International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 03 | Mar-2018 www.irjet.net p-ISSN: 2395-0072

Temperature Conditioning for Solar Dryer

Kumbhar B.A.[1], Mote P.S. [2], Dr. Vibhute A.S.[3]

[1,2] *SVERI's college of Engineering Pandharpur*
[3] *Professor, Dept. of Electronics &Telecommunication Engineering, SVERI's college of Engineering Pandharpur, Maharashtra, India.*

Abstract –*Solar drying is renewable and environmentally friendly technology. Solar drying is an advancement of natural sun drying. Nowadays drying fruits and vegetables have great attention and there are various methods of drying fruits, vegetables such as dehydration, canning etc. due this the quality of such product is degraded so solar dryer is used to avoid wastage, increase the productivity of agricultural, also the production in terms of quality and quantity*

***Key Words*: Microcontroller, Sensor, Foldable Solar Dryer, LCD Display.**

1.INTRODUCTION

Usually the Sun is the source of energy. Sun drying is the process where directly sun radiations come in contact with the things which are going to dry such as drying of grapes, different vegetables, fruit vegetables, fruits. As in sun drying process if heat will increase then it will affects on the product quality such as color of that product get changed also it takes more time for drying, large investment as well as space due to these all problems, productivity get reduced and that badly affects on the agricultural progress so to avoid these all problems we go for solar dryer. In solar dryer the temperature of product increased by direct absorption of solar radiation. The temperature in the solar dryer is higher than sun drying and this reduces the drying time and improves the quality of product. But in different seasons there is problem of temperature means we didn't get required heat for drying any product. It means there is problem of maintaining the constant temperature according to above mentioned products. There is no facility of automatic temperature conditioning so we designed hardware for this. In this we maintain the different temperature ranges as per the product and this temperature is adjusted depending upon the moisture contents. Drying of product is identified by measuring the weight of respective product using sensor. If once drying process will complete then it must give an alarm that indicates drying process has completed.

2. METHODOLOGY

The design used for fruit drying chamber needs the temperature to be maintained constant throughout the drying chamber and also removal of moisture content from the fruit. Solar energy is utilized for dehydrating the fruits. Over drying and under drying are harmful for agricultural products [1].

Figure-1: Foldable Solar Dryer

The shape of foldable solar dryer is rectangular at a base and triangular at top. The solar radiations are absorbed by black metallic outer surface of dryer. Heat is absorbed by inside air through conducting metallic plates which is placed on dryer. The structure of solar dryer ensures that resultant hot air heats the product and dries it by disappearing trapped moisture from the product. Finally, this air escapes through vent at top. The dryer is of modular type can be easily dismantled into a thin rectangular box for easy transportation and storage [2]. The microcontroller is used and programmed to control and manage the overall process of the unit. Different fruits will have different temperatures to dry. Sensors are used to read the temperature in the cabinet connected to microcontroller. A display is use to see the process continuously for the temperature value. If the monitoring temperature is greater than the set temperature value, increase the speed of the fan else decreases. Once the process is completed generate the alarm [3].

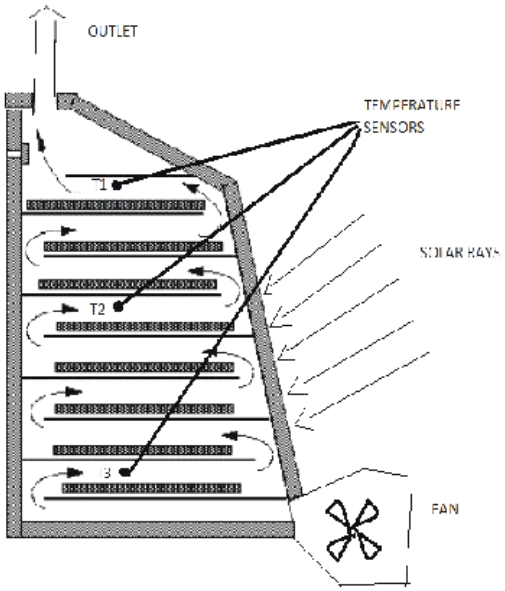

Figure-2: Internal diagram of solar dryer

To calculate the amount of heat required to dry a given quantity of fruit, vegetables for storage, the following equation is used [4].

