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The Smart Hybrid Chamber for Cinnamon Drying and Storing Operations

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***Abstract*—**Drying, cooling, and storing food is a challenging task in many food manufacturing industries. Measuring temperature and humidity using the Arduino tool and sensors, which helps balance the environmental factors to increase productivity in the agricultural sector. This product is significantly related to Cinnamon storing and drying because industries are facing several issues related to controlling the storage condition. Therefore, controlling humidity and temperature into the cinnamon storage room is very important to reduce the postharvest losses. The standard optimum humidity level of cinnamon storage is 60% - 70%, and the temperature level is 27°C - 30°C. This primary aim is to develop a smart hybrid drying chamber and make storing unit for Cinnamon. This product included monitoring indoor humidity levels, controlling temperature and humidity levels, and sending notifications across Bluetooth modules to a mobile application. Furthermore, this process mainly using an Arduino UNO microcontroller, DHT11 sensor, and Bluetooth module. The result of this project helped to bring about a qualitative and quantitative change in cinnamon export. All the system functions are controlled automatically, so it is more advantageous and more efficient for cinnamon industries.

***Keywords*—**Cinnamon, SMART, Drying, Humidity, Temperature

I. Introduction

Many companies use drying technology. Agriculture, biotechnology, food, and paper are only a few examples. Drying aims to reduce the moisture content of a product by using heat. Monitoring dryers was mainly manual in the early days; automatic control appeared only more recently in commercial drying equipment (Chandra, Amarasinghe and Walpolage, 2011). Measure temperature and humidity using the Arduino tool and sensors, which helps balance the environment to increase productivity in the agricultural sector. Suppose a suitable humidity control unit is created for the institution. Being able to control the humidity in the storage room can solve the problem by increasing moisture content and can provide a storage facility for a more extended period. Therefore, this study is significantly beneficial to the cinnamon factory to maintain storage temperature and humidity levels for the storage room. The objective of this study was to develop a suitable cinnamon drying and storage room to control and monitor the atmospheric temperature and humidity inside the chamber by using the Internet of Things.

Fresh cinnamon chips contain a very high amount of moisture, up to about 60%. Drying is the most common and fundamental method for post-harvest. The cinnamon storage room should be clean, dry, and free from pests. The moisture content of the Cinnamon should be kept to a minimum. The moisture content should be around 15% according to export standards. Temperature and humidity are some of the critical environmental factors in a cinnamon storage room. The cinnamon storage room temperature is between 27°C - 30°C, and Relative Humidity is between 60% to 70%. That needs to be controlled relative humidity should be checked using the wet-bulb thermometer and dry-bulb thermometer (Chandra, Amarasinghe and Walpolage, 2011).

The primary aim of drying is to increase the shelf life of foods by decreasing their in-water activity. In the absence of adequate water, microorganisms cause food spoilage and decay and many enzymes that encourage undesirable changes in the chemical structure of the food. In-tray dryers, the food is laid out, normally very loosely, on the trays where it is cleaned. An air current sweeping through the trays, conduction from heated trays or heated shelves on which the trays are placed, or radiation from heated surfaces may all be used to heat the trays (Bernard *et al.,* 2014). Air heats most tray dryers and also removes the humid water vapors. Any kind of disequilibrium in the environmental conditions can create a monetary loss in the agricultural sector industry's productivity. Bluetooth is a wireless networking technology. Short-wavelength radio communications are famous for transmitting data over short distances (Riman, 2019). Smart sensors pass some of the reasoning work down to the physical level to provide intelligent functionality (Kaushal *et al.,* 2019). The device is built on sensors to measure the

temperature and relative humidity in the drying chamber in real-time.

II. MATERIALS AND METHODOLOGY

All of this is done to create a method that is useful in resolving industry-related problems. This project consists of two parts: hardware implementation and software development. Firstly, the hardware setup was done. The connection between the Bluetooth module and the DHT-11 sensor was made using conventional methods.

A. Proposed System

Figure 01 exposes the block diagram of the proposed method. It consists of an Arduino UNO microcontroller with a DHT11 humidity sensor and Bluetooth Module in the drying chamber.

