Evolution in Electrical and Electronic Engineering Vol. 2 No.1 (2021) 131-137

EEEE

Homepage: http://publisher.uthm.edu.my/periodicals/index.php/eeee
e-ISSN : 2756-8458

Automatic Dryer for Shoe using Incandescent Bulbs

Mohd Syafiq Shukor[1], **Rohaida Mat Akir** [1*]

[1]Department Electronic Engineering, Faculty of Electrical and Electronic, Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Johor, MALAYSIA

*Corresponding Author Designation

DOI: https://doi.org/10.30880/eeee.2021.02.01.015
Received 23 February 2021; Accepted 30 April 2021; Available online 30 April 2021

Abstract: Nowadays, climate change makes weather unpredictable and sometimes on a rainy day, they need to dry their shoe in a very short time. The automatic dryer is intended to enhance human life to change the traditional technique to the modern method of drying. The primary goal of this research is to create a prototype for drying without depends on sunlight. Besides, the automatic dryer can be more convenient for people who are too busy and have limited space in the house to drying shoes. The system automatically operated and used Arduino Uno to act as the microcontroller. The automatic dryer consists of a sensor for temperature and humidity. The temperature and humidity condition is controlled by bulbs, fans and buzzer to ensure the shoe is dry in good condition. The sensor is played a role to conduct the system of the automatic dryer. It is responsible for running the program and controls all the modules needed for the system to work. The predicted outcome of this research is that we can automatically help the peoples drying the shoe anytime within a short time.

Keywords: Automatic dryer, Temperature, Bulbs, Time, Drying

1. Introduction

A shoe dryer is one of the items that people require nowadays. Since the given purpose of a product is the reason for its existence, everyone would agree that wearing a wet shoe is not the most enjoyable experience, particularly on cold or rainy days. Previously, the traditional method of drying shoes in the sun was used, which took longer for people in a hurry [1]. Multifunctional shoe dryers have recently become available in a variety of styles. However, most common products on the market are bulky, expensive, and use a lot of energy, as well as taking a long time to dry the shoes. Some of the reasons they prefer to use the traditional method of drying are that it is inexpensive and does not necessitate any power efforts. Some argue that technology and design are overly complicated, and that the price range is not quite affordable [2].

Climate change has made weather unpredictable, and on rainy days, they may need to dry their shoes in a very short period of time. However, shoe dryers are only found in a few places, such as a shopping mall or a hotel. The shoe dryer is intended to assist people who are in a hurry to dry their

*Corresponding author: rohaida@uthm.edu.my

shoes on the go [3]. The most difficult thing is to dry the clothes while staying in the house with limited space and this product is heavy duty can use last longer.

Development of method in previous drying system was summarized by Table 1 below, the author mostly used PIC microcontroller and Arduino Uno because that kind of microcontroller is useful for drying project. There has a different build of type for every material that shows in the table. Every material had time consumed to dry not too specific but it is running as a system that has been programmed. Different type of sensor is applied which is the function of every sensor have a different method of using the dryer. Following Table 1, it does not show the type of heating element to drying, but basically, some research mostly using heating ventilation or bulbs.

Table 1: Development of method in the previous drying system

Author	Type of dryer	Microcontroller Operated	Type of Sensor
(Mutalib et al., 2019)	Shoes	PIC16F877A	Temperature and ultrasonic sensor
(Hasnati et al., 2019)	Shoes	Arduino UNO	DHT 11
(Sundi et al., 2019)	Clothes	Arduino UNO R3	Water Sensor
(Kalyankar et al., 2018)	Clothes and food	PIC Microcontroller	Temperature and humidity sensor
(Sunny et al., 2018)	Food spice	Arduino UNO	Temperature sensor
(Prakash, Bommanan,& Kavin, 2018)	Multipurpose	PIC Microcontroller	Temperature sensor

The design of this project is supporting the needs of dry in a short time. Ideally, this thought can be satisfied, and the design can satisfy the customer's needs and particular can fulfill the customer's needs. Individuals would now be able to dry their shoes effectively, quicker, and without any doubt of rain. [4].

2. Materials and Methods

The justification process of choosing the right components behind the automatic shoe dryer project is based on several factors to ensure the automatic shoe dryer able to perform its tasks efficiently. In this project, we divide into two part which is software and hardware development. Figure 1 shows the hardware development with the block diagram of the shoe dryer system which is consists of a DHT22, LCD, Fans, Bulbs, buzzer and relay used in this work. Another below diagram is the basic idea of this project whereby Arduino Uno is used to programming the system process. The flowchart project of the system is shown in Figure 2.

