"TRANSFORMER OVERHEATING PROTECTION"

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ABSTRACT

The main intention of this project is to design a Thermoelectric cooling system that can be used in transformer overheating protection. The system checks the operating parameters of the transformer i.e. Losses and reports the quantity of heat generating that is in the transformer. The system is designed such that it is able to detect temperature rise above the normal operating level and the system automatically turn ON-OFF and if temperature rise above extremely operating level then transformer automatically isolate in power system. During this system is to ensure that the transformer is safe from temperature that can make it to overheat thus get damaged. It gives a solution to the need to reduce cost of maintenance and ensure that transformer temperature can be maintain of this cooling system.

Keyword: - *Thermoelectric cooling, Transformer, Overheating Protection, Temperature Controlling*

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1. INTRODUCTION

Thermoelectric cooling system through cooling by power transformer for protection against overheating. The system is designed such that it is able to detect temperature rise above the normal operating level and the system automatically turn ON-OFF. During this system is to ensure that the transformer is safe from temperature that can make it to overheat thus get damaged. It gives a solution to the need to reduce cost of maintenance and ensure that transformer temperature can be maintain of this cooling system.

1.1 OBJECTIVE

- Selection of TEC module for transformer cooling.
- Made temperature controlling command circuit.
- Proper selection of transistor according TEC module carrying current rating and used as a switch for controlling cooling system.
- Objective of work was the evaluation of made of cooling system for cooling of transformer on normal operating level for protection against overheating.

1.2 TEC Module

A practical thermoelectric cooler module consists of two or more elements of semiconductor material that are connected electrically in series and thermally in parallel. These thermoelectric elements and their electrical interconnects typically are mounted between two ceramic plates. The substrates serve to hold the overall structure together mechanically and to insulate the individual elements electrically from one another and from external mounting surfaces. After integrating the various component parts into a module.

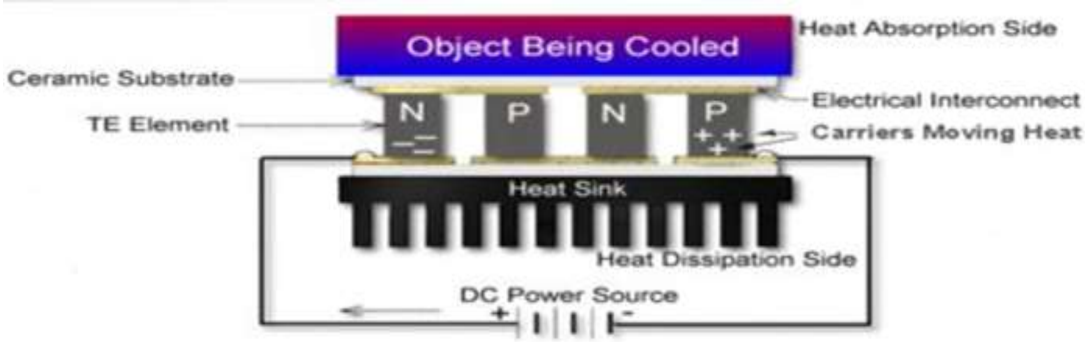

Fig 1: Schematic Diagram of a Typical Thermoelectric Cooler

Heat flux (heat actively pumped through the thermoelectric module) is proportional to the magnitude of the applied DC electric current. By varying the input current from zero to maximum, it is possible to adjust and control the heat flow and temperature.

1.3 Advantanges

- A TEC module works on electricity so they have no moving parts so they could less maintance.
- Precise Temperature Control
- This device do not use or generate any kind of gases those harmful for environment.
- TEC modules generate virtually no electrical noise and can be used in conjunction with sensitive electronic sensors.
- TEC modules operate directly from a DC source. TEC having a wide range of input voltages and currents are available. Pulse Width Modulation (PWM) may be used in many applications.
- Thermoelectric coolers will either cool or heat depending upon the polarity of the applied DC power. This feature eliminates the necessity of providing separate cooling and heating functions within a given system.

