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Air Temperature And Humidity Data Loggers Equipped with Labview and Arduino-Based Warning Systems

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In the industrial world the process of measuring air temperature and humidity is a very important measurement process in the production process. But in practice in the field, the process of measuring air temperature &humidity is mostly done manually, which is done by recording which has the disadvantage of inaccurate measurement data. Recording temperature measurements that are done manually causes the product results to be not good, both in terms of quantity and quality. Related to these problems, the author took the initiative to create an alternative data logger device that is simpler, easier to integrate and relatively more affordable, without reducing the value of measurement accuracy. This data logger tool functions to monitor air temperature and humidity in real time, whose monitoring results are displayed through a system interface with the help of Labview software, Arduino Uno & DHT sensor. The final results of the trial design of the data logger tool are able to & have advantages, among others, air temperature and humidity parameters can be monitored automatically accompanied by alarm notifications, air temperature and humidity data parameters can be recorded automatically into logging data in the form of MS Excel format, and user can analyze data on air temperature and humidity parameters and the final results of the trial This air temperature & humidity data logger tool has an error rate of 0.5%.

Keywords— LabView, Data Logger, Arduino Uno

I. INTRODUCTION

In the industrial world the process of measuring temperature is very important in a production process. However, in practice in the field, the temperature measurement process is mostly done manually, which is done by taking notes, which has the disadvantage of inaccurate measurement data. Recording temperature measurements that are done manually causes the product results to be not good, both in terms of finished results and quality. It was from this problem that the author took the initiative to make a study with the title "Design and Build a LabView-Based Temperature Data Logger System". With the hope of monitoring the temperature & humidity of the air in this system has advantages, Temperature and humidity can be monitored automatically, air temperature and humidity data can be recorded automatically into logging data in the form of MS Excel format.

II. METHOD

A. Product Design

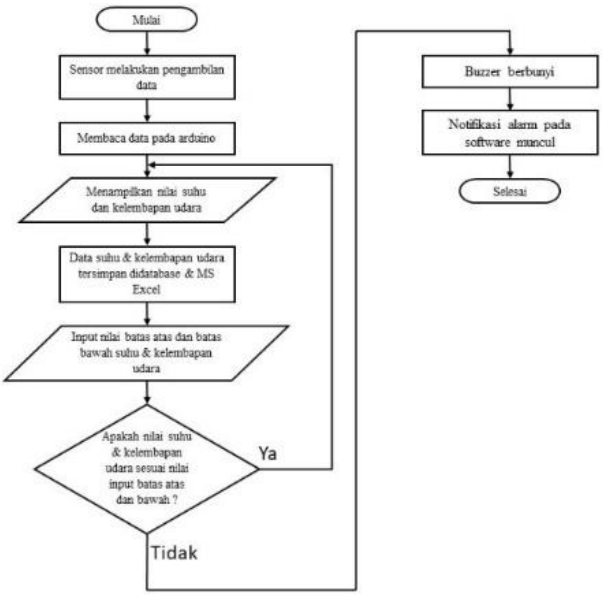

Fig. 1. Flowchart

B. Product Range

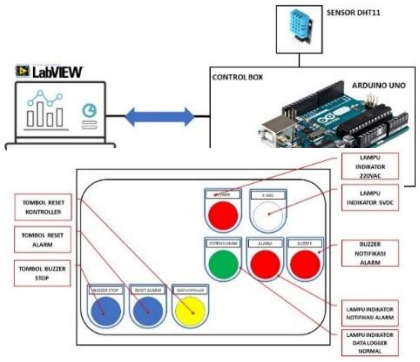

Fig. 2. Air temperature and humidity data logger system

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Fig. 3. Control box data logger design and air humidity temperature

Fig. 4. Main view of dashboard data logger

C. *Variable Operational Definition.*

- Free variables

In this study, the free variables are air temperature and humidity. Where is the temperature and humidity of this air that will be monitored by the application.

