Journal ELPER-Tech (Electronic Logic Power- Technology)
Vol.1, No.1, March 2025, pp. 1~6
ISSN (print): _____ , ISSN (online): _____
DOI:

Design and Construction of a Mini Weather Station Based on Telemetry

Sandi Luthfi Yazid[1], Rindi Wulandari[2*]
Electrical Engineering Study Program, Faculty of Engineering University of Swadaya Gunung Jati, Cirebon, Indonesia
e-mail: *****rindi.wulandari@ugj.ac.id

Abstract

Today, the weather is difficult to predict, so we need a weather observation tool that can provide weather information quickly. AWS (Automatic Weather Station) is an automatic type of traditional weather station, to save manpower or to take measurements from remote areas. AWS real time is an AWS system that can present information in real time to users accompanied by several other features such as warning alarms. Based on the background above, a telemetry-based mini weather station system was created in the form of a model, using the Arduino ATmega2860 Microcontroller as data collector and data processor, the BME Module as a temperature, pressure and humidity sensor, the RTC DS3231 is used as a time and date generator, and SIM 800l as a remote control application. The research conducted includes applied research, with experimental research methods. Testing the tool in the form of taking the average data of the 10th minute and 30th minute. Data is sent via the SIM800l module using the prime sim card which has been filled with an SMS package, with an estimated delivery time of around -10 seconds.

Keywords—*Weather Station, Arduino Uno, Telemetery*

1. INTRODUCTION

Observation of weather factors is very important for humans for several reasons such as recognizing the climatology of a region, or even avoiding the risks due to bad weather [1]. Nowadays, the weather is difficult to predict so that a weather observation tool is needed that can provide weather information quickly. In Indonesia, there are still many weather stations that are operated manually so that the delivery of information is still delayed [2].

Automatic weather observation stations are better known as AWS (Automatic Weather Station) as well as the term in the Guide to Meteorological Instruments and Methods of Observation Number 8 document from the World Meteorological Organization (WMO) [3]. AWS is an automatic type of traditional weather station, both to save human energy and to allow measurements from remote areas, AWS consists of sensors that automatically collect and store weather information [4].

AWS consists of two types of systems, the first is real-time AWS and the second is offline AWS. AWS real time is an AWS system that can present information in real time to users along with several other features such as warning alarms. Off-time AWS does not automatically present information, the system records information then stores it on storage media and shows actual information [5].

The remote measurement system or telemetry has several advantages, namely, data can be sent in real time, the media for sending data from an object point to a monitoring station can use a WiFi network [6]. One of the technologies that supports data transmission is the Wireless Sensor Network (WSN), which is one of the rapidly developing network technologies that has

led to advances in the field of communication [7].

Based on the background above, a mini weather station system based on telemetry was created in the form of a model, using the Arduino ATmega2860 Microcontroller as a data collector and data processor, the BME Module as a temperature, pressure and humidity sensor, RTC DS3231 is used as a time and date generator, and SIM 800l as a remote control application. The data will be displayed on the monitor layer using Visual Basic software that has been programmed. The data stored in the micro SD and sent via SMS by sim800l is the average data per 10 minutes and per 30 minutes.

2. RESEARCH METHODS

The research conducted includes applied research, with experimental research methods [8]. The mini weather station design process consists of design & ideas, product analysis, PCB design, hardware and software. Design and ideas include the initial planning of the project to be created. Product analysis is to determine the amount of material/components used. PCB design design to create a PCB circuit path. Hardware design includes what hardware is used in making this mini weather station, while software design includes creating a program for the Arduino Mega 2560 as a control unit. Figure 1 shows the flowchart of the system to be designed.

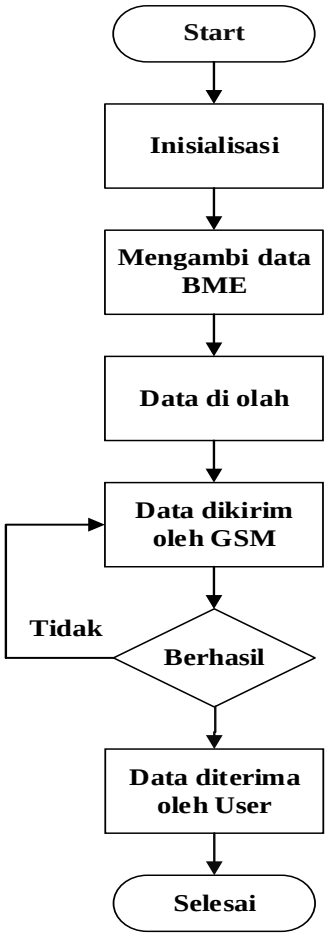

Figure 1. Flowchart of a telemetry-based mini weather station

The research conducted includes applied research, with experimental research methods. The design process of the mini weather station consists of design & idea, product analysis, PCB design, hardware and software. Design and idea include the initial planning of the project to be

made. Product analysis is to determine the amount of material/components used. PCB design design to create a PCB circuit path. Hardware design includes what hardware is used in making this mini weather station, while software design includes making a program for the Arduino Mega 2560 as a control unit. Figure 1 shows the flowchart of the system to be designed.

