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Artificial Intelligence Assisted Solar Biomass Hybrid Dryer for Drying Cocoa

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ABSTRACT

This journal paper aims to design and fabrication of artificial intelligence assisted solar biomass hybrid dryer for drying cocoa. This work mainly concentrates on offering an authentic and reliable solution to the drying of cocoa beans. Commercially available solid edge software was used for designing the solar biomass hybrid dryer for drying cocoa. Based on the research and calculation, done the fabrication of solar biomass hybrid dryer for drying cocoa which aims to minimize manpower and time consumption in drying cocoa beans.

Keywords: Cocoa dryer, Hybrid dryer, Solar dryer, Biomass dryer, Ecofriendly.

I. INTRODUCTION

Cocoa beans are widely used in different areas for various applications such as supporting brain health, cure for diseases it acts as a good source of antioxidant, regulating cholesterol level in the blood and it helps for the prevention of skin cancer and diabetes and it is also mainly used for manufacturing of chocolates [1].

The traditional ways of drying cocoa seeds are two ways such as open air drying and solar roof heat drying. So this drying methods use to take 3 to 4 days for drying in open air drying and solar roof drying. There will be sudden changes in weather so it may affect the quality of cocoa beans. For good quality of cocoa seeds the moisture content should be maintained 5% to 7% [2]. In these methods of drying its difficult to maintain this moisture content level so, came across with the concept of making "artificial intelligence assisted solar biomass hybrid cocoa dryer for drying cocoa".

In this work, designed that if the weather changes it will not affect the cocoa seeds. We made a hybrid dryer it can dry cocoa seeds quickly by using simultaneously solar heat and biomass heat. So, it will reduce the time of drying and for maintaining the moisture content with the help of artificial intelligence to continuously check the moisture content in the seed. So, it will reduce labour for monitoring the drying of cocoa seeds and it will maintain the criteria and the quality of seeds will be good.

II. OBJECTIVES

To design and fabricate artificial intelligence assisted solar biomass hybrid cocoa dryer. To use artificial intelligence to maintain the moisture content to 5% to 8% which helps to maintain good quality cocoa beans. To reduce the time of cocoa drying. To improve the quality of cocoa beans and to reduce the labor cost. To

make an eco-friendly and economically reliable machine.

III. METHODS

In this methodology it's a process of project planning and executing where all the major and minor steps of the project either it may be logical or creative fabrication application steps are systematically explained. Methodology is one of the major components in project planning where all the possible elements and their results effects are relatively considered for the most appropriate and effective project management.

In the present work, collection of methods or practices done are as follows:

A. Literature Review

The journal papers are reviewed because to acknowledge and study the recent trends in the field of cocoa seeds drying process. Surveying of literature review helps us in easy understanding of the overall activities in our specific topic. It also helps us to implement further modification of work in our research.

B. Designing

Completely designed the model of the solar biomass hybrid dryer for drying cocoa by using solid edge software according to the actual dimensions as shown in fig.1, which was useful during the period of fabrication work. Fabrication work carried out according to the actual design and dimensions. Designing of any product or machine is an important. Because, each and every dimension that gives very significant. So, every part is interconnected to each other during the assembly. And used Arduino software to feed a program in the Node MCU board.

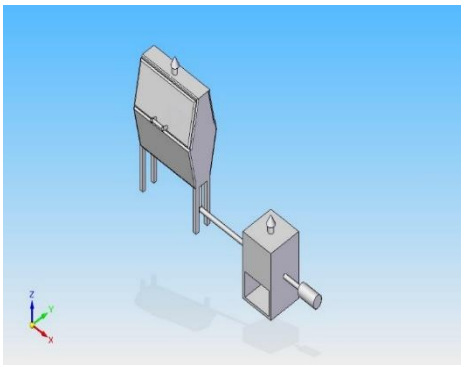

Fig. (1) CAD Model

Table1. Represents the design characteristics of artificial intelligence assisted solar biomass hybrid dryer for drying cocoa.

TABLE I

DESIGN CHARACTERISTICS

Metal Sheet	16-gauge metal sheet
Metal rod	Mild steel rod
Glass	Fiber glass
Pipe	Mild steel pipe
Blower type	Air blower 220v/600w
Control board	Node MCU
Moisture sensor	LM393 Moisture sensor
Temperature sensor	DS18B20 temperature sensor
Display	16*2 LCD display
Battery	5v/1a

C. Fabrication

Fabrication is a sequence of events which is done to create something from the scratch rather than just assembling it. In this fabrication work is the building of artificial intelligence assisted solar biomass hybrid dryer for drying cocoa from the scratch. Building each part individually and assembling or welding it together is the major goal of our project. Below figure shows different parts and assembled parts.

