International Journal of Engineering and Technical Research (IJETR)
ISSN: 2321-0869 (O) 2454-4698 (P), Volume-4, Issue-3, March 2016

IR Based Electronic Grape Drying System

Mr.G.D.Lohar, Mr. A.G.Nandekar, Mrs. W.S.Kandlikar

***Abstract*— Grape is a seasonal crop and gets spoiled fast. Therefore all the grapes of a season must be utilized within short span of 4 -5 days. Present natural process of grapes (Kishmis making) requires 12-15 days. Hence the investment of space and infrastructure are large and cannot be afforded by Indian farmers. There are also locations where the ambient conditions are good for grapes growing but adverse for Kishmis (Raisins) making which has almost twice of profit than grapes and has long shelf-life. In this paper existing natural grape drying process is modified with suitable enclosure containing IR radiators and allied system. Appropriate sensors are used to measure parameters like humidity, temperature and weight of sample. Experimental analysis done with the help of dryer proves the uniform drying of the grapes with the help of infrared radiation. The original color of grapes is better conserved as the drying takes place at low temperature. The drying time is reduced to a significant level as compared to natural drying process.**

***Index Terms*— Grape drying, Ardiuno uno,DHT11 sensor, Relay interfacing Board,HX711,LCD Display.**

I. INTRODUCTION

Science of grapes cultivation is called Viticulture. India produces grapes on commercial scale in subtropical regions of Maharashtra, Tamilnadu, Karnataka, Andhra Pradesh, Punjab and Haryana. Maharashtra is leading producer of grapes.

In Afghanistan, natural shade drying process is very pop-ular as it is easy and cost effective. It gives results in three to four weeks. In Australian, cold dipping process is used where the grape clusters are dipped into potassium carbonate and ethyl oleate for few minutes (Osman *et.al.*,2008).During processing cracks are generated on the grapes, thus the grapes are ready for further processing.
In India, natural drying methods such as shade drying and sun drying are used for raisin making (Horticulture Crops,

1993). But this process have few drawbacks:

- The drying process is carried out manually and do not have any control.

G.D.Lohar Doing His M.Tech In Electronics Design Technology **From** National Institute Of Electronics And Information Technology, From August, 2014

Amit G.Nandekar Doing His M.Tech In Electronics Design Technology **From** National Institute Of Electronics And Information Technology, Aurangabad From August, 2014

The uniform spreading of grapes on mesh and cleaning of surrounding area is done manually.

- The area required to dry the grapes is very large, thus miss utilization of the valuable agricultural land. The investment on space and infrastructure is very large and cannot be afford by small farmer.
- The drying process is long lasting of about 15 to 20 days.
- Quality of raisins is not uniform.
- The drying process is not possible in adverse weather condition.

Continuous monitoring is required to control the birds from eating grapes.
Dust from external environment degrades the quality of product.
Mechanical dryer cannot control the temperature and humidity during drying process.

II. DEVICE DESIGN ANDOPERATION

Drying chamber
The drying chamber is designed such that inlet air can be uniformly blown through the grapes placed in tray. Using heater and fan assembly, the air is uniformly heated to the required temperature and by using tubing assembly the heated air is forcefully blown through the grapes. Along with heated air, IR radiations are also used to dry the grapes.
These IR radiations deeply penetrate the grapes to make the maintained to some fixed value by controlling the CFM

Specification of Grape Dryer unit
Input power: 230 V, 1 PHASE, 50 Hz Supply.
Capacity: 1 kg of grapes.
Range of temperature: Ambient to 40^0C .
Humidity: 20 % RH.
Power: 336 W.
Construction Details
The setup of Grape Dryer unit is shown in Figure 2.
Material: Propylene
Size: 40 cm ×40 cm ×60 cm.
Weight: 20 Kg.

Sensed Parameters: Temperature, Humidity and Weight.
Controlled parameter: CFM of Blower- Fan.
Life of Unit: 10 year.

III. HARDWARE IMPLEMENTATION

The hardware components used for designing the prototype described in this paper are:

A. Arduino Uno

The Arduino Uno is a microcontroller board based on the AT mega328 . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDIUSB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino1.0.

B.DHT11 Temperature and Humidity Sensor

DHT11 digital temperature and humidity sensor is a composite Sensor contains a calibrated digital signal output of the temperature and humidity. Application of a dedicated digital modules collection technology and the temperature and humidity sensing technology, to ensure that the product has high reliability and excellent long-term stability. The sensor includes a resistive sense of wet components and an NTC temperature measurement devices, and connected with a high-performance 8-bit microcontroller.

C.HX711 Weight Sensor

Based on Avia Semiconductor's patented technology, HX711 is a precision 24-bit analog-to-digital converter (ADC) designed for weigh scales and industrial control applications to interface directly with a bridge sensor.

