International Journal of Scientific Research and Management Studies (IJSRMS)
ISSN: 2349-3771 **Volume 3 Issue 10, pg: 330-338**

HUMIDITY CONTROLLED AIR COOLER

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ABSTRACT

In the past decade, with the introduction of semiconductors the application related to it takes a vast area and is increasing day by day. The target of this project is to control the speed of fan and pump according to the humidity of the room to increase the comfort level by making it work automatically.
In this project we uses the straight forward concept of pulse width modulation. For this along with the Arduino board having Atmega 328 humidity and temperature sensor DHT -11 are used. The temperature and humidity of the room is shown on LCD which is interfaced with the microcontroller Arduino UNO that is used to make the necessary calculations.

KEYWORDS-*humidity and temperature controlling, PWM (pulse width modulation), Microcontroller Arduino Atmega 328, DHT 11 sensor, Quadrac, relay.*

I. INTRODUCTION

The born of an evaporative air cooler is a long back when humans are inventing things to lead a comfortable life for their own sake of living. Evaporative Air Cooler is one of the appliances that keeping the atmosphere cool. The basic idea of water cooling is to find a medium that can handle and transport heat more efficiently than air. Water has a good ability to retain heat, in the meantime stay in a liquid form. .Evaporative cooling is based on a physical phenomenon in which evaporation of a liquid into surrounding air cools an object or a liquid in contact with it. As the liquid turns to a gas, the phase change absorbs heat. Latent heat of evaporation. Water is an excellent coolant because it is plentiful, non-toxic, and evaporates easily in most climates. The concept, was refined, became the evaporative coolers which will provide a low-cost, alternative to refrigerated air conditioning.
Now it's a time to advance the level born with the energetic crisis, in the era of semiconductor , humidity controlled air cooler is introduced in which coolee is working according to the humidity of the room with the help of microcontroller to increase the comfort level along with greater efficiency.

II. HISTORY AND EVOLUTION

There are certain traces where one can say that these are basic ideas for evaporative cooler from which an evaporative air cooler is introduced.
An earlier form of air cooling, the wind catcher was used in ancient Egypt and Persia thousands of years ago in the form of wind shafts on the roof, which caught the wind, passed it over subterranean water in a qanat and discharged the cooled air into the building.
Leonardo da Vinci at the beginning of the 16th century was credited with inventing the first hygrometer that used a ball of wool to provide this indication of humidity level. Da Vinci was likely the first to use a mechanical air cooler. This air cooler consisted of a hollow water wheel with an air passage constructed to guide the air from the water wheel to his patron's wife's boudoir. The air was cooled by the splashing and evaporation of water during operation of the water wheel. Motive power

was provided to move the air by the water turning a partially submerged wheel. Namely, as sections of the wheel would be submerged into the stream water level moved from the outer edge of wheel toward the center compressing the air in this chamber and forcing it to move through the passages to the boudoir.

In 1974, William H. Goettl invented the "Combination Refrigeration and Evaporative Cooling Air Conditioner" in Arizona after noticing that evaporative cooling technology works better in arid climates rather than humidity but that a combination unit would be more effective.

In india , "Vaayu India" is the India`s first patent of Hybrid cooling Machine producing evaporative cooler in india. Then later on certain modifications and advancement are done in the evaporative cooler to produce a better one but till now the basic model of air desert cooler having fan and pump controlled with manual switches is running and is demanded all over the world because of its low cost.

III. LIMITATIONS OF THE AVAILABLE COOLER

As conventional cooler available in the market having manual control in the front panel which is quite a bit discomfortable for controlling again and again along with the humidity and temperature of the room. Also the accuracy is not high Plus the pump speed i.e. the flow of water inside the cooler cant be controlled so it's a time to advance a level with the use of semiconductor technology so a need arises to control the moisture of the room to achieve a comfort level, to increase the efficiency of the room, to get the accurate output speed of fan as needed and to save energy this humidity and temperature controlled air cooler concept comes in mind.

IV. PROPOSED SOLUTION

So this project main focuses on increasing the comfort level by making the cooler work according to the atmosphere by the use of microcontroller.

