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# Smart Solar Air Dryer for Arecanut

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**ABSTRACT**--The system consists of a solar collector, a drying chamber, and a fan to circulate air through the chamber. The solar collector absorbs the sun's energy and heats the air, which is then circulated through the drying chamber to dry the arecanuts. The dryer is designed to operate in a way that maximizes the use of solar energy and minimizes the loss of heat. The abstract provides an overview of the solar air dryer system and highlights its benefits, such as reduced energy costs and improved drying efficiency. It gives the design and development of automatic solar powered areca nut dryer used to remove the moisture content from areca nut. The drying is achieved by allowing the heat from heating coil with the help of exhaust fan. The areca nut is spreaded over the chamber and the heated air passed to extract the moisture from the Areca nut. Arduino UNO along with appropriate sensors are used to monitor and control the moisture content and temperature of the heating chamber. Based on the moisture content present in the areca nut the sensor sends the control signal to the controller. The prototype of the system is developed and powered using solar photovoltaic energy generated from 10W solar panel in conjunction with buck-boost converter and charge controller. The result will be good response in removing the initial moisture content without altering their nutritional values. solar drying is a potential decentralised thermal application for solar energy.

**KEYWORDS** - Solar drying, Arecanuts, Drying technology, Drying process, Agricultural drying, Solar energy, Heat transfer, Moisture content

## I. INTRODUCTION

A solar air dryer for arecanuts is a device that uses solar energy to dry arecanuts. Arecanuts are a type of fruit that is commonly grown in tropical regions, and they are used for their nut and leaf properties. The solar air dryer works by using a solar collector to capture the energy from the sun, which is then used to heat up air that is blown through the dryer. The heated air is circulated around the arecanuts, which are spread out on trays inside the dryer. As the air passes over the arecanuts, it absorbs the moisture from them, and then the moist air is expelled outside the dryer.

The use of a solar air dryer for arecanuts has several advantages over traditional drying methods. First, it is much more energy-efficient, as it uses only renewable solar energy instead of fossil fuels. Second, it is a more environmentally friendly method of drying, as it produces no emissions or pollutants. Finally, the solar air dryer can be used in remote areas where access to electricity or fuel may be limited. After drying of arecanut the evaporation and condensation process takes place and the condensed water comes out in the form of distilled water. The solar air dryer is a sustainable and cost-effective way to dry arecanuts using solar energy. Arecanut is a widely consumed product in many parts of the world, and it requires a dry environment to preserve its quality and taste.

Traditional drying methods involve exposing the arecanuts to direct sunlight or using artificial heat sources, which can be time-consuming and costly.

The solar air dryer offers a solution to these challenges by harnessing the sun's energy to dry the arecanuts. The system is designed to optimize the drying process by using a combination of solar collectors, a drying chamber, and a fan to circulate air. As the air is heated by the solar collector, it is circulated through the drying chamber, absorbing moisture from the arecanuts, and then expelled outside, creating a continuous flow of dry air.

## II. LITERATURE REVIEW

[1] Arecanut drying-In this paper Dr. Kennathj.hellevang has describe the amount of percentage of moisture present in the arecanut and also how much amount of percentage is required for suitable for long time storage and short time storage.

2] Design and construction of solar dryer for drying Agricultural Products-In this paper Prof. Praveen M Gupta has explained the performance of existing solar food dryers and still be improved upon especially in the aspect of reducing the drying time and probably storage of heat energy within the system.



3] Agricultural drying system-In this paper Dr. Drick E Mainer has described the different types of drying method used for drying agricultural products also how much amount of heat is safe for.

### **III. PROBLEM DEFINITION**

In India farmers faces lots of problems in farming in pre harvesting to post harvesting one of the problem is drying of arecanut properly and protect the arecanuts against fungus and to prevent moisture from the arecanut. If the drying is not done properly, the farmer will be in loss no matter how good the storage is. In the natural sun drying technique the space used for drying will be large and time consumption for drying will be also more.