Next is Figure 2 showing the wiring diagram of the system to be designed. This hardware design consists of: Arduino Mega ATmega2560 which functions as a control center and data processing; RTC DS3231 functions as an accurate time source; GSM SIM800L as a remote control application via Mobile Phone; BME280 is an electronic component that can measure temperature, humidity, and air pressure.; LM2596 as a DC-to-DC power converter that reduces the voltage from the Power Supply input.; Modbus RS485 functions as an RS485 serial communication device to the Microcontroller; The 12V adapter is an AC to DC step down converter used as a power supply from 220V AC PLN installation electricity to 12V DC voltage.

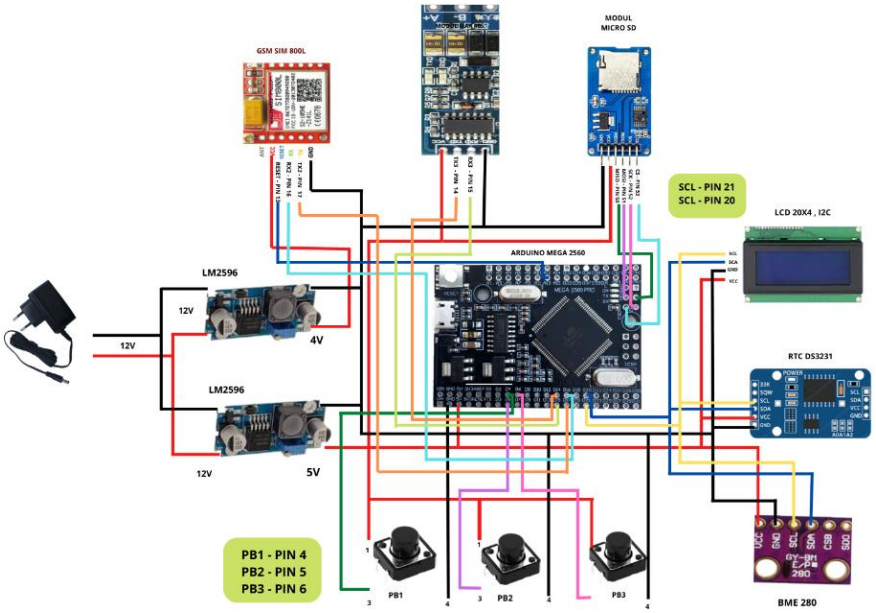

Figure 2. Wiring Diagram of Telemetry Based Mini Weather Station

3. RESULTS AND DISCUSSION

The design of the mini weather station, the author conducted an experiment to determine whether the device was functioning or not. The first experiment was to read the average data stored on the SD card at a time of 10 minutes and 30 minutes. The second experiment was to send average data sent via SMS using the SIM800l module received by the user at a time of 10 minutes and 30 minutes. Figure 3 shows the design of the mini weather station from above.

Figure 3. Design of a Mini Weather Station System Based on Telemetry Top View

Table 1 and table 2 show the experimental data conducted on December 14, 2022 at 21.00 until completion. Data collection was carried out 10 times and repeated 3 times so that the data displayed is the average of the three data.

Table 1. Average Data Reading Results Every 10 minutes

Number	Date	time	Temperature ^{0}C	Humadity (%RH)	pressure (hPa)
1	2022-12-14	21:10::01	27.62	71.88	922.56
2	2022-12-14	21:20::01	27.59	71.89	922.52
3	2022-12-14	21:30::01	27.60	71.77	922.53
4	2022-12-14	21:40::01	27.61	71.91	922.55
5	2022-12-14	21:50::01	27.62	71.92	922.56
6	2022-12-14	22:00::01	27.58	71.83	922.50
7	2022-12-14	22:10::01	27.39	71.33	922.48
8	2022-12-14	22:20::01	27.67	71.88	922.30
9	2022-12-14	22:30::01	27.68	71.85	922.56
10	2022-12-14	22:40::01	27.69	71.82	922.44

Table 2. Average Data Reading Results Every 30 Minutes

Number	Date	time	Temperature ^{0}C	Humadity (%RH)	pressure (hPa)
1	2022-12-14	18:01:00	26.87	71.28	920.71
2	2022-12-14	18:31:00	27.09	71.43	921.91
3	2022-12-14	19:01:00	27.52	72.03	921.06
4	2022-12-14	19:31:00	27.16	72.89	921.17
5	2022-12-14	20:01:00	27.13	72.15	921.24
6	2022-12-14	20:31:00	27.07	72.26	921.45
7	2022-12-14	21:01:00	27.15	72.98	921.61
8	2022-12-14	21:31`:00	27.06	72.49	921.73
9	2022-12-14	22:01:00	27.00	71.85	921.81
10	2022-12-14	22:31:00	27.93	71.89	921.88

The following is the result of reading data sent to users via SMS gateway. The time interval for users to receive messages from the system built is 5-10 seconds after the system reads the measured data.