In this the speed of fan and pump of cooler is controlled according to the humidity of the room by using arduino which uses the concept of pulse width modulation for controlling the speed, which provides required duty cycle for the speed variance also at the same time, arduino send signal to lcd display to give out the present temperature and humidity of the room through display. Here for sensing the temperature and humidity of the room we uses sensor DHT 11.

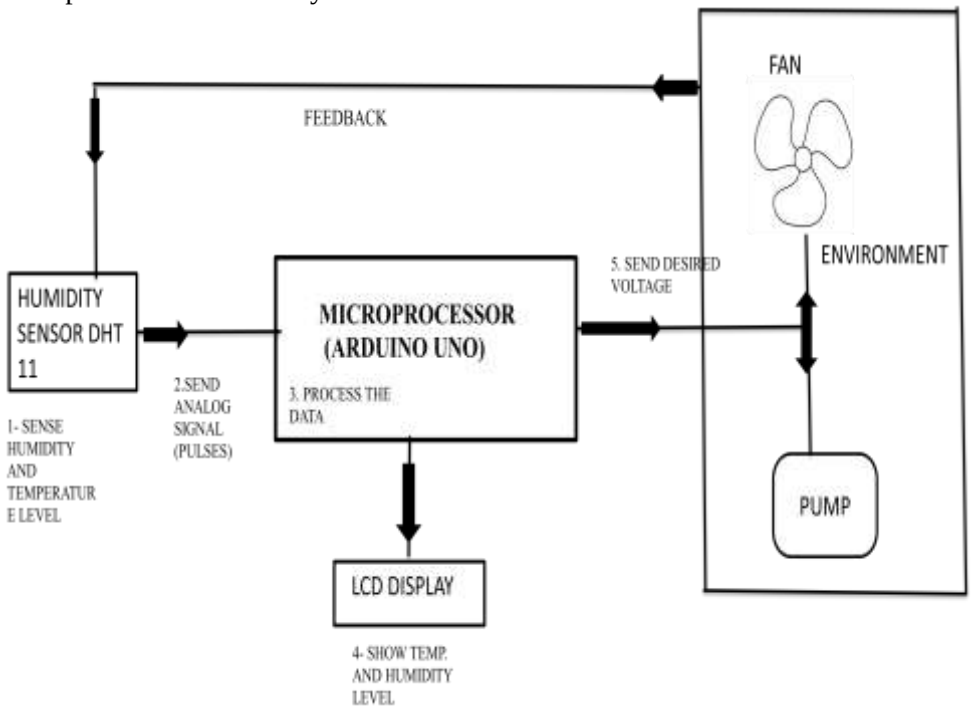

FIG -1 Block Diagram Showing Working

As till now among the consumers the basic air desert cooler having manual control of controlling the fan speed at 3 level – low, medium, high and pump ON and OFF is very popular among the consumers because of its low cost .
The target of this project also focuses on cost in parallel with the technology. So its cheap and affordable.
Also in future regarding this humidity controlled air cooler we can create a box, A humidity and temperature controlling box which consist of whole system of controlling humidity or temperature i.e. box having sensor, dc;ac link and microcontroller which is used to control the humidity or temperature of the room with the help of manual switching on someone's choice.

V. POWER ELECTRONIC DEVICES

1- TRIAC-

A TRIAC can conduct in both directions and is normally used in AC phase control. It can be considered as two SCRs connected in antiparallel with a common gate connection as shown in Figure2. Because a TRIAC is a bidirectional device, its terminals cannot be designated as anode and cathode. If terminal MT2 is positive with respect to terminal MT1, the TRIAC can be turn on by applying a positive gate signal between gate G and terminal MT1. If terminal MT2 is negative with respect to terminal MT1, it is turned on by applying a negative gate signal between gate G and terminal MT1. It is not necessary to have both polarities of gate signals, and the TRIAC can be turned on with either a positive or a negative gate signal. In practice, the sensitivities vary from one quadrant to another, and the TRIACs are normally operated in quadrant I+ (positive gate voltage and gate current) or quadrant III- (negative gate voltage and gate current).

