Temperature and Humidity Observation System in ATmega8 Microcontroller-Based Homes

Abdul Latif*, Kuat Supriyadi

Department of Electrical Engineering, [Universitas Islam Sultan Agung], Semarang Indonesia

*Correspondent Email: 4bdul@gmail.com

Abstract. In our daily life it is sometimes necessary to measure the temperature and humidity of the environment around us. Many kinds of sensors for measuring temperature or humidity, such as LM35, DS18S20 or DHT11. To measure the temperature and humidity of the environment around us, we can choose a sensor that is quite cheap, namely DHT11. DHT11 has a calibrated digital output. This sensor consists of resistive type humidity measuring components and temperature measurements via NTC and is connected with 8 bit uC so that it gives good results, sufficient response speed, has good resistance to interference and is quite cheap in price. The interface used is a single write serial interface which is quite fast and easy. Small sensor size, low power consumption requirements and able to transmit its output within a distance of 20 meters. The disadvantage of this sensor is the lack of accuracy, besides the temperature measurement range is only 0 to 50 degrees Celsius but with a fairly cheap price this sensor can be an alternative to be used in temperature and humidity measurements that do not really need good accuracy. For example measurement of room temperature, measurement of temperature and humidity of incubators and others. If the sensor distance to the uC is less than 20 meters, then a 5K pull up resistor must be installed on the data pin. Meanwhile, if the distance is more than 20 meters, then the size of the pull up resistor should be adjusted. The power supply needed by DHT11 ranges from 3.5V to 5V. Access to the sensor is only allowed more than 1 second after the first power supply is supplied. It is also necessary to add a 100nF capacitor between the VCC and GND pins for the power supply filter.

1. Introduction

Various types of technology have been created by many people to be able to facilitate their daily activities in carrying out their work. As one of the developing technologies is technology in the field of temperature measurement [1] [2] - [4] and humidity. Temperature gauges [5] - [9] and humidity are very much needed in certain cases. For example, in a storage warehouse it is very important to pay attention to the temperature and humidity of the warehouse room to store goods properly, in the computer server room also requires a certain temperature so that the server can still work well, as well as in a house, so that residents in the house can monitor and control the temperature inside. Departing from this, the researchers wanted to make the application of DHT11 [10], [11], [11] - [14] as an ATmega8-based temperature and humidity sensor, DHT11 sensor as a temperature and humidity sensor, LCD as a display, and a minimum system ATmega8 microcontroller as the center. The results
show the ATmega8 Microcontroller [16] - [18] has an input in the form of a temperature sensor, this sensor will detect the temperature and humidity inside the house and display it on the LCD.

2. Methodology

A. Power Supply
In general, the term power supply means a rectifier filter system, the circuit of which converts the AC voltage from the PLN source voltage to a pure DC voltage. The basic components used in power supply circuits are transformers, rectifiers, stabilizers.

B. DHT11 Sensor
The DHT11 sensor is a sensor with a digital signal calibration that is able to provide temperature and humidity information. This sensor is classified as a component that has a very good level of stability, moreover coupled with the ability of the ATmega8 microcontroller [19]. The highest quality products, fast response readings, and anti-interference trays, at an affordable price. DHT11 [14], [20], [21] has a very accurate calibration feature. This calibration coefficient is stored in the OTP program memory, so that when an internal sensor detects a temperature [22] or humidity, this module reads the sensor's coefficient. Its small size, with signal transmission of up to 20 meters, makes this product suitable for many temperature and humidity measurement applications. For shapes and legs DHT11 [23] - [26] can be seen in figure 1.

C. Microcontroller ATmega8
The ATmega8 microcontroller [27] has 28 pins for the PDIP model. The names of the pins on this microcontroller include: • VCC for positive power supply voltage. • GND for negative power supply voltage. • PortB (PB0 - PB5) as an Input / Output port and also has other capabilities. • PortC (PC0 - PC6) as Input / Output ports for ATmega8 and ADC ports. • PortD (PD0 - PD7) as an Input / Output port and also Program Filling in the AVR Microcontroller To program in the AVR microcontroller, Atmel has provided special software that can be downloaded from the official website of Atmel. The software is AVR Studio [27]. This software uses assembly language as its intermediary language.

Besides AVR Studio, there are several third party software that can be used to create programs on AVR. This third-party software uses high-level programming languages such as C, Java, or Basic. To transfer from the computer to the chip, you can use several methods such as using a JTAG cable or using an atmospheric vehicle registration, or you can also use a USB downloader.

D. LCD (Liquid Crystal Display)
LCD (Liquid Crystal Display) is a type of display media that uses liquid crystal as the main viewer [28]. LCD has been used in various fields such as electronic devices such as televisions, calculators, or computer screens. In this research, the LCD application used is dot matrix LCD with 2x16 characters. The LCD is very function as a viewer which will later be used to display the temperature and humidity sensor DHT11.

Figure 1. DHT11
E. How it Works

When the power supply is powered by an electric current in the form of AC current, the AC current is converted to a DC current in the power supply. Then transformed into the MCU (Microcontroller unit) [29], the DHT11 sensor sends a signal into the MCU and the results are displayed on the LCD.

![Tool block diagram](image1)

Figure 2. Tool block diagram.

The input and output addresses of the microcontroller are shown in table 1 below.

| No | Alamat Output | Jenis Alat |
|----|---------------|------------|
| 1. | Port D4 – Port D6 | LCD |
| 2. | Port D3 | Sensor DHT11 |

F. Electronic Design

1) Power Supply Circuit

The power supply circuit provides a voltage supply to the controller. The power supply circuit gets a voltage source from PLN of 220 VAC. The 220 VAC voltage is then reduced to 12 VAC via a voltage-reducing transformer. The 12V AC voltage is directed by the bridge diode to the DC voltage. The output of this bridge diode then enters the polar capacitor whose function is to stabilize the voltage. The 100nF capacitor serves to get rid of noise at the voltage. The following is a series of drawings, layout and component layout of the power supply.

![Power Supply](image2)

Figure 3. Power Supply

2) Minimum System Series

This microcontroller circuit is the main controller for the system that has been made. Basically this microcontroller circuit is a minimum system of ATmega8 microcontrollers.
G. Overall Series
The whole circuit is a combination of a series of power supplies and a microcontroller whose results are displayed by the LCD.

H. Measurement Analysis
The measurement this time was carried out in a 3x3m room with the window open and the weather conditions bright, the following are the results of the measurement table:

| No | Sensor DHT11 | Termometer | Hygrometer |
|----|--------------|------------|------------|
|    | suhu | kelembaban  | suhu | kelembaban  |
| 1  | 25 °C | 95% RH | 24 °C | 1 |
| 2  | 26 °C | 93% RH | 26 °C | 2 |
| 3  | 26 °C | 95% RH | 25 °C | 3 |

From the results of the measurements of the two samples above between props with a temperature thermometer and hygrometer, there is no significant difference in temperature and humidity.

3. Conclusion
The incubator analyzer works properly after measurement using comparative equipment. From the results of the trial by comparing the values produced by the TA module with a comparison tool, the results were quite significant. At humidity the error value was below 2% and was still on the tolerance
threshold ± 5%, where the biggest error in the measurement value was 37 °C which was 1.56% and the smallest error at the measurement of 35 °C is 0.75%.

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