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Drying Cabinet Using UV Lamp

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ABSTRACT

Drying clothes is an activity carried out by the community. Uncertain weather, such as rain, causes the movement of drying clothes to be hampered. The uncertain weather factor caused by global warming causes the temperature to change, sometimes, it is hot, and sometimes it rains. This causes clothes not to dry entirely and causes damp garments frequently. In this scientific work, the researcher will make a device that functions as a drying cabinet which is equipped with a temperature sensor and drying time uses a DHT22 sensor temperature sensor and LCD, which works to display the drying process. and the time needed to dry the clothes equipped with a heater which functions as a heat source so that the clothes will dry to the maximum. Measurements were made at several test points in the circuit designed to get the most significant error percentage of 5.5% with an average error of 2 .40 %. The results of the design are carried out by the criteria used. From the results of the tests, the drying process using the tools designed has succeeded in drying clothes to the maximum and minimizing germs.

Keywords: *Dryer, ESP32, 4 channel relay, dht22 sensor, UV lamp*

Introduction

A world that has been experiencing global warming lately is causing climate change and seasons worldwide. One of the impacts felt is the sudden change in weather which can cause hassles if the rainy weather comes suddenly[1]. Whether that is difficult to predict can cause problems, such as drying clothes [2]. The weather significantly affects the drying process of clothes. The weather greatly affects the drying process of clothes. In addition, it takes a long time to dry clothes made of thick material because they have a dense fabric weight and are difficult to dry. In addition to leaving an unpleasant smell, this adversely affects wet clothes [3]. Damp clothes can be wrong for your Health. Clothes are generally dried in a conventional way, namely the drying of clothes directly outside the room with exposure to sunlight and using the wind. The drying process of clothes can also be done using a washing machine. The drying process using a washing machine can dry 75%-90% in general and requires time to dry under sun exposure. Thick-fitting clothing such as jeans requires a longer drying time [4]. Therefore, a clothes dryer machine is needed that not only serves to dry clothes but can kill germs [5].

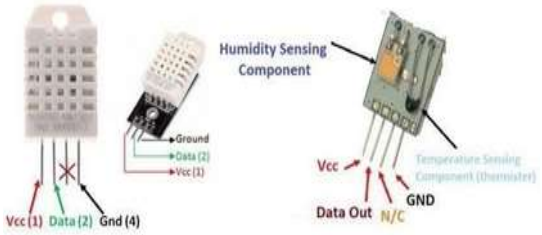

Figure 1 DHT22 Sensor

The DHT22 sensor is a sensor that can take measurements of temperature and humidity simultaneously [6]. By calibrating this sensor, the sensor does not require additional components to measure relative temperature and humidity. This sensor uses a capacitive humidity sensor and a thermistor to measure the surrounding temperature [7].

Figure 2 4 Channel Relay Module

Figure 3 ESP32 Microcontroller

The successor to the ESP8266 SoC using the Xtensa LX6 32-bit Tensilica Microprocessor with Wi-Fi and the one integrated with Bluetooth is called ESP 32. The ESP32 microcontroller has a good thing, as the ESP8266 is an RF component such as a Power Amplifier, Low-Noise Receive Amplifier, Antenna Switch, and Filter integrated.

Figure 4. LCD 16 X2

LCDs are liquid crystalline materials whose operation uses a matrix dot system. LCD is widely used to display electronic devices such as calculators, digital multimeters, and clocks [9]. There are two types of LCDs, namely text LCDs and graphic LCDs. LCD text is used to display specific text or symbols. As for the LCD, graphics make it possible to display images.

Figure 5. UV lamp

Figure 6 Push Button Switch

A switch that only serves to cut off the electric current from two or more points in the electronic circuit when the button is pressed (ON) and disconnects two or more points when the button is not pressed (OFF). A push button switch is generally a form of control that, when pressed, contacts for a few moments before returning to NO[10]. Typically, this type of NO switch includes a locking circuit connected to the contactor, and a NO type is used for the on button. An NC-type push button, usually used for the off button, is also available. There are four different push button switch settings[11].

UV lamps are electromagnetic radiation with wavelengths between 1 and 4000 A that cannot be seen by the human eye (ultraviolet light). UV lamps are electromagnetic radiation with wavelengths between 1 and 4000 A that cannot be seen by the human eye (ultraviolet light). In 1677, Danish researcher Niels Ryberg Finsen first used UV light to kill harmful germs known as UV rays [12].