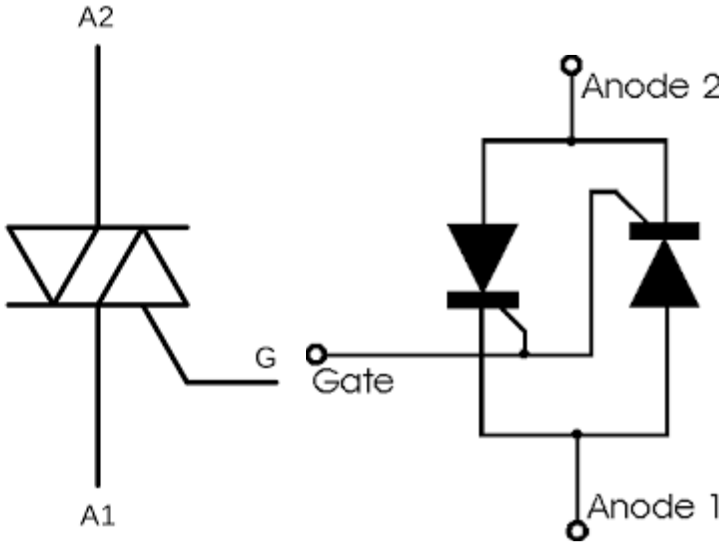

FIG -2 TRIAC Equivalent Circuit and Symbol

Characteristics of TRIAC

The TRIAC has on and off state characteristics similar to SCR but now the characteristic is applicable to both positive and negative voltages. This is expected because TRIAC consists of two SCRs connected ib parallel but opposite in directions. The gate triggering may occur in any of the following four modes (Fig. 2):[2]
Quadrant I operation: VMT21positive; VG1 positive
Quadrant II operation: VMT21 positive; VG1 negative
Quadrant III operation: VMT21 negative; VG1 negative
Quadrant IV operation: VMT21 negative; VG1 positive
Where VMT21 and VG1 are the voltages of terminal MT2 and gate with respect to terminal MT1.

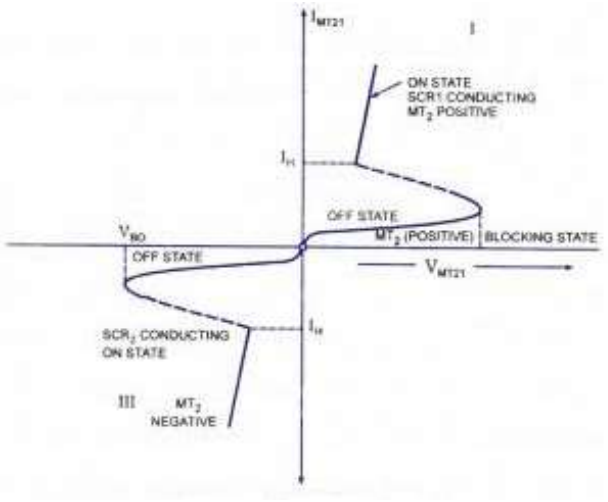

FIG -3 TRIAC Characteristic

The gate is the control terminal of the device, by applying proper signal to the gate the firing angle of the device can be controlled. The gate triggering circuit usually generates trigger pulses for firing the device. The trigger pulse should be of sufficient magnitude and duration so that firing of the device is assured. Usually the duration of 35μs is sufficient for sustaining the firing of the device

2- DIAC

The DIAC is a diode that conduct electrical energy only after its break over voltage, VBO, has been reached momentarily. The term is an acronym of diode for alternating current.

When breakdown occurs, the diode enters a region of negative dynamic resistance, leading to a decrement in the voltage drop in the diode, usually a sharp increase in current through the diode. The diode remains in conduction until the current through it drops below a value characteristic for the device, called the holding current IH. Below this value, the diode switches back to high resistance, non-conducting state. This behavior is bidirectional meaning typically the same for both directions of current. Most DIACs have a three layer structure with breakover voltage of approximately 30V. Their behavior is similar to that of a neon lamp, but it can be more precisely controlled and takes place at a lower voltage. DIACs have no gate electrode, unlike some other thyristors that they are commonly used to trigger, such as TRIACs, like quardrac, contain a built in series with the TRIAC‟s Gate terminal for this purpose.

