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Temperature and Humidity Control Systems for Dryer Machines in Industrial Salt Factory Based on Fuzzy Logic

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Abstract

At this time the industrial era entered 4.0 which is known as the industrial revolution. The existence of the industrial era 4.0 has many benefits to support everyday human life. These developments relate to the automation and exchange of information technology as wellOne of the manufacturing industry processes is the Internet of Things (IoT). This article will discuss how to implement the Internet of Things (IoT) in the Salt Industry Factory,

In the process of making salt, it is very important to monitor, one of which is the drying process in the dryer. In the drying process must have a stable temperature and humidity.

From the analysis of QC (Quality Control) workers, salt which after the drying process changes color to yellowish which does not match the desired quality. Therefore it is necessary to control the temperature of the dryer which can be monitored via Android.
Keywords: Internet of Thing and monitoring

1. Introduction

PT. GARAM (Persero) is a company engaged in the production of the oldest salt in Indonesia which is owned by the state and also as a development service agent. This company is stable in maintaining the availability of State Salt, and always strives to achieve food self-sufficiency in the salt industry. In the salt industry division which is one of the divisions that has the task of producing iodized and non-iodized salt which is supported by production machines.

In today's industrial world, many are using the industrial 4.0 system which illustrates the development towards automation and exchange of technological information and manufacturing industrial processes, one of which is the Internet of Things (IoT). Starting from changing conventional systems to automatic ones aimed at company efficiency. In the production process there are several things that can affect the quality of salt products, one of which is the temperature in the dryer during the drying process. If the temperature in the dryer is too high, the product will turn yellow and if it is too low, it will not dry completely.

Temperature monitoring in the dryer is very important in the quality of salt production. During the drying process, the dryer temperature is between 100°C-115°C. If the temperature exceeds 115°C, the salt that comes out of the dryer will turn yellow and not comply with PT GARAM's quality standards. If below 100°C the salt that comes out of the dryer has a high water content so it does not pass the QC (Quality Control). So with advances in technology today, now the temperature data in the dryer can be controlled online via an Android application.

Making a temperature and humidity measurement system for server rooms that use Arduino to stabilize electrical energy efficiency (Yusuf Nur Unsan Fathulrohman et al, 2018). After designing the temperature and humidity gauges in this study, the conclusion was obtained, namely to find out whether the air in the server room is good or bad for objects or components.

Monitoring the temperature in the room for daily human activities. temperature and humidity of the air in the room that affect activity and work efficiency (Hannif Izzatul Islam et al, 2016). Working in an environment that is too hot or too humid can reduce physical performance and cause premature fatigue, while working in an environment that is too cold can reduce body movement, causing stiffness.

The solution that can be used is measuring temperature and humidity with an IoT-based system that can be monitored via an Android application. The application is used to monitor and control temperature, with the system accessing temperature data on the dryer in real-time. NodeMCU ESP8266 acts as a data processing and control center in process control to regulate cooling fan speed. Smartphones function as surveillance tools and are intended to access data directly and issue commands remotely as an implementation of the Internet of Things (IoT).

From the explanation above, this article has the goal of making a real-time monitoring and control design to find out the temperature and humidity in the dryer through the Android application. Apart from that, it also builds a real-time monitoring system to find out the temperature and humidity in the Internet of Things-based dryer.

2. Research Methods

This research was made using a methodology flow arranged in the form of a flowchart. The flowchart in Figure 2.1 explains the methodological process for making this final project:

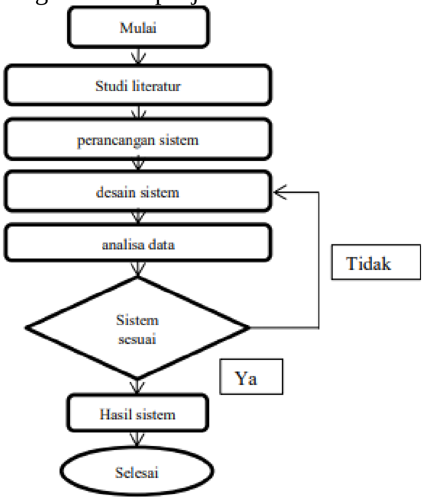


Figure 1 Research Flowchart

A. Study of literature

The first stage in this research method is a literature review, which is a search for information about the components needed in research, online resources and books. The results of discussions and consultations with people who have mastered this field become direct sources. The following is the literature that has been obtained:

1. Internet of Things
2. Esp8266
3. DHT11
4. Ds18b20
5. Blynk

B. System planning

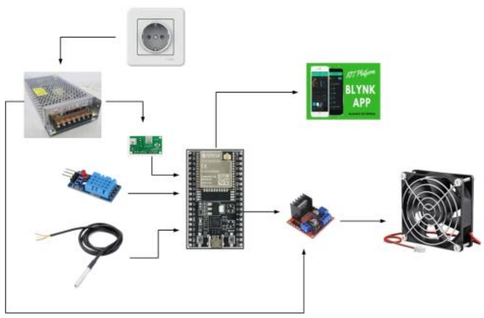


Figure 2 Planning System Design

NodeMCU ESP8266 is in charge of controlling the temperature and humidity control system and also functions to send data to Android applications. From NodeMCU ESP8266 connected to the DS18b20 sensor to determine temperature and DHT11 to determine humidity in the dryer, and also connected to*coolingfan*to stabilize the temperature in the dryer.

C. Fuzzy Control Chart

Figure 3 Fuzzy Control Diagram

The following is an explanation of the system flow diagram in Figure 2.3 above:

1. The input variable of this control system uses two input variables consisting of: temperature and humidity sensors.
2. The second step is the application of the implication function to the Mamdani fuzzy method. The implied function in this design is to find out what logic will be used according to our needs. (Ade Lahsasna, 2010).
3. The third step is the composition of the rules for the Fuzzy Mamdani Method. In this third step, the way to determine set inference and correlation between rules will apply to the Max Method in a different sense, namely the method for mixing member functions in the rules for applying implication functions (Ade Lahsasna, 2010).
4. The final step is defuzzification, when the defuzzification process is used to interpret the results of the fuzzy sets which become terms or real numbers (Bova, 2010).
5. At the fuzzy logic output, the settings obtained are determined from the defuzzyfication result value of the colling fan speed level which is determined from the defuzzyfication result value.

   In the fuzzy output section there is a coolingfan output to neutralize heat in the Dryer with 3 speed settings namely slow, medium fast. The following are all variables that can be seen in the table that have gone through the calculation process in Matlab.

