DESIGN MANUFACTURE A GRAIN DRYING MACHINE BASED ON PLTA

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ABSTRACT

Particularly in the Village of Pool, Percut Sei Tuan District, rice is one of the agricultural products, where the current season is uncertain which results in problems in drying rice/grain, although currently there are grain dryers with the help of heating from the combustion process which can cause air pollution. , and even then the tool is still rarely owned by the farmers. Therefore researchers want to design a grain dryer that can be used at any time, with the drying process using the conversion of electrical energy into heat as a producer of hot air and a more automatic tool using a hydroelectric power source as a source of electricity.

This PLTA-based grain dryer is controlled using a microcontroller with a diameter of 50 cm as a drying tube, and an air heater as a hot air generator. The grain in the drying tube will be stirred during the drying process with a vane-shaped stirrer, so that the grain can be evenly distributed during drying. The capacity of the tool is 1 – 3 kg, the drying time and also the drying temperature can be adjusted as needed. If the drying time setting has been met, the grain output door will open automatically with the help of a sliding door driven by a dc motor.

In the tool tests that have been carried out, the tool is able to reduce the average grain moisture content by up to 3.5% per hour, at a heating temperature setting of 40˚C - 50˚C and a capacity of 1 – 3 Kg. For the use of electric power in drying at this temperature is ± 0.25 KWh every 1 hour.

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INTRODUCTION

Pool Village, Sei Tuan Deli Serdang District, is located within the State of Indonesia. One of Indonesia's main agricultural products is rice, which is also the staple food of Indonesian society. Seasonal changes, which are currently uncertain, cause various problems in the community, one of which is rice farmers. Currently, the frequent rains during the day make rice farmers confused, because many farmers in Indonesia still use the traditional method of drying grain by drying it in the sun.

Drying grain in the traditional way has several drawbacks, namely, it requires a large area for drying grain, drying using sunlight is not right, because currently it often rains during the day making rice farmers who dry their grain in the traditional way have difficulty drying grain. during the day, if it is drying the grain and it rains, the farmers must immediately clean up the grain and that requires a lot of energy.

The purpose of this research is to make a grain dryer that uses hydropower and is more automatic and utilizes the heat obtained from the conversion of electrical energy into heat by using a heating element (heater). Because traditional drying of grain using sunlight is considered inefficient because it requires a large area and it also rains frequently, as well as the use of burning coals which is also considered inefficient because the combustion process will cause air pollution.

In order for the writing of the results of this research to work properly and become clear, it is necessary to limit the scope of the study, including:

1) Making tools in the form of prototypes with a capacity of 1-3 kg of clean grain.
2) Heater / heater as a producer of hot air.
3) Microcontroller as a control unit.
4) Timer as a drying time limit.
5) AC motor, 90 watts, 1300 rpm, with 1:25 gearbox ratio as mixer.
6) Determination of the water content is done manually and is done when the grain enters and exits the dryer.

DESIGN METHOD

2.1 Mechanical Components

1)Induction Motors

The AC gearbox motor acts as a propeller drive to stir the grain in the tube. In the design of this grain dryer prototype using a single phase induction motor

Figure 1. Single phase induction motor

with

Variable speed control 1 phase AC motor gearbox HOULE 220V 15W ... dynamo 5 hp 1 phase 1400 rpm / induction motor 5 pk 1 phase / Dinamo.

$$HP = \frac{T \times n}{5250} \qquad T = \frac{5250 \,.\, HP}{n} \qquad n = \frac{5250 \,.\, HP}{T}$$

Dimana :

T = Torsi motor (dalam lb ft)

n = kecepatan putar motor (rpm)

HP = Daya kuda motor (HP = 746 watt)

5250 = Konstan

2)DC Motors
automatic. Using a DC gearbox motor, brand Pittman, Type GM8712G569, with an input voltage of 24 VDC, with a gearbox ratio of 582:1, with a gearbox motor speed of 14 rpm.

