Review of Ultra Fast Acting Electronic Circuit Breaker at Overloading

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ABSTRACT: The project is designed to cut off the power supply when it is overloaded. Traditional circuitbreaker like MCB based is on thermal bimetal lever trip mechanism. MCB is very slow and the trip time varies according to the percentage of overload. The concept of electronic circuit breaker came into focus when the traditionalcircuit breakers such as MCBs take longer time to trip. Eventually, for susceptive loads it is very important to activate the tripping mechanism at the instantaneously at shortest possible time. This project is displaying fast tripping mechanism as against the slow one like MCB.The concept of this project is based on the voltage drop across a series element(resistor) proportional to the load current.In this project this voltage is sensed by opto-coupler and then compared with a preset voltage by an Op-amp to generate an output that drives a relay to trip the load. The unit is extremely fast and overcomes the limitation of the thermal type. It uses a microcontroller of AT89S52.

KEYWORDS: Microcontroller, Relay, opto-coupler

I. INTRODUCTION

An electronic circuit breaker mainly consists of automatic operation switch which is controlled by the feedback from the load. It is based on the fact that when the current is too much drawn by the loads or being too much flowing in the line due to overload, the switch is automatically closed. The switch is an electromechanical switch like a relay, which is controlled by microcontroller through a current sensing element like a resistor. This ultra fastelectronic circuit breaking device uses a series resistorto sense whenever the current exceeds the set value(due to overload), the corresponding voltage drop (across the series resistor) also increases. This voltage is sensed and then compared with a preset voltage by an op-amp to generate an output that drives a relayto trip the load within a millisecond. The tripping timeis very low as it is rooted on the principle of current sensing. A microcontroller is used for displaying the status of the circuit breaker on the LCD.A resistor is used as a current sensor and current is sensed by comparing the voltage drop across the resistor with a fixed voltage. In case of any abnormalities, the voltage drop goes high, which leadsthe load to trip, i.e. power supply gets disconnected from the circuit.This project is designed to build a circuit breaker which is used to sense the over load current (through series resistor) and accordingly power supply is isolated from the load. Traditionally fuses were used for this purpose, which is unconvincing and unreliable and hence switches are used. The lineal switches used are the Miniature Circuit Breakers which have the drawback of longer tripping time due to the presence of bimetallic strip.
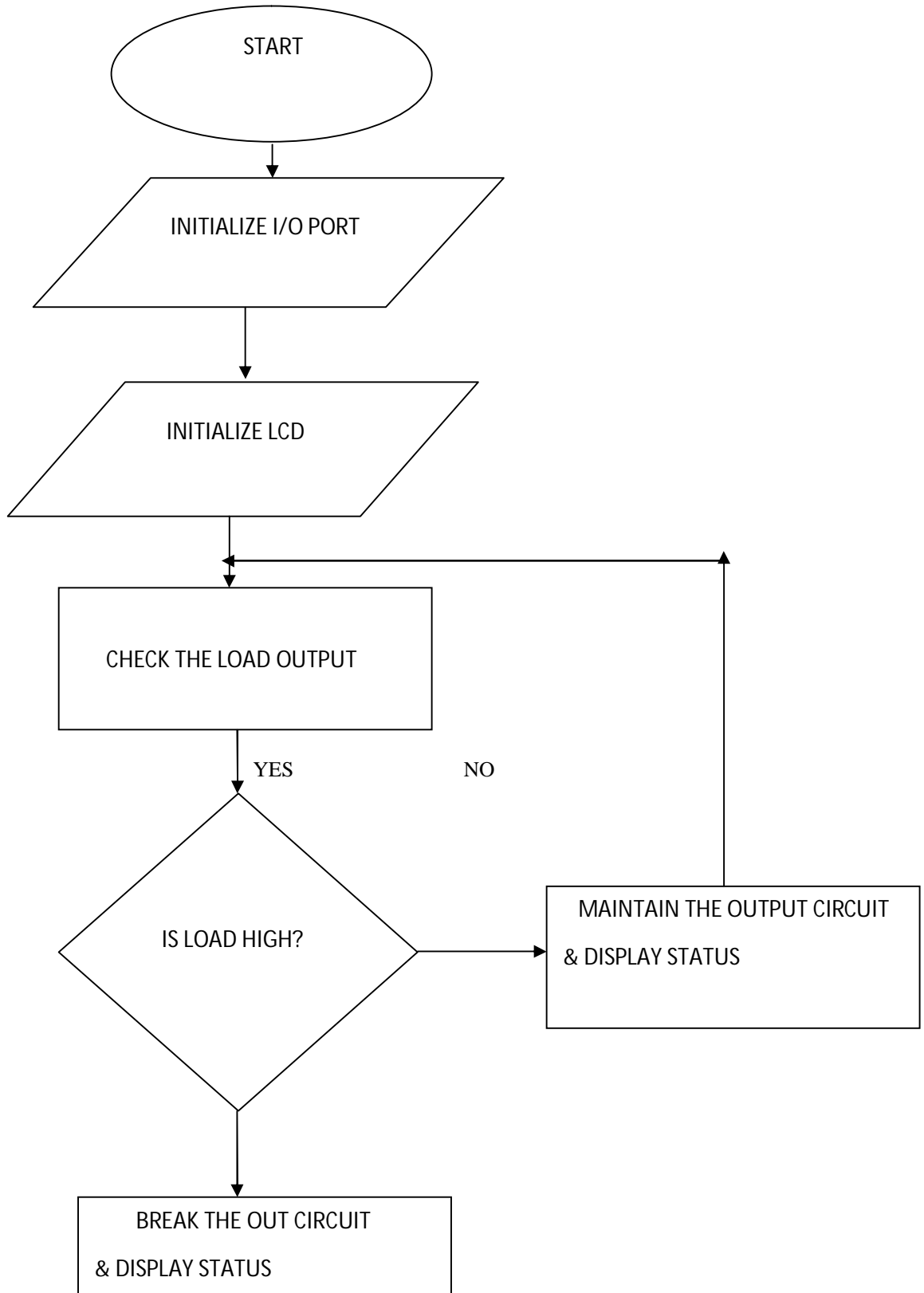
II. SYSTEM DESIGNING AND PLANNING

