CONCEPTUAL DEVELOPMENT OF DOMESTIC GRAIN DRYER

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***Abstract*:**
This project intent to design and develop the concept of the domestic grain dryer which used to remove the moisture content from grain. The drying is achieved by allowing the heat from heat chamber to flow though the treys placed in dryer cabinet with the help of exhaust fan present in the heat chamber. The grains are layered evenly in the trays through which the heated air is passed to extract the moisture from the grains. The appropriate sensors are used to monitor and control the moisture content and air temperature of the cabinet. Based on the inside temperature present in the cabinet, the sensor sends the control signal to the controller. Thus, the constant desired temperature is maintained using control system.

***Index Terms*:** Conceptual Development, Domestic Grain Dryer, Solar Power, Grain Drying, Agriculture Engineering.

I. INTRODUCTION

Drying is the process of removing the moisture content from the grains of the crops after they have been harvested[1]. Also we can say that, Drying is proses to maintain the quality of grain during storage to prevent the growth of bacteria and fungi and the development of insects and mites. After harvesting grains usually contain about 25 to 30% moisture content which is not ideal to store them. Because the safe moisture content for cereal grains is usually 12 to 14% on wet basis. So It is important to dry grains as soon as possible after harvesting ideally within 24 hours.There is need to have some measures that can solve the grain drying problem using renewable energy making it eco-friendly and economical[2].

Once a year, India produces roughly 260 million tonnes of food grains. 95 million tonnes of wheat and 105 million tonnes of corn are the primary components of production. 18 million tonnes of pulses and grains, as well as tonnes of rice. This may rise as a result of agricultural technical advancements and the development of high-yielding varietals. During the post-harvest procedure, an average of 10% of the crop is wasted[3].

II. LITERATURE REVIEW

1. Grain drying -: In this paper Dr. Kenneth j. hellevang (Extension Agriculture Engineer) has describe the amount of percentage of moisture content present in the grain also how much amount of percentage is required for suitable for long time storage and short time storage[4].

2. Design and Construction of Solar Dryer for Drying Agricultural Products - in this paper Prof. Pravin M. Gupta (Mar. 2017) 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[5].

3. Grain drying system - in this paper Dr. Drick E. Mainer has described the different types of drying method used for drying grains also how much amount of heat is safe for grains[6].

4. Automatic control for maintaining equilibrium, temperature/moisture between stored grain and atmosphere - Sylvester L. Steffen[7].

5. In-Bin controlled atmosphere, grain drying system – James R. Hotovy: -
In this research paper we have studied the proper amount of moisture is required for grains. One of the prime objects of the present invention is to design a drying system of the type described which, with but a single slide gate mechanism, essentially spans a recycle duct portion and an inlet air duct portion, and directly proportions the volume of recirculate air and ambient air being supplied to achieve the desired level of relative humidity in the bin. Another object of the invention is to design a system of the character described wherein the temperature of the recycled air is employed to warm the outside air being admitted, when the outside air is relatively cooler, to thereby decrease the load on the burner used to warm the drying air flow, and effect an energy savings which is important in cooler clime[8].

III .CONCEPTUAL WORKING OF DOMESTIC GRAIN DRYER -

Mainly working concept of our design about grain dryer can be divided into three part which is –

1 Power system
2 Cabinet system
3 Control system

POWER SYSTEM

Our system uses solar energy as a source of it's power, in order to run the system. But solar generate electricity according to intensity of sun so overcome this problem we use MPPT which is connected to the solar panel varies the ratio between the voltage and current delivered to the battery. In this way battery charged by solar panel. If solar panel absent then battery charging takes place through the electrical unit[8].

CABINET SYSTEM

The dryer consists of a cupboard containing trays during which the grains to be dried are spread. After the grains are loaded, the cabinet is closed and heated air of about required temperature and blown across the grains. Drying start from the bottom of the grain bin where the drying air enters the grain. drying progresses upward within the direction of aviation which is from rock bottom upward. The greater the air flow

Drying starts at rock bottom of the bin, which is that the first place air contact. The dry air is mentioned by the fan through a layer of wet grain. Cooling of grain after drying is important; high temperatures can spoil the grain. To cool, close up the heater and permit the fan to work until the grain is cooled to within 100 F of out of doors air.

CONTROL SYSTEM

The design uses a microcontroller and a temperature sensor to monitor and control the temperature of a cabinet. The temperature sensor will sense the surrounding temperature inside the cabinets and communicates with the microcontroller. If the measured value is less than the desired value, the heater will be automatically triggered ON to warm up the temperature. The system responds by turning ON and OFF of heater automatically depending on the temperature difference.

Two humidity sensors are used, one at inlet of fan housing and other inside the cabinet to sense the humidity. Timer is used to switch off the fan and heater after running specified amount of time. The time is set according to the calculation done for respective moisture content of grain and capacity.