The input multiplexer selects either Channel A or B differential input to the low-noise programmable gain amplifier (PGA). Channel A can be programmed with a gain of 128 or 64, corresponding to a full-scale differential input voltage of ±20mV or ±40mV respectively, when a 5V supply is connected to AVDD analog power supply pin. Channel B has a fixed gain of 32. On-chip power supply regulator eliminates the need for an external supply regulator to provide analog power for the ADC and the sensor. Clock input is flexible. It can be from an external clock source, a crystal, or the on-chip oscillator that does not require any external component. On-chip power-on-reset circuitry simplifies digital interface initialization.

There is no programming needed for the internal registers. All controls to the HX711 are through the pins.

FEATURES-

- Two selectable differential input channels
- On-chip active low noise PGA with selectable gain of 32, 64 and 128
- On-chip power supply regulator for load-cell and ADC analog power supply
- On-chip oscillator requiring no external component with optional external crystal
- On-chip power-on-reset
- Simple digital control and serial interface: pin-driven controls, no programming needed
- Selectable 10SPS or 80SPS output data rate
- Simultaneous 50 and 60Hz supply rejection
- Current consumption including on-chip analog power supply regulator:
- normal operation < 1.5mA, power down < 1uA
- Operation supply voltage range: 2.6 ~ 5.5V
- Operation temperature range: -40 ~ +85℃
- 16 pin SOP-16 package

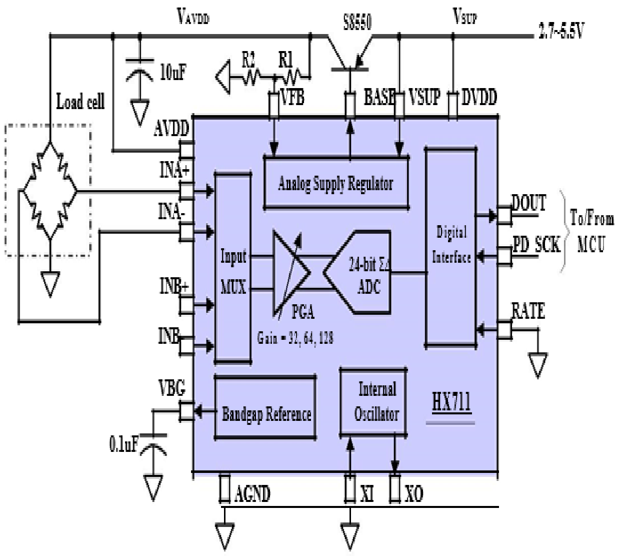


Fig. 1 Typical weigh scale application block diagram

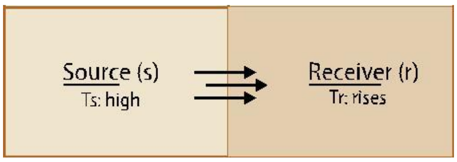
.

D.Infrared Lamp

Heating principle

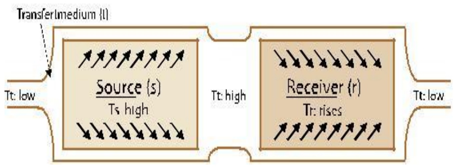
Basically there are three main heating principles:

Conduction



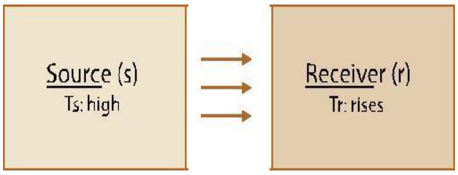
Heat transfer is by direct contact between the source and the object.

Convection



Heat transfer is by a flow of liquid or gas which is itself heated by a heat source.

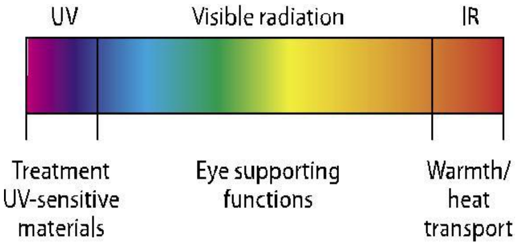
Radiation

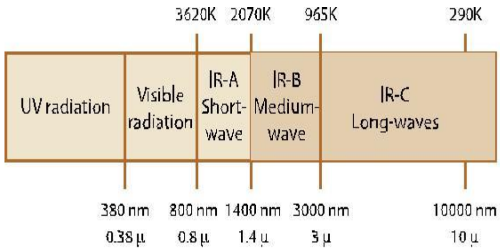


Heat transfer is by the emission of radiation from a hotter object such as the sun, an open fire or an infrared lamp to its cooler surrounding environment. Objects which receive this radiation from the heat source absorb it and become hotter.

Philips infrared lamps use this radiation principle. They directly heat an object or person at which they are directed without heating the surrounding air. This is what makes them highly efficient heat sources.