The first step in the process of designing any electronic circuit is the construction of the layout of that electronic circuit for the circuit board.

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                        ┌───────────┐
                        │   START   │
                        └─────┬─────┘
                              │
                     ┌────────▼────────┐
                    /  INITIALIZE I/O  /
                   /      PORT        /
                  └────────┬─────────┘
                           │
                  ┌────────▼────────┐
                 /  INITIALIZE LCD  /
                └────────┬──────────┘
                         │
                ┌────────▼─────────┐
                │  CHECK THE LOAD  │
                │     OUTPUT       │
                └────────┬─────────┘
              YES                 NO
                 │
            ◇ IS LOAD HIGH? ◇───►  MAINTAIN THE OUTPUT CIRCUIT
                 │                  & DISPLAY STATUS
            BREAK THE OUT CIRCUIT
            & DISPLAY STATUS
```

START

INITIALIZE I/O PORT

INITIALIZE LCD

CHECK THE LOAD OUTPUT

YES   NO

IS LOAD HIGH?

MAINTAIN THE OUTPUT CIRCUIT & DISPLAY STATUS

BREAK THE OUT CIRCUIT & DISPLAY STATUS
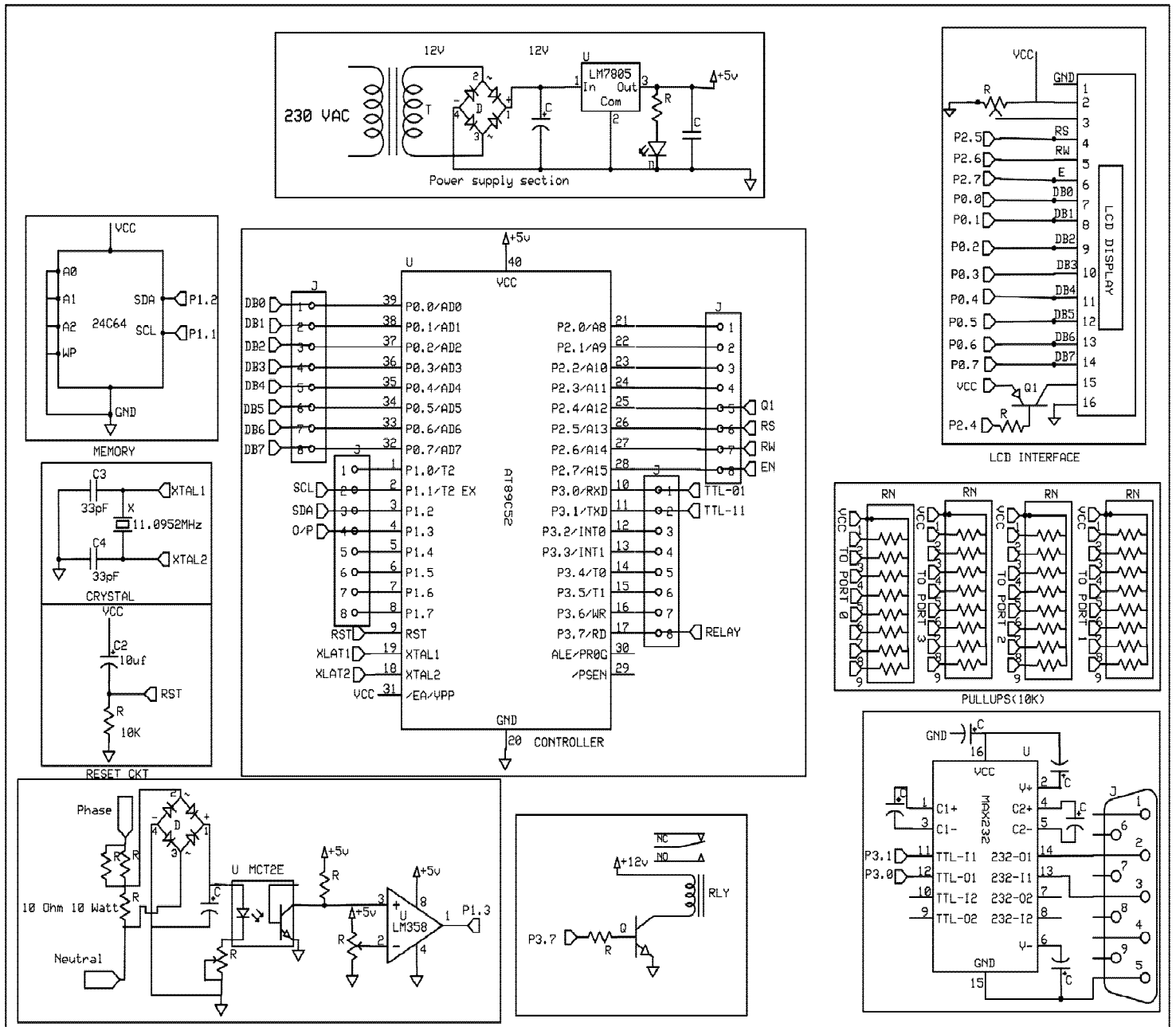
III. METHODOLOGY

3.1 CIRCUIT DIAGRAM

In this project we use AT89S52 microcontroller. LCD is connected to the port 0 and MCT2E connected through op-amp at port 1.3 into the microcontroller. Relay is connected into the port 3.7.

Fig 1-Circuit Diagram OfUltra Fast Acting Electronic Circuit Breaker

3.2 CIRCUIT DESCRIPTION

In this project, we have used AT89S52 microcontroller. This controller has 8kb of flash memory and 256 byte of RAM and it is easily available in the market.