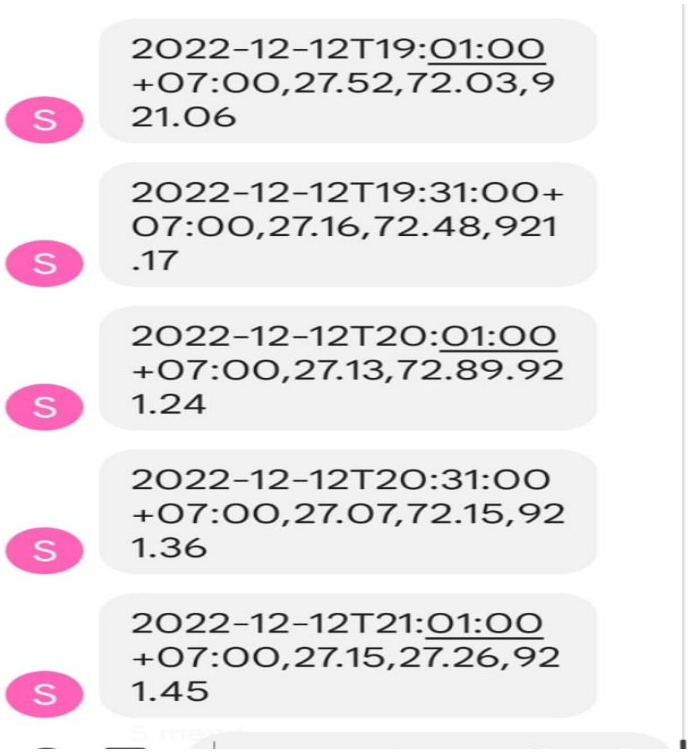

Figure 4. Results of Reading Data on SMS Received by Users Every 30 Minutes

4. CONCLUSIONS

The design of a mini weather station system based on telemetry can function well after being tested. The tool test is in the form of taking average data for 10 minutes and 30 minutes. Data is sent via the SIM800l module using a starter SIM card that has been filled with an SMS package, with an estimated delivery time of around 10 seconds.

5. SUGGESTION

It is necessary to develop the system so that it can be tested during extreme weather to function properly. In addition, it is necessary to compare the system with a system that is already accurate and calibrated.

REFERENCES

[1]. D. H. Zulfikar And A. Harjoko, "Perbandingan Kapasitas Pesan Pada Steganografi Dct Sekuensial Dan Steganografi Dct F5 Dengan Penerapan Point Operation Image Enhancement," Ijccs (Indonesian J. Comput. Cybern. Syst., Vol. 10, No. 1, P. 35, Jan. 2016 [Online]. Available: Https://Jurnal.Ugm.Ac.Id/Ijccs/Article/View/11187. [Accessed: 16-Feb-2017]

[2]. Emanuel, T. I. (2021). Pengamatan Laut Dan Cuaca Menggunakan Automatic Weather Station (Aws) Stasiun Mteorologi Maritim Kelas I Tanjung Priok. *Karya Tulis*, 1-8.

[3]. Sakti, Q. B., & Rahmawati, E. (2019). Rancang Bangun Arduino Mini Weahter System(Awms). *Inovasi Fisika Indonesia*, 14-15.

[4]. Sucipto, W. H. (2017). Rancang Bangun Perangkat Pemantau Cuaca Otomatis Berbasis Mikrokontroler Pada Jaringan Wlan Ieee . *B. J. Spektrum, 4(02)*,, 48-55.

[5]. Ariffudin, P. M. (2022). Analisa Sistem Komunikasi Data Berbasis Internet Of Things (Iot) Menggunakan Metode Pieces Pada Sistem Pengamatan Cuaca Otomatis Di Badan Meteorologi Klimatologi Dan Geofisika (Bmkg). Jurnal Meteorologi Dan Geofisika, 83-92.

[6]. Firda Aini Zulafah, D. D. (2022). Rancang Bangun Stasiun Cuaca Berbasis Wireless Sensor Network Dengan Lora Sx1278. Tesla, 116-128.

[7]. Muhammad Hidayatullah, J. F. (2018). Prototype Sistem Telemetri Pemantauan Kualitas Air Pada Kolam Ikan Air Tawar Berbasis Mikrokontroler . Positron, 43-52.

[8]. Rindi Wulandari, N. T. (2022). Rancang Bangun Sistem Irigasi Otomatis Berbasis Rtc Menggunakan Solar Panel. Ijeis (Indonesian Journal Of Electronics And Instrumenations Systems), 12(2), 1-10.