temperatur / humudity	0-95	100-113	115-120
0-4	1	2	3
05-09	1	2	3
10-100	1	2	3

Figure 4 Table of Cooling fan Operational Parameters

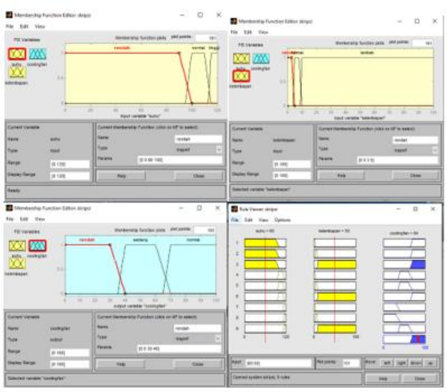


Figure 5 Parameter Generation Process via matlab

D. Software Planning

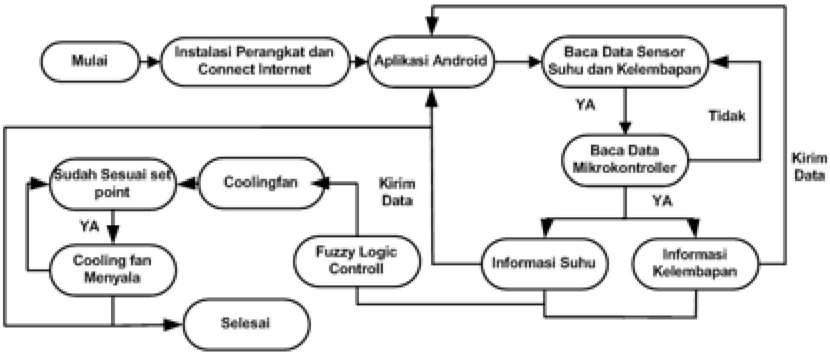


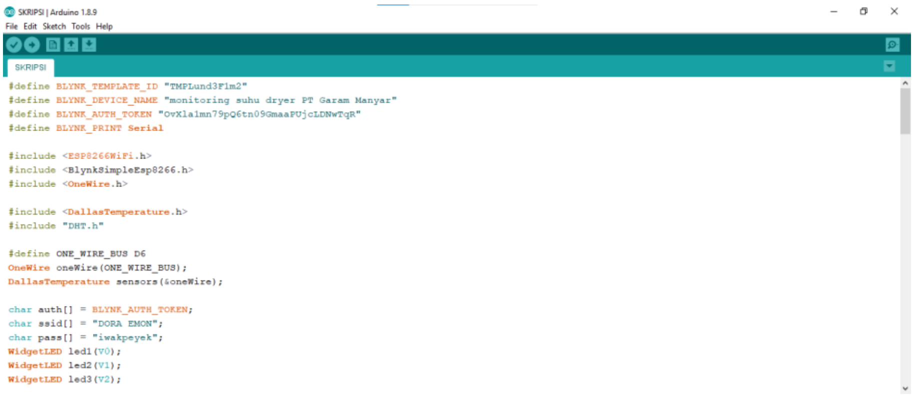
Figure 6 Software Planning Flowchart

3. Results and Discussion

According to the flowchart that has been made, the last stage is testing the tool to find out whether the tool works according to this plan or not. The test results include the results of the input and output data displayed on the BLYNK platform.

A. Tool Design

Before the tool test stage, namely programming first using the Arduino IDE application to connect the Esp8266 with the BLYNK application.


SKRIPSI | Arduino 1.8.9
File Edit Sketch Tools Help
SKRIPSI

```
#define BLYNK_TEMPLATE_ID "TMPLund3F1m2"
#define BLYNK_DEVICE_NAME "monitoring suhu dryer PT Garam Manyar"
#define BLYNK_AUTH_TOKEN "OvXla1mn79pQ6tn09GmaaPUjcLDNwTqR"
#define BLYNK_PRINT Serial

#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include <OneWire.h>

#include <DallasTemperature.h>
#include "DHT.h"

#define ONE_WIRE_BUS D6
OneWire oneWire(ONE_WIRE_BUS);
DallasTemperature sensors(&oneWire);

char auth[] = BLYNK_AUTH_TOKEN;
char ssid[] = "DORA EMON";
char pass[] = "iwakpeyek";
WidgetLED led1(V0);
WidgetLED led2(V1);
WidgetLED led3(V2);
```

Figure 6 IDE Programs

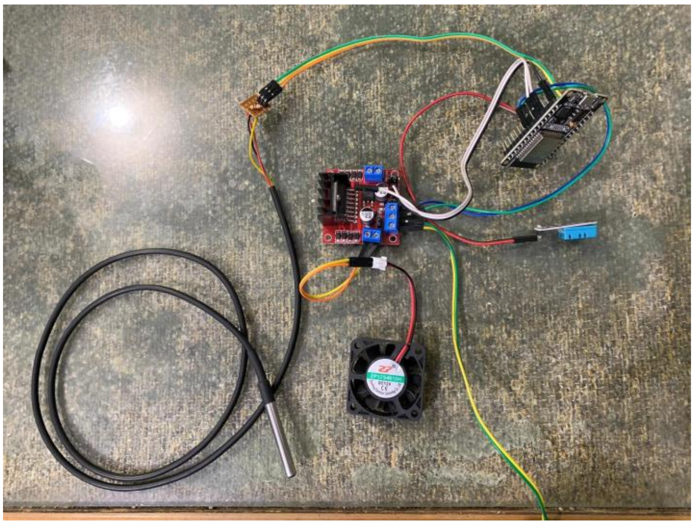


Figure 7 Tools and Materials

B. BLYNK Monitoring Test

Figure 8 Display of Blynk Application Monitoring

Figure 8 displays the monitoring display that will be used in this study. The system works according to the input given using the DHT11 sensor to display humidity and the DS18b20 sensor to display temperature.

