Moisture Sensor Based Vacuum Chamber

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ABSTRACT

The proposed work describes the design of prototype of automatic moisture detector system controlled by microcontroller 89c52 on the working principle and the hardware structure of the system.Automatic moisture detector system process is one of the most important and necessary processing step for fruits drying system,in our country has lots of market for grapes and raisins goes on increasing day to day while making of grapes to raisin by the farmer quality and production may be lossing .so we understand this problem from the farmer that's why we try to avoid this problem to get large market in domestic as well as international we will try to implement such system have a greater control over the process. Microcontroller is used for the control of the system. This system can replace existing natural drying systems which consume lots of time & efforts. This system is interfacing by microcontroller controls with the conventional software code it is possible to achieve a good results in the form of reduced human efforts & quality of raisins or fruits

Keywords: *Microcontroller89c52, LCD, moisture sensor, Model*

1. Introduction

In our project we using moisture sensor to detect the moisture content present in the particular object which is placed in the vacuum chamber for drying. When moisture sensor detects the moisture it sends signal to signal conditioning circuit. Circuit detect the signal coming from moisture sensor and gives the instruction to 16*2 LCD display to show the amount of moisture present in particular object which was placed by us in vacuum chamber to user. Again signal conditioner gives instruction to vacuum pump driver circuit to start the vacuum pump to suck moisture content present sealed vacuum chamber for preserve the object.A vacuum chamber is a rigid enclosure from which air and other gases are removed by a vacuum pump. This result in a low-pressure environment within the chamber commonly referred to as a vacuum. A vacuum environment allows researchers to conduct physical experiments or to test mechanical devices which must operate in outer space (for example) or for processes such as vacuum drying or vacuum coating. Chambers are typically made of metals which may or may not shield applied external magnetic fields depending on wall thickness, frequency, resistivity, and permeability of the material used. Only some materials are suitable for vacuum use.

Chambers often have multiple ports, covered with vacuum flanges, to allow instruments or windows to be installed in the walls of the chamber. In low to medium-vacuum applications, these are sealed with elastomeric o-rings. In higher vacuum applications, the flanges have knife edges machined onto them, which cut into a copper gasket when the flange is bolted on.A type of vacuum chamber frequently used in the field of spacecraft engineering is a thermal vacuum chamber, which provides a thermal environment representing what a spacecraft would experience in space.

1.1 Objective of project

The objective of this project is to design to detect moisture in the chamber that will have the following functionalities:

- To dry the grapes without losing the nutrient contents and natural colour with optimized artificial dehydration system.
- To identify and optimize various parameters affecting the quality of raisin.
- To design the process equipment.
- To identify the control and manipulation variables.
- To develop PIC microcontroller based system to control the process.

2. Significance and Scope of the Project

Water vapor, desorbing from the internal surfaces of vacuum systems, is a problem that's common to vacuum technology as a whole. Every time a vacuum system is opened to ambient air with its attendant humidity, the internal surfaces become covered with layers upon layers of water molecules. Every item placed within a vacuum system is likewise covered with water molecules. Every pumpdown cycle from atmosphere will go through two overlapping stages. Firstly, the permanent gases making up the air mixture in the system's volume, such as nitrogen (N2) and oxygen (O2) will be pumped away. Secondly, the water molecules desorbing from the internal surfaces must be pumped away. Once the pressure is in the low millitorr range, the desorbing water makes up over 99% of the total gas load. If, for example, you turn on a residual gas analyzer (RGA) in the high 10-4 torr range during a pumpdown from air, the O2 and N2 will drop off-scale almost immediately while the water vapor peak will seem to be fixed. Alternatively, if you pump a system down to its ultimate pressure of, say 10-6 or 10-7 torr, and then backfill it to atmospheric pressure with dry N2, it will pump back down to its ultimate pressure again in minutes instead of hours. This is explained by the fact that the pumpdown rate is not controlled by the amount of water vapor within the chamber but by its desorption rate from the internal surfaces. Since a certain amount of sorbed water had already been removed by the first pumpdown, the desorption rate is still at the same lowered level it had been prior to the N2 backfilling, and the low pressure equilibrium could be quickly re-established. The time vs pressure pumpdown curve, then, will be controlled by the changing desorption rate of the water molecules from the system's internal surfaces.