Infrared within the optical spectrum

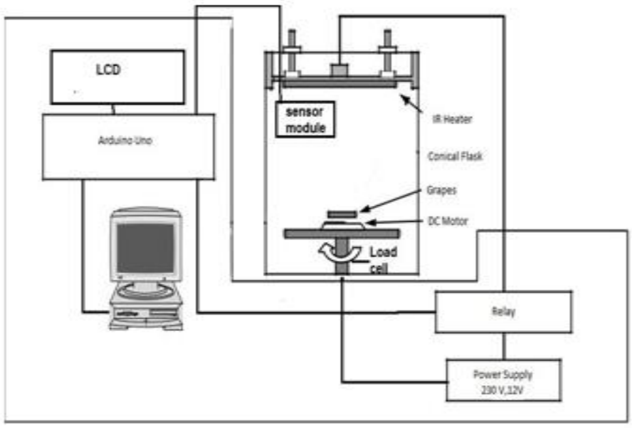




The infrared part of the optical spectrum is split into three parts:
Short wave: IR-A Medium wave: IR-B Long wave: IR-C
Philips infrared lamps have a broad spectrum (see graph below), but most of the radiation they produce is in the IR-A part. For most industrial heating applications this is the region that gives the highest heating efficiency.

. *SYSTEM OVERVI EW.*

BLOCK DIAGRAM



IV. EXPERIMENT RESULTS

Figure 2 Photograph shows the Grapes before processing in Drying Unit. Figure 4 Photograph shows the Raisins after processing in Drying Unit. Table No.1 gives comparison of different method of drying.

Table No.1: comparison of different method of drying

SN.	Method of Drying	Duration of Drying	Quality
1	Natural shade Drying (Without pretreatment)	3-4 weeks	Golden brown colour due to large drying period and enzymatic activities.(dependent on natural conditions)
2	Natural shade Drying	12-15 days	Golden green colour.Natural taste and flavour is maintained.
3	Micro wave Drying	6-8 hours	Raisins are brown in colour and soft textured.
4	Infra red Drying	12-15 hours	Golden brown raisins with soft texture

FIG: GRAPES

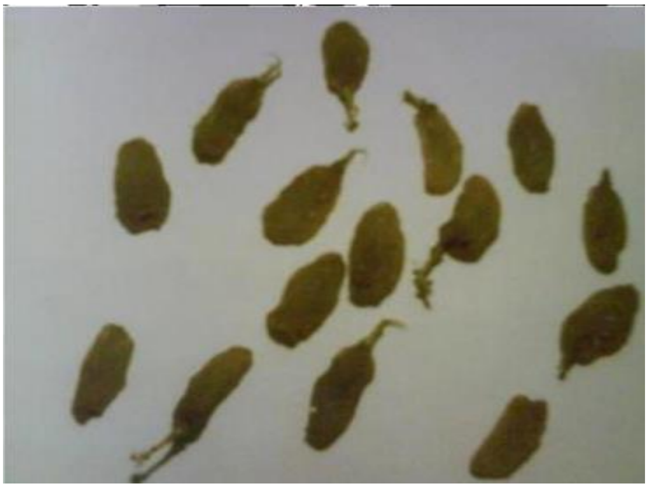


FIG:RAISINS

V. CONCLUSION

IR LED source is used to get requiredgreen raisins profile. Green grape raisins obtained from this drying unit are of GradeA export quality. Power required to the Drying unit is 326.53 Wh. Efficiency of Drying unit is about 68.75%. This Drying unit have more flexibility for other fruits and vegetables like tomatoes, potatotes etc.In traditional Drying of grapes duration of drying is about 4-5 days with other losses and drying time in this Drying unit is 18 hours with no losses.

REFERENCES

[1]V.L.Singleton, E.Trousadale and J.Zaya,"One Reason Sun-Dried Raisins Brown So Much" ,Dept .of VERC, University of California.

[2]"Effect Of Different Pretreatment and Drying Temperatures on Chemical Composition of aisins",J.Maharashtra agri.Univ,28(3):325-327(2003

[3]Huai-wen Yang and Matthew Yen,"A Computation Method to Estimate Moisture Content by Product weight", VERC Research notes.

[4]John.B.Peatmen," Design with PIC Micro-controllers" , Pearson Education A.Chakraverty,"Post

[5]Harvest Technology of Cereals, Pulse and Oilseeds" Oxford and IBH Publishing Co.PVT.LTD. Page no. 25-60.

[6]Arun.S.Mujumdar,"Handbook of Industrial Drying "MarcelDekka ,New York,Volume-I,Page no.567-586

[7]R.F.Schiffman, "Microwave and Dielec

AUTHORS

Ganesh D. Lohar, He is doing MTech in Electronics Design Technology from National Institute of Electronics and IT,Aurangabad

Amit G. Nandekar, He is doing MTech in Electronics Design Technology from National Institute of Electronics and IT,Aurangabad

Mrs. Warsha S. Kandlikar, She is Working as a scientist “c” in National Institute of Electronics and IT,Aurangabad