Novelty Journals

ISSN 2394-9678

International Journal of Novel Research in Electrical and Mechanical Engineering
Vol. 3, Issue 1, pp: (29-34), Month: January-April 2016, Available at: www.noveltyjournals.com

Super-Fast Electronic Circuit Breaker

Abhishek Gupta[1], Shobhit Ahuja[2], Teeka Ram Saini[3], Mohit Kumar[4], Sarita Meena[5], Neetlata[6]

[1,2] Assistance Professor, [3,4,5,6] Student B.Tech-IV Year
Department of Electrical Engineering Swami Keshvanand Institute of Technology, Management & Gramothan, Ramnagariya, Jagatpura, Jaipur, Rajasthan – India

Abstract: **The project is designed to shut down a power supply when it is overloaded by using a super-fast electronic circuit breaker. The concept of electronic circuit breaker came into focus realizing that the conventional circuit breakers such as MCBs take longer time to trip. Therefore, for sensitive loads, it is very important to activate a tripping mechanism at the shortest possible time, preferably instantaneously. The electronic circuit breaker is based on the voltage drop across a series element proportional to the load current, typically a low-value resistor. This voltage is sensed and rectified to DC, and then is compared with a preset voltage by a level comparator to generate an output that drives a relay through the MOSFET to trip the load. The relay use in place of a semiconductor switch is preferred because such solid state switches would invariably fail in case of accidental short circuits. A circuit breaker is automatic operated switch designed to shut down the power supply when overloaded. The tripping depends on the current passing through the CT's which is connected in series with load. It uses the PIC- microcontroller into which program is dumped for the operation. The unit is extremely fast and over comes the drawback of thermal type circuit breaker like MCB based on a thermal bimetal lever-trip mechanism which is very slow.**

Keywords: **Current transformer, comparator IC, micro controller 8051 family, MOSFET, relay, transistor, voltage regulator.**

I. INTRODUCTION

In this project electrical system can be protected from the over load condition. Industrial instruments or home appliances failures have many causes and one of the main causes is over load. The primary of the distribution transformer or any other transformer is designed to operate at certain specific current, if that current flowing through that instrument is more than the rated current, then immediately the System may burn because of over load, through this project we are going to protect the system from over load condition. In this project work for generating high current or over load current more loads are applied to the circuit; so that the current will be increased. Whenever the over current is drawn by load the circuit will be tripped. To trip the circuit we are using one relay which will be controlled through PIC microcontroller. When over load occurred the relay will trip the total circuit. And it will be monitored on the LCD. LCD displays are used to display the status of circuit breaker. For protection from over current condition first we have to measure the total load current. Here we are using CT for measuring the load current and the output of CT is given to ADC for converting analog output of CT into digital data. Hence ADC output is given for monitoring purpose. When current increases behind certain limit then we are going to trip the load by using relay. In this project we are using 230v bulbs as a load. We are going to increase the load by increasing the number of bulbs ON. When we ON more bulbs it causes over load condition and microcontroller will detect that and it will trip the total load by using relay through MOSFET which acts as switching circuit.

II. LITERATURE REVIEW

The history of power electronics is very much connected to the development of switching devices and it emerged as a separate discipline when high-power and MOSFET devices were introduced in the 1960s and 1970s.Since then, the introduction of new devices has been accompanied by dramatic improvement in power rating and switching performance. Because of their functional importance, drive complexity, fragility, and cost, the power electronic design engineer must be equipped with a thorough understanding of the device operation, limitation, drawbacks, and related reliability and efficiency issues. In the 1980s, the development of power semiconductor devices took an important turn when new process technology was developed that allowed integration of MOS and bipolar junction transistor (BJT) technologies on the same chip. Thus far, two devices using this new technology have been introduced: insulated bipolar transition (IGBT) and MOS controlled thyristor (MCT). Many integrated circuit (IC) processing methods as well as equipment have been adapted for the development of power devices. However, unlike microelectronic ICs, which process information, power device ICs process power and so their packaging and processing techniques are quite different. Power semiconductor devices represent the ‘‘heart’’ of modern power electronics, with two major desirable characteristics of power semiconductor devices guiding their development:

1. Switching speed (turn-on and turn-off times)

2. Power handling capabilities (voltage blocking and current carrying capabilities)

Improvements in both semiconductor processing technology and manufacturing and packaging techniques have allowed power semiconductor development for high-voltage and high current ratings and fast turn-on and turn-off characteristics.