1.4 Disadvantage

- It able to dissipate limited amount of heat flux.
- Low amount of coefficient of performance than vapor-compression systems.
- Relegated to low heat flux produce applications.
- Total amount of heat to remove than without a TEC.

1.4 Application

- Integrated circuit cooling
- Long lasting cooling devices
- Low noise amplifier
- Black Box Cooling

2. HARDWARE IMPLEMENTATION

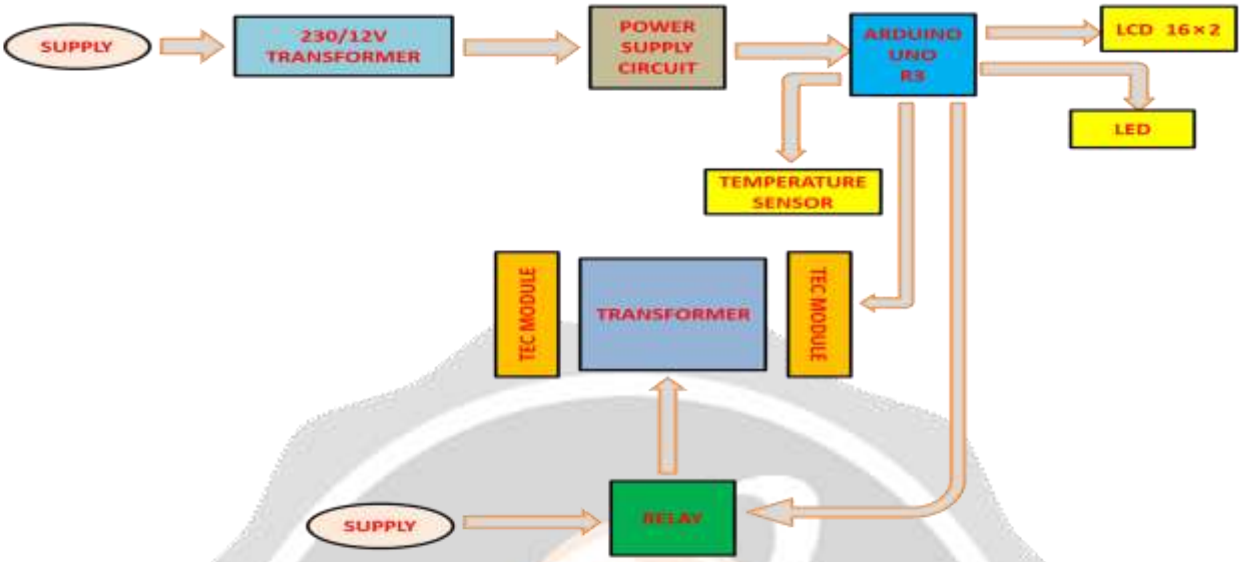

Fig 2: Block Diagram

The ARDUINO UNO R3 has been used as the main device in the development of this system. The microcontroller controls the both inputs and outputs of the circuit. It heats and cools one side of TECs by using a transistor as a switch circuit. The TEC is will be attached to the heat sink. The most pivotal part of this heating/cooling of the suit is performed by the TEC-12706. The thermoelectric cooler (TEC) is also called as Peltier cooler. The peltier cooler is a solid state heat pump which uses the peltier effect to move heat. Thermoelectric cooler were selected with a maximum operating voltage of 16.4V and 6.4Amp. It releases all heat from the hot side of the thermoelectric device. Hence this use for cooling purpose in transformer.

2.1 ARDUINO UNO

The Arduino Uno is a microcontroller on a circuit board based on Atmega328. It has 14 digital input and output pins in which 6 can be used as PWM outputs. It also has 6 analog inputs, a USB connection, a power jack, a 16MHZ ceramic resonator, an ICSP header and a reset button. The Arduino Uno has Flash memory is 32KB ,SRAM is 2KB, EEPROM is 1KB and the Clock speed is 16mhz.The Arduino Uno can be powered through the USB association or with an external power supply. The power source is chosen naturally.