### **IV. OBJECTIVES**

The main objective of this project is to reduce the time and produce hygienic and quality dried crop.

The objective of a solar air dryer for arecanut is to provide a sustainable, cost-effective, and efficient solution for drying arecanuts using solar energy. The specific objectives of this technology include:

To design a solar air dryer system that can effectively dry arecanuts while minimizing energy consumption and maximizing the use of solar energy.

To improve the quality of dried arecanuts by ensuring that the drying process is consistent and uniform, resulting in a product that is free from mold, fungi, or other contaminants.

To reduce the cost of arecanut drying by utilizing renewable energy sources such as solar power and reducing reliance on fossil fuels.

### **V. METHODOLOGY**

A simple solar powered automatic arecanut dryer is designed to dry the arecanut effectively and in a fast manner. The dryer has a simplistic architecture which makes assemble and disassemble of the parts easier. to determine the amount of arecanut that needs to be dried in a day. This will help in determining the capacity of the solar air dryer. Design the dryer: The design of the dryer will depend on the capacity required, the amount of sunlight available, and the climatic conditions of the location. The dryer can be designed as a simple cabinet or a box with a transparent cover to allow sunlight to enter.

Proper airflow is essential for effective drying. The dryer should be designed in such a way that air can circulate freely through the arecanut

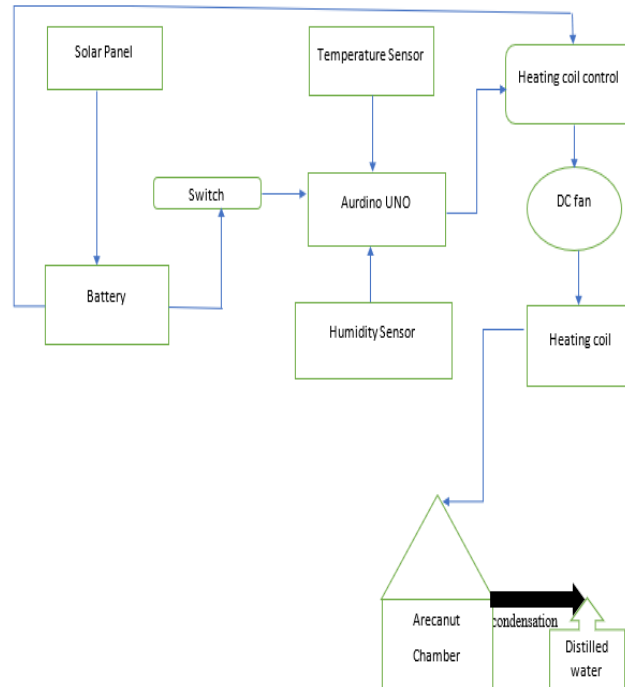
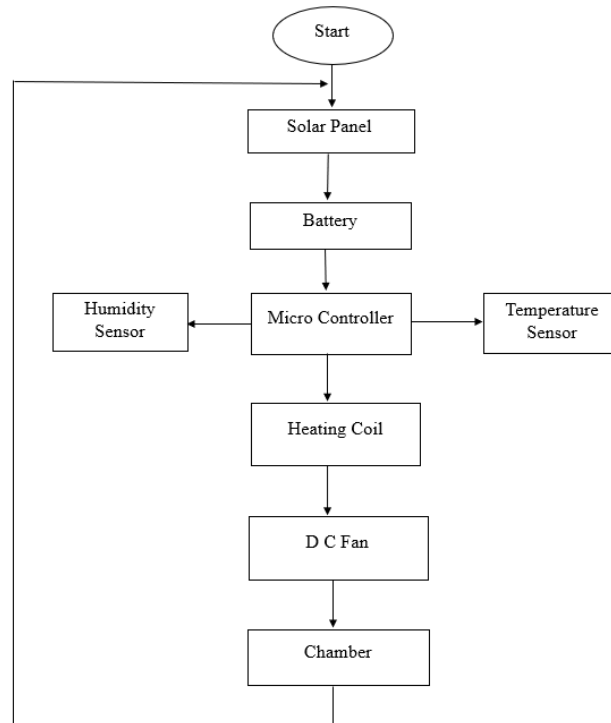


