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Fast Acting Electronic Circuit Breaker for Overloading Using Microcontroller

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ABSTRACT: Increase in population will lead to increase in electricity consumption in domestic as well as in industrial purposes, and therefore it is mandatory to protect the electrical system from overload. A circuit breaker is a device that breaks the circuit in case of overloading. Tripping of circuit is depending on the current passing through the load. Conventional circuit breaker takes longer time to trip because of mechanical construction. Therefore we can use electronic devices that have fast response time. An electronic circuit breaker is based on the voltage drop across a series element, and then this voltage drop is compared with the preset value using comparator. A Microcontroller is used to perform the operation of this circuit breaker. This will energize the relay through MOSFET and trips the load.

KEYWORDS: Microcontroller, relay, MOSFET, LCD, Comparator, ECB

I.INTRODUCTION

In this project overload condition is minimized in an electrical system. In homes as well as in industries the main cause of electrical system failure is overloading. In any electrical device if the current following through it is more than the rated current then immediately that device will burn because of overloading. In this project overloading condition will be achieved by connecting more loads in series with the existing load. So whenever over current is drawn by load the circuit will be tripped. To trip the circuit in millisecond we are using one relay that is energized by the output of the MOSFET. A microcontroller is used for displaying the status of the circuit breaker on the LCD. Current is sensed by comparing the voltage drop across the resistor with a fixed voltage using comparator IC. 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 loads it causes over load condition and microcontroller will detect that and it will trip the total load by using relays 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 aseparate 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.

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II.EXPLANATION AND HARDWARE IMPLEMENTATION

Hardware Implementation

The figure shows the hardware implementation of fast acting electronic circuit breaker using microcontroller. In the figure we can see that supply in connected to both transformer as well as load. Transformer side supply is used to run microcontroller, LCD and other component that are using DC.

