Environmental Sensor Design Prototype for Genset Backups Power at Ground Station and Data Centers Based on Internet of Things Devices

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Environmental Sensor Design Prototype for Genset Backups Power at Ground Station and Data Centers Based on Internet of Things Devices

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Abstract. Earth station and data center devices require stable backup power. The remote sensing earth station has 2 generators that can operate simultaneously or alternately. This Generator Set has optimal ability to work at room temperature up to 50 degrees Celsius. This environmental sensor prototype consists of three main parts: temperature sensor, ESP wifi module and website to display updated information at any time. The generator set system is only able to work under room temperature 50 degrees Celsius, if the room temperature exceeds 50 degrees Celsius the system will turn off the generator. This sensor system is used to monitor the room temperature so that it is not more than 50 degrees Celsius. All of the above systems can be accessed through the Local Area Network within the Parepare Remote Sensing Earth Station. With this system is expected to natural disturbances that occur in the antenna can be minimized so that the antenna ability to track and data acquisition can be maximized. The end of this prototype sensor is expected to help extend the life of antennas operating in the remote earth station LAPAN Parepare.

1. Introduction

The remote sensing earth station of the national aviation and space agency (SBPJP LAPAN) is one of the parts that is sheltered by the remote sensing deputy LAPAN, maintaining the continuity of the availability of low, medium resolution remote sensing data [1]. And the high and international standard remote sensing remote satellite station is the vision and mission of the remote satellite sensing system. To support the ability to achieve the vision and mission, the remote sensing earth station is equipped with remote sensing satellite data reception equipment that is in accordance with the established standards [2]. One of the main equipment used is the antenna to receive signals emitted by remote sensing satellites that pass in Indonesian territory [3, 4].

Earth station operations and data centers have backup power. This backup power system Electric backup system in the form of a generator set is 2 units [5]. This system is able to work together or alternately in supporting the operation of earth stations and data centers in parepare. The ability of the generator when operating is to reach room temperature below 50 degrees [6]. The heat of the ambient temperature in South Sulawesi's Parepare is approximately 33 degree. The Generator set also generated the heat and its multiply with the environments room, conditions like this can cause the air temperature in the generator room to be out of control. To determine the increase in room temperature, a system that is able to monitor the temperature remotely is needed. By knowing the actual temperature conditions in the field, further action can be taken by opening the main door and

automatically turning on the additional fan, if the temperature approaches the maximum value of 50 degrees. Thus, the system can run optimally without experiencing power disruption.

2. Design System

This system uses several devices namely temperature and humidity sensor DHT 11, NodeMCU ESP8266 contains an Arduino module and wireless device, wifi router and PC monitoring. This system can be seen in the picture below.

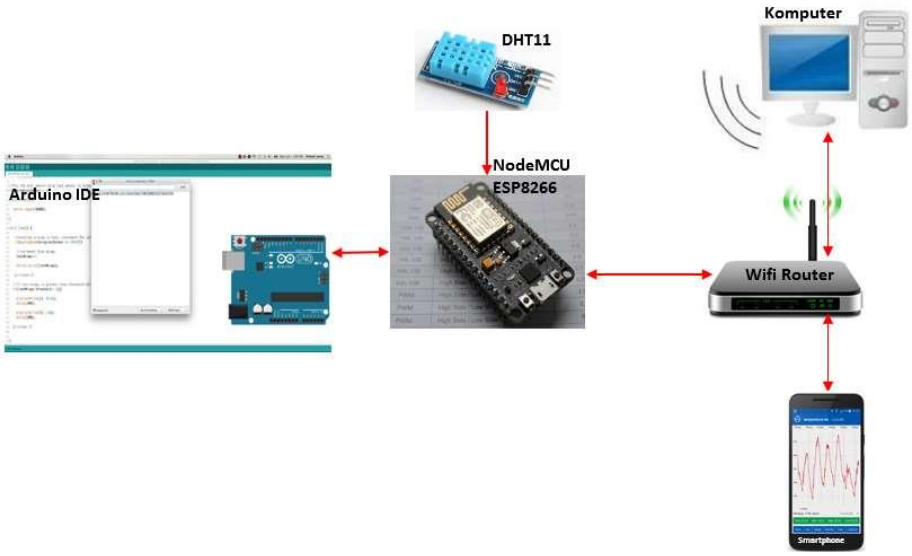

Figure 1. Design systems

2.1. Arduino module and system

The Arduino module in this series is intended to facilitate each component to be interconnected and to give orders to each component or as a terminal to process data sent by the sensor before being displayed in the user display [3].Here is a picture of Arduino and its datasheet. The Arduino module already inserted to RF Part in this application.