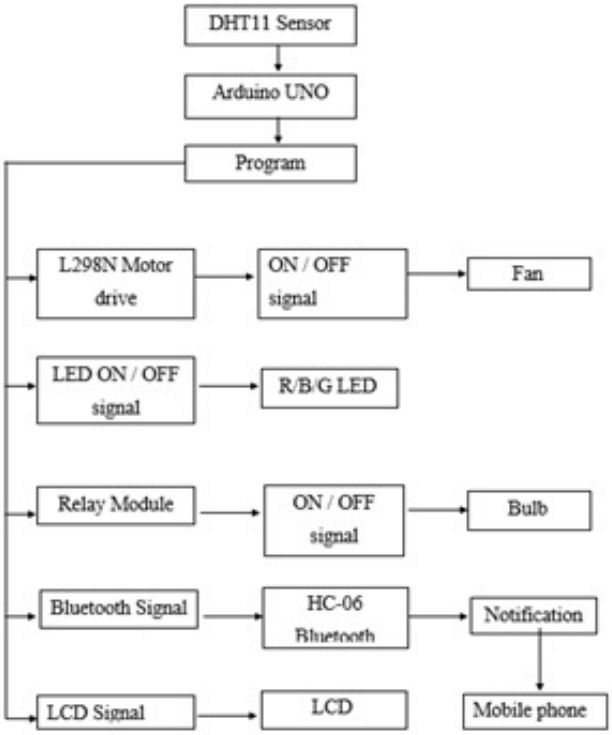

Figure 1: System Block Diagram.

Arduino UNO Microcontroller:
Arduino is a modern hardware and software system that is an open-source microcontroller board based on the Microchip ATmega328P microcontroller created by Arduino. An Arduino Uno operates the smart hybrid chamber. The DHT 11 sensor sends a signal to the Arduino, and Arduino receives parameters. Uses Arduino IDE to create programs.

DHT11 sensor:
This module has a humidity and temperature complex with a measured digital signal output, which means the DHT11 sensor module is a hybrid humidity and temperature sensor with a calibrated digital signal output. DHT11 has extremely accurate humidity and temperature readings, as well as high durability and long-term stability.

HC-06 is a Bluetooth module:
The HC-06 is a Bluetooth module that allows two microcontrollers or systems to communicate wirelessly for short distances. This is the cheapest and most flexible option for wireless data transfer, and it can also send files at speeds of up to 2.1Mb/s. The UART interface is used to communicate with the HC-06 module.

B. Development

The simulation setup of interfacing of Arduino UNO microcontroller along with the temperature and humidity sensor is shown in Figure 02. The components are Arduino UNO, LCD (16X4), humidity and temperature sensor, motors for fan and heat bulb.

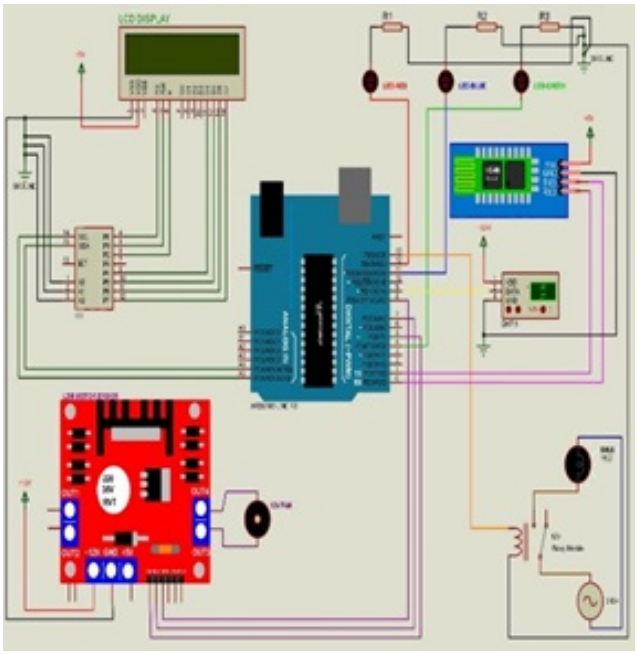

Figure 2: Circuit Diagram.

C. System Design

The temperature increases fan is switched ON. The heat bulb is switched ON if the humidity increases. When the values again reach normal, the fan and heat bulb is switched OFF. The data are transmitted to mobile phones via using Bluetooth module. The flow diagram of the proposed method is shown in Figure 03.