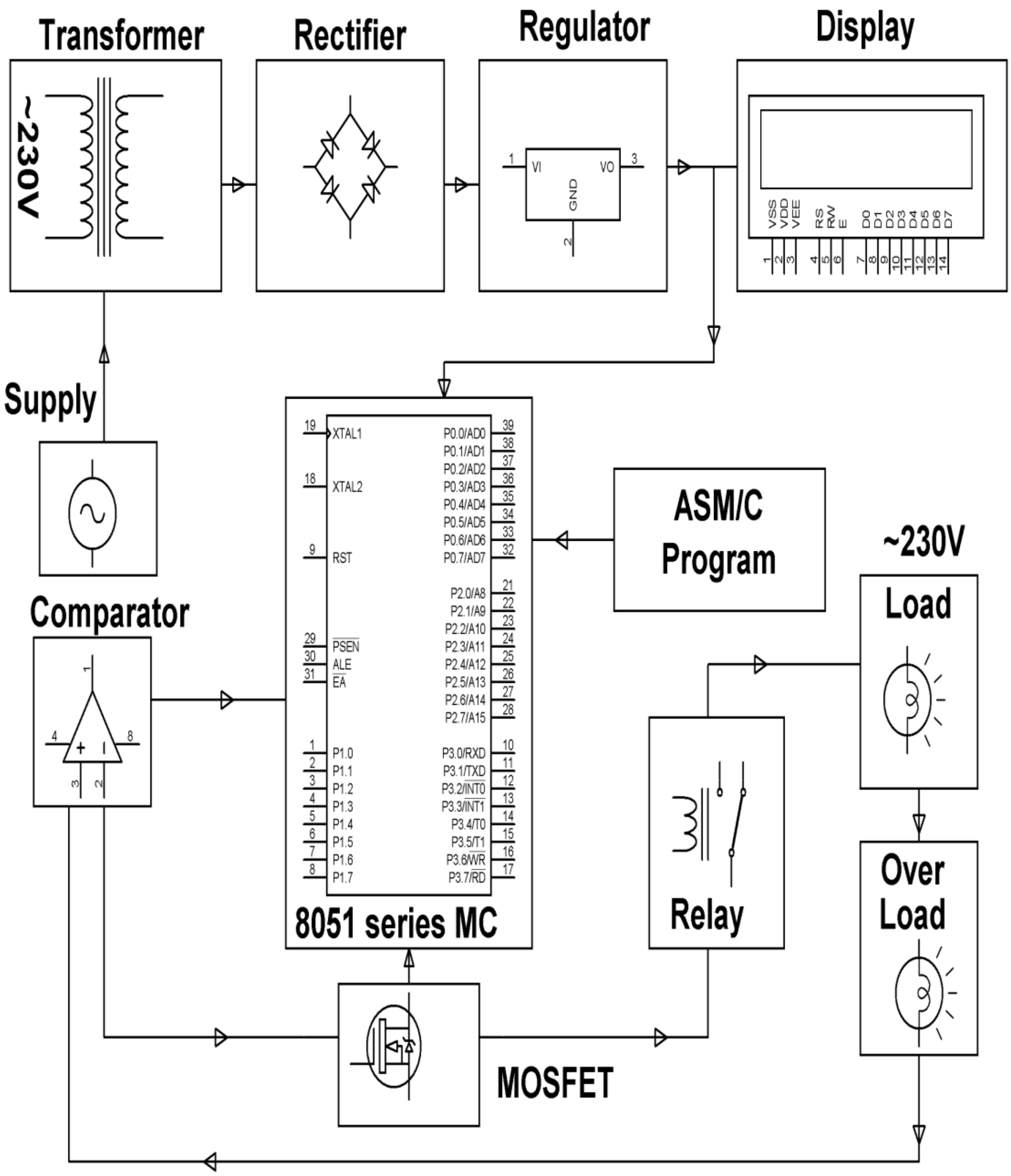

Fig 1 Block Diagram

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Explanation

Power supply of 230V AC is given directly to the load as well as the transformer that step-downs it to 12V and then supplied to the bridge rectifier that convert it into 12V DC. This DC is then passed through the IC 7805 that regulates 12V DC into constant 5V DC as a supply for microcontroller, filters are used to get pure DC without any ripples. Comparator IC compares the load current value with the preset value. If the value is greater than the preset value then relay will trip the circuit with the help of MOSFET. 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. 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 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.

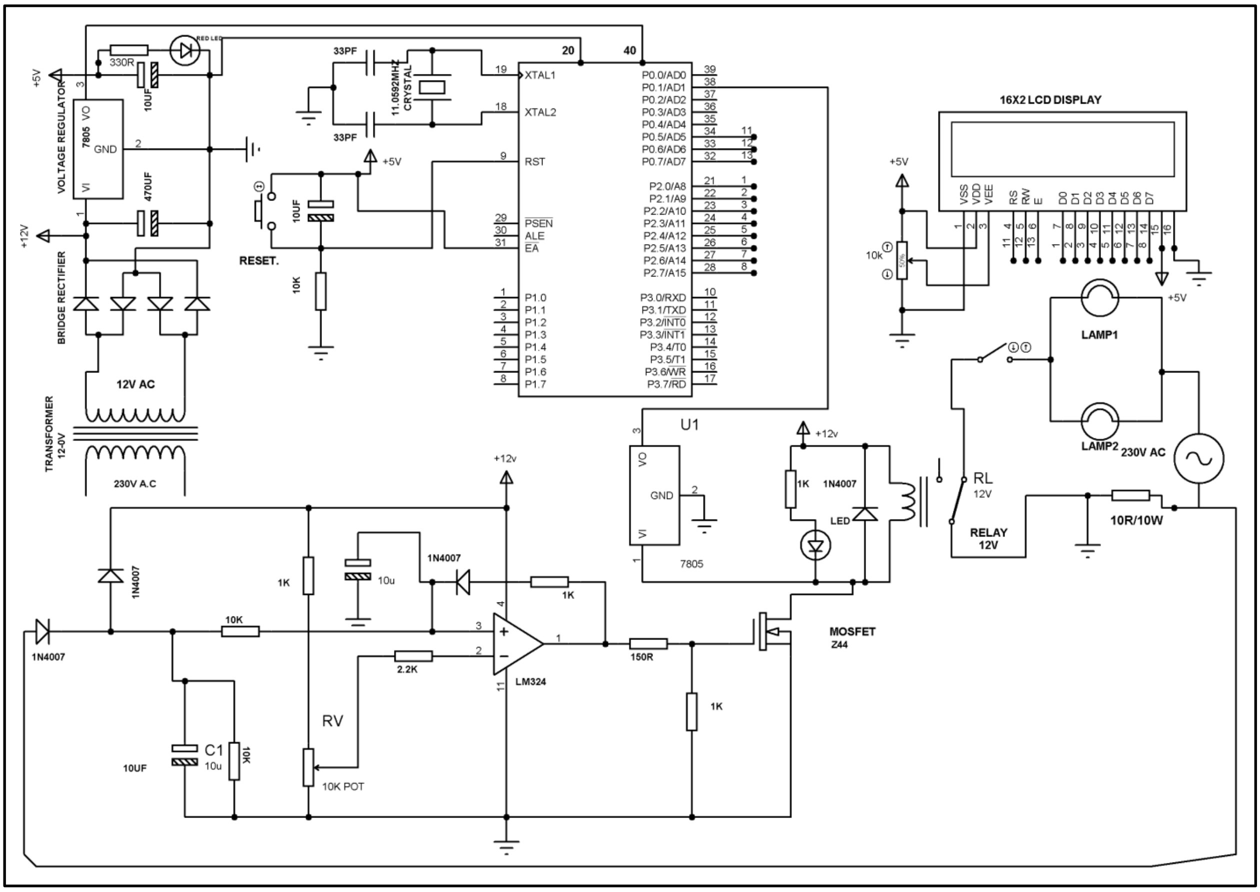

Fig. 2 Circuit Diagram

III.COMPONENTS DISCRIPTION

Below are the components and there specifications that are used in this particular project. And some components that doesn't have particular specification and also shown in the miscellaneous component section.

