

The Electronic Aspects of Smart Cooler

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Abstract- This research paper is regarding the various electronics used in this project- Design and Fabrication of smart cooler, which has become a prominent topic of today's discussion. This electronic component are used to control the various component of it, such as temperature adjusting switch, water lifting pump, moisture soil sensor. The components of smart cooler are described in this paper sequentially. The heating and cooling operation can be attained by achieving control on various parameters of these electronics components individually by means of microcontroller, relay switches and printed circuit board (PCB) mounted components..

Keywords- Etching Process, Rectification, Microcontroller Programming, Capacitive Filter, Regulation Of Current.

I. INTRODUCTION

The electronic aspect of smart cooler consist of various components which make an arrangement of complete automatic temperature conditioning system. It is a combination of mechatronics and thermal science, which is used to conditioned the room. In this paper we talked about various feature of this components which control the humidity of room, there are different relay switches to cut on/off the potential voltage to different mechanical component such as fan (blower), heating coil and pump.

The power supply to the controller which provide different voltage to the different components mounted on PCB circuit as per the voltage requirement of components. The five process done on PCB i.e. etching, drilling, soldering, mounting, testing. The mounted components are rectifier, filter capacitor, relays, microcontroller, regulator and display. the rectifier is used to convert the current from AC to DC. The relays require 12 volt, supply to pump, fan and heating coil. The other components require 5 volt as potential (microcontroller, filter, display, etc) regulated by regulator. The temperature sensor and moisture sensor are used for sensing the temperature and humidity. So in this page we talked about the control of circuit on cooler and how it can achieve the set temperature in cooling mode as well as heating mode.

II. COMPONENTS

A. Step down Transformer

The step down transformer concept is very simple. The turns of wire on primary coil is more than the secondary coil in step down transformer. Thus the voltage induced in secondary coil is reduced, which simultaneously reduces the output voltage. Hence it looks like that the voltage get reduced and output power will also decrease from transformer, but that is not the case. According to the laws of physics, the current and voltage has inverse relation i.e. $P = V \cdot I$, so current will goes up by drop in voltage in graph of volt vs current.

B. Rectifier

The conversion of current from AC to DC, wich allow the current to flow in one direction, is done by rectifier.-based semiconductor switches. Some year ago before the evolution in electronics engineering, electro-mechanical switches and motors had been used. Rectifiers have many applications in various electronics devices as a component of DC powersupply and high-voltage direct current power transmission systems. Rectification also have other roles in various devices, the detector of radio signal uses rectifier for detection. In gas heating systems the presence of flame is detected by rectifiers.

C. Capacitive Filter

Capacitor is a reactive element, which make it suitable for use in electronic filters. The reason behind this is that the impedance of a capacitor is a function of frequency, as explained in the article. Therefore the effects of capacitor on signal is frequency dependent, so by considering it the filter can be designed.

To perform predefined signal processing function, analog electronic filters are used. Example: low-pass filter (LPF), which blocks high frequencies but passes through low frequencies. Another example is the high-pass filter (HPF), which blocks low frequencies but passes through high frequencies. These are basic filter types, by combination of these more complicated filters can be created, such as band-

pass or notch filters. So the current from the rectifier is get by capacitive filter which filter the current and pass to the regulator for modification of current voltage as per the requirement of component.

D. Regulator

A stable DC voltage independent of the load current, temperature and AC line voltage variations can provided by a voltage regulator. a simple feed-forward design or negative feedback may be used by a voltage regulator. Depending on the design,it may use electronics component or may be electro-chemical, it is used to regulate the current.

Regulators are stabilized the DC voltages used by the processor and other elements in smart cooler circuit board. In automobile alternators and power generator plants, it control the output of the plant.

The circuit consists of following four parts.

- Reference voltage circuit
- Error amplifier
- Feedback network
- Series pass transistor

E. Microcontroller

A microcontroller is a system with peripherals, a processor and memory which is embedded as one system. It is also called as embedded controller. The circuit include solenoids, LCD displays, relays, switches and sensors for data like humidity, temperature or light level, amongst others in this project “smart cooler”.The two modes of our project are cooling and heating, a set temperature can be achieve by the circuit so the main component is microcontroller, which get the feedback by means of temperature sensor and moisture sensor and correct the fluctuations of the temp. the microcontroller just minimize the errors and achieved the humidity and require temperature.16F886 is used in this PCB circuit.

F. Relays

Relays are basically act as switches. In our project the mounted relays are for three purposes i.e. for water lifting pump, heating coil and blower. 12 V is used for relays for these three operation. It is basically an electronic switches. A contactor is a type of relay can handle high power electric motor or other loads. The regulator supplies 12 volt to the relays for operating the function. It get controlled by microcontroller for performing three operations.

