

Automation of Grain Storage in India

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Abstract—Automation is the state of the art of modern day's technology. With the application of automation in grain storage system in India, the losses incurred every year can be minimized to a quite low extent. At present grains are stored in sheds which are kept open most of the time for their aeration. Aeration is important for grains as a rise in humidity or temperature in the climate where they are stored can lead to their infestation. However this system of aeration also causes damage to the grains as they are prone to the attack by rats, birds, insects etc. This paper proposes a model of solar energized automated grain storage system which is equipped with defense mechanism against attack by rodents. Utilizing solar energy can save lots of power consumption and is also reliable source of energy in tropical regions. In country like India where huge quantity of grains are wasted every year due to inefficient storage mechanism, this model can bring desirable changes in the future.

1. INTRODUCTION

India ranks 55 in the Global hunger index (GHI). With such a ranking worldwide it is a sin to let our food grains get wasted. Grain storage is a very important and tedious task. It requires constant inspection of the climate where they are stored for long period of time. The climate should be dry otherwise infestation can take place in grain. At present most of activities involved in storage and maintenance of grains are done manually. Our country not only faces shortage of storage houses but shortage of labor is also a problem. All these factors leads to huge loss of grains every year. Grains are stored in sheds which are kept open for aeration. This causes exposure of grains to the attack of birds, rats, insects etc. The bags in which grains are packed get damaged by such attacks and hence it results in increase of expenditure and degradation of quality of grains.

Sensing of climatic condition at proper stage of grain storage can save the grain from deterioration. Humidity and temperature are the factors which affect the grain. Undesirable combination of humidity, temperature and pests in the environment can lead to potential damage.



Fig. 1. Grain storage shed kept open for aeration

Through aeration of grains proper climate inside the storage sheds can be restored. The rate of air flow of [12] $6(\text{m}^3/\text{hr})/\text{tonne}$ must continuously operate in the storage shed. High-airflow forced aeration can maintain the stored grain in a condition which prevents immediate damage and it normally contributes to much improved storability.

2. LITERATURE REVIEW

Lots of research work has been done over storage of food grains. Effect of [4] humidity and temperature has been studied with different framework. Sensors such as [6] MG811 which is a CO_2 gas sensor is used for sensing the germination of grains in storage house. [7] Electronic-nose has been developed to sense the spoilage of grains on the basis of odor. Controllers such as [5] fuzzy logic and [4] distributed control system has been used to control different mechanism like opening of window or switching on the refrigeration system. [3] Wireless technology such as Bluetooth and ZigBee has been used to receive data from grain storage. Concepts of [8] nanoware houses has been proposed for effective distribution and management of grains throughout the country.

Proposed model

There is a need to automate the functioning of grain storages in India. With the use of sensor technology regular update regarding the temperature and relative humidity of the environment can be obtained and on the basis of that a controller can start the aeration of grains. The grains are

aerated in the closed sheds with automatic window, fans and exhaust fans. For proper ventilation inside a room the position of window and exhaust fan should be opposite to each other such that the window is at a lower level and the exhaust fan is near the ceiling so that cool air can rush inside and warm air can be expelled out of the room. There is a motion sensor mounted outside the window such that if any unwanted element tries to enter the room through the window, the controller triggers the defense system. The defense system mentioned here is a circuit designed on the basis of [1] “transcutaneous electric nerve stimulator (TENS)” which is used in medical application for stimulation of nerve cells by mild electric shock. This circuit can also be used to give powerful shock by using powerful transformer in its circuit.

The rods of the window is connected with wires coming out of the defense circuit and as the motion is detected near the window, current is released in its rods. There is a GSM module which is interfaced with the controller in order to send updates of all these activities through SMS to the manager of the grain storage shed.

