Development of Robotic Aromatherapy Air Humidifier Using Arduino

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Abstract: Nowadays, people have become more concerned about maintaining their health. Hence, an air humidifier is one way to keep the air moisturized, cleaner and safer to breathe in. Even though people are gaining knowledge on how to clean the air, these methods are still insufficient to ensure good air quality. If the air humidifier keeps moisturizing the air, it can make the humidity level too high, and this also can cause harmful side effects. The idea of this product is to create an air humidifier that can detect the temperature and humidity of the surroundings and automatically produce the water mist if the moisture of the surrounding is too low (RH < 55%) and stop the water mist if the humidity of surrounding is too high (RH > 55%). The heating plate will warm the water to produce a warm water mist if the temperature is low (Temperature < 24˚C) and stop the heating when the temperature is high (Temperature > 24˚C). This product is also designed to be moveable by itself to cover a large area in the room. The unstable temperature indoors due to air conditioning and the weather outside the house can cause problems to health. The sudden temperature change can cause the body to have a fever or skin discomfort. To maintain the suitable room temperature, this product provides a system that uses a heating coil and produces a warm mist to comfort the skin. In the existing product, the humidifier is static and usually placed in the room's corner. Since the water mist is produced based on the humidity surrounding of the product, it can only react depending on the humidity in the close area. The problem occurs when the humidity at the corner with the humidifier is different compared to the other corner of the room without the humidifier. The unbalance of humidity will happen, and the resident will benefit less. Hence, this project is designed to be robotic, which it is installed with a self-driving motor that act by itself to move around to detect the humidity around the room and cover the humidity in a large area. Therefore, this project is beneficial for patients suffering from skin conditions such as eczema and respiratory problems such as asthma who are required to be in clear air and the proper air humidity.

Keywords: DHT22, Ultrasonic mist maker, Relative Humidity, Aromatherapy

1.0 INTRODUCTION

Air humidifiers are becoming more common in every household. The purpose of the air humidifier is to increase the humidity of the surrounding. The air humidifier will produce the water mist and spread it into the air to make the humidity level of surrounding increase. As the water mist spread out in the air, the air will become clearer and fresher as it will make the harmful substances in the air such as dust and bacteria to stay in the floor. In the medical purpose, the patient who have breathing problems such as asthma will be better with clean air. Even more, right level of humidity level of the surrounding will help the skin and face become less dry and reduce and skin problem.

However, the existing air humidifier in the market need to be controlled fully manual by the user. The user needs to turn on and let the air humidifier increase the humidity in the air without stopping. If the air humidifier were kept humidify the air, the humidity level of the air humidifier will become too high. Too high of humidity of surrounding will lead to form many fungi in the house. To overcome this problem, the existing product were analyzed and upgraded to make the air humidifier to become more efficient and safer to use. Hence, the Development of Robotic Aromatherapy Air Humidifier Using Arduino was created.

The idea of this product is to created air humidifier that can detect the temperature and humidity of the surrounding and automatically produce the water mist if the humidity of the surrounding is too low and stop the water mist if the humidity of surrounding is too high. This product is also designed to be moveable by itself to cover

large area in the room. The scent of water mist is carefully selected for aromatherapy purposes.

To achieve the results as expected according to the objectives, which is to develop self-moving humidifier to make sure the relative humidity level of entire room space has same humidity reading, to design a humidifier system that produce different scent water mist at different time duration and to develop a system that regulate the surrounding temperature into ideal temperature range.

For aromatherapy, it is a holistic procedure for healing that encourages wellness and well-being by using natural plant extracts. It is called essential oil therapy sometimes. Aromatherapy medically utilizes herbal essential oils to enhance the health of the body, mind, and spirit. This improves the health of both physically and mentally.

In term of sleep quality and anxiety, the research show anxiety intensity of aromatherapy group is 0.36 meanwhile the controlled group is 3.11. The study also shows the sleep quality of the aromatherapy batch had a rest result of 52.7 though the benchmark group had a score of 36.2[1]. Hence, this proves aromatherapy beneficial for anxiety and sleep quality.