IV. DIAGRAM –

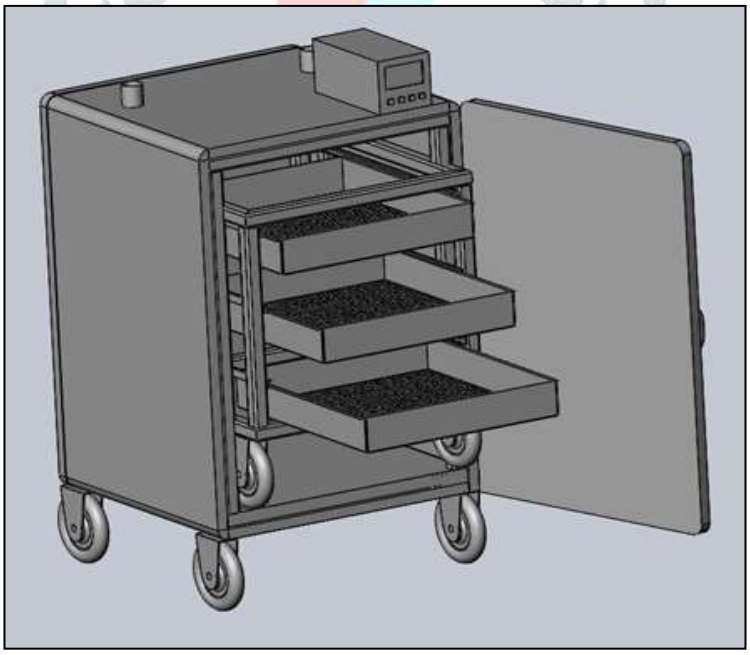

Figure 1: Isometric view of grain dryer

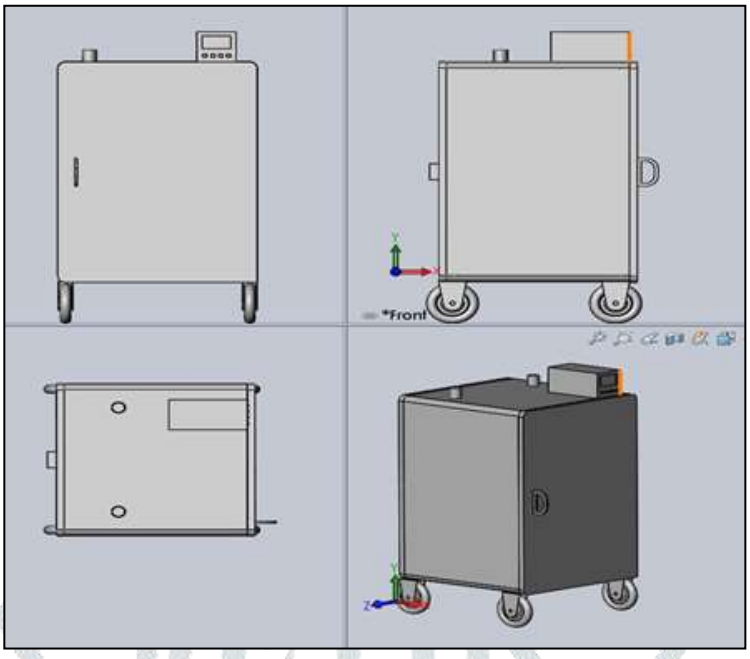

Figure 2: Orthographic view of grain dryer

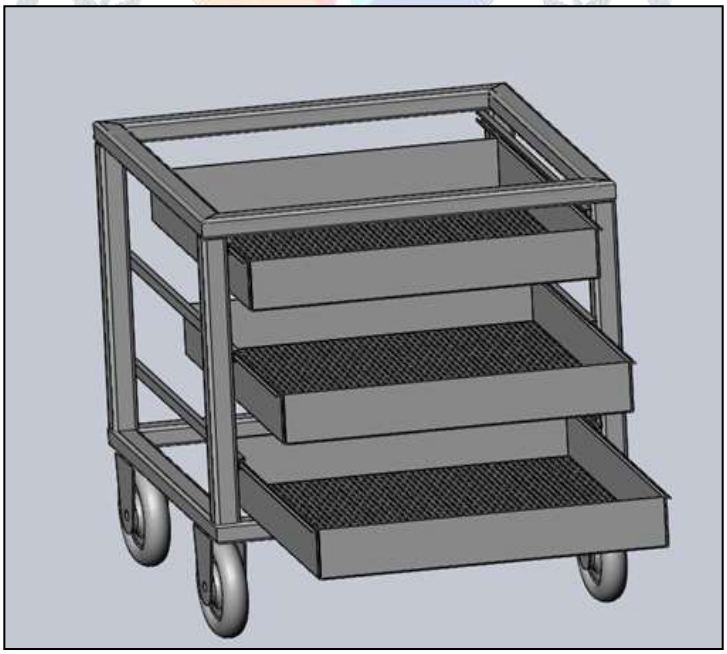

Figure 3: Trays of grain dryer

V EXPECTED OUTCOME

- Moisture Removal : It is expected that the dryer should be run effectively and to succeed in achieving the desired moisture content
- It should complete the process within stipulated time.

- The dryer should maintain consistent temperature which is desired. The desired air temperature and relative humidity
- It is expected to maintain the desired condition so as to avoid the cracking of grain sample due to over drying resulting from rise in temperature

VI CONCLUSION –

1. Grain drying is very important because it increases the storage life of grains. Sun drying method has a lot of deficiencies in terms of drying speed, efficiency, productivity, quality and safety. The improved design takes care of most of these problems.

2. The heater supplies the right quantity of heat and incorporates a fan to distribute this heat evenly to all grains in the drying chamber. Fire hazards are reduced owing to the use of gas in the some of the grain dryer design. We recommend this design for small scale farming where quantity of grain to be dried is not very large.

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