Research Methods

Research methods on the manufacture of Drying Cabinet Using UV lamps

1. Create a design tool
2. Designing tools and tool installation
3. Testing of tools and sensors
4. Analysis of tool test results with multimeter measuring instruments
5. Making conclusions

The stages of the study are shown in figure 7

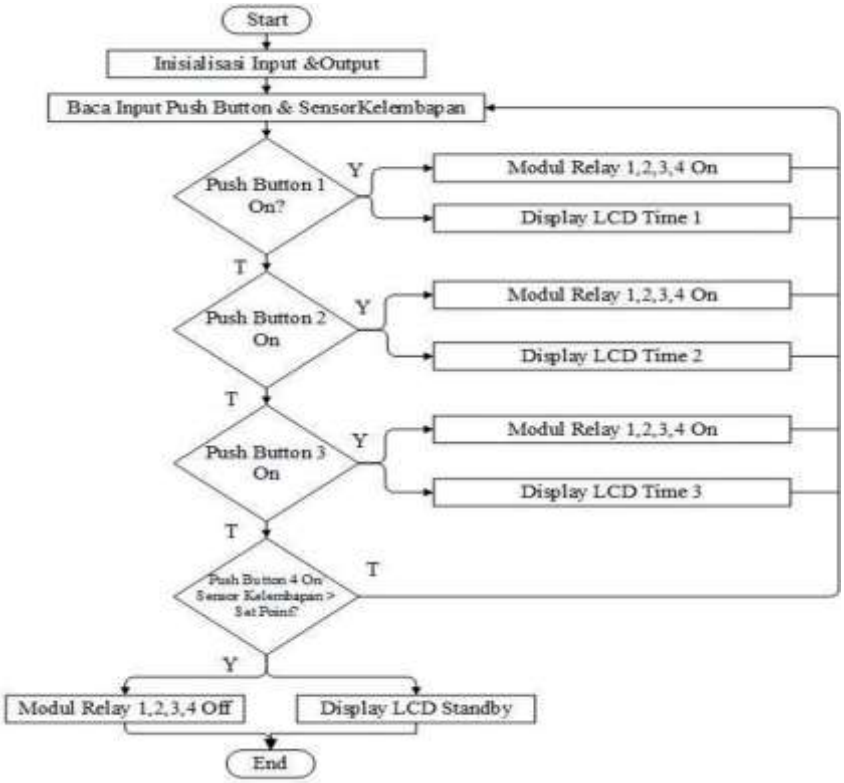

Figure 7. Flowchart Research

Results and Discussion

The picture below is a circuit schematic of the Drying Cabinet Using UV Lamps.

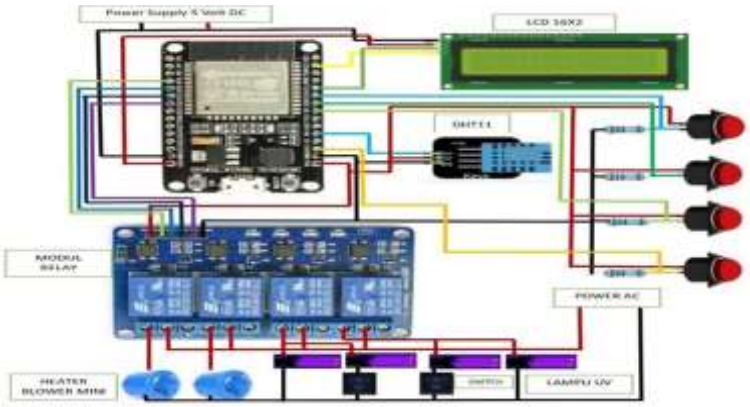

Figure 8. Circuit Schema

Planning Tools

Planning aims to facilitate the manufacture of tools by paying attention to the economical price and use of spare parts available on the market and obtaining tools that are as expected. Can be seen in figure 9