2.2. DHT sensor module 11

DHT11 is a digital sensor that can measure the temperature and humidity of the surrounding air. Has a good level of stability and calibration features. The calibration coefficient is stored in the OTP program memory, so that when the internal sensor detects something, this module includes the coefficient in its calculation, this DHT11 includes sensors that have the best quality, judged by the response, fast data reading, and anti-interference capability. Small size, and with signal transmission up to 20 meters, with specifications: Supply Voltage: + 5V, Temperature range: 0-50 °C error of ± 2 °C, Humidity: 20-90% RH ± 5% RH error, with digital specifications interfacing system. make this product suitable for many temperature and humidity measurement applications.

Table 1. Characteristics of air humidity / Humidity sensors

Model	DHT11
Power supply	3-5.5V DC
Output signal	digital signal via single-bus
Measuring range	humidity 20-90% RH ± 5% RH error temperature 0-50 °C error of ± 2 °C
Accuracy	humidity +-4%RH (Max +-5%RH); temperature +-2.0Celsius

Resolution or Sensitivity	humidity 1%RH; temperature 0.1Celsius
Repeatability	humidity +-1%RH; temperature +-1Celsius
Humidity hysteresis	+-1%RH
Long-term Stability	+-0.5%RH/year
Sensing period	Average: 2s
Interchangeability	fully interchangeable
Dimensions size	12*15.5*5.5mm

2.3. NodeMCU ESP8266

To be able to read all sensor devices and display them into an open source web site, a device that can function as a wifi modem is needed. The NodeMCU device can function as a modem or sensor device control unit (H Ardian, 2017). NodeMCU is an opensource IoT platform. Consists of hardware in the form of ESP8266 System On Chip from ESP8266 made by Espressif System, also the firmware used, which uses scripting programming language.

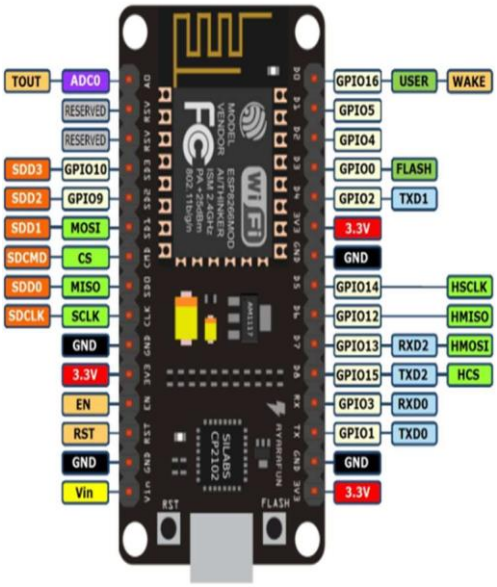

Figure 2. Layout module nodeMCU ESP8266

The system process starts from the device connection to Arduino, Arduino then performs sensor readings through the sensor port. If the port sensor is read successfully, the sensor readings are sent via the wireless network. Whereas if the reading process fails, the reading port process is repeated. The results of the sensor reading are then displayed on the display.