W1 (100 - M1) = W2 (100 - M2)

Where W1 is weight in Kg of fresh fruit, M1 is % initial moisture content in fresh fruit, W2 is weight in Kg of dried fruit and M2 is % final moisture content in dried fruit.

3. CIRCUIT DIAGRAM

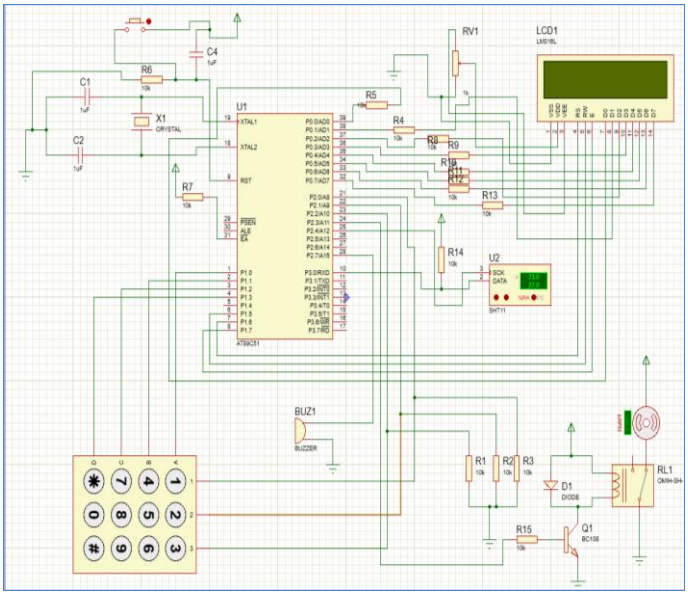

Figure-3: Block Diagram of Solar Dryer

4. BLOCK DIAGRAM

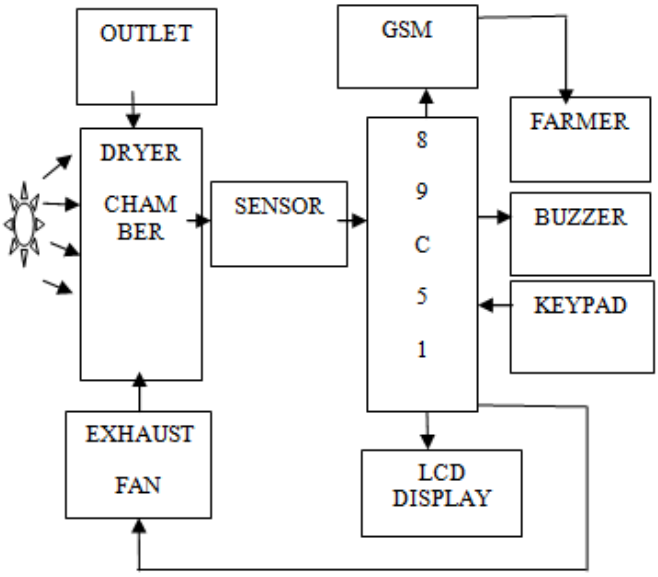

Figure-4: Circuit Diagram of Solar Dryer

Solar Panel:

Solar panel means to a panel designed to absorb the sun's rays as a source of energy for generating electricity. A photovoltaic module is a packaged, connected assembly of typically 6 x 10 solar cells. Solar Photovoltaic panels constitute the solar array of a PV system that generates and supplies solar electricity for the electrical components. Here we use a 40watt PV panel. The output of the PV panel drives the electrical components of the dryer.

Keypad :

A basic 12 button keypad is used for user input. The buttons are setup in a rows and coloumn format. This allows a microcontroller to scan the 7 output pins to see which of the 12 buttons is being pressed.