DIACs are also called symmetrical trigger diodes due to the symmetry of their characteristic curve, because DIACs are bidirectional devices.

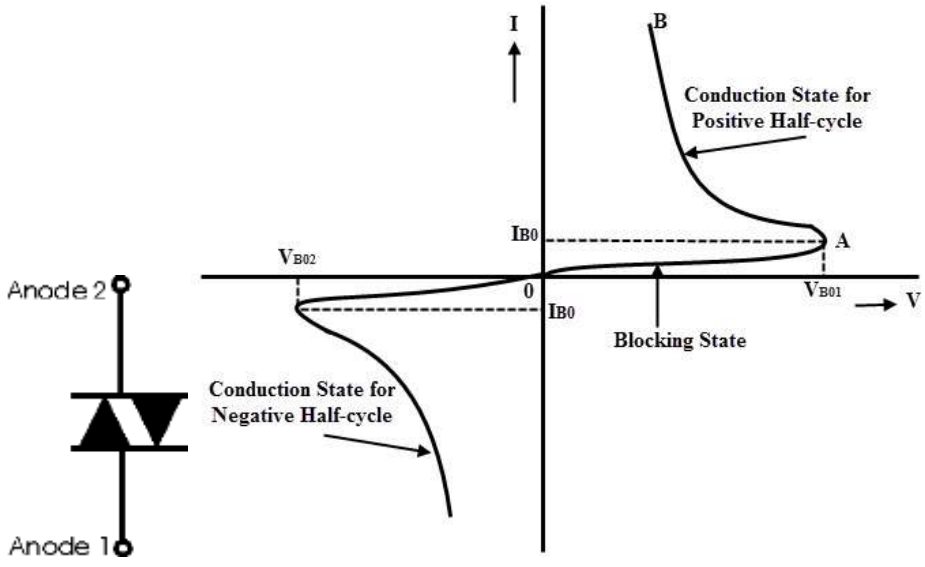

FIG 4 – DIAC Symbol and Characteristics

VI. SPEED CONTROLLING

The characteristics of a single phase induction motor are identical to three phase induction motor except that single phase induction motor has no inherent starting torque and some special arrangement have to be made for making itself starting. Though single phase induction motor is not self-starting, we are using it because the three phase supply is not present at everywhere.
When pulse to gate are delayed then reduced voltage is applied to the induction motor stator terminals and thus as voltage and torque are proportional to each other torque decreases and simultaneously speed of the motor gets reduced. The control circuitry consists of the following:
1. quadrac circuit

2. relay circuit.

1- QUADRAC CIRCUIT –

The Quadrac is basically a diac and triac fabricated together within a single package and as such are also known as "internally triggered triacs". The Diac is a very useful device which can be used to trigger triacs and because of its negative resistance characteristics this allows it to switch "ON" rapidly once a certain applied voltage level is reached. However, this means that whenever we want to use a triac for AC power control we will need a separate diac as well.