Figure 2. DC motors

3) Tool Concept
The prototype grain dryer is designed like a tube, as shown below:

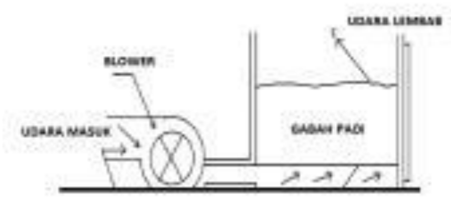

Figure 3.The Concept of Grain Dryer.

The tube body uses a 3mm plate, the legs support leg using elbow 40 (L40). The stirrer functions to change the position of the grain in the tube, the mixer drives using an AC gearbox motor, with a pulley diameter of 50 mm, with a ratio of 1:1 between the motor pulley and the axle axle pulley. The heating tube is where the heater produces heat, the fan functions to transfer hot air from the heating tube to the grain drying tube. The air outlet chimney is where the air comes out as well as the place to place the humidity sensor. The output chimney is the place where the grain comes out after it is dry and there is a sliding door which is driven by a DC motor. The DC motor is used as a driving force for the door of the output path/out of the grain from the tube, in a way

2.2 Electrical Components
1) Air Heating Element (Heater)
The heating element here acts as a producer of hot air which will be placed on the heating tube. Working voltage of 220 VAC and 500 watts of power.

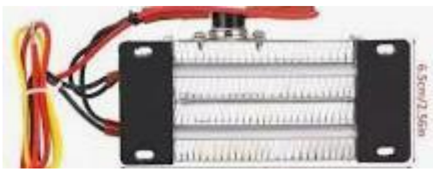

Figure 4 Air heating elements

2)Digital Thermostat

Digital thermostat is a thermostat module that works by means of a digital system that has a probe as a sensor. Its function is to stabilize and measure temperature and if the temperature is in accordance with the set temperature, the relay will be active or deactivated, depending on the mode that is set (as heating or cooling mode). This thermostat requires a voltage of 12 volts DC to work.

Figure 5. Digital thermostat

Later the temperature sensor will be placed in front of the heater in the heating tube. Serves to regulate the heating temperature in the grain dryer, which can be set to the temperature requirements required in the drying process.

3) Sunon DP200A fan

In this grain dryer, the fan acts as a tool to distribute heat from the heating tube to the grain drying tube. Working voltage 220 VAC, and current 0.14 A.

Figure 6. Fan

4) AT8N timers

The timer here is used to set the length of the drying process in the grain dryer to be designed. Plays a role for input in the PLC in the control circuit of the device. Operates on 220 VAC voltage

Figure 7. Timers

5) Power Supply (Power Supply)

Power supply is an electronic device that is used as a source of power for other devices, especially electric power. Basically a power supply is not just a device that produces electrical energy, but there are several power supplies that produce mechanical energy and other energy.

Figure 8. Power Supply

6. Water turbine
A water turbine is a rotating machine that extracts kinetic energy from flowing water. Inside view of Kaplan Turbine and power generator. Water turbine.

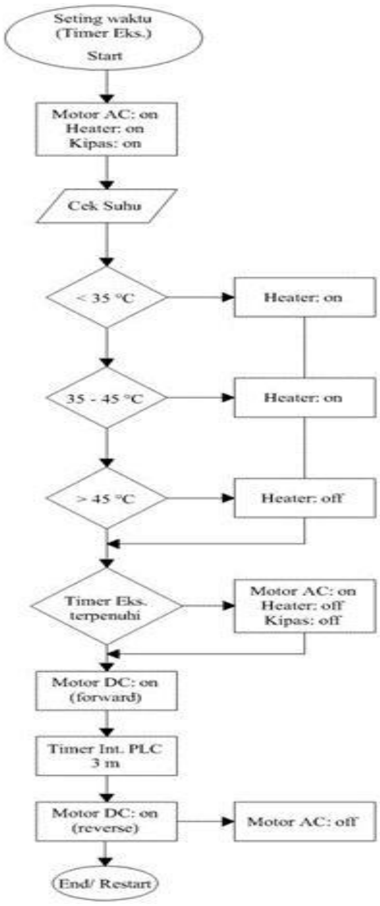

Figure 9. Flow chart of how the Grain Dryer works

2.3 Method of Analysis

1) Moisture Analysis Method

In SNI 6128: 2008, the determination of water content is carried out by the "Air Oven Method" (AOAC, 2006), or by an electronic moisture tester that has been calibrated with an oven standard. Determination of water content in the oven method (Air Oven Method):