For the daylight, it is suggested for the scent of lemon scent. The basic oil of lemon is utilized to ease tension, as an antibacterial, anticoagulant, upper, hostile to infective, calming, sterile, antiviral, astringent, cell reinforcement, and antimicrobial operator, as a stomach related energizer, safe sponsor, and lymphatic specialist [2]. This scent has antidepressant effect that help the user especially in stressful day.

For the nightfall, the chosen scent is lavender. Lavender is used as a fundamental oil, as a pain relieving, calming, antifungal, and antispasmodic; as a narcotic; and for wound recuperating; for loosening up the sensory system, bringing down pulse, and diminishing uneasiness and torment sensations[2]. This scent has calming and relaxing effect that help the user for easier sleep and maintain sleep quality.

For humidity, the comfort of relative humidity for winter (20 °C - 23 °C) and summer (24 °C – 26 °C) is between 30% RH and 70% RH [3]. Research also found that 40%t RH activates the evaporation of water in the droplets of cough, leading to droplet shrinkage and prolonged air suspension, while high RH increases the droplet size at 95% due to hygroscopic growth with higher fractions of deposition both on humans and on ground[4].

An experimental was done by survey of 21 person of skin comfort based on the temperature of 24°C, 26°C and 28°C. Based on the result, the most comfort temperature by the subjects is 24°C and 26°C[5]. There is study done by non-profit organization show that in walled workplaces that are in precisely aired and very much fixed places of business, these provide guidelines on achieving good Indoor Air Quality (IAQ) and thermal conditions[6]. The result achieved by the study are shown in Table 1.

Table 1: The satisfactory employable temperature ranges dependent on safe place charts in ASHRAE Standard-55-2004

Conditions	Acceptable operative temperatures	
	°C	°F
Summer (clothing insulation = 0.5 clo)		
Relative humidity 30%	24.5–28	76–82
Relative humidity 60%	23–25.5	74–78
Winter (clothing insulation = 1.0 clo)		
Relative humidity 30%	20.5–25.5	69–78
Relative humidity 60%	20–24	68–75

2.0 MATERIALS AND METHODS

The project being developed using several processes that is complex to make sure that the system working as intended. Figure 1 shows the block diagram of the project.
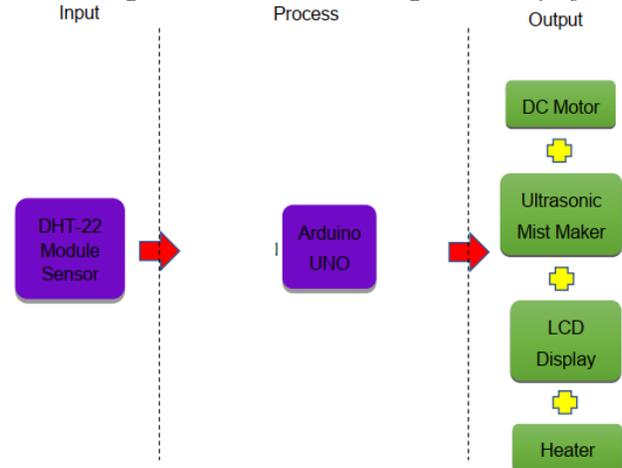

Figure 1: Block Diagram

For the input of the project, there is only power source. For the project, power bank (rechargeable battery) is used as the project is made to be mobile and portable, hence using direct plug to power outlet will limit the movement.

For the process of the project, there are two things activated by the power source (input). First is DHT-22 module sensor. This sensor is turn on by 5V from the power source. This sensor will detect the surrounding relative humidity and temperature and sent the data to the Arduino UNO for further action.

Next is Arduino UNO. Arduino Uno is microcontroller that act like "brain" of this project. Arduino UNO will receive data from the DHT-22 Module Sensor and will process it to DC motor, Ultrasonic mist maker, LCD Display and Heater.

After receiving the data from the microcontroller, few components are activating depending on the variables. First is DC motor. The motor will turn on by activating push

button and the tri-wheel at the mid bottom of the project will make the project to make in the straight line. this tri-wheel is supported by the four wheels at each side of the project. If the machine is blocked by any obstacles such as wall, the tri-wheel are spinning and thus, make the project to turn direction.