D. **Components**

Fig. (2) Dryer Chamber

Dryer Chamber

In this drying chamber kept cocoa inside the chamber as shown in fig.2. It has a capacity of drying one kilograms of cocoa seeds. Inside the chamber the moisture sensors and temperature sensors are placed and it sense the moisture content of the seeds and chamber temperature.

Fig. (3) Connecting Pipe

Connecting Pipe

This connecting pipe is connected with biomass chamber and dryer chamber. Fig.3 represents the connecting pipe which carry hot air from biomass chamber to the drying chamber.

Fig. (4) Biomass Chamber

Biomass Chamber

In this biomass chamber we burn biomass and it heats the pipe as represented in fig.4. The external air from blower it forces the heated pipe air towards the chamber. Biomass was used mainly for two reasons one is to dry cocoa seeds quickly and second reason is to use dryer in unseasonal time or in rainy seasons.

Fig. (5) Air blower

Air Blower

Fig.5 illustrates the Air blower is used to force the hot air towards the chamber. The specification of Air blower is of 220v/600w and it carries hot air in 30 miles/hour.

Fig. (6) Moisture sensor controller

Moisture Sensor Controller

In this the controller used is NODEMcu board. The program used is #c program and uploaded into the control board. The sensors used are LM393 Moisture sensor and DS18B20 temperature sensor. The moisture sensor senses the moisture content of the cocoa seeds and displays in the display and even the temperature is displayed of the inside chamber. The display used is 16*2 LCD display as shown in fig.6.

Fig. (7) Assembled Parts of Artificial intelligence assisted solar biomass hybrid dryer for drying cocoa

Assembled part

Figure.7 represents the complete assembly of the artificial intelligence assisted solar biomass hybrid dryer for drying cocoa.

IV. RESULTS AND DISCUSSION

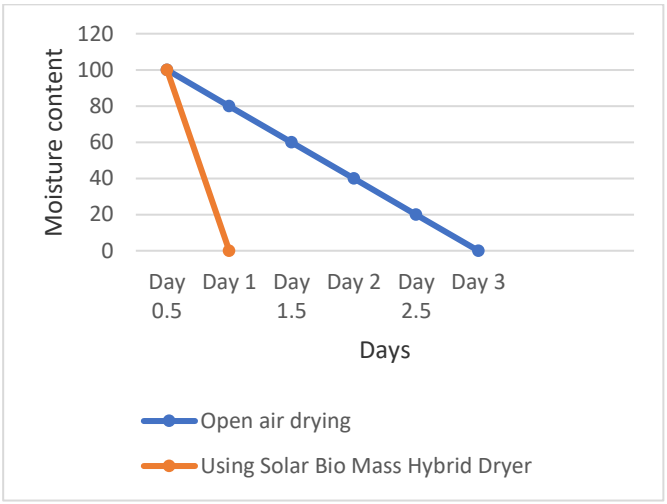

Fig. (7) Moisture V/S Days Graph

In Traditional method such as Open-Air Drying, it takes approximately 3 days to dry the cocoa seeds, whereas in the proposed method "Artificial Intelligence assisted solar Bio Mass Hybrid Dryer" takes 1 day for drying the same. Final aim of our project fabrication has successfully been completed. We have successfully conducted the test of our project and met required objectives.

Since it will reduce the time of cocoa drying and it will improve the quality of cocoa seeds from dust particles, it also reduces the labour cost. By using artificial intelligence, we can detect the moisture content 5% to 8% which results into obtain good quality of cocoa seeds. Less spoilage or less wastage of dried products. Better prices due to postponed market serve. Different value creation possible since dried products have higher margins. High hygienic standards (no dust, no pollution, no fungus, no animals, no foreign materials etc.)

The initial cost and maintenance for this project is high and drying process involves with some chemical reactions begins during foaming, which causes to a decrease in the sharpness, contracting and acidity of cocoa seeds

V. CONCLUSION

Artificial intelligence assisted solar biomass hybrid dryer for drying cocoa prototype was designed. Normally in open air it will take 3 to 4 days for drying cocoa seeds and it will get affected by the dust particle. By using artificial assisted solar biomass hybrid dryer for drying cocoa, get good quality of cocoa seeds by drying, reduce the time duration of 2 days and also, monitor the moisture content from the sensor controller. Other benefits include the ease of operation, no skilled manpower required for monitoring. Thus, during rainy season when sun radiation is low, can dry the cocoa seeds by burning bio-mass fuel. Therefore making the dryer use full in all-weather condition.

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