Fig 2.1: Arduino Uno

2.1 INTERFACING LM 35 TO ARDUINO

The LM35 sensor is a precision integrated circuit temperature device with an output voltage is linearly proportional to the centigrade temperature. It would be connected to the microcontroller.. As a temperature sensor, the circuit will read the temperature of transformer and is converted from binary to decimal via programming of the microcontroller which we will be able to read from the computer of the Arduino serial monitor. This is done by the programming loaded into the Arduino. LM 35 has three pins, Vcc pin are connected to 5V to arduino, GND pin are connected to GND on arduino and output pin connected to anyone pins of analogues pins (A0-A5) of arduino.

2.2 INTERFACING LED TO ARDUINO

LED has two pins anode and cathode are respectively. Anode pin is connected to pin no. 13 of arduino and cathode connected to GND through ground of arduino.

2.3 INTERFACING LCD TO ARDUINO

LCD can be interfaced with arduino in 4 Bit or 8 Bit mode. These differs in how data is send to LCD. In 8 bit mode to write a character, 8 bit data is send through the data lines D0 – D7 but 4-Bit Mode uses only four data lines D4 – D7. 4-bit communication is a bit slower than 8-bit communication but this speed difference can be neglected since LCDs are slow speed devices. Thus 4-bit mode data transfer is most commonly used.

LCD has total 16 pins. Pin 1, 5, 16 are connected to GND of arduino, Pin 2 and 15 connected to 5V of arduino, Pins 10 to 14 are connected to digital pins of arduino.

2.4 INTERFACING TIP 122 TRANSISTOR TO ARDUINO

TIP 122 interface to arduino for used as a switch for controlling thermoelectric cooling system. TIP 122 has a three pins, these are base pin is connected to pin no. 5 output pin of arduino, collector pin is connected to cathode pin of TEC module. Emitter pin is connected to ground pin of arduino. Diode is joined between collector and emitter pin for safety purpose.

2.5 INTERFACING RELAY TO ARDUINO

In all electronic appliance we need to switch or control high currents or high voltages. In these cases we may use electromagnetic or solid state relays. In this circuit we are using a single Pole Double Throw (DPDT) relay. It has 1 terminals and 2 connectors. A 240v supply is connected to relay and applying the transformer when internal temperature sensor is beyond certain limits than relay operates and trip of transformer and cooling system turn off. Otherwise the relay switches the transformer.

3. RESULT AND ANALYSIS

We design a system into three cases according to temperature range (Assume we take X & Y temp. value).

- CASE 1: X < Temp. (°C), LED On
- CASE 2: X < Temp. (°C) < Y, Cooling System On
- CASE 3: Temp. (°C) > Y, Transformer Trip

3.1 CASE 1: X < Temp. (°C), LED On

In this case we can set temperature at desired value e.g. X°C so when temperature increase below (normal) this temperature that time LED can on and TEC system at this time would be off.

