DESIGN AND DEVELOPMENT OF SOLAR POWERED AUTOMATIC GRAIN DRYER FOR STORAGE

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Abstract:

This paper presents the design and development of an automatic solar powered grain dryer used to remove the moisture content from grains, post harvesting. The drying is achieved by allowing the heat from heat chamber to flow on to the conveyor belt with the help of exhaust fans present in the heat chamber. The grains are layered evenly on the conveyer belts upon which the heated air is passed to extract the moisture from the grains. Arduino Uno (ATmega328P) along with the appropriate sensors are used to monitor and control the moisture content, speed of the motor and temperature of the heating chamber.

Keywords: Arduino Uno, charge controller circuit, conveyer belts, DHT11, heating Chamber, L298n motor driver IC, moisture content, moisture sensor

Introduction:

India being a predominately agriculturally based country, where in 70% of the populationare farmers and practice agriculture for a living, technological advancement should improvise in order to reduce the work load of a farmer and make their work more mechanized and easier.
Agriculture serves to be the backbone of Indian economy. It is very important to improve the efficiency and productivity of agriculture by simultaneously providing safe cultivation to the farmers. Drying is the process of removing the moisture content from the grains of the crops afterthey have been harvested, after harvesting grains usually contain about 25 to 30% moisture contentwhich is not ideal to store them as they may led to discoloration, spoilage, encourage development of melds, and increase the likelihood of attack from pests. It may lead to decrease the germinationrate in case of rice seed. Hence, it is important to dry grains as soon as possible after harvesting—ideally within 24 hours. Delays in drying, incomplete drying or ineffective drying will reduce grainquality and result in losses.

There are plenty of applications using automatic grain dryer. The crops can be harvested at any time of the year and be stored for a long period of time. Drying the grains to the optimum value of moisture content will increases the shelf life of the grain

tremendously. The burden and work load on the farmers will be reduced drastically and they can utilize this time elsewhere. Usingan automated system of drying, the drying process can be completed within few hours. Paddy contains about 25-30% of moisture content after it is been harvested. To preserve/store them for alonger time, they need to be dried to 14% of moisture. It also reduces harvesting losses, including head shattering and cracked kernels. Further it helps in reducing the dependency on weather conditions for harvest and drying. Which in turn allows the farmer to spend more time on other activities postharvest.

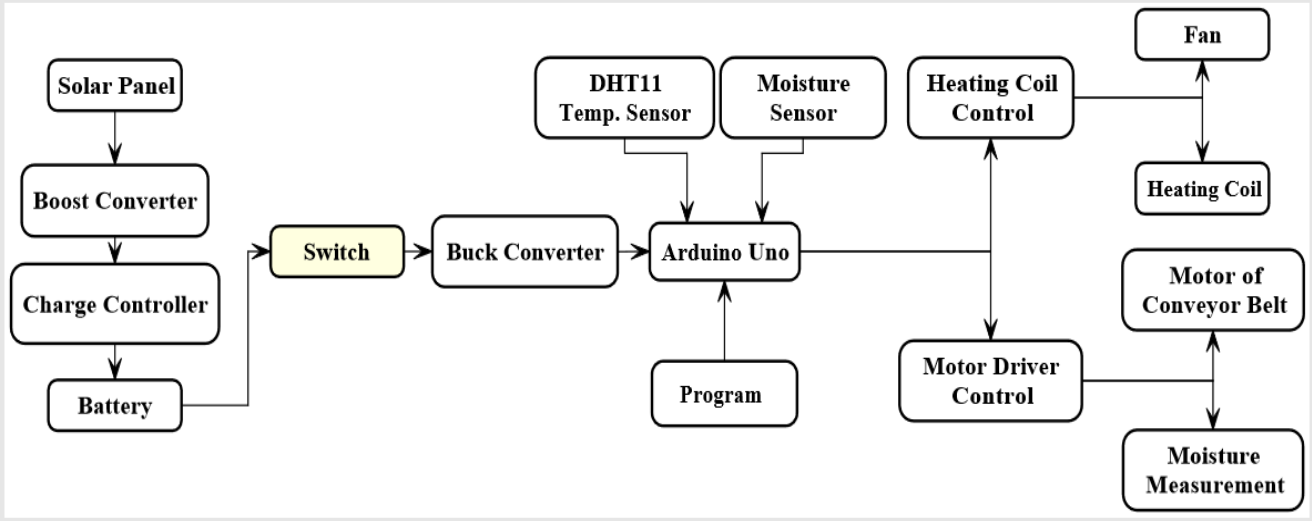
Objective:

The main objective of this paper is to make the work of farmers easy, faster and highly efficient in grain drying, post-harvest for storage. The designed mechanism takes less time to dryup grain using solar photovoltaic based drying as compared to traditional drying process. It also aims to reduce intensive labor experienced by the farmers. The purpose of storage is to provide the dried grain with protection against insects, molds, rodents and birds, and to prevent moisture from re-entering the grain. But, if the drying is not doneproperly, there will be losses no matter how good the storage. Time has always been the greatest enemy and shortage of time has led to many problems faced by every individual on this planet. In order to reduce the time of the farmer post-harvest, the proposed idea is been implemented. Technological advancements have brought about a lot of changes in our day-to-day life and we have been immensely grateful for that similarly, the agricultural sector has been growing everyday either in its production or in the technological as pact.