3. Framework of the Project

- Moisture sensor SY-HS 220
- AT89C52 Controller
- Power supply
- Display 16*2
- Vacuum Chamber
- Relay Circuit
- Vacuum Pump
- Application Software
- Signal Conditioner

3.1 MOISTURE SENSOR (SY-HS 220)

Fig.1 Moisture sensor

Sensing Principle

Humidity measurement can be done using dry and wet bulb hygrometers, dew point hygrometers, and electronic hygrometers. There has been a surge in the demand of electronic hygrometers, often called humidity sensors.

Specification:-

- Rated Voltage: DC 5.0V
- Current Consumption: 1.6mA
- Operating Temperature Range: 0-60°C
- Operating Humidity Range: under 95%RH
- Storable Temperature Range: 0~70°C
- Storable humidity range: lower 95%RH
- Standard output voltage: DC 1.980 mV (at 25°C, 60%RH)
- Accuracy: ± 5% RH (at 25°C, 60%RH

Working

Humidity is the presence of water in air. The amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. The presence of water vapor also influences various physical, chemical, and biological processes. Humidity measurement in industries is critical because it may affect the business cost of the product and the health and safety of the personnel. Hence, humidity sensing is very important, especially in the control systems for industrial processes and human comfort.Controlling or monitoring humidity is of paramount importance in many industrial & domestic applications. In semiconductor industry, humidity or moisture levels needs to be properly controlled & monitored during wafer processing. In medical applications, humidity control is required for respiratory equipments, sterilizers, incubators, pharmaceutical processing, and biological products. Humidity control is also necessary in chemical gas purification, dryers, ovens, film desiccation, paper and textile production, and food processing. In agriculture, measurement of humidity is important for plantation protection (dew prevention), soil moisture monitoring, etc. For domestic applications, humidity control is required for living environment in buildings, cooking control for microwave ovens, etc. In all such applications and many others, humidity sensors are employed to provide an indication of the moisture levels in the environment.

3.2 ATMEL 89C52

AT89C52 is an 8-bit microcontroller and belongs to Atmel's 8051 family. AT89C52 has 8KB of Flash programmable and erasable read only memory (PEROM) and 256 bytes of RAM. AT89C52 has an endurance of 1000 Write/Erase cycles which means that it can be erased and programmed to a maximum of 1000 times

Fig.2. ATMEL 89C52

Features

- 8-bitarithmetic logic unit (ALU) and accumulator, 8-bit registers (one 16-bit register with special move instructions), 8-bit data bus and 2×16-bit address bus/program counter/data pointer and related 8/11/16-bit operations; hence it is mainly an 8-bitmicrocontroller

- Boolean processor with 17 instructions, 1-bit accumulator, 32 registers (4 bit-addressable 8-bit) and up to 144 special 1 bit-addressable RAM variables (18 bit-addressable 8-bit)
- Multiply, divide and compare instructions
- 4 fast switchable register banks with 8 registers each (memory mapped)
- Fast interrupt with optional register bank switching
- Interrupts and threads with selectable priority
- Dual 16-bit address bus – It can access 2 x ^{216} memory locations – 64 KB (65,536 locations) each of RAM and ROM
- 128 bytes of on-chip RAM (IRAM)
- 4 KB of on-chip ROM, with a 16-bit (64 KB) address space (PMEM). Not included on 803X variants
- Four 8-bit bi-directional input/output port, bit addressable
- UART (serial port)
- Two 16-bit Counter/timers
- Power saving mode (on some derivatives)

3.3 Vacuum chamber

It is a rigid enclosure from which air and other gases are removed by a vacuum pump. These results in a low-pressure environment within the chamber commonly referred to as a vacuum. A vacuum environment allows researchers to conduct physical experiments or to test mechanical devices which must operate in outer space (for example) or for processes such as vacuum drying or vacuum coating. Chambers are typically made of metals which may or may not shield applied external magnetic fields depending on wall thickness, frequency, resistivity, and permeability of the material used. Only some materials are suitable for vacuum use

Fig.3: vacuum chamber

3.4 Vacuum pump

Fig.4 Vacuum Pump

It is a device that removes gas molecules from a sealed volume in order to leave behind a partial vacuum. The first vacuum pump was invented by Otto von Guericke, and was preceded by the suction pump, in our project vacuum pump is used to suck the moisture present in the vacuum chamber .its set point is 50% whenever the moisture goes on increasing above 50% pump start his working .