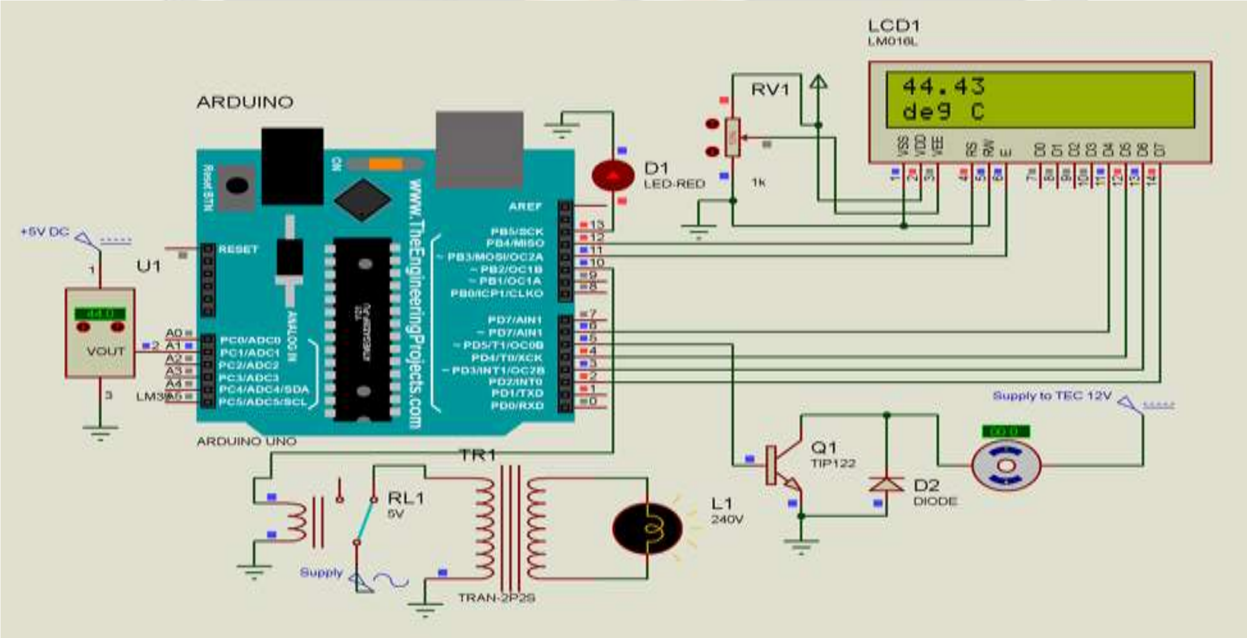

Fig -3.1: CASE 1: X < Temp. (°C), LED ON

3.2 CASE 2: X < Temp. (°C) < Y, Cooling System On

In this case we can set temperature at desired value e.g. in between (X < Temp. °C < Y) so when temperature increase beyond (normal) certain limits and in between this limits then that time LED can off and TEC system at this time would be ON.