Other than DC motor, the LCD Display will show the display the reading of relative humidity and temperature. The heater is activating if the temperature surrounding is detected below that 24°C by giving currents to the heating coil to warm the water.

Lastly, the ultrasonic mist maker. This component will produce water mist if the relative humidity is below than 55% and turn off in the relative humidity of surrounding is higher than 55%.
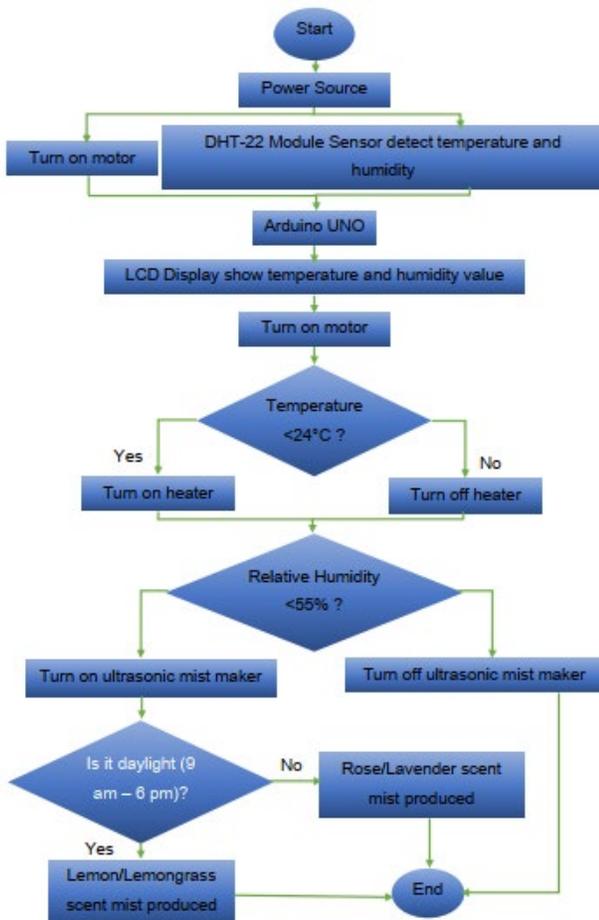

Figure 2: Flow Chart.

To start the device, the user needs to press a button that connect the power source (rechargeable battery). As the device turn on, it will start the motor under the device to spin the wheels and activate the DHT-22 Module sensor to detect the surrounding temperature and relative humidity. The surrounding temperature and relative humidity detected data are sent to Arduino UNO.

As the Arduino UNO received the needed information from DHT-22 Module Sensor, the data are transferred to LCD Display to show the exact value of temperature and relative humidity of the surrounding. The value will affect the heater and the ultrasonic mist maker in later process.

If the DHT-22 Module sensor detect the temperature of the surrounding is below than 24°C, the heating coil connected with 5V will turn on and heat the water for 60 seconds. The heating coil will not turn on if the temperature is higher than 24°C.

Then, if the relative humidity is lower than 55%, the ultrasonic mist maker will turn on and release the scented mist. However, the ultrasonic mist maker will turn off if the relative humidity is higher than 55%.

As for the scented mist, the project is aim for the different type of scented mist for daylight and nighttime. However, in this prototype device, the different mist is set by 555 IC timer that switch scents for every 100 seconds. This is to indicate the lemon scented mist is for daylight and lavender scented mist for the nighttime.
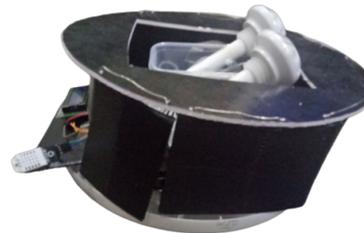
3.0 RESULTS

Figure 3: Project design

Figure 4: Hardware Placement inside the casing.

Figure 3 show the prototype design and Figure 4 show the placement of each component without the casing.

Figure 5: The RH higher than 55%

Figure 5 shows the ultrasonic mist maker turns off when the Relative Humidity is higher than 55%.

Figure 6: The RH below than 55%

Figure 6 shows the ultrasonic mist maker turns on when the Relative Humidity is below than 55%. Therefore, the Relative Humidity can be regulated by maintaining the 55% of Relative Humidity.
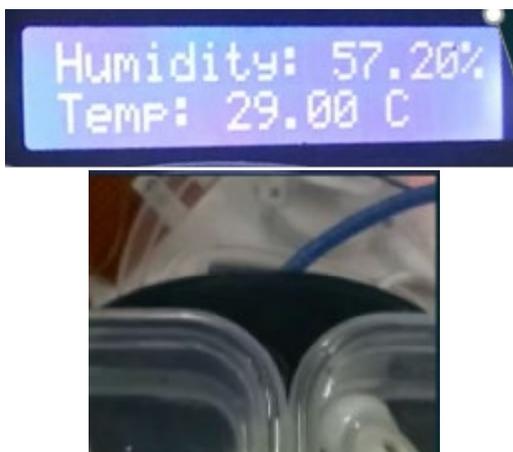

Figure 7: The temperature higher than 24 ˚C

Figure 7 shows the heating plate turn off when the temperature is higher than 24˚C.

Figure 8: The temperature below than 24 ˚C

Referring to Figure 8, the heating plate turn on when the temperature is below than 24˚C and start to heat the water in the water storage. Therefore, surrounding temperature can be regulated by maintaining the 24˚C of water mist.

Figure 9: The Switch between two ultrasonic mist makers.

As shown in Figure 9, the two different essential oil put on different water storage and each mist scented will be produced depends on the period of day or night.

Table 2: Time taken for the room to reach ideal RH and Temperature

Area (ft)	Initial Temperature (˚C)	Initial Relative Humidity (%)	Final Temperature (˚C)	Final Relative Humidity (%)	Time Taken (min)
10 x 10	20	60	24	56	25
15 x 15	21	40	25	54	40

4.0 DISCUSSION

From Table 2, the prototype was put in the room size 10 x 10 feet to analyze how long it takes for the room to

reach desired relative humidity and temperature. For the room with that size, it takes 25 minutes to reach the temperature up to 24˚C from 20˚C. The time taken only stop when both RH and temperature reach at the ideal point.

For the room size 15 x 15 feet, the initial temperature is 21˚C and the final temperature is 24 ˚C. The RH value also increase from 40% to 54% in 40 minutes.

From this data, it proven that project is working properly and achieve the objectives. This result is achievable due to the project ability to self-move in the room and change the direction if facing any obstacles.

5.0 CONCLUSION

For the conclusion, the project design was successful because only used a simple design to make sure it is easy to carry. It used the creativity and need a lot of cooperation in making the circuit design and the casing project. At the end of the project, all the objectives have been achieved. From the project, new experience can be gained and evaluate the knowledge by practicing it to real technology application. All of this equip able to design, troubleshooting, creative thinking and completing the task according to the time given. The problems occurred can be solved during the process and gained a lot of experience that are very valuable and can be used in the future.

Therefore, this project can achieve the objectives and aims for the project. The prototype can self-moving to all around the room and change the direction of the movement when it bumps to the wall or any obstacles. With this self-moving feature. The problem of unstable relative humidity in the room due to static humidifier are solved. When it moves forward, the DHT22 sensor can detect the relative humidity and turn on the ultrasonic mist maker when the RH value is below 55%. Thus, the relative humidity of the entire room can be stabilized.

As for the aromatherapy purpose, the prototype can switch two different scents for different period. The lemon water mist scents are produced for the daylight and lavender water mist scent are produced during nighttime. The separated water storage in the prototype accomplished the objective to create energetic mist during day and relaxing mist for the night.

Lastly, the heating plate that are placed under the water stored act as a warmer to heat up the water up to 50˚C when the surrounding temperature is below than 24˚C. This feature is built to achieve the regulation of surrounding temperature by producing warm water mist when the temperature detected are below the 24˚C and stop heating when the surrounding temperature is higher than 24˚C.

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