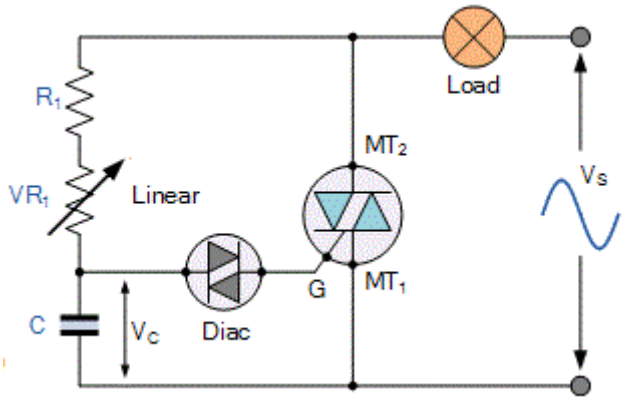

FIG 5 -Quadrac Circuit

2- RELAY CIRCUIT –

Relays are electromechanical devices that use an electromagnet to operate a pair of movable contacts from an open position to a closed position.
The advantage of relays is that it takes a relatively small amount of power to operate the relay coil, but the relay itself can be used to control motors, heaters, lamps or AC circuits which themselves can draw a lot more electrical power.
The electro-mechanical relay is an output device (actuator) which come in a whole host of shapes, sizes and designs, and have many uses and applications in electronic circuits. But while electrical relays can be used to allow low power electronic or computer type circuits to switch relatively high currents or voltages both "ON" or "OFF", some form of relay switch circuit is required to control it.
Here relay circuitry is used as a potentiometer help in triggering the quadrac circuit. Giving out a control by varying the voltage level.

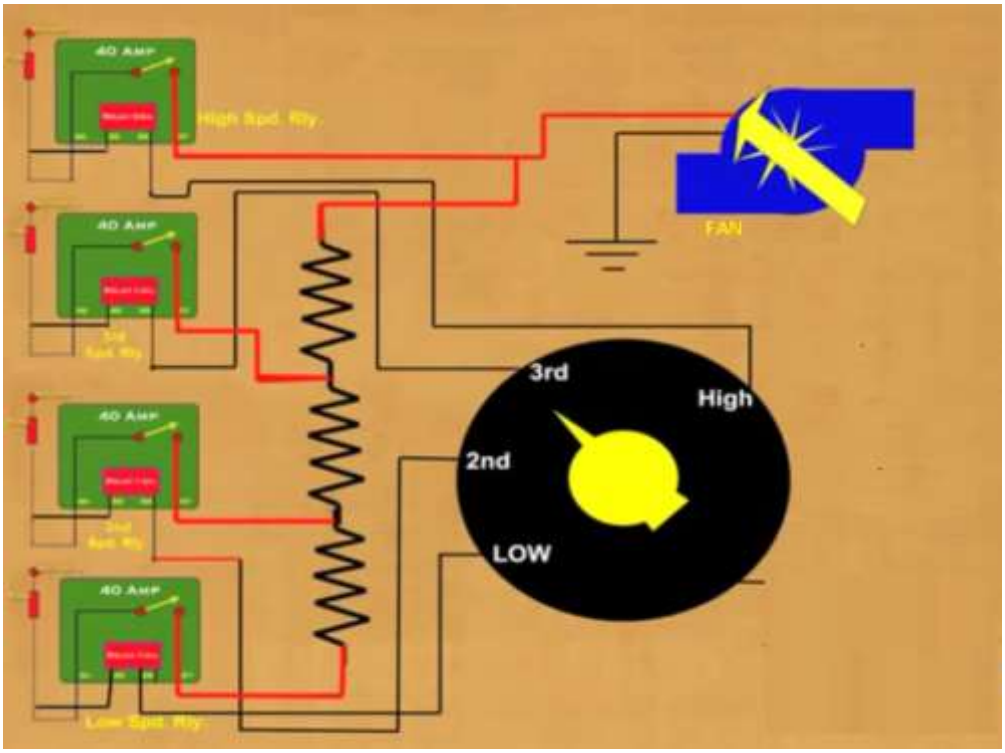

FIG 6-Relay Circuit

VII. RESULTS AND CONCLUSION

In this paper we are able to control the working of cooler automatically and proposed a new method of controlling the speed of fan motor (induction motor) by the use of relay, atmega 328 and triac.
The future proposal is that we can use this circuit as a box which can control any of the conventional available cooler to work automatically.