Methodology:

The **components** used to solve the problem includes the following: solar panel, buck boost converter, charge controller circuit, Johnson DC geared motor (10rpm), Arduino Uno, temperature and humidity sensor (DHT11), moisture sensor, 5V dual channel relay, L298N H Bridge motor driver circuit, heating elements, DC fans, Conveyer belts, bread board and jumper wires.

Working: A simple, solar powered automatic grain dryer is designed to dry the grains effectively andin a fast manner. The functional block diagram of the dryer is shown in Figure Working of each block is explained in this section. The power circuit system comprises of solar panel, controller, battery charging circuit and battery. The Solar Panel will provide electricity to charge the battery during day time, which in turn is used to power the system. The charging of the battery is controlled by a solar charge controller. DHT11 temperature and humidity sensor they will measure both the humidity and temperature. Geared DC motors can be defined as an extension of DC motor which already had its Insightdetails demystified here. A geared DC Motor has a gear assembly attached to the motor. Battery (electricity), an array of electrochemical cells for electricity storage, either individually linked or individually linked and housed in a single unit.

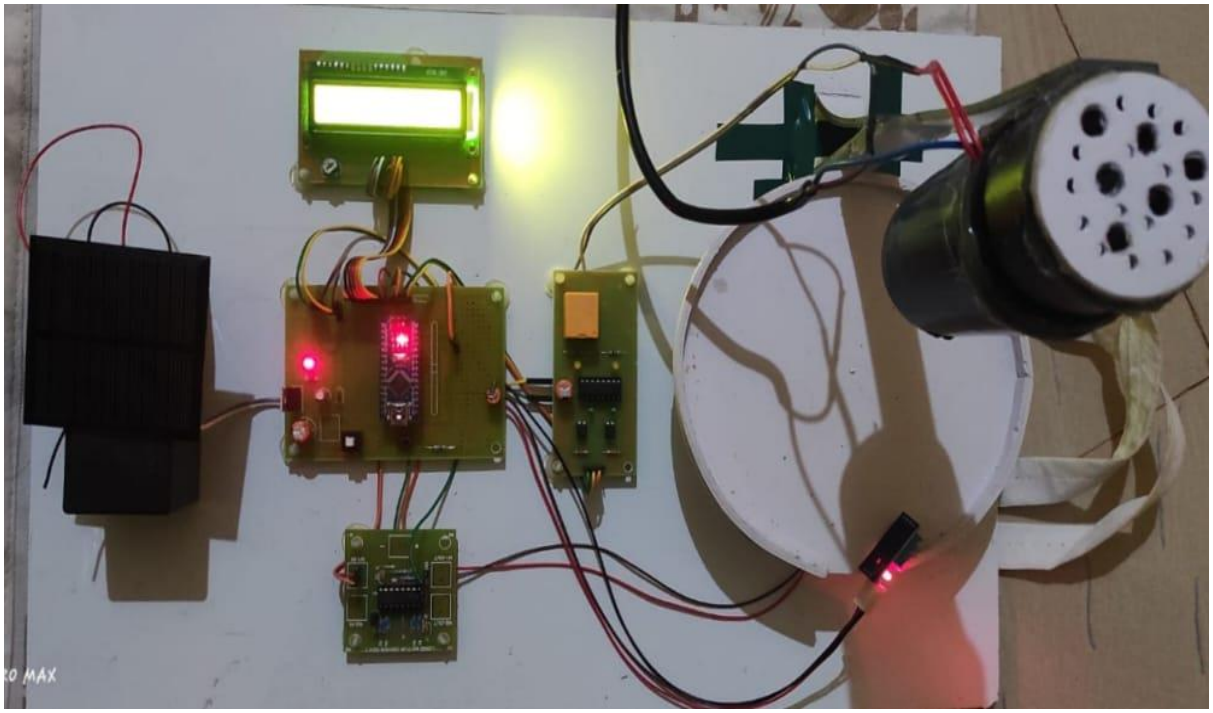


Result and Conclusion:

The proposed project demonstrates how the grains after harvesting can be dried easily without any hassle and time delay. The model gave a fairly good idea of the how the system can be implemented on a larger scale keeping the same idea and prospectus in mind. In addition to thetimesaving aspect of the farmers, it also shows how the technologically advanced controlling action, where each aspect of the grain is measured and controlled to give accurate and effective results. The proposed system is portable and handy to use and does not require any expertise on the operation as everything works automatically. The system is most suited for small and mediumscale farmers who don't have the accessibility to use technologically advanced expensive dryers. The work of the farmer is eliminated as he does not have to spread the grains across huge landfillsto dry them under the sun. The drying process can be completed within few hours in this system.

Keeping the present temperature of Bangalore in mind, the output of the solar panel is goodand it could achieve up to10V, by using boost converter at the output has reached the voltage up to 30V DC with 1 amp current.

The initial cost and the running cost of the proposed system is very less as all the components usedare very cost effective and are readily available. The developed system can be use dot dry grains such as wheat, paddy, lentils, ragi, millets, corn and coffee.



Scope for future work:

Being a portable prototype model, this project needs to be implemented on a larger scalekeeping the same aspects in mind, so that the project can be proven effective in a real world situation.

A designated area can be allotted to a village where in this larger project system is fixedand implemented, so that all the farmers can gather at a particular place and dry their grains effectively. The moisture sensor used is a simple Arduino compatible soil moisture sensor, thereare few grains Moisture meters available in the market which are expensive, such grain moisturemeters can be implemented in the future. To have a better heating system, a heating chamber canbe designed where in heating coils are with large capacity DC fans, to dry the grains much faster