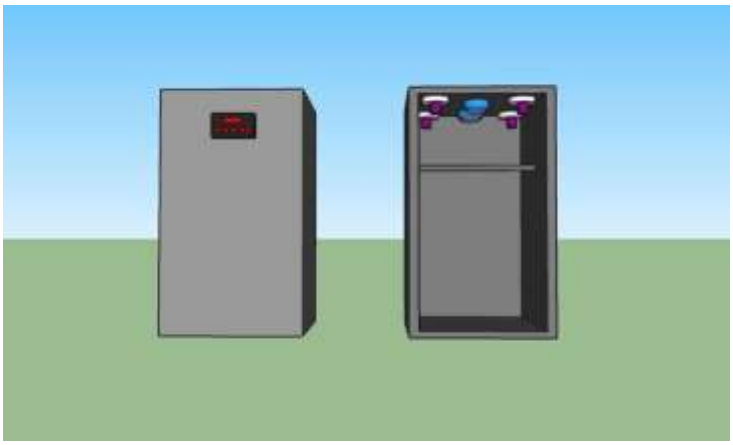

Figure 9. Planning Tools

Designing Tools

Tool design is the planned assembly of tool components. At this stage, the equipment and sensors are connected and install the prototype papa connect all parts with jumper cables at each existing output load [13]–[18].

Figure 10. Drying Cabinet Design Using UV Lamp

Five-tool measurements were obtained at each test point from the results of measuring tool components using a multimeter. It can be seen in table 1 that the voltage values obtained have different effects and then calculate the average measurement. It can be seen that measures on the components of the tool tend to be stable [19]–[22].

Table 1. Tool Measurement Results

Measurement Position	Point Measurement	Measure 1	2	3	4	5	x
PLN Input	(TP 1)	220	220	220	220	220	220
Transformer	(TP 2)	16,2	16,2	16,2	16,2	16,2	16,2
Diode	(TP 3)	13.4	13.4	13.4	13.4	13.4	13.4
Capacitor	(TP 4)	22.28	22.28	22.28	22.28	22.28	22.28
IC 7805	(TP 5)	4.97	4.97	4.97	4.97	4.97	4.97
Microcontroller	(TP 6)	4.97	4.97	4.97	4.97	4.97	4.97
ESP32 LCD 16 X 2	(TP 7)	4.97	4.97	4.97	4.97	4.97	4.97
Sensor DHT22	(TP 8)	3,33	3,33	3,33	3,33	3,33	3,33
Relay	(TP 9)	3,34	3,34	3,34	3,34	3,34	3,34

From the measurement results, such as the data above, there is an average value at each measurement point. The value has a function to get the error percentage value in the measurement. To perform the calculation, use the following equation:

$$\% \text{ Error} = \frac{|Measurement - calculation}{Measurement} \text{ x } 100\%$$

$$\% \text{ Error} = \frac{|Datasheet - calculation}{Datasheet} \text{ x } 100\%$$

The following is the result of the percentage of error obtained from the previous measurement results in table 2.

Table 2. Error Percentage Results

Measuring Position	**Point Measurement**	**Average Measurement (V)**	**Account/ Data Sheet (V)**	**Error (%)**
Power Supply	TP1	220	220	Good
	TP2	16.2	15,3	5,5
	TP3	13,3	12,98	2.40
	TP4	22,28	23,31	-4.6
	TP5	4.97	0-5	Good
ESP 32	TP6	4.97	0-5	Good
16 X 2 LCD	TP7	4.97	0-5	Good
Sensor DHT22	TP8	3.33	0-3,3	Good
Relay	TP9	3.34	0-3,3	Good

From the results of testing the tools that have been carried out, the test results are obtained as follows

Table 3. Results of testing the tools

Clothing Materials	Drying Time	Number of Clothes	Number of UV Lamps used
Cotton	20 minutes	1	2
Spandex	30 minutes	1	2
Jeans	1 hour	1	2

Conclusion

Drying Cabinet uses uv lamps using the ESP32 microcontroller as a controller of all circuit components, such as in the temperature sensor that uses dht22, which functions as a temperature and humidity reader in the tool, relays to lower high to low mains voltage, 16x2 LCDs the duration of time and the process of drying clothes. The heater serves as a heat source. This tool uses a UV lamp that functions to minimize germs. This tool also has a temperature limit where if the temperature exceeds 38 °C, the heater and uv lamp on this tool will turn off.

References

[1] W. Wang, "Post-drying decontamination of laver by dielectric barrier discharge plasma, UV radiation, ozonation, and hot air treatments," *LWT*, vol. 176, 2023, doi: 10.1016/j.lwt.2023.114518.

[2] X. Chen, "Application of combining ozone and UV-C sterilizations in the artificial drying of persimmon fruits," *LWT*, vol. 134, 2020, doi: 10.1016/j.lwt.2020.110205.

