Intelligent Humidity Controlling Device For Increasing Efficiency Of Dryer

Prof. Z.V.Thorat [1], Mr. SwapnilKokate[2],Manohar Maladkar[3], Soham Save[4], Prachi Shastrakar[5]
Dept of Electronics and Telecommunication
BharatiVidyapeeth College of Engineering, Belpada, Navi Mumbai

Abstract- *There are many industries which make use of dryers. Such as chemical industry, clothes industry, food industry, etc. Drying plays a vital role in these industries. Humidity has an important part in drying process, as the relative humidity is inversely proportional to the drying rate i.e.lowerthe humidity faster the drying process. Also high humidity may result in spoiling of products. Main purpose of our project is to keep humidity low, which will result in faster drying. Every dryers have flaps basically made to control the humidity. They're opened or closed manually. Our project helps to open or close these flaps automatically depending on the humidity inside the dryer.*

Keywords- Atmega328p, Stepper Motor, Humidity Sensor, Humidity, Rotation, Dryer

I. INTRODUCTION

Drying is defined as the application of heat under controlled conditions, to remove the water present in foods, chemicals, etc. by evaporation to yield dried solid products.In order to achieve optimum performance of a food dryer, we need to keep in check the humidity surrounding the dryer before and during the drying process. The main purpose of drying is to extend the shelf-life of foods by reducing their in-water activity. This is a very crucial requirement in certain industries. So, in order to achieve this, it is important that the operating conditions are correctly specified and that the dryer is fitted with an effective control system. The operating conditions will naturally influence the quality of the dried product.

Adequate control of the humidity inside a dryer is important for maintaining the production of consistent, high quality product at least cost. Dryers have a life in service of 20 years and often more. In consequence, it is common for them to be used to dry several different products during their lifetimes.

II. LITERATURE REVIEW

Relative humidity is a measure of the current amount of water vapor in the air relative to the total amount of water vapor that can exist in the air at its current temperature, and is expressed as a percentage.A relative humidity of 100% means the air cannot contain any more water vapor at that temperature, whereas a relative humidity of 50% means that the air only has only half as much water vapor as it can hold at the current temperature.

Drying simply means removing liquid remaining on the parts as a result of the cleaning and rinsing process. This is accomplished in one of two ways. One is physical removal. Physical removal of liquids may be as simple as placing the part in an orientation that will allow liquid to drain due to gravity. Or, it may involve using a blast of air or some other means such as centrifugal force or vibration to cause removal of liquid from the part being dried. The other (and probably more common) method of drying is evaporation. Evaporation of liquid is usually enhanced through the use of heat and the movement of air over the parts.

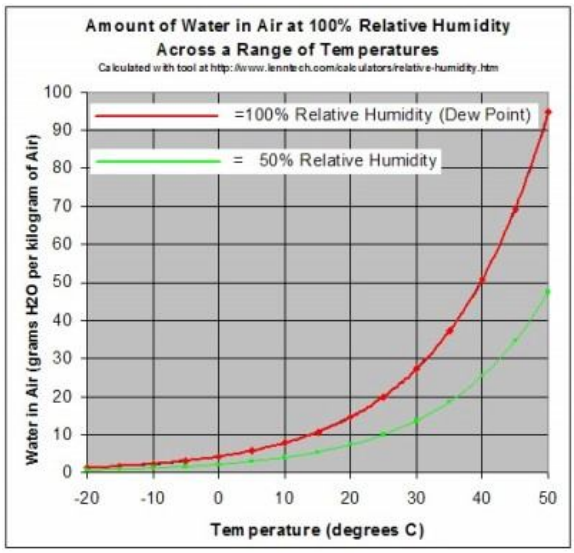
The rate of evaporation is actually driven by the relative humidity to a greater degree than by temperature. But, in fact, the two are inter-related. As the temperature of air is increased, it can absorb more liquid and, therefore, the relative humidity is decreased. Lower relative humidity

promotes faster drying. The following chart and graph which both show essentially the same data are very interesting.

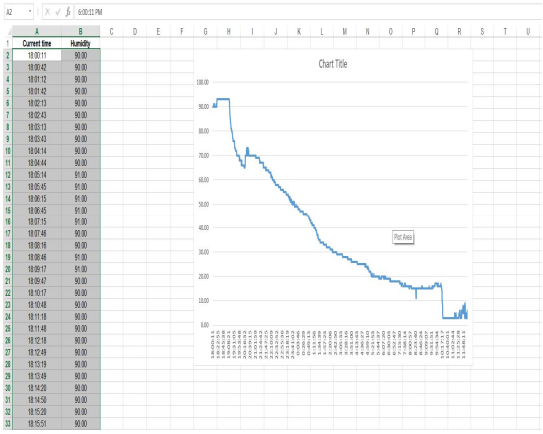
Specific humidity of a kilogram of air (at average sea level pressure)

Temp. (°C)	Temp. (°F)	Grams of water vapor per kg of air (g/kg)
-40	-40	0.1
-35	-31	0.2
-30	-22	0.3
-25	-13	0.51
-20	-4	0.75
-10	14	1.8
0	32	3.8
5	41	5
10	50	7.8
15	59	10
20	68	15
25	77	20
30	86	27.7
35	95	35
40	104	49.8

The next graph shows that as the temperature of air increases, the amount of water required to saturate it increases exponentially. A few degrees of increase in temperature has an increasingly large effect on the saturation point.