Today switching devices are manufactured with amazing power handling capabilities and switching speeds as will be shown later. The availability of different devices with different switching speeds, power handling capabilities, size, cost etc., makes it possible to cover many power electronics applications. As a result, trade-offs are made when it comes to selecting power devices.

III. EXPLANATION

The main power supply is given directly to load through CT and step down transformer. 230 volt is Step down to 12v and supplied to regulated supply unit which consist of bridge rectifier to convert ac to dc and passed through 7805 regulator to get 5v supply for working of microcontroller, capacitor filters are used to remove the ripples to get pure constant dc voltage. The current passing to load is sensed by the current transformer and output of CT will be in analog form is given to the ADC pin of PIC microcontroller for converting the analog output to digital data. The current sensed is compared with the inbuilt comparator of microcontroller which as pre-set reference value. If the current sensed is less than the pre-set value than MOSFET will be in OFF state and relay will not trip the supply to load. As we increase the load current drawn is more so if the current is increase than the pre-set value than MOSFET will turn ON and energizes the relay. Thus LED used as an Indicator is properly biased, and it glows. The relay coil gets energized, causing the armature to shift its position to the normal open point from the normal closed point. The AC supply to the load is thus cut off from the load and the load is tripped. Once the circuit is tripped it must be reset for further use using reset button. In either case, the microcontroller is programmed so as to show the status of the output on the LCD interfaced to it. In case of normal operation microcontroller will pin will receive 5v dc from regulator and accordingly displays the status on the LCD. In case of any abnormalities, the microcontroller pin doesn’t receive the 5V input signal and the related status is accordingly display on the LCD.

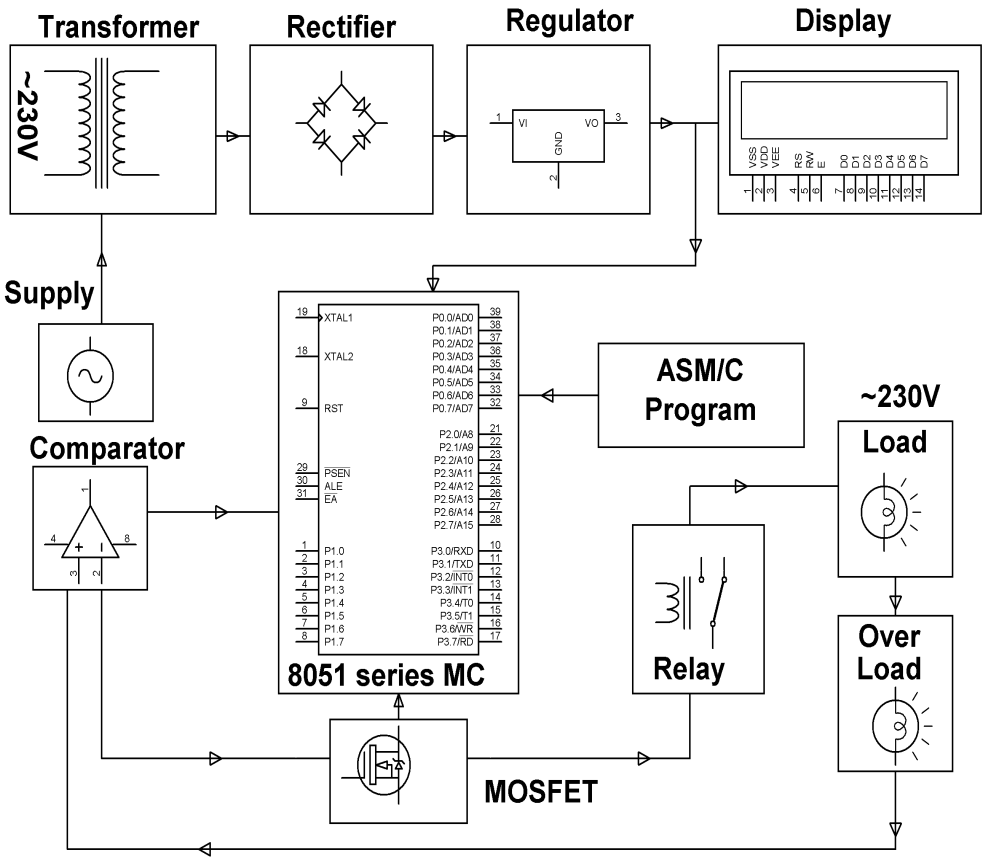
IV. HARDWARE IMPLEMENTATION

The figure shows the hardware implementation of ultra fast acting electronic circuit breaker using microcontroller.