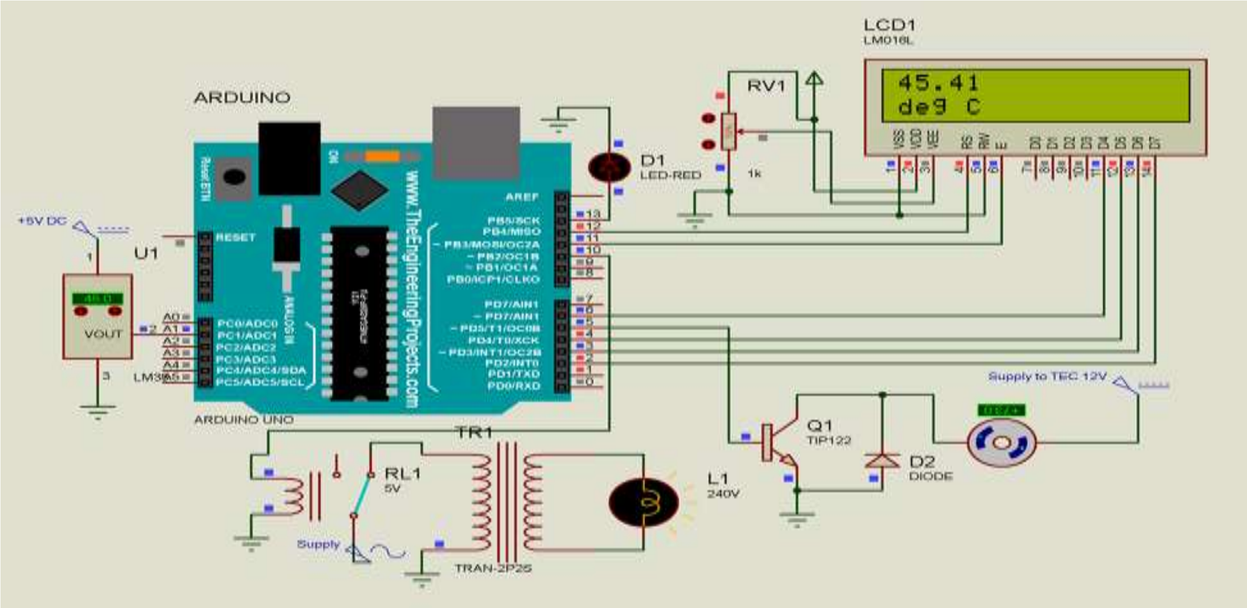

Fig -3.2: CASE 2: X < Temp. (°C) < Y, Cooling System On

3.3 CASE 3: Temp. (°C) > Y, Transformer Trip

In this case when temperature increase beyond Y°C (certain limits) so this time cooling system will be off and relay through main transformer would trip immediately.

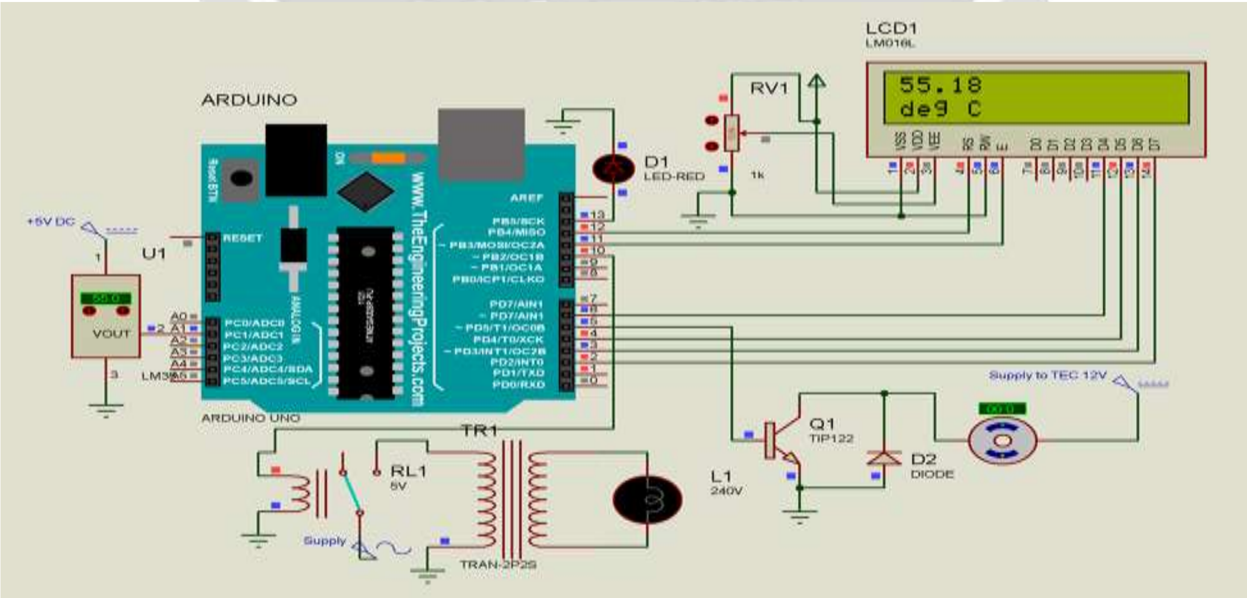

Fig -3.3: CASE 3: Temp. (°C) > Y, Transformer Trip

4. CONCLUSIONS

A basic reason of overheating in transformer is failure in cooling system. Now days used cooling systems are required more maintance, increase size of transformer and easily failure. This problem is overcome by the new techniques. This thing is approved by the Thermo-electric cooling system. Comparative analysis of this cooling system with other cooling system is better cooling with equal time periods and no need more maintance, controlling temperature setup range is quitter easy for understand and operated.

Overall conclusion for this techniques point out that this system operated through arduino so we can easily choose temperature according to our required and this cooling system made by thermo-electric module so it's better cooling comparetely other systems.

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