Microcontroller:

1. Compatible with MCS-51 Products
2. 4Kbyte Reprogrammable Flash Memory.
3. Fully Static Operation: 0 Hz to 24 MHz
4. 128 x 8-Bit Internal RAM
5. 32 Programmable I/O Lines
6. Two 16-Bit Timer/Counters

DHT22:DHT22 utilizes exclusive digital signal collecting technique and humidity sensing technology and can output calibrated digital signal. Small size, low power consumption & long distance (20 meters) communication. Power voltage should be between 3.3V and 6V DC. When power is supplied to sensor don't send any instruction to it within one second

to pass unstable status. One 100nF capacitor can be added between VDD and GND for wave filtering

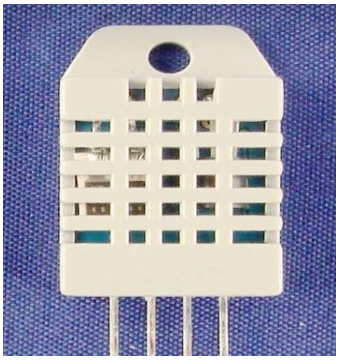

Figure-5: DHT22

DHT22 specifications:

1. power supply: 3.3V – 6V DC
2. output signal: single-bus
3. sensing element: polymer humidity capacitor & DS18B20
4. measuring range: humidity 0-100% RH / temperature -40°C – 125°C
5. accuracy: humidity ±2%/temperature ±0.2°C sensing period: ~2s

Trays:

Figure -6: Tray

Drying chamber designed in a such a way that it consists of 4 trays which would hold drying products. Its dimension is about 60 x 50 x 4.25 cm (l x b x h). About 12 liters of product volume can be placed in

5. ALGORITHM

1. Select the product using keypad and set temperature and humidity

RANGE	PRODUCT	TEMPERATURE (□)	HUMIDITY (%)
Range 1	Pomegranate	40 to 52	75
Range 2	Tulsi	45 to 48	60
Range 3	Onion Slice	45 to 49	70
Range 4	Coriander slice	42 to 48	60
Range 5	Raisin	40 to 54	80

2. Set any range.
3. Read temperature and humidity and compare it with set point:

Sr. No.	Temperature	Humidity	Action
1.	T<set point	H<set point	Fan OFF
2.	T>set point	H<set point	Fan ON
3.	T<set point	H>set point	Fan OFF
4.	T>set point	H>set point	Fan ON

4. Display selected range on LCD display.
5. Turn ON buzzer.

TEMPERATURE RANGES IN DIFFERENT SEASONS

Table1.Temperature Range in Summer Season

Sr. No.	Product Name	Weight Before Drying (gm)	Weight After Drying (gm)	Moisture Removal (%)	Drying Time In Dryer (hrs)	Outside Drying Time (hrs)	Temp Range (□)
1.	Pomegranate	48.71	9.210	81.0	60	110	40 to 52
2.	Onion slice	10kg 200gm	1.270	89.7	24	26	45 to 49
3.	Coriander Leaves	400	0.180	84	5	6	42 to 48

Table2.Temperature Range in rainy Season

Sr. No	Product Name	Weight Before Drying (gm)	Weight After Drying (gm)	Moisture Removal (%)	Drying Time In Dryer (hrs)	Outside Drying time (hrs)	Temp Range (□)
1.	Pomegranate	48.47	12.40	65.12	96	192	30 to 35
2.	Onion slice	10kg 200gm	1.1	60	35	45	32 to 35
3.	Coriander Leaves	400	0.30	70	10	15	33 to 36

Table3.Temperature Range in winter Season

Sr. No	Product Name	Weigh Before Drying (gm)	Weigh After Drying (gm)	Moisture Removal (%)	Drying Time In Dryer (hrs)	Outside Drying time (hrs)	Temp Range (□)
1.	Pomegranate	48.47	10	75	70	130	24 to 27
2.	Onion slice	10kg 200gm	1.15	76	30	35	25 to 29
3.	Coriander Leaves	400	0.20	73	6	8	22to25

REFERENCES

[1] K. Sharma, A. Colangelo & G. Spagna, "Experimental Performance of Indirect Type Solar Fruit and VegetableDryer", ENEA- C. R. E. Trisaia, Italy.

[2] www.barc.gov.in/akruti-tp

[3] Mazidi, Muhammad Ali, McKinlay, Rolin D; Causey, Danny; “PIC Microcontroller and Embedded Systems”,First Edition

[4] Sanjay Sharma, R.A.Ray& V.K. Sharma. "ComparativeStudy of Solar Dryer for Crop Drying", Centre forEnergy Studies, IIT, Delhi.