C. Tool Trial Results

Table 1 Tool Testing

Testing	sensors		BLYNK
	DHT11	DS18b20	
1	15%	90°	Speed 1
2	10%	105°	Speed 2
3	3%	115°	Speed 3
4	7%	110°	Speed 2
5	30%	120°	Speed 3

Table 1 above explains that BLYNK works according to plan and sensors work according to their function according to Figure 4.

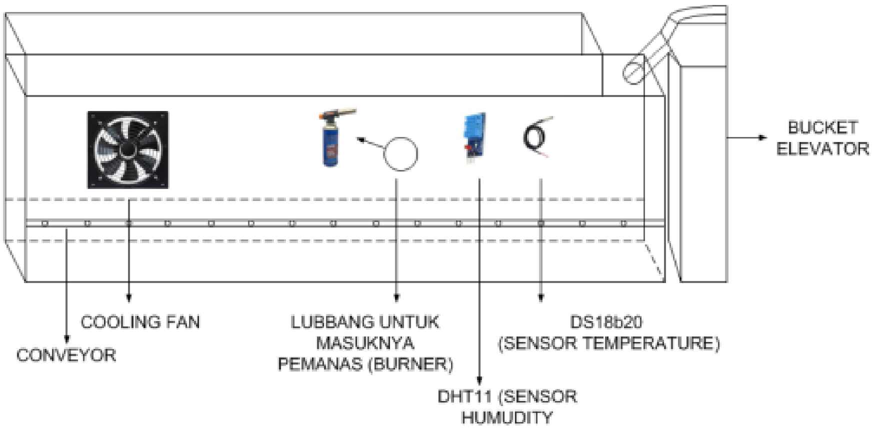


Figure 9 Design Prototype

4. Conclusion

Based on the steps that have been carried out by the researcher, it is concluded that this tool works as expected. The temperature that can be read by the DS18b20 sensor cannot be more than 130 °. The system works according to what the author wants, namely if the temperature is above 120° then the cooling fan turns on at speed 3, namely the maximum speed and if below 90° then the cooling fan turns on at speed 1. This prototype can already be applied to the drying process on industrial salt but to be applied in the world of industry requires higher quality sensors to get maximum results.

5. Bibliography

AF Silvia, E. Haritman, & Y. Muladi. (2014). Design of Arduino and Android-Based Access Control Gates, Electrons. 13,1-10.

AH Saptadi. (2014). Comparison of Temperature and Humidity Measurement Accuracy Between DHT11 and DHT22 Sensors, Infotel Journal. 6, 49-59.

AS Rafika, Sudaryono, & WD Andoyo. (2014). Prototype Design of Room Temperature Automatic Reading System Using Fan Output and LM35 Sensor Based on ATmega16 Microcontroller. 8, 102-111.

Arafat & Ibrahim. (2020). Green House Temperature and Humidity Control Monitoring Tool System Based on the Internet of Things. 21(1).

Aulia, R., Rahmat, AF, & Imran, L. (2021). Arduino-Based Fan Room Temperature Controller and DHT11. (Journal of Computer Engineering Systems and Science. 6(1).

Darwinson, R. Wahyudi. (2015). Speed Control of Hexapod Fire Extinguisher Robot Using Fuzzy Logic Method, National Journal of Electrical Engineering. 4, 227-234.

Fathulrohman, Yusuf, NI, Saepulloh., & Asep. (2018). Temperature and Humidity Monitoring Tool Using Arduino Uno. Journal of Management and Informatics Engineering, 2(1),161-170.