REFERENCES

[1]. Design of a Microcontroller based Fan Motor Controller for Smart Home Environment by Chee-Hoe Pang, Jer-Vui Lee, Yea-Dat Chuah, Yong-Chai Tan and N. Debnach Faculty of Engineering and Science, Universiti Tunku Abdul Rahman, Kuala Lumpur, Malaysia in International Journal of Smart Home Vol. 7, No. 4, July, 2013
[2]. Automatic Fan Speed Control System Using Microcontroller by Mustafa Saad, Hossam Abdoalgader, and Muammer Mohamed in 6th Int'l Conference on Electrical, Electronics & Civil Engineering (ICEECE'2014) Nov. 27-28, 2014 Cape Town (South Africa)
[3]. Fan Speed Controller using PWM by Akash Sharma , Vishal Pramanik in Abhiyantriki An International Journal of Engineering & Technology Vol. 3, No. 5 (May, 2016)
[4]. Real Time Remote Temperature & Humidity Monitoring Using Arduino by Vijay S. Kale , Rohit D. Kulkarni in International Journal of Innovative Research in Electrical, Electronics, Instrumentation And Control Engineering Vol. 4, Issue 6, June 2016
[5]. Room Temperature based Fan Speed Control System using Pulse Width Modulation Technique by Vaibhav Bhatia , Gavish Bhatia in International Journal of Computer Applications (0975 – 8887) Volume 81 – No5, November 2013
[6]. Ashfaq Husain "Electrical machines" second edition, Formerly, Reader in Electrical engineering University Polytechnic, Aligarh Muslim University, Aligarh.

APPENDIX

ARDUINO PROGRAMMING-

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(7,8,9,10,11,12);
```

```
#include <dht.h>
#define dht_dpin A0
int i, j;
dht DHT;
void setup()
{
  Serial.begin(9600);
     lcd.begin(16,2);
       lcd.setCursor(0,0);
      lcd.print("Weather Monitor");
   //  delay(4000);
     lcd.clear();
      lcd.setCursor(0,0);
      lcd.print("MIT");
        lcd.setCursor(0,1);
      lcd.print("Moradabad");
   //   delay(3000);
       lcd.clear();
       lcd.print("Made by:-");
        lcd.setCursor(0,1);
      lcd.print("Mohsin asad");
   //  delay(3000);
       lcd.clear();
      lcd.print("Md. Shadab");
   //   delay(3000);
       lcd.clear();
       lcd.print("Sarfaraz");
    //  delay(3000);
       lcd.clear();
        lcd.print("Ateequr");
    //  delay(3000);
       lcd.clear();
       lcd.print("Amit")
     // delay(4000);
       lcd.clear();
      lcd.setCursor(0,0);
      lcd.print("HUMIDITY:");
       lcd.setCursor (14,0);
      lcd.print("%");
      lcd.setCursor (0,1);
      lcd.print("TEMPERATURE:");
        lcd.setCursor (15,1);
      lcd.print("C");
      pinMode(5, OUTPUT);       //(RELAY1)
      digitalWrite(5, LOW);
      pinMode(2, OUTPUT);       //(RELAY2)
      digitalWrite(2, LOW);
      pinMode(3, OUTPUT);       //(RELAY3)
      digitalWrite(3, LOW);
      pinMode(4,OUTPUT);      // pump
      digitalWrite(4, LOW);
      delay(300);      //Let system settle
      analogReference(DEFAULT);
      delay(700);      //Wait rest of 1000ms recommended delay before
}
```

```
void loop()
{
    DHT.read11(dht_dpin);

 i=DHT.humidity;
    j =DHT.temperature;
  Serial.print(i);
  Serial.print(" ");
  Serial.println(j);
       lcd.setCursor (10,0);
            lcd.print(i);
              lcd.setCursor (12,1);
           lcd.print(j);
          if(i<=10)
          {
            digitalWrite(4, HIGH);
          }
           if(i>10 && i<20)
          {
            digitalWrite(4, LOW);
          }
           if(i>=10)
          {
            digitalWrite(4, LOW);
          }
          if(j<=20)
          {
            digitalWrite(5, LOW);
            digitalWrite(2, LOW);
            digitalWrite(3, LOW);
          }
           if(j>20 && j<25)
          {
            digitalWrite(5, HIGH); //speed 1 low
            digitalWrite(2, LOW);
            digitalWrite(3, LOW);
          }
           if(j>=25 && j<30)
          {
            digitalWrite(5, LOW);
            digitalWrite(2, HIGH); //speed 2 med
            digitalWrite(3, LOW);
          }
          if(j>=30)
          {
            digitalWrite(5, LOW);
            digitalWrite(2, LOW); //speed 3 high
            digitalWrite(3, HIGH);
          }
  delay(200);
}
```

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