IV. PROGRAM OF MICROCONTROLLER

Device = 16F886

OSC = 4

INCLUDE “LCD.H”

EQU MODE = PORTA.5

EQU FAN = PORTC.0 "*****FAN
 EQU PMP = PORTC.1 "*****PUMP
 EQU HTR = PORTC.2 "***** HEATER

Dim SM As BYTE
 Dim STP As BYTE

Dim TEMP As Float

MAIN:

LCD_CLEAR
 LCD_WRITE 1,1,"SMART COOLER"
 LCD_WRITE 2,1," TESTING"
 WAIT_(2000)

While 1=1

LCD_CLEAR

If MODE = 1 Then

LCD_WRITE 1,15,"HM"
 TEMP = ADC_READ(0) ' READC_READ()G TEMP
 TEMP = (TEMP * 5000) / 1024
 TEMP = TEMP / 10
 LCD_WRITE 1,1,"T= ", TEMP," C"

STP = ADC_READ(2)
 STP = STP / 10
 LCD_WRITE 2,1,"SP=",Dec STP

Else
 '=====

LCD_WRITE 1,15,"CM"

```

TEMP = ADC_READ(0)
TEMP = (TEMP * 5000) / 1024
TEMP = TEMP / 10
LCD_WRITE 1,1,"T= ", TEMP," C"

```

```

STP = ADC_READ(2)
STP = STP / 10
LCD_WRITE 2,1,"SP=", STP

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```

End If

```

```

WAIT_(1000)

```

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Wend

```

V. CIRCUIT OF SMART COOLER

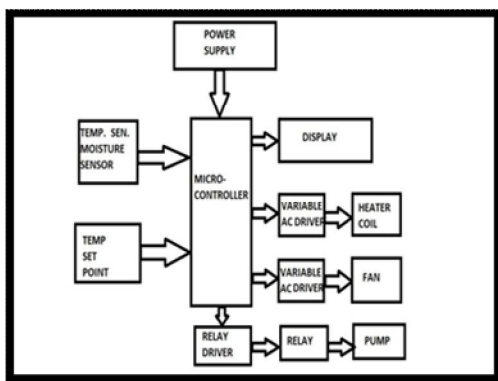


Fig.1. Circuit Diagram Of PCB

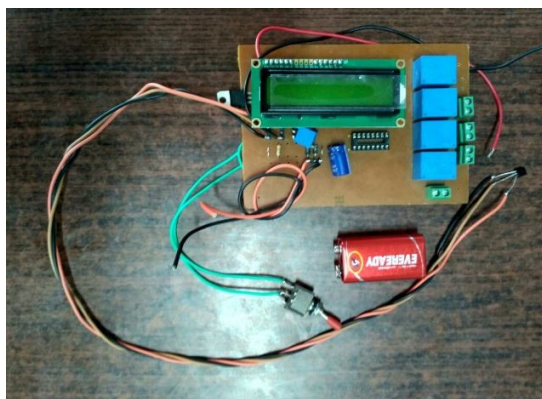


Fig.2. Components Mounted on PCB

VI. WORKING OF CIRCUIT BOARD

The working of PCB circuit board work on simple concept, the resistor, rectifier, filter capacitor, microcontroller are mounted on circuit board. The AC current supply from the power source get rectified by rectifier, the conversion of AC to DC is done by rectifier. The require voltage can be achieved by step down transformer. The DC current then pass through

the capacitive filter, which filter the current, then by regulator regulates the current. The microcontroller, display (LCD), resistor temperature sensor and moisture sensor require 5 volt. If the temperature increases than the set temp., the sensor will detect the variation in temperature and give the feedback to the microcontroller, the fluctuations can be minimize by the microcontroller. The heating mode and cooling mode can be by means of controller. the moisture sensor sense the moisture and maintain by means of microcontroller. If the temperature maintain as per the requirement in cooling mode then by cutting the power supply and control the pump, the consumption of water for wetting the wood wool is very less than normal air cooler. In case of heating mode by using microcontroller the set temperature of the individual requirement can be maintain by giving the command to the heating coil. The coil of 300 watt consume less power than the room heater and by means of blower the warm air get circulated. In this way the working of circuit board can be done.

VII. CONCLUSION

The world is moving towards the user friendly appliances which must be multitasking and compact. The space requirement can solved by this project. The electronic aspect of smart cooler are help to manage to control over the system. By this electronic circuit the set temperature can be achieved. It is perfect combination of innovation and compactness. Comfort zone temperature according to set up program in microcontroller is maintain by smart cooler. The humidification and cooling can be maintain as per requirement of the individual by use of electronic circuit board.

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