III. RESULT OF STUDY



From the information we gathered, we decided to conduct experiment. We visited food industry, there we obsereved that air drying is widely used in the drying process. We set up a humidity sensor inside a dryer and took readings overnight through out the drying process. From this we came to the conclusion that humidity is inversely propotional to drying that means at low humidity drying is faster. Another important observation came under our notice that humidty is not constant. Sometimes it is high sometimes it is low. We have to maintain constant low humidity.

IV. PROPOSED WORKED

Food scientists have found that by reducing the moisture content of food to between 10 and 20%, bacteria, yeast, mold and enzymes are prevented from spoiling it. The flavor and most of the nutritional value is preserved and concentrated. This led to the application of various types of drying devices like solar dryer, electric dryers, wood fuel driers and oil-burned driers. However, the high cost of oil and electricity and their scarcity in the rural areas of most third world countries have made some of these driers very unattractive.

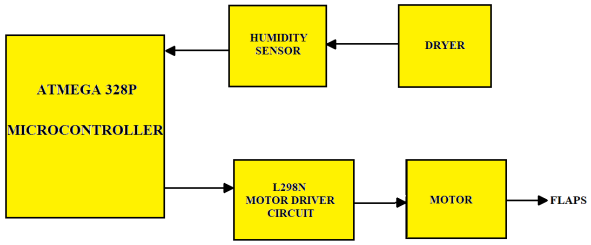
Therefore interest has been focused mainly on the development of dryers. Dryers are usually classified according to the mode of air flow into natural convection and forced convection dryers. Natural convection dryers do not require a fan to pump the air through the dryer. One basic disadvantage of forced convection dryers lies in their requirement of electrical power to run the fan. Since the rural or remote areas of many developing countries are not connected, the use of these dryers is limited to electrified urban areas.

The main objectives of this project is to increase the Efficiency of HAD through proper control of humidification and maintaining the heat energy by motor operated adjustable vanes with following specific objectives.

● To study the drying mechanism of HAD.
● To design the damper operated by PLC.
● Compare the performance of optimized HAD over traditional HAD based drying system.
● To monitor changes in humidity and temperature using IOT on open source platform

BLOCK DIAGRAM:

Humidity sensor is inside the dryer. The humidity sensor keeps track of humidity. It collects data and gives it to microcontroller. Microcontroller processes the data. It checks in which humidity range observed humidity lies. Accordingly it opens the flap at an angle which is predefined the flaps are connected to stepper motor.



COMPONENTS:

1. ATMEGA 328P microcontroller
2. Oscillator
3. Resistor
4. Stepper Motor
5. L298IC
6. GSM Module

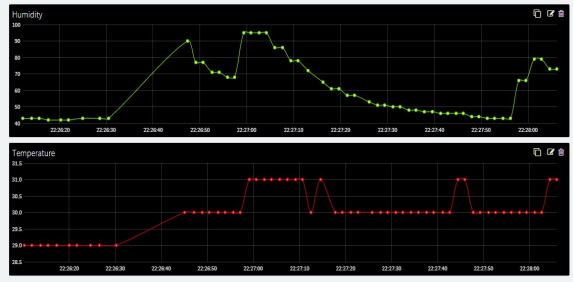
SOFTWARE USED:

1. Arduino IDE
2. Excel
3. Hyperterminal
4. Putty
5. Proteus

ALGORITHM:

Step 1 : Define input and output pins for humidity sensor and stepper motor.
Step 2 : Define stepper motor sequence for clockwise and anticlockwise movement.
Step 3 : Define a variable humidity and temperature to store value of humidity and temperature respectively.
Step 4 : Take reading from surrounding(humidity) and store it in humidity.
Step 5 : Define ranges of humidity (No particular number of steps).
Step 6 : Define an angle for a each set of which we want the flaps to be open at.
Step 7 : Check the value in humidity lies in which range.
Step 8 : According instruct stepper motor to rotate at that angle and direction.
Step 9 : Go to step 4.

V. MONITORING OF REAL TIME DATA



With the help of IOT we can show real time changes occurring inside the dryer. These changes can be monitored on an open platform called as thinger.io.This data is useful for many applications in the industry as it shows changes happening with respect to time.

We have used NodeMcu. It includes firmware which runs on the ESP8266 Wi-Fi and hardware which is based on ESP-12 module.

The main objective of this part of project is easy access to data. We can get this data at our own comfirt.

VI. FUTURE SCOPE

1. Cloth Industry
2. Installing a swirl element at the entrance of the drying chamber to give rotation effect to the air and fixing bended sheet strips inside the chamber to direct the airflow.
3. Increasing collector tilt angle length and breadth to a certain limit to raise the temperature of the dryer.
4. Providing dehumidifier before the drying chamber for removing moisture in the air to improve the drying rate.
5. Improvements in the performance of the dryers could lead to the performance enhancement of the dryer for use in small scale business enterprises.
6. Neural network model can be used to predict the potential of the dryer for different locations and can also be used in a predictive optimal control algorithm.

VI. CONLUSION

1. Drying is essential in many industries like food, clothing, chemicals, etc.
2. Humidity plays vital role in it.
3. If humidity isn't controlled properly products will be wasted.
4. We're working on the same for making the dryers efficient.

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