H. Guntoro, Y. Somantri, E. Haritman. (2013). Design of Magnetic Door Lock Using Keypad and Solenoid Based on Arduino Uno Microcontroller, Electrans. 12, 39-48.

H. Nainggolan, & M. Yusfi. (2013). Design of a Temperature and Relative Humidity Control System in a Room Using a DC Motor Based on an ATmega8535 Microcontroller, Journal of Physics Unand. 2, 1-5.

Hidayati, N., Aisuwarya, Ratna, & Putri, RE, (2017). Rice Warmer Temperature Stability Control System Using Fuzzy Logic Method.

Huda, MBR (2022). Analysis of Temperature Control System Using Arduino Microcontroller Based DS18b20 Sensor. 7(2), 18-23.

Islam, HI, Nida, N., Sofyan, SS, Dendy, HS, Gagat. MP, Ade. K., … Izraman. (2016). Arduino Uno-Based Room Air Humidity Control and Control System Using DHT22 and Passibe Infrared Sensors. E-Journal Proceedings of the National Seminar on Physics. 5.

Istifada. (2015). Manufacture of an Arduino Uno-based Temperature and Humidity Measurement Tool with DHT22 at the Class III Meteorological Station BMKG Citeko.Bogor, Indonesia.

L. Aprilianto, Priyambodo Kindergarten. (2014). Automatic Fire Extinguishing with Room Temperature and Humidity Control Using Fuzzy Logic, IJEIS. 4, 189-200.

M. Ichwan, MG Husada, & MIA Rasyid. (2013). Development of an Electrical Equipment Control System Prototype on the Android Platform, Journal of Informatics. 1, 13-25.

Mardhiyya, A., Fajar, R., & Nurfajriah. (2020). Design of a Notification System and Control of Temperature and Humidity Using the Blynk Application for Oyster Mushroom Cultivation. 11(1).

Masturi, M., Bayu, E., & Andrian, R. (2017). Prototype Of Automation Of Water Content Based On Fuzzy Logic.

Muhamad, I., Pangaribuan, P., & Wibowo, AS, (2017). Design and Implementation of Microcontroller Based Water Temperature Controller. eProceedings of Engineering. 4(1), 53-59.

Muttaqin, IR, Dian, BS (2021). Arduino Uno Based Automatic Fence Prototype With Hc-SR04 Ultrasonic Sensor. Retrieved November 21, 2022, from https//www.jurnalteknik.unisla.ac.id/index.php/elektronic

P. Mandarani, & Zaini. (2015). Development of a Monitoring System for a Web-Based Building Automation System (BAS) at the Faculty of Engineering, Andalas University, Journal of Electrical Engineering ITP. 4, 7-16.

Primary, A, P. (2022). Brine Water Quality Control System in Industrial Salt Factory Based on Fuzzy Logic.

Purba, Dina, S., Pangaribuan, P., & Wibowo, AS (2018). Controlling Water Temperature Based On Heating Duration Using Fuzzy Logic And Pi Controller. eProceedings of Engineering. 5(3),4011-4017.

RH Zain. (2013). Room Security System Using Passive Infrared (PIR) Sensors Equipped with Lighting Controls in Rooms Based on Microcontroller ATmega8535 and Real Time Clock, Journal of Information Technology and Education. 6, 146-162.

Rahmatullah, W. (2014). Design of DHT22 Sensor Based Data Logger to Measure Real-Time Temperature and Humidity of Herpetofauna Habitat. Bogor Agricultural Institute, Bogor, Indonesia.

SA Nugroho. (2013). Room Temperature Detector with Manual Adjustment Button Based on AT89S51 Microcontroller, Seruni- FTI UNSA National Leading Research Seminar on Informatics and Computers. 2, 15-21.

Subandi. (2013). Monitoring and Controlling Temperature Using GPRS Media on GSM Cellphones, Journal of Technology Technoscientia. 5.207-210.

Syahputra, A., Dedek, IGH, & Samsir. (2019). Multimedia-Based Addition and Subtraction Learning Media Application Design. 3(1),35-42. DOI: 10.52332/u-net.v3i1.20.