As shown in the circuit diagram we have connected 10 k 9-pin SIP resistor in the port line of microcontroller. 10k ohm resistor and 2.2uF capacitor form the reset circuit for microcontroller. 11.0592 MHz crystal in connected in 18 and 19 pin of microcontroller with 33-pf capacitor.

We are using op-amp for sensing load. As output pin of op-amp, get high then relay on. Relay connected with port P3.7 pin of microcontroller [1]. Through relay we can connect any device. For message display, we are using LCD. Control lines of LCD connected with P2.5, P2.6 and P2.7 and data lines connected with P0. Power Supply made up of simple bridge diode filter and regulator IC. All the ICS are work on 5 volts so we have employed 5-volt regulator here and 12-volt supply for the motor driver IC.

3.3 WORKING

The main power supply is given directly to load and step down transformer. 230 volt is Step down to 12v and then we use diodes which are act like a rectifier to convert ac to dc and passed through 7805 regulator to get 5v supply for microcontroller, capacitor filters are used to remove the ripples to get pure constant 5v dc voltage. In this project, we are protecting our circuit from excessive load current. As load increases then device get OFF otherwise it remains in its original state. For that, we are using opto-coupler. Load connected with opto-coupler. If there is single load then circuit works properly. If load increases then current rating increases that get fire the opto-coupler. Due to firing, opto-coupler gives low voltage to the op-amp through which it is connected. Op-amp connected with microcontroller. Output of op-amp applies to controller. If output is low then controller