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SERIAL NO.	COMPONENTS	SPECIFICATIONS
1.	Resistors	330,150,1K,2.2K,10K,10/10w,10K Preset,10K SIP
2.	Capacitors	1000uF/35V, 10uF/63V, 33pF Ceramic
3.	ICs	7805, 8051,LM324,IRF530
4.	LED	Red
5.	Load (Bulb)	100W
6.	Transformer	0-12V
7.	Relay	12V
8.	LCD	16*2
9.	Diode	1N007

Miscellaneous Component:

1. Bulb Holder
2. 4-Pin Push Button
3. Crystal 11.0592MHz
4. Heat Sinks
5. AC Connector
6. Power Cord
7. Slide Switch
8. PCB Connectors
9. Female Burge 16 Pin for LCD
10. Male Burge 2 Pin

IV. ACTUAL HARDWARE

Below are the actual hardware shown in both normal as well as in overload condition. First fig. shows the circuit breaker in normal load condition and in second fig when one more bulb is connected circuit breaker goes to the overload loading condition and therefore the circuit will trip and both bulbs will go off.

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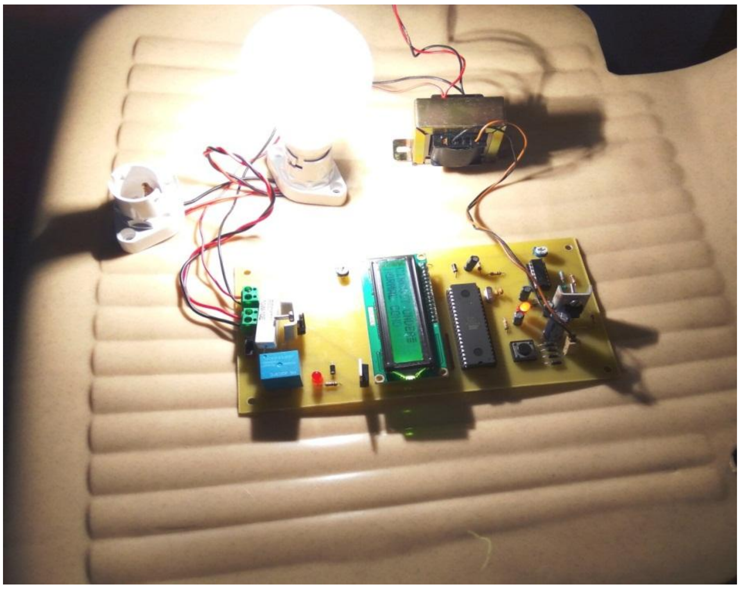

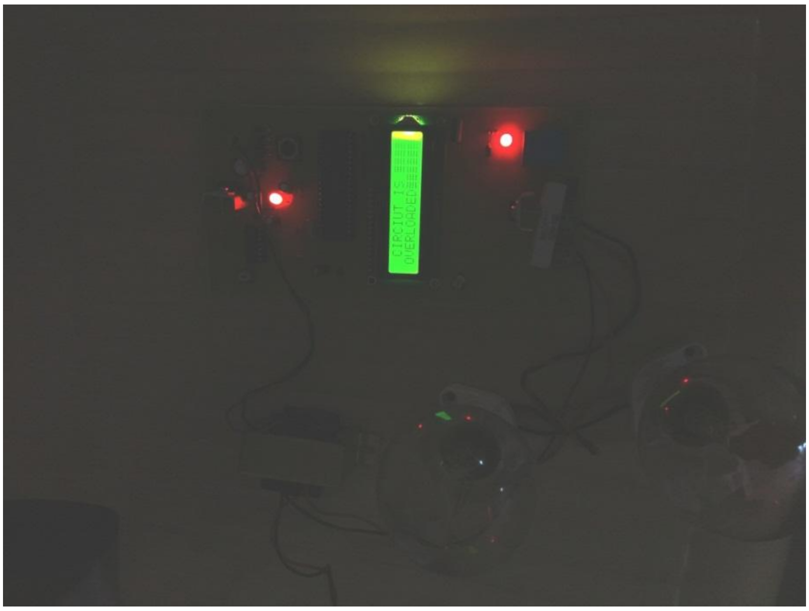

Fig. 4.2 ECB on overload condition

VI.CONCLUSION

Thus this project will trip the circuit when overload condition occurs this will therefore save many electrical devices and person near it. 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

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circuit breaker. The experiment is successful and energy saving. Further research on improving the load capacity and tripping time is being undertaken.

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