3.5 5 12V Relay Switch

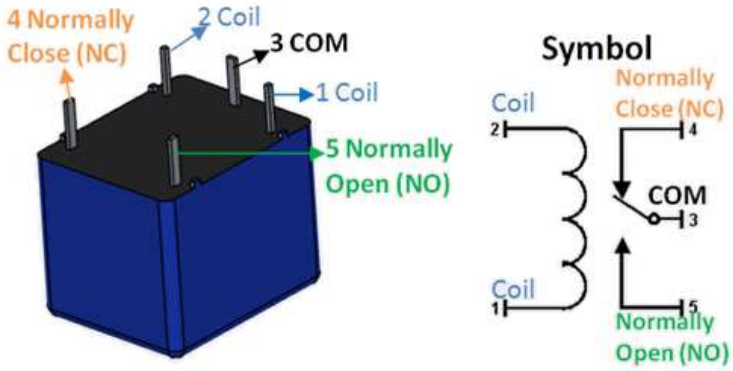

Fig.5 12V Relay Switch

Relays are most commonly used switching device in electronics. There are two important parameters of relay, first is the Trigger Voltage, this is the voltage required to turn on the relay that is to change the contact from Common → NC to Common → NO. The other parameter is your Load Voltage & Current, this is the amount of voltage or current that the NC, NO or Common terminal of the relay could withstand, in our case for DC it is maximum of 30V and 10A. Make sure the load you are using falls into this range.

4 Circuit Diagram

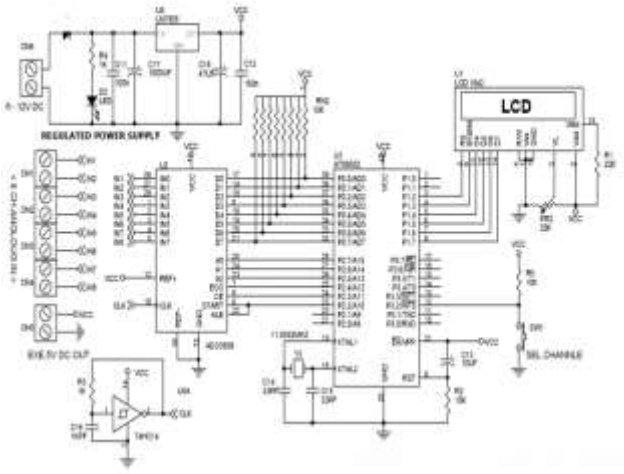

Fig. 6 Circuit Diagram

Working:-

moisture sensor to detect the moisture content present in the particular object which is placed in the vacuum chamber for drying. When moisture sensor detects the moisture it sends signal to signal conditioning circuit. Circuit detect the signal coming from moisture sensor and gives the instruction to 16*2 LCD display to show the amount of moisture present in particular object which was placed by us in vacuum chamber to user. Again signal conditioner gives instruction to vacuum pump driver circuit to start the vacuum pump to suck moisture content present sealed vacuum chamber for preserve the object.A vacuum chamber is a rigid enclosure from which air and other gases are removed by a vacuum pump. This result in a low-pressure environment within the chamber commonly referred to as a vacuum. A vacuum environment allows researchers to conduct physical experiments or to test mechanical devices which must operate in outer space (for example) or for processes such as vacuum drying or vacuum coating. Chambers are typically made of metals which may or may not shield applied external magnetic fields depending on wall thickness, frequency, resistivity, and permeability of the material used. Only some materials are suitable for vacuum use.

5. CONCLUSIONS

The project design objectives of the moisture sensor based vacuum chamber system were successfully achieved. The system displaying unit (LCD) was able to monitor the values of moisture in % of items placed in vacuum chamber .The readings made were sent to LCD display. These readings were sent to vacuum pump driver circuit unit then vacuum pump starts its working when readings of moisture are more than set point(50%). This system can be great economic value in dehydration system.

6. REFERENCES

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