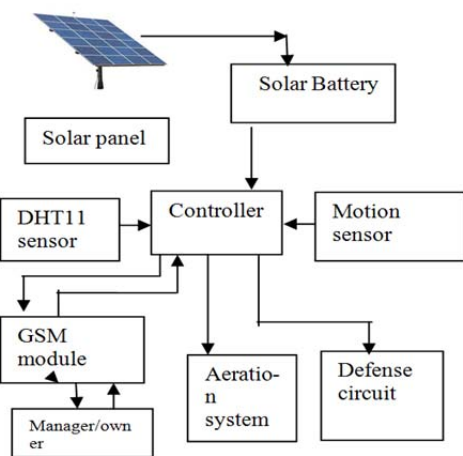


Fig. 2. Block diagram of proposed model.

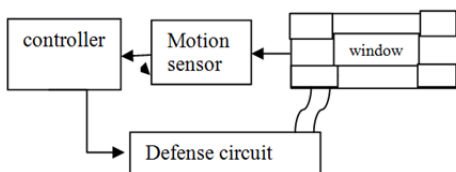


Fig. 3: Block diagram to show working of defense mechanism against rodents

There is a need of continuous power supply for all these functioning which should be derived through solar energy. There is enough space on roofs of sheds for mounting the solar panel. Using the solar energy for these purposes not only saves the grid power but also the roof space is effectively utilized. Mounting of solar panels on the roofs of sheds can also help to

reduce heating of roof top thereby indirectly controlling the temperature of sheds. The tropical climate of India is suitable for harnessing solar energy and hence this energy source must be utilized.

Aeration system

The aeration system consists of exhaust fan, normal fans and window. With detection of rise in humidity or temperature, the controller actuates the fans and window through relay. DC motors are used to run the fan and open the window automatically by controller. A motor driver IC is used for controlling more than two motors simultaneously in either direction.

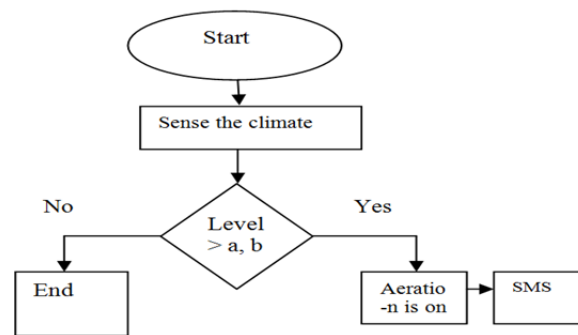


Fig. 4: Flow chart for aeration.

Defense system

The defense circuit is designed same as TENS[12] circuit. It consists of CMOS 555timer for generating a brief pulse to a miniature transformer. The transformer makes a parallel resonator circuit with 4.7 nf capacitor. The resonance leads to an increase in the output voltage. The potentiometer is used to adjust the pulse width and is connected with an on-off switch. Wider the pulse higher is the output voltage.

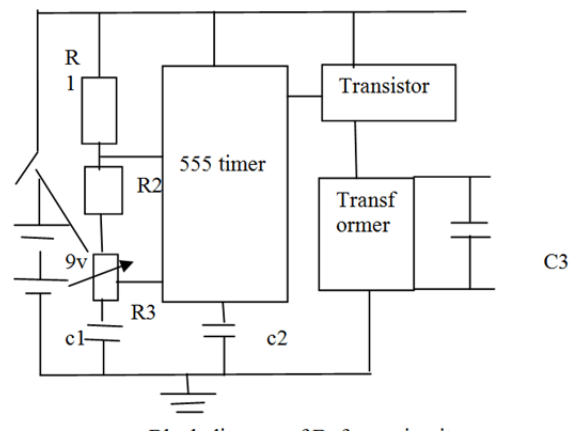


Fig. 5: Block diagram of Defense circuit

3. CONCLUSION

The proposed model is desirable in the country like India where millions of people are below poverty line and are not able to meet the daily requirement of food. With such a huge population there is tremendous pressure over conventional energy resources which will keep declining day by day. Therefore power consumption for such activities must be utilized from renewable sources such as solar energy, wind energy, biofuels or hybrid of all these resources. Use of Current technologies such as sensor technology, wireless networks etc. must be employed for getting better results. There is a need to merge the available technologies to make the traditional system of grain storage house an advanced storage system

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