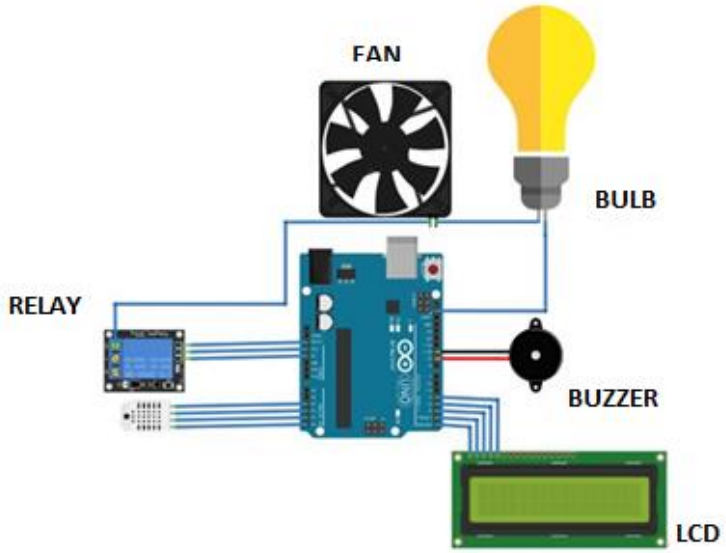

Figure 1: System diagram of an automatic dryer

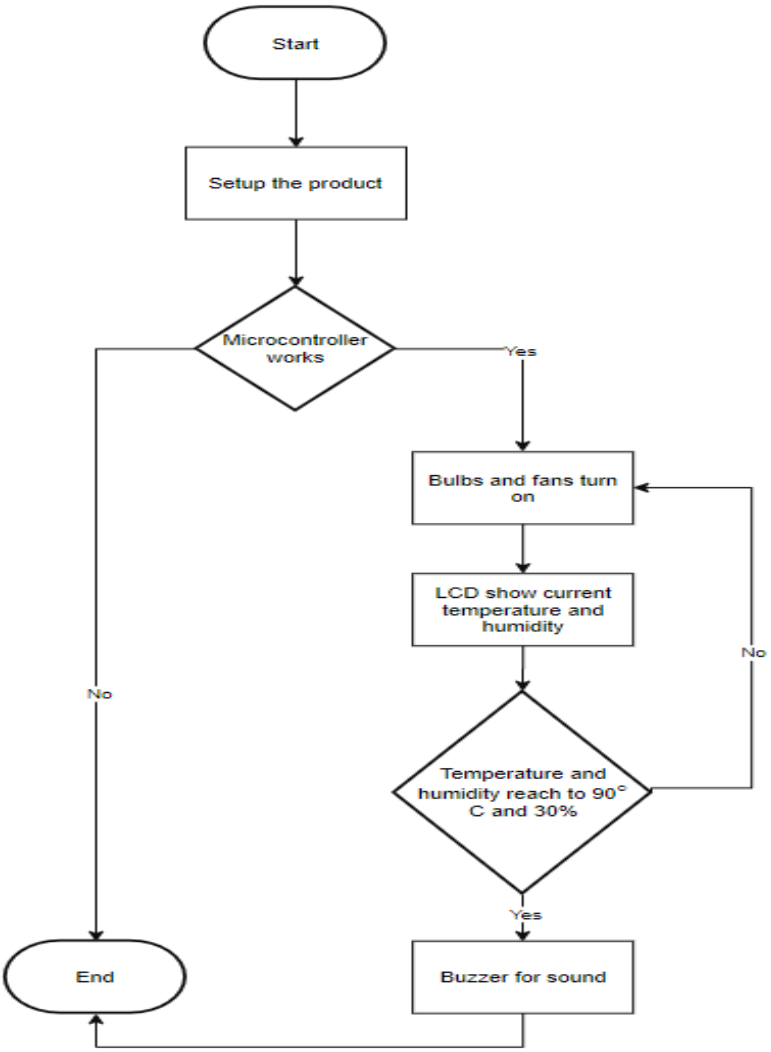

Figure 2: Flowchart Automatic Dryer for Shoe

2.1 Hardware development

The operation of the system is on the run as the user puts the shoes inside the box. The temperature and humidity sensor was set up after Arduino UNO. The time duration to dry the shoes depend on temperature and humidity in for example if the temperature reaches 90°C or humidity for 30% in the dryer box either one, the DHT22 will notify using the buzzer. The fans and bulbs will stop after the temperature and humidity reach 90°C and 30%. It will show that the shoes dry. Any modifications that may happen will appear on the LCD board. When the temperature and humidity reach 90°C or 30%, the relay automatically changed to normally open and turn off the bulbs and fans. While the temperature and humidity out of reach 90°C or 30%, the relay will return to its normal position and turn on the bulb. The process repeat until the buzzer will notify the sound.

Table 2 shows the list of components needed with the function in the project. The Arduino was the main component in this project. It combined with other devices to make this project works well.

Table 2: List of equipment and function

Devices	Function
Arduino Uno	Processing input from sensor and determines what to do with system
Temperature & Humidity Sensor DHT22	Measure the temperature and humidity in the box
LCD Display (16x2)	The current temperature and humidity display on the LCD
Bulbs	Generate heating to drying the shoe
5V Fans	Give extra heat winding in the box during the process
Buzzer	Notify user when process is finish
Relay	To set operating bulbs, fans and buzzer

2.2 Software Implementation

The design of the box would not only fill up with shoes but with temperature and humidity sensors as well known as DHT22. Aside from that, fans and bulbs are put inside the box as the main component to dry the shoes. Besides, the fans give as a helper to bulbs to give more heat and dry will quickly. The condition's status in the box shows up on the LCD screen display.

The main element that was controlled in this project was Arduino UNO. It is included everything necessary for supporting the microcontroller by merely plug it into the laptop with a USB cable or power it with a battery. This box was user-friendly as the box of the dryer can be easily carried around in short distancing.

2.3 Design of an automatic shoe dryer