a) A sample of 5 grams of rice is weighed in a cup whose fixed weight is known;

b) Then dried in an oven cup at 105⁰C for 3 hours or until the weight remains constant;

c) Stored in a desiccator, weighed after cooling;

d) The water content of rice is calculated as % mass fraction.

Main Features of Rice Grain Moisture Meter JV-002S:

Moisture meter for rice, paddy LCD display. Weight measurement and automatic temperature compensation.

$$\text{Kadar Air Beras} = ((B - C)/D) \times 100\% \quad (2.3)$$

Information:

A = Weight of cup

B = Sample weight + cup

C = Weight of dry sample + cup

From equation 2.3 above it can be simplified as follows:

$$\text{Kag} = \frac{Mg\ 1 - Mg\ 2}{Mg\ 1} x\ 100\% \quad (2.4)$$

Information :

Kag = grain moisture content (%)

Mg 1 = mass of grain (sample) before drying

Mg 2=gab mass (sample) after drying

2) Drying Rate Analysis Method

Drying rate is the decrease in grain moisture content per unit time. This is done by measuring the water content every 1 hour interval.

$$\text{LP} = \frac{Ka\ Mg\ in - Ka\ Mg\ out}{t} \quad (2.5)$$

Information :

LP = Drying Rate per Hour (%/ hour)

Ka Mg in = Moisture content of grain before drying (%)

Ka Mg out = grain water content after drying (%)

t = time needed to reduce the water content (hours).

3) Drying Cost Analysis Method

Analysis of drying costs is the product of the power of the equipment during drying (Kwh) multiplied by the price per Kwh (Rp/Kwh)

Bx% = (PP x CoshKwh) /(Mg in) (3.1)

Information:
B x% = Drying cost (Rp/Kg)
PP= Total power of the appliance during drying (Kwh) Costkwh= Price of electricity (Rp/Kwh)
Mg in = Mass of dried grain (Kg)

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RESULT.

3.1. Minimum Hardware And Software Requirements

A system will run optimally if the system is run with minimum hardware and software. This is because each designed system requires different hardware and software specifications in order to function optimally. The hardware and software requirements to be able to run the "Coconut Climbing Robot Using Voice Commands" are as follows.

3.2.Implementation

After all required systems that have been prepared have been fulfilled, the next step is to implement and build the system that will be created.

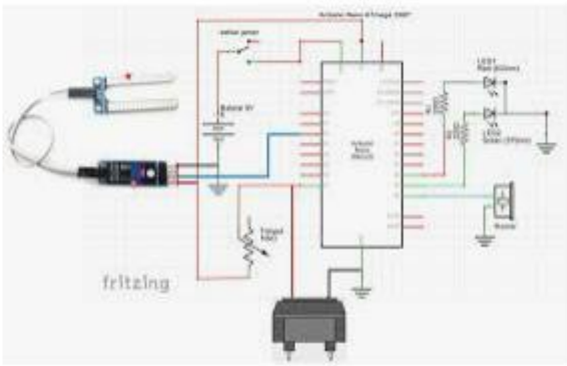

Figure 10. Coconut Climber Robot Test Results

Figure 11. Results of the planning of the Coconut Climber Robot Tool with Voice Command

CONCLUSION.

1. To turn on the Coconut Climber Robot using voice commands by connecting Bluetooth to an Android smartphone and no need to reach for the switch.
2. The Coconut Climber Robot used uses an electricity supply instead of the existing PLN electricity.

Control of the Coconut Climber Robot will not work if the Android smartphone is outside the range of the Bluetooth wireless transmission from the Bluetooth module

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