 provide 8-bit PWM output.
• **SPI:** D16 (MOSI), D14 (MISO), D15 (SCK).
• **LED:** D13 There is a built-in LED driven by digital pin 13. When the pin's val
• **TWI:** D2(SDA), D3(SCL). **Other pins on the board:**
• **Reset:** Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

2.2. **ThingSpeak**

ThingSpeak is free web services to collect and store sensor data in the cloud and develop IoT applications [11]. ThingSpeak Webservices provides applications to analyse and visualize data in the form of graphics or processed in MATLAB. ThingSpeak can receive data from various hardware devices such as Arduino, Raspberry Pi, BeagleBone Black, and other hardware devices. Basic element of Thingspeak is a channel contains data fields, location fields, and status fields. ThingSpeak has been widely used in several jobs in the IoT field [12,13].

2.3. **System Design**

The system design process consists of two parts, the first is the design of hardware reading data on the sensor. The second is sending data to ThingSpeak capable to be resuscitated which is can be accessed via internet using a browser. The block diagram of this design can be seen in figure 2.

![System block diagram](image)

**Figure 2.** System block diagram

Readings of temperature and humidity data using DHT sensor 11. DHT 11 sensor is a sensor module serves to censor temperature and humidity objects have analog voltage output and continues processed using a microcontroller [14]. The DHT 11 sensor is connected to the GPIO port on LattePanda. DHT 11 data pin is connected to D7 pin on GPIO LattePanda. Next is for each VCC and GND pins on DHT 11 are connected to each VCC and GND pin on LattePanda. The figure of wiring circuit can be seen in figure 3.
Figure 3. Wiring diagram

Then sending data received by Arduino GPIO on Lattepanda to ThingSpeak. Data transmission is done by accessing the API in ThingSpeak. Capable to send the sensor data, the channel must registered first which is displayed in ThingSpeak. In this work the data sent to ThingSpeak is the temperature and humidity sent every 30 seconds. After the registration obtained, the API URL from ThingSpeak assessed by Lattepanda. Because Lattepanda has an Ethernet module and a Wifi module, the API can be accessed directly through one of these modules. In this work we use an Ethernet module to access the API.

3. Result and Discussion
From the results of system design, it tested by turning on and put Lattepanda in the Server room connected to the DHT 11 sensor through the Arduino GPIO pin. From the test results, Lattepanda managed to send data continuously to ThingSpeak every 30 seconds. The data sent in the form of a temperature in degrees Celsius and the percentage of humidity. Examples of data sent can be seen in table 1.

Table 1. Examples of monitoring data

| No. | Temperature(°C) | Humidity (%) |
|-----|----------------|--------------|
| 1   | 18             | 19           |
| 2   | 17             | 19           |
| 3   | 17             | 19           |
| 4   | 17             | 19           |
| 5   | 17             | 19           |
| 6   | 17             | 19           |
| 7   | 17             | 19           |
| 8   | 18             | 19           |
| 9   | 18             | 19           |
| 10  | 17             | 19           |
| 11  | 17             | 19           |
| 12  | 17             | 19           |
| 13  | 17             | 18           |
| 14  | 17             | 19           |
| 15  | 17             | 20           |
From ThingSpeak data can be seen from the channel URL which is visualizes the data in graphical form. Figure 4 and Figure 5 show the data displayed in graphical form through the channel in ThingSpeak.

![Field 1 Chart](image1)

**Figure 4.** Graph of temperature monitoring on ThingSpeak

![Field 2 Chart](image2)

**Figure 5.** Graph of humidity monitoring on ThingSpeak

4. **Conclusion**
From the results of the test, it can be seen that LattePanda can be used for temperature and humidity in the server room. The temperature and humidity can be monitored in real time (every 30 seconds) through the channels provided by ThingSpeak. For work, acceleration done by increasing the number of points and sensors to obtain more accurate data.

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