Fig. 1 Solar Air Dryer

The above figure shows the block diagram of the solar air dryer for arecanut. The solar panel collects the electricity and stored in the form of battery. Then the connection is given to the Arduino UNO. The Arduino UNO is connected to temperature and moisture sensor to measure the temperature of the room and moisture of the arecanut. Then through the Arduino the heating coil collector is used to heat the air. DC fan is connected to heat coil through which heat air enters the chamber. After drying of arecanut the evaporation and condensation process takes place and the condensed water comes out in the form of distilled water.



## VI. APPLICATIONS

- They can be used in food and fruit processing industries.
- Solar dryers are used to eliminate the moisture contents from crops, vegetables and other agri products.
- Solar dryer can be utilized for various purposes. They also find numerous applications in industries such as wood, textiles, agro-industries etc.
- The temperature inside the solar chamber dryer can be controlled by using microcontrollers like 8051, ARM, Arduino.
- The solar air dryer can also help farmers increase their crop yields and improve the quality of their arecanuts, leading to higher prices and increased profitability.
- The solar air dryer can be used in rural communities that lack access to electricity and other energy sources.
- The solar air dryer is an eco-friendly solution for drying arecanuts, as it uses renewable energy sources and produces no emissions or pollutants.
- Overall, the solar air dryer for arecanut has numerous applications that can benefit farmers, food processors, researchers, and rural communities, while also promoting sustainable and eco-friendly practices.

## VII. ADVANTAGES

- **Cost-effective:** The solar air dryer uses solar energy to dry arecanuts, reducing the cost of energy and making it an affordable and cost-effective solution for farmers.
- **Energy efficient:** The solar air dryer uses renewable energy sources, which reduces the dependency on non-renewable sources of energy such as electricity or fossil fuels.
- **Improved quality:** The solar air dryer ensures that arecanuts are dried uniformly, leading to a consistent quality product that is free from mold, fungi, or other contaminants.
- **Easy to use:** The solar air dryer is easy to operate and requires minimal maintenance. It can be built using local materials and can be easily adapted to local conditions.
- **Scalable:** The solar air dryer can be designed to fit the specific needs of different communities or industries.
- **Consistent drying:** The solar air dryer uses a controlled drying environment, which ensures that arecanuts are dried consistently and uniformly.



### **VIII.RESULT**

After the study we found tht the solar dryer gives more than three four times heat inside the chamber than that of the outside atmosphere temperature and in normal drying process it takes more than 15 days to dry the arecanut. But from our experiment of smart solar air dryer it is possible to dry the arecanut in 4 to 5 days under the good condition.

The results of using a solar air dryer for arecanut are promising. The solar air dryer has been shown to provide uniform and consistent drying of arecanuts, resulting in improved product quality and shelf life.

In this project by maintaining temperature and humidity we can control the moisture content of the arecanut.

Blackness of arecanut can be avoided.

Moisture content of the arecanut can be evoparted and condensed.then the condensed water can be used as a distilled water.

### **IX. CONCLUSION**

In conclusion, the solar air dryer for arecanut is a sustainable, cost-effective, and efficient solution for drying arecanuts using solar energy. It offers several advantages over traditional drying methods, including improved quality, energy efficiency, and environmental sustainability. The solar air dryer is easy to use, scalable, and can be adapted to different communities and industries. Its applications range from arecanut farming to food processing, research, and rural communities. The solar air dryer has the potential to revolutionize the arecanut industry by reducing costs, increasingprofitability,and promoting sustainable agricultural practices.

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