Novelty Journals

ISSN 2394-9678

International Journal of Novel Research in Electrical and Mechanical Engineering
Vol. 3, Issue 1, pp: (29-34), Month: January-April 2016, Available at: www.noveltyjournals.com



COMPONENTS DISCRIPTION:

TABLE 1: COMPONENTS TABLE

S.R. NO	NAME OF COMPONENT
01	8051 Series Microcontroller
02	Transformer
03	Diodes
04	Capacitor
05	Resistors
06	Led
07	Voltage regulator
08	Relay
09	Lamps
10	Comparator IC
11	Switch
12	LCD connector
13	Transistor
14	MOSFET
15	Toridal Coil

Novelty Journals

ISSN 2394-9678

International Journal of Novel Research in Electrical and Mechanical Engineering
Vol. 3, Issue 1, pp: (29-34), Month: January-April 2016, Available at: www.noveltyjournals.com

TABLE 2: TRIP CURRENT SETTING

Voltage across CT In volts	Filtered DC trip current In amps	Full wave DC & AC trip current In amps
2.85	14.25	10.08
2.70	13.50	9.55
2.55	12.75	9.02
2.40	12.00	8.49
2.25	11.25	7.96
2.00	10.00	7.07
1.95	9.75	6.90
1.80	9.00	6.36
1.65	8.25	5.83
1.50	7.50	5.30
1.35	6.75	4.77
1.20	6.00	4.24
1.05	5.25	3.71
0.90	4.50	3.18
0.75	3.75	2.65
0.60	3.00	1.59
0.45	2.25	1.06
0.30	1.50	1.06
0.15	0.75	0.53
0.10	0.50	0.3

HARDWARE IMPLEMENTATION:

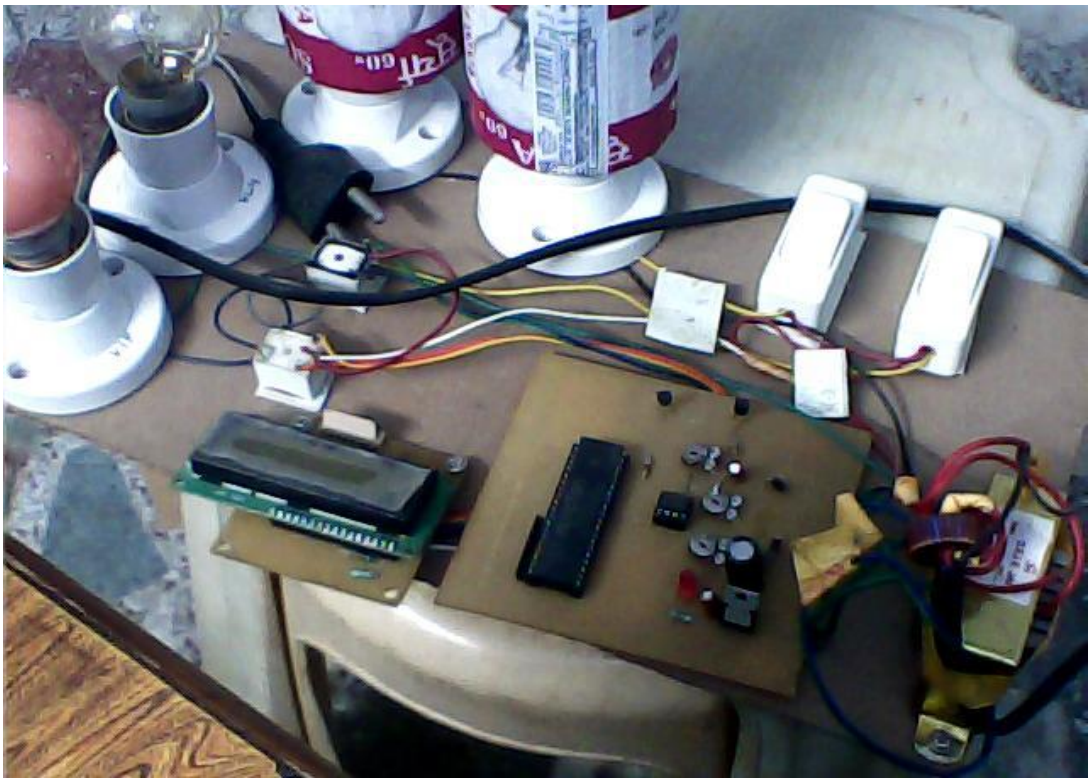


Fig. - Mechanical Implementation of the project

Novelty Journals

ISSN 2394-9678

International Journal of Novel Research in Electrical and Mechanical Engineering
Vol. 3, Issue 1, pp: (29-34), Month: January-April 2016, Available at: www.noveltyjournals.com

V. PROGRAMMING

```
#include<at89x52.h>
#include<lcd.h>
short int u1,u2;
void main( )
{
   P0=0x00;P2=0xFF;
   P3_2=1;P3_3=1;P3_4=0;P3_5=0;
   LCD_INIT();LCD_CMD(0x0C);
   LCD_WRITE("    *WELCOME* ");DELAY(2000);
   LCD_CMD(LCD_CLEAR);LCD_WRITE(" over load");
   LCD_CMD(0xC0);LCD_WRITE("  SYSTEM NORMAL");
   P3_4=1;P3_5=1;
   while(1)
   {
        if(P3_2==0&&u1==0)
        {
         LCD_CMD(0xC0);LCD_WRITE("LOAD 1  DISCONN");
          P3_4=0;u1=1;
        }
        else if(P3_2==1&&u1==1)
        {
          LCD_CMD(0xC0);LCD_WRITE("  SYSTEM NORMAL");
          P3_4=1;u1=1;
        }
        if(P3_3==0&&u2==1)
        {
          LCD_CMD(0xC0);LCD_WRITE("    LOAD 2  DISCONN");
          DELAY(2000);
           while(P3_3==0){P3_5=0;DELAY(2000);P3_5=1;DELAY(2000);}
        }
        if(P3_3==1&&u2==0)
        {
           LCD_CMD(0xC0);LCD_WRITE(" LOAD 1 CONNECTED");
          P3_5=1;u2=0;
        }
   }
}}
```

VI. CONCLUSION

Now A days the protection and control of equipment plays a very important role. To avoid electrical failure we use fast responding circuit breakers because of its considerable accuracy in fault detection and cut off- time, and also its smooth operation compared to conventional type. Comprehensive experiments conducted by constructing the necessary circuit yielded successful results. It was proved that electronic circuit breaker is very useful circuit for sensitive loads. The main advantage of this circuit is that over all tripping time is less as compare to conventional circuit breaker. The experiment is successful and energy saving. Further research on improving the load capacity and tripping time is being undertaken.

VII. FUTURE SCOPE

The operating time of electromagnetic relay can be improved by using sophisticated electronic components.

REFFERENCES

[1] Francesco Bittoni Guido Fiesholi , Lorenzo , Cincinelli "Electronic Circuit Breaker ", Patent# Wo 2004/082091 A1 September 2012.

[2] J. Meyer, A Rufer, "DC Hybrid CB with ultra fast contact opening with IGCT", IEEE transactions on power delivery, April 2006.

[3] International Journal of Scientific Engineering and Technology Research 'Ultra Fast Acting Electronic Circuit Breaker' Volume.04, IssueNo.11, May-2015, Pages: 2130-2131

[4] Raj kamal –Microcontrollers Architecture, Programming, Interfacing and System Design.

[5] Mazidi and Mazidi –Embedded Systems.

[6] PIC-Microcontroller Manual – Microchip.

[7] A M S Almadji & J G J Sloot review of Current limitting IEEE.

[8] T. Genji , Nakamar: high speed circuit Breaker for electric power system.