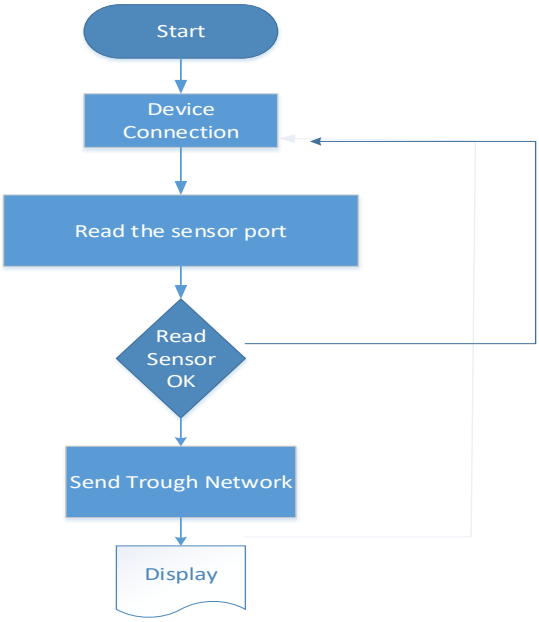

Figure 3. Flowchart system

3. Implementation and Analysis

The system design is then implemented in the generator system then the results are compared with thermometers that have been installed on the generator set.

Figure 4. Generator set position

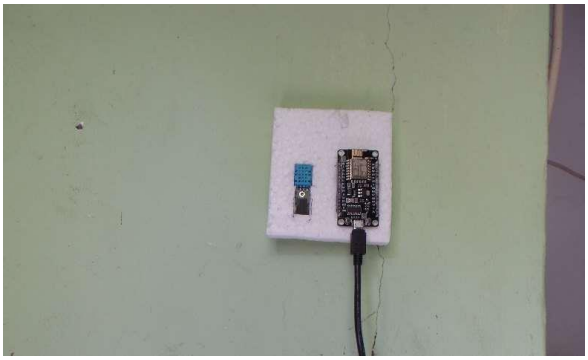

Figure 5. Test system sensors

3.1. Implementation

After assembling and programming on the arduino IDE, a device is produced that is able to measure temperature and humidity in realtime. Testing is done in the room to find out the sensor function that has been programmed with the esf8266 module, the DHT11 temperature sensor has sensitivity in reading the room temperature conditions which are given several conditions in the testing stage. Sensor readings can be monitored through iOT Thingspeak connected to the esf8266 module, besides the iOT Thinspeak results are also found in the arduino IDE monitor series.

This tool rank consists of Module Nodemcu ESP8266, temperature sensor DHT11 and project board, after building the rank then connected to the PC to upload the program into the esp8266 module. Connections between ranks are:

Table 2. Pin position

Pin Nodemcu ESP8266	Pin DHT11
3 V	VCC
G	GND
D7	DATA

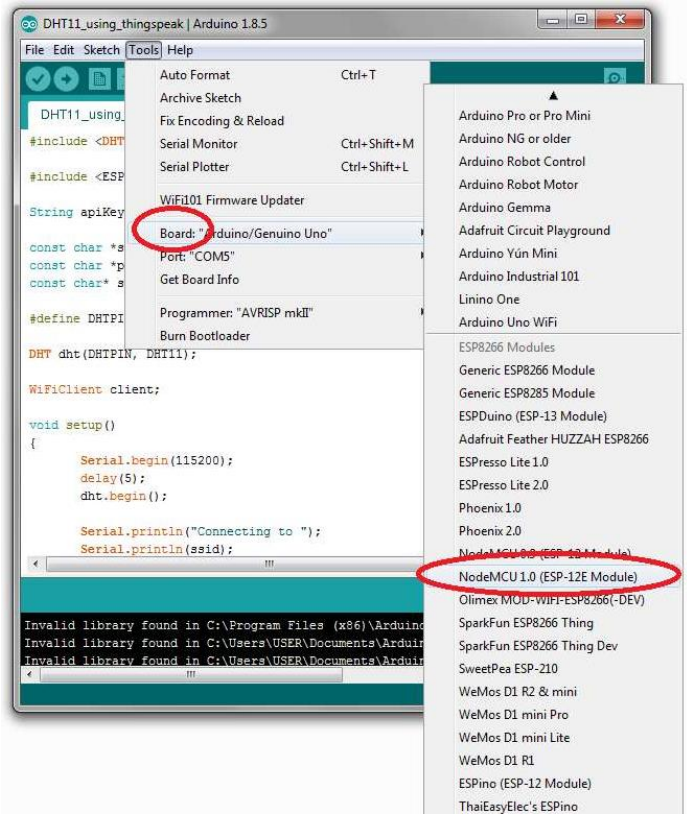

Figure 6. Configuration

3.2. Measurement result

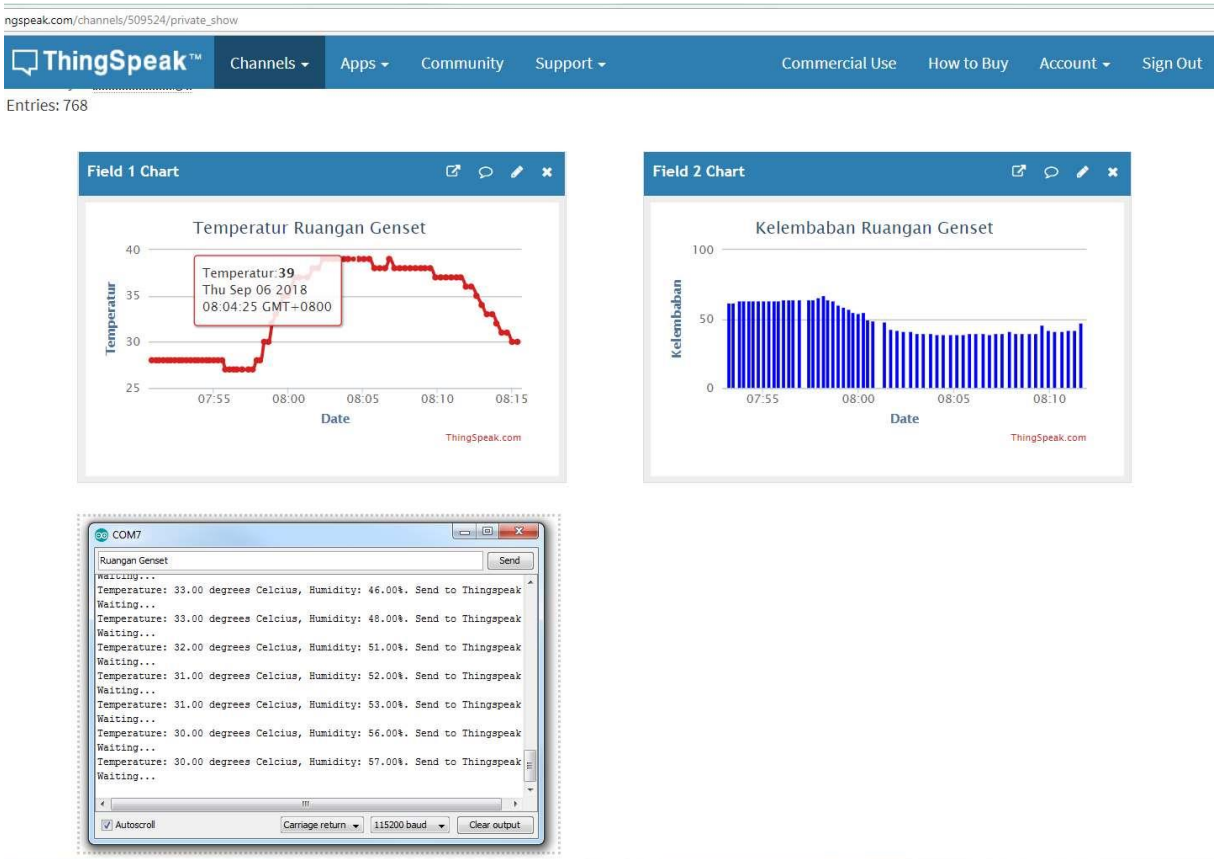

Figure 7. Test systems

Temperature can be viewed using the web by entering the URL or IP address of the device, thus making it easier to monitor using a web browser application. The test was carried out by bringing the genset engine closer to a higher temperature, it can be seen that the graph rises according to the measured temperature value.

Figure 8. Existing termometer

3.3. Analysis

The value of the measurement results with the value of the digital display thermometer in the generator has a difference of 1 degree centigrade. This system can also be monitored through a web browser or using an android application. This makes it easy in daily observations, the system can also be combined with automatic switch to turn on the exhaust fan and additional cooling fans.

4. Conclusions

Measurements using a DHT11 sensor with measurements using a digital sensor get a data difference of 1 degree Celsius. Temperature changes in the generator room can be monitored directly through a web based application. Thus, this system can be implemented as a system that is used to monitor indoor temperature based online.

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