The design of the automatic shoe dryer prototype is shown in Figure 3. In the market, dryer boxes usually use materials such as composite steel. The main objectives of this material selection are to use the other materials to compare with the market materials. It is best to use steel. However, it cost more to manufacturing parts. Hence, using a combination of plywood and wood was more economical. This was because the materials were suitable for dryer boxes such as heating exchange that involving bulbs and fans. This dryer box can fill up one pair of adult shoes and can put multiple shoes for children size at one time. The dimensional measuring of the dryer box is 40.2cm long x 40.2cm wide x 42.5cm in height. Then, 2 bulbs have placed on the wall inside of the box. The bulbs usage is 100 Watts that supply heat to the shoes as shown in Figure 4.

Figure 3: The process prototyping an automatic shoe dryer

Figure 4: After sealed with aluminum foil and added fans and bulbs

On the software development part, the Arduino Uno microcontroller has been chosen because it is low-cost and more practical. The Arduino Uno coding was assembled and compile using Arduino software IDE then being combined with the designed hardware. After validation of the connection between software and hardware establish, users can easily control all the environment of the shoe dryer.

3. Results and Discussion

The results and analysis of the automatic shoe dryer will be discussed in this section. The overall view of the show dryer as previously shown in Figure 3 and Figure 4. The hardware includes two bulbs for each placed at the upper side of the dryer to supply heat source, and two 5V DC fans to help in circulating the hot air in the dryer box, LCD, relay, power supply and Arduino Uno. An experiment was conducted to test the functionality and reliability of the designed shoe dryer. The analysis begins with testing on the performance of the shoe dryer, as shown in Figure 5. Figure 5 depicts a single pair of shoes inside the dryer box. The dryer box can hold a maximum of two pairs of shoes at once, but we only used one pair during our testing.

Figure 5: Automatic shoe dryer interior design with putting shoe inside.

The validation of the parameter for the dryer has been carried out. The automatic shoe dryer has been tested with a general different shoe condition level which is wet, slightly wet, and dry. At the end of the testing process, we want to compare how many times the sensor has been reached at 90°C for temperature or 30% for humidity.