- Bound variables

DHT11 sensor, we will monitor the temperature and humidity values of the air read from the DHT11 sensor connected to the Arduino and the values will be visualized in the form of an applied dashboard and air temperature and humidity parameters can be stored in MS Excel.

- Data Analysis Methods

The data analysis method used from this study is qualitatively discriminatory by recording the results of product tests after it is operated. Includes how to operate, how to analyze, and how to record into MS Excel.

III. Result And Discussion

A. *Result*

Fig. 5. Control box and data logger software

Information:

1. Personal computer
2. USB Cable
3. Box Control
4. Power cable
5. DHT sensor cable

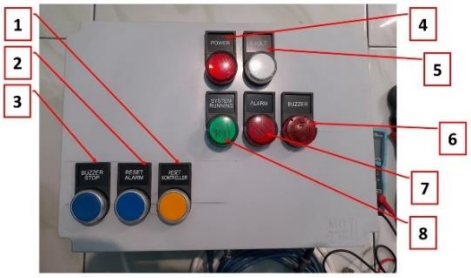

Fig. 6. Control box data logger temperature and humidity air

Information :

1. Controller reset button
2. Alarm reset button
3. Buzzer button
4. Indicator light
5. Light indicator 5 volts
6. Indicator Light indicator system running

Fig. 7. Software data logger suhu & udara kelembapan

Information :

1. Actual value of air temperature and humidity
2. Navigation main menu
3. Indicator system
4. Reset button
5. Buzzer stop button
6. Button storage parameter
7. Button exit button Software
8. graph air temperature
9. value Setting upper limit and lower limit values of air temperature
10. Graph of air humidity value Active
11. table of alarm

Fig. 8. Alarm active table

To display an alarm that is happening. The list of alarms in the data logger system is:

- ERR-01: KONTROLLER TERPUTUS
- ERR-02: SUHU UDARA TIDAK STANDART
- ERR-03: KELEMBAPAN UDARA TIDAK STANDART
- ERR-05 : SENSOR DHT 22 TERPUTUS

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- ERR-S1: DATABASE HISTORICAL ALARM ERROR
- ERR-S2: DATABASE HISTORICAL PARAMETER ERROR

12. Sub menu navigation
    - Tab menu real time
    - Tab historical chart
    - Tab historical alarmTab filter data

B. Product Test

Researchers manually tested the air temperature and humidity data logger tool system against the functions and menus of the existing data logger tool system. There are 2 items tested, namely on the software and hardware side.

The test was carried out every 5 hours without breaking, and the data was taken once every 1 hour by means of manual recording. This is done with the aim of obtaining data on the stability and resilience of the data logger system.

TABLE I. TESTING THE OPERATION OF THE DATA LOGGER TOOL SOFTWARE

No.	Item	Test-1		Test-2		Test-3		Test-4		Test-5	
		Vin	Vact	Vin	Vact	Vin	Vact	Vin	Vact	Vin	Vact
1	Alarm indicator light	220	218	220	217	220	219	220	220	220	216
2	System running indicator light	220	218	220	217	220	219	220	220	220	216
3	Buzzer	220	218	220	217	220	219	220	220	220	216
4	Power indicator light	220	218	220	217	220	219	220	220	220	216
5	5 VDC indicator light	5	4,9	5	4,7	5	4,6	4	4,9	5	4,8
6	Buzzer stop button	5	4,9	5	4,7	5	4,6	4	4,9	5	4,8
7	Alarm reset button	5	4,9	5	4,7	5	4,6	4	4,9	5	4,8
8	Controller reset button	5	4,9	5	4,7	5	4,6	4	4,9	5	4,8