[3] D. Vernez, "Reusability of filtering facepiece respirators after decontamination through drying and germicidal UV irradiation," *BMJ Glob. Heal.*, vol. 5, no. 10, 2020, doi: 10.1136/bmjgh-2020-003110.

[4] T. R. Braga, "Drying of mangoes (Mangifera indica L.) applying pulsed UV light as pretreatment," *Food Bioprod. Process.*, vol. 114, pp. 95–102, 2019, doi: 10.1016/j.fbp.2018.11.013.

[5] S. Sumardiono, "Physicochemical and rheological properties of sago (metroxylonsagu) starch modified with lactic acid hydrolysis and UV rotary drying," *ASEAN J. Chem. Eng.*, vol. 18, no. 2, pp. 41–53, 2018, [Online]. Available: https://api.elsevier.com/content/abstract/scopus_id/85065242584

[6] D. Sun, "Ultrafast fabrication of organohydrogels with UV-blocking, anti-freezing, anti-drying, and skin epidermal sensing properties using lignin-Cu^{2+}plant catechol chemistry," *J. Mater. Chem. A*, vol. 9, no. 25, pp. 14381–14391, 2021, doi: 10.1039/d1ta02139g.

[7] C. Koga, "Stability of Trans-Resveratrol Encapsulated in a Protein Matrix Produced Using Spray Drying to UV Light Stress and Simulated Gastro-Intestinal Digestion," *J. Food Sci.*, vol. 81, no. 2, 2016, doi: 10.1111/1750-3841.13176.

[8] M. M. Thu, "Effects of drying temperature on tomato-based thin film as self-powered UV photodetector," *Appl. Surf. Sci.*, vol. 445, pp. 186–196, 2018, doi: 10.1016/j.apsusc.2018.03.162.

[9] F. Bigi, "Multivariate exploratory data analysis by PCA of the combined effect of film-forming composition, drying conditions, and UV-C irradiation on the functional properties of films based on chitosan and pectin," *LWT*, vol. 137, 2021, doi: 10.1016/j.lwt.2020.110432.

[10] P. K. Nair, "Prospects toward UV-blue filtered solar drying of agricultural farm produce using chemically deposited copper chalcogenide thin films on cellular polycarbonate," *Sol. Energy*, vol. 203, pp. 123–135, 2020, doi: 10.1016/j.solener.2020.04.012.

[11] C. Moon, "Intense Pulsed Light Annealing Process of Indium-Gallium-Zinc-Oxide Semiconductors via Flash White Light Combined with Deep-UV and Near-Infrared Drying for High-Performance Thin-Film Transistors," *ACS Appl. Mater. Interfaces*, vol. 11, no. 14, pp. 13380–13388, 2019, doi: 10.1021/acsami.8b22458.

[12] G. Cardwell, "Effect of air-drying on the generation of vitamin D<inf>2</inf> and 25-hydroxyvitamin D<inf>2</inf> by pulsed UV irradiation in button mushroom (Agaricus bisporus)," *J. Food Compos. Anal.*, vol. 115, 2023, doi: 10.1016/j.jfca.2022.105034.

[13] A. Forouzanfar, "Influence of uv-b pretreatments on kinetics of convective hot air drying and physical parameters of mushrooms (Agaricus bisporus)," *Agric.*, vol. 10, no. 9, pp. 1–10, 2020, doi: 10.3390/agriculture10090371.

[14] Q. Jiang, "UV induced conversion during drying of ergosterol to vitamin D in various mushrooms: Effect of different drying conditions," *Trends in Food Science and Technology*, vol. 105. pp. 200–210, 2020. doi: 10.1016/j.tifs.2020.09.011.

[15] N. Nölle, "Vitamin D<inf>2</inf> enrichment in mushrooms by natural or artificial UV-light during drying," *LWT*, vol. 85, pp. 400–404, 2017, doi: 10.1016/j.lwt.2016.11.072.

[16] H. Hwang, "All-photonic drying and sintering process via flash white light combined with deep-UV and near-infrared irradiation for highly conductive copper nano-ink," *Sci. Rep.*, vol. 6, 2016, doi: 10.1038/srep19696.

[17] J. Huang, "Lignin nanorods reinforced nanocomposite hydrogels with UV-shielding, anti-freezing and anti-drying applications," *Ind. Crops Prod.*, vol. 187, 2022, doi: 10.1016/j.indcrop.2022.115324.