Table 3 summarize the testing process with three (3) different condition level which is wet, slightly wet, and dry. Wet condition represented to 0%, for slightly wet represented 25% and 50% and then for wet condition represented for 75% and 100%. Every level had its specific shoe wet percentage condition. From the observation, we found that shoe conditions after the drying process become dry from wet, slightly wet, and dry for every shoe wet percentage. It is shown that the time consuming to become dry is between 16.20 and 49.03 minutes from dry to wet condition level. The different time duration between 0% and 25% is 1 minute because the sensor reached the temperature and the humidity limit takes 16 minutes in the box even the percentage of the shoe is 0% wet.

The rest of the results are increasing following the heating generated in the dryer box. From the result obtained, it is shown that temperature and humidity settings at 90°C and 30% are the best reaching to ensure the drying process successfully.

Table 3: Parameter for different condition

Before		Monitoring Process			After
Shoe level	Shoe wet percentage (%)	Time (Minute)	Temperature(°C)	Humidity (%)	Shoe dry condition (%)
Dry	0	16:02	79	32	100
Slightly wet	25	17:17	78	28	100
	50	27:05	87	30	100
Wet	75	30:56	90	32	100
	100	49:03	83	28	100

Figure 6 shows that the best condition is obtained when the dryer was set at 90°C or 30%. The setting is very significant in the drying process. Therefore, it is set as the default setting of the dryer. If the sensor does not reach the limit of the set temperature and humidity, then the process is still working until the shoe completely dries.

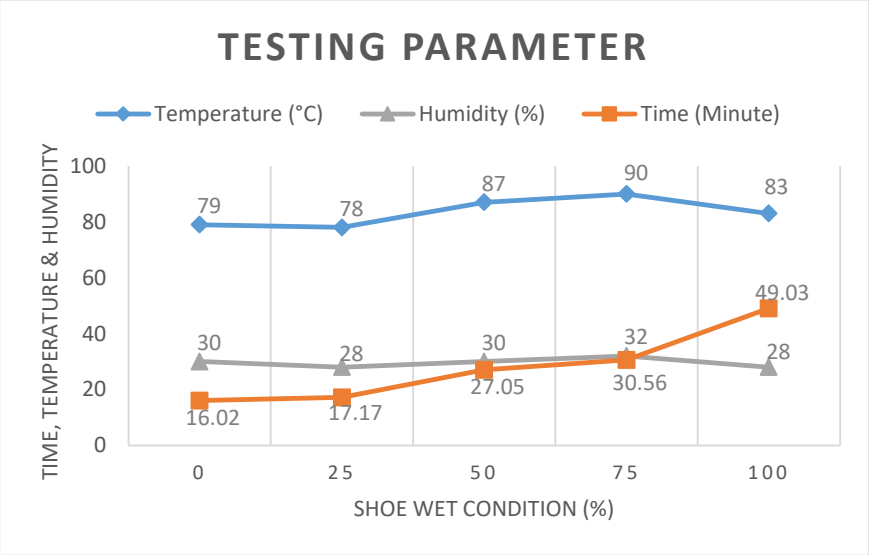

Figure 6: Testing parameter graph.

4. Conclusion

In conclusion, drying the shoe in a short time can help peoples minimize the time. The component is economical designed and very convenient to use. Users are capable to dry their shoes within the expected time. The first objective has been achieved because all of the data have been obtained such as the sizes of the box, used DHT22, 2 fans, 2 bulbs, and buzzer controlled by Arduino Uno. Next, the second objective is to evaluate the performance by using a heat bulb system also have been successfully done. This method approximately the same compare to the product market by the temperature and humidity for every product generate. Lastly, the size of the design suitable for time and space. It is synchronized with temperature and time to get a short time when the drying process.

Acknowledgement

The authors would also like to thank the Faculty of Electrical and Electronic Engineering, Universiti Tun Hussein Onn Malaysia for its support.

References

[1] M. R. bin Adnan, "Development of Simple Shoe Dryer Apparatus," FYP Report, Faculty of Mechanical Engineering, University Malaysia Pahang, November, 2007.

[2] N. Hasnati, B. Abdull, S. B. Din, P. Sultan, M. Zainal, and A. Uno, "Automatic shoe dryer," vol. 1, pp. 119–127, 2019.

[3] N. A. Mutalib et al., "Development of Shoe Dryer System Using Microcontroller with GSM module," Int. J. Integr. Eng., vol. 11, no. 3, pp. 272–279, 2019.

[4] S. Yao-jun, W. Nai-qun, and D. Ye, "Research on Innovative Design of Portable Quick-drying Machine," vol. 8, no. 1, pp. 149–156, 2015.