TABLE II. TESTING THE HARDWARE OPERATION OF THE DATA LOGGER TOOL

No.	Item	Indicator	1st hour	2nd hour	3rd hour	4th hour	5th hour
1	Stored storage function buttons parameters to Microsoft	If pressed there is no error	VALID	VALID	VALID	VALID	VALID
2	Alarm notification	If there is an alarm then it is active	VALID	VALID	VALID	VALID	VALID
3	Alarm Indicator	If there is an alarm then it is active	VALID	VALID	VALID	VALID	VALID
4	Notification sound	If there is an alarm then it is active	VALID	VALID	VALID	VALID	VALID
5	Alarm reset button	If there is an alarm then it flashes	VALID	VALID	VALID	VALID	VALID
6	Alarm active table	If there is an alarm then it is active	VALID	VALID	VALID	VALID	VALID
7	Screen navigation table	Works according to the menu name	VALID	VALID	VALID	VALID	VALID
8	Buzzer stop button	If pressed the buzzer will turn off	VALID	VALID	VALID	VALID	VALID
9	Alert lost control	If it is not connected to the hardware then it is active	VALID	VALID	VALID	VALID	VALID

TABLE III. ONLINE SOFTWARE AND HARDWARE TESTING RESULTS

No.	Item	Indicator	1st hour	2nd hour	3rd hour	4th hour	5th hour
1	Alarm light indicator	If there is an alarm, then active	VALID	VALID	VALID	VALID	VALID
2	Connectivity of software and hardware	no error : controller disconnected	VALID	VALID	VALID	VALID	VALID
3	System running indicator light	if the system is normal then it is active	VALID	VALID	VALID	VALID	VALID
4	sound indicator	If there is an alarm, then active	VALID	VALID	VALID	VALID	VALID
5	power indicator light	If the 220V AC voltage has entered then it is	VALID	VALID	VALID	VALID	VALID
6	5 VDC indicator light	If the 5V DC voltage has entered then it is active	VALID	VALID	VALID	VALID	VALID
7	Buzzer stop button	If pressed, the buzzer is	VALID	VALID	VALID	VALID	VALID
8	Alarm reset button	If there is an alarm then it flashes	VALID	VALID	VALID	VALID	VALID
9	kontroller reset button	If the hardware is not connected to the software and the button is pressed then the system returns to normal	VALID	VALID	VALID	VALID	VALID
10	Unnormal air temperature alarm	If the temperature value is less or more than the default value, the setting will be active	VALID	VALID	VALID	VALID	VALID
11	unnormal air humidity alarm	If the humidity value is less or more than the default value, the setting will be active	VALID	VALID	VALID	VALID	VALID
12	Disconect DHT22 Sensor Alarm	If the DHT22 sensor is not connected to the hardware it will be active	VALID	VALID	VALID	VALID	VALID
13	Parameters graph function	humidity values appear on the graph	VALID	VALID	VALID	VALID	VALID
14	Parameter history graph function	humidity values appear on the graph	VALID	VALID	VALID	VALID	VALID

TABLE IV. HARDWARE OPERATION TESTING DATA LOGGER TEMPERATURE & HUMIDITY AIR

No.	Item	Indicator	1st hour	2nd hour	3rd hour	4th hour	5th hour
1	Parameter storage in database	There are no errors in the software	VALID	VALID	VALID	VALID	VALID
2	Parameter storage in MS Excel	There are no errors in the software	VALID	VALID	VALID	VALID	VALID

Below is a report on the collection of air temperature and humidity data taken from the software. Air temperature and humidity data reports are stored automatically in the database, and can be processed into several kinds of report formats, namely in the form of MS Excel and MS Word.

Report Date :19/05/2022 21:21:21

First Data Collection Date :19/05/2022 19:25:58

Last Data Collection Date :19/05/2022 20:13:08

AIR TEMPERATURE

Max. Air Temperature : 31 °C

Min. Air Temperature : 30 °C

Average Air Temperature : 30 °C

AIR HUMIDITY

Max. Air Humidity : 100 %

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Min. Air Humidity : 96 %

Average Air Humidity : 99 %

TABLE V. AIR TEMPERATURE & HUMIDITY RETRIEVAL DATA FROM DATA LOGGER

	Air Temperature (°C)	Air Humidity (%)
19/05/2022 19:25:58	30,000	98,000
19/05/2022 19:26:08	30,000	98,000
19/05/2022 19:26:18	30,000	98,000
19/05/2022 19:26:28	30,000	98,000
19/05/2022 19:26:38	30,000	98,000
19/05/2022 19:26:48	30,000	98,000
19/05/2022 19:26:58	30,000	98,000
19/05/2022 19:27:08	30,000	98,000
19/05/2022 19:27:18	30,000	98,000
19/05/2022 19:27:28	30,000	98,000
19/05/2022 19:27:38	30,000	98,000
19/05/2022 19:27:48	30,000	98,000
19/05/2022 19:27:58	30,000	98,000
19/05/2022 19:28:08	30,000	98,000
19/05/2022 19:28:18	30,000	98,000
19/05/2022 19:28:28	30,000	98,000
19/05/2022 19:28:38	30,000	98,000
19/05/2022 19:28:48	30,000	98,000
19/05/2022 19:28:58	30,000	98,000
19/05/2022 19:29:08	30,000	98,000
19/05/2022 19:29:18	30,000	98,000
19/05/2022 19:29:28	30,000	98,000
19/05/2022 19:29:38	30,000	98,000
19/05/2022 19:29:48	30,000	98,000
19/05/2022 19:29:58	30,000	98,000
19/05/2022 19:30:08	30,000	98,000
19/05/2022 19:30:18	30,000	98,000
19/05/2022 19:30:28	30,000	98,000
19/05/2022 19:30:38	30,000	98,000
19/05/2022 19:30:48	30,000	98,000
19/05/2022 19:30:58	30,000	98,000
19/05/2022 19:31:08	30,000	98,000
19/05/2022 19:31:18	30,000	99,000
19/05/2022 19:31:28	30,000	100,000
19/05/2022 19:31:38	31,000	100,000
19/05/2022 19:31:48	31,000	100,000
19/05/2022 19:31:58	31,000	97,000
19/05/2022 19:32:08	31,000	96,000
19/05/2022 19:32:18	31,000	96,000
19/05/2022 19:32:28	31,000	96,000
19/05/2022 19:32:38	31,000	96,000
19/05/2022 19:32:48	30,000	96,000
19/05/2022 19:32:58	30,000	96,000
19/05/2022 19:33:08	30,000	96,000
19/05/2022 19:33:18	30,000	96,000
19/05/2022 19:33:28	30,000	96,000
19/05/2022 19:33:38	30,000	96,000

TABLE VI. HISTORY ALARM DATA LOGGER

START ALARM	END ALARM	AREA	ALARM DESCRIPTION
19/05/2022 20:03:18	19/05/2022 20:03:20	FIELD	ERR-02: AIR TEMPERATURE IS NOT STANDARD

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19/05/2022 20:03:24	19/05/2022 20:03:28	FIELD	ERR-02: AIR TEMPERATURE IS NOT STANDARD
19/05/2022 20:03:32	19/05/2022 20:03:44	FIELD	ERR-02: AIR TEMPERATURE IS NOT STANDARD
19/05/2022 20:03:48	19/05/2022 20:03:52	FIELD	ERR-02: AIR TEMPERATURE IS NOT STANDARD
19/05/2022 20:03:56	19/05/2022 20:04:12	FIELD	ERR-02: AIR TEMPERATURE IS NOT STANDARD
19/05/2022 20:04:14	19/05/2022 20:04:20	FIELD	ERR-02: AIR TEMPERATURE IS NOT STANDARD
19/05/2022 20:04:22	19/05/2022 20:08:56	FIELD	ERR-02: AIR TEMPERATURE IS NOT STANDARD
19/05/2022 20:09:00	19/05/2022 20:09:04	FIELD	ERR-02: AIR TEMPERATURE IS NOT STANDARD

TABLE VII. DHT22 SENSOR ACCURACY TEST RESULTS

No.	Test	Result				Differences	
		Sensor DHT22		Termodigital			
		Temperature (°C)	Humidity (%)	Temperature (°C)	Humidity (%)	(°C)	(%)
1	Test-1	29,1	87	29,1	87	0	0
2	Test-2	28,2	90	28,2	91	0	1
3	Test-3	27,5	85	27,7	86	0,2	1
4	Test-4	28,5	88	28,6	89	0,1	1
5	Test-5	30,1	87	30,1	88	0	1

The test of taking air temperature and humidity data was carried out for 5 hours without stopping. for the retrieval of air temperature and humidity data taken once every 10 seconds by the software. And here are the test results of the report in the form of MS Excel.

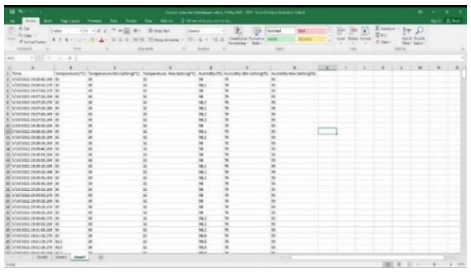

Fig. 9. MS Excel temperature &humidity logger data report

From this test, the air temperature and humidity parameters are well stored in the form of MS Excel format without errors. And the air temperature and humidity report data can be used by users. The data is still in the form of raw, can be processed into pivot form and analyzed in the form of graphs.

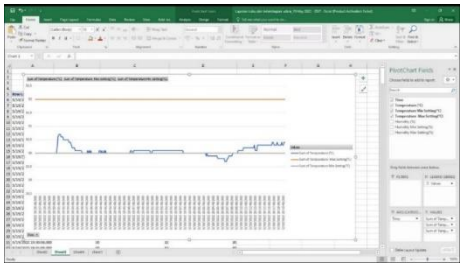

Fig. 10. MS Excel air temperature &humidity logger data report in graphic form

C. Data Analysis

From the test result data of the data logger tool, the test results of hardware and software test results data are divided per experimental item. Researchers set the overall data logger tool error tolerance standard at 3%. Hardware error tolerance standard of 5%.

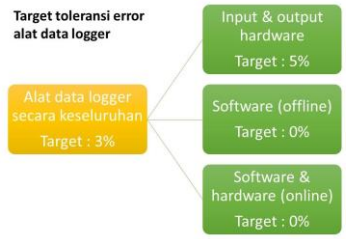

Fig. 11. Error tolerance targets

Hardware test result
Error : 2 %
Error tolerance standard : 5 %
Software test result
Error : 0 %
Error tolerance standard : 0 %
Software & hardware test results
Error : 0 %
Error tolerance standard : 0 %
Error database test result
Error : 0 %
Error tolerance standard : 0 %
Test result of sensor temperature accuracy DHT
Error : 0.2 %
Error tolerance standard : 3 %
DHT Sensor moisture accuracy test result
Error : 0.9 %
Error tolerance standard : 3 %

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D. Discussion

TABLE VIII. OVERALL PRODUCT TEST RESULTS

Test Items	Error Value (%)	Error Value Standart (%)
Hardware	2,0	4,5
Software	0,0	0,0
Hardware & software	0,0	0,0
Database	0,0	0,0
Temperature Accuracy	0,2	3,0
Humidity Accuracy	0,9	3,0
Average	0,5	1,8

Overall data logger tool test results
Error : 0.5 %
Error tolerance standard : 3 %

From the data from the test results, it was found that the error rate was 0.5%, while the tolerance standard set by the researcher was 3%. It can be said that this air temperature and humidity data logger tool works well and successfully.

IV. CONCLUSION

From the research and testing of the air temperature and humidity data logger tool, it can be concluded as follows:

1. The tools and all the components needed to take the temperature and humidity of the air with the software can function properly.
2. Data on temperature parameters and air resistance of alarms can be stored in the database and can be printed in the form of MS Excel.
3. For installation, the control box must be placed in the room.
4. This temperature and air absorption data logger tool only functions to monitor the temperature and humidity of the air, not control the temperature and humidity of the air.

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