III. IMPLEMENTATION

The system is powered after Cinnamon is stored in the chamber. The DHT11 sensor monitored the temperature and humidity of the indoor atmosphere. The standard temperature to be maintained is between 27Co to 30Co. Here, when the temperature rises more than 30Co, the exhaust fan expels hot air. The standard humidity level to be maintained is between 60% to 70%. Here 75W bulb lights up when the humidity

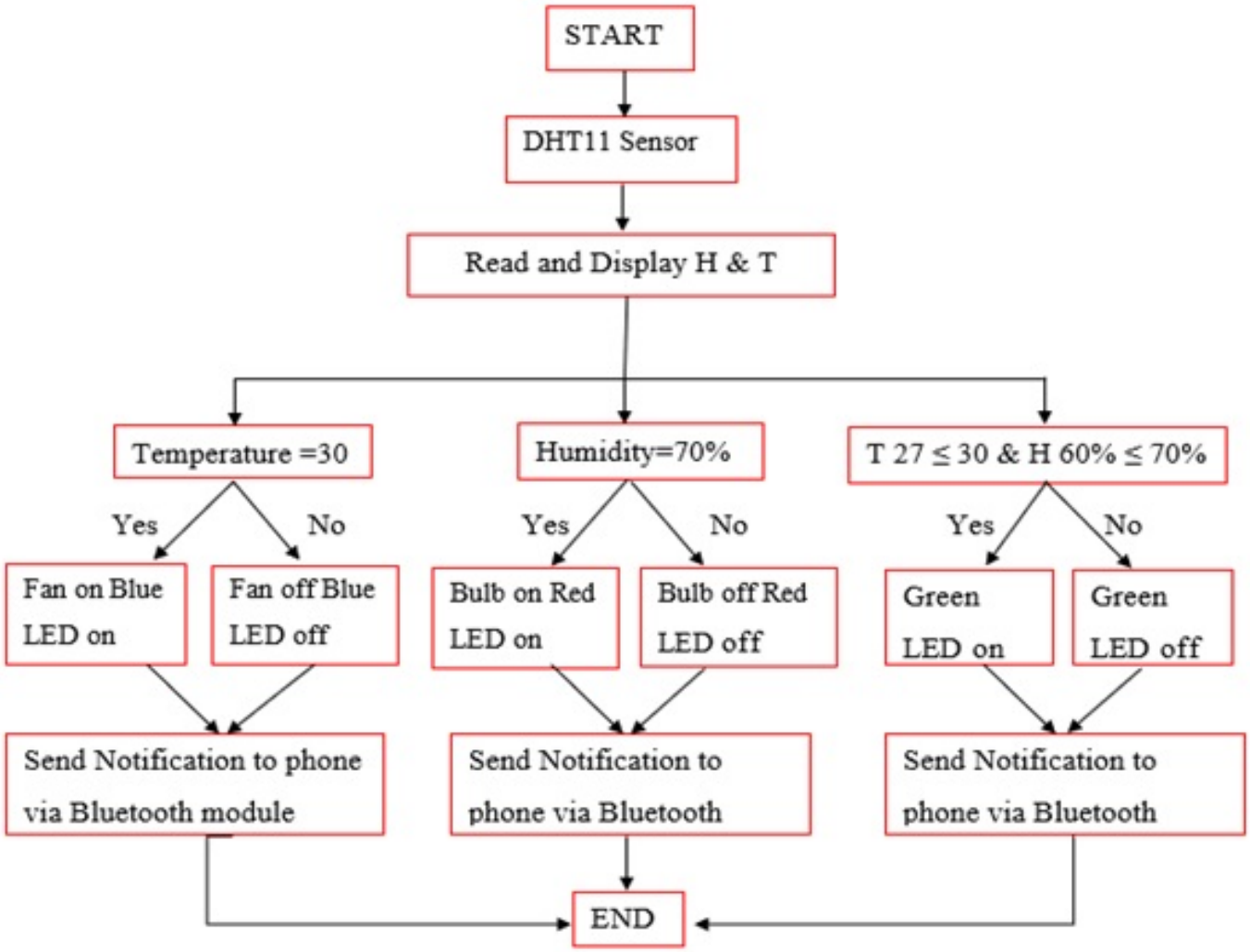

Figure 3: Circuit Diagram.

level is more than 70%. The "Smart Hybrid Drying chamber" shows figure 04.

Figure 4: Smart Hybrid Drying chamber.

All this information is available on the mobile phone via Bluetooth. This information is available on mobile phones through the Arduino serial monitor app. Figure 05 shows the Bluetooth notification.

Figure 5: Bluetooth notification.

IV. Discussion

A device was designed based on the needs of the cinnamon farmers. Drying is one of the pre-processing techniques in the cinnamon industry—the hot air cinnamon chip dryer using the air heating exchanger method. The System uses a 75W heat bulb to control the humidity. This can quickly raise the temperature of the System. Measuring the moisture in the cinnamon drying unit is an important task. The cooling unit is used to control the situation when the internal temperature rises. Here exhaust ventilation systems and fans are used. Using the Bluetooth data exchange module, the person can easily access the required information even from a distance. Features of this system can be obtained from the mobile phone. As a result of this process, the temperature and humidity in this system are automatically controlled without the intervention of people. The 75W bulb and 12V exhaust fan control the internal environment of the system by activating it. Internal activity can be observed from the outside. Those are shown by LCD and LED bulb systems.

V. Conclusion

The device has been successfully tested under simulated conditions and showed the ability to control temperature and humidity. This control system can control the environmental conditions of temperature and humidity in cinnamon storage. The use of this cinnamon drying and storage chamber allows for efficient and accurate drying and storage. In each case, the temperature and humidity in the chamber are measured, which automatically controls the action taken at that time. The communication is done correctly without any interference between the sensor and the Arduino UNO board. The System showed the capability of changing controlling parameters via Bluetooth notification. All the System functions are controlled automatically, so it is more advantageous and more efficient for industries. The result of this project helped to bring about a qualitative and quantitative change in cinnamon export.

VI. Recommendation and Future Work

The Bluetooth module transfers signal only for a very short distance. It is best to use the GSM or Wi-Fi module. A smart weight sensor can be used to calculate the weight of Cinnamon, and it can be easily mounted on a tray to compare wet and dry weight. Incorporate the recommended features so that you can get better results. A more appropriate information exchange system should be created to know information from anywhere and a control system. This system should be upgraded using solar panels. This system saves the wastage of Cinnamon and reduces human resources to monitor them physically in the smart drying chamber.

References

Bernard, D. et al. (2014) 'The Effect of Different Drying Methods on the Phytochemicals and Radical Scavenging Activity of Ceylon Cinnamon (Cinnamomum zeylanicum) Plant Parts', European Journal of Medicinal Plants, 4(11), pp. 1324–1335. doi: 10.9734/ejmp/2014/11990.

Chander, B. R. and Kumari, G. S. (2020) 'FOOD QUALITY MONITORING SYSTEM BY USING ARDUINO', 11(4), pp. 625–630. Chandra, K. A., Amarasinghe, A. D. U. S. and Walpolage, S. (2011) 'Performance Analysis of a Dryer Design for Drying Cinnamon Chips', pp. 362–367.

Das, T. K. and Das, Y. (2013) 'Design of A Room Temperature And Humidity Controller Using Fuzzy Logic', (11), pp. 86–97. Kalshetty, P. V. G. Y. R. (2017) 'Bluetooth Based Smart Automation System Using Android', International Journal of Science and Research (IJSR), 6(5), pp. 1003–1006. Available at: https://www.ijsr.net/archive/v6i5/3051709.pdf.

Kaushal, R. K. et al. (2019) 'Iot Based Smart Food Monitoring System', International Journal of Current Engineering and Scientific Research, 6(6), pp. 73–76. doi: 10.21276/ijcesr.2019.6.6.14.

Kwag, B. C. et al. (2019) 'Evaluation of effects of the humidity level-based auto-controlled centralized exhaust ventilation systems on thermal comfort of multi-family residential buildings in South Korea', Sustainability (Switzerland), 11(17). doi: 10.3390/su11174791.

Malik, N. and Bodwade, Y. (2017) 'Literature Review on Home Automation System', Ijarcce, 6(3), pp. 733–737. doi: 10.17148/ijarcce.2017.63173.

Riman, C. F. (2019) 'Cheap Bluetooth Solution for Smart Controlled Home Devices', Journal of Mechatronics and Robotics, 3(1), pp. 589–595. doi: 10.3844/jmrsp.2019.589.595.

Srivastava, D., Kesarwani, A. and Dubey, S. (2018) 'Measurement of Temperature and Humidity by using Arduino Tool and DHT11', International Research Journal of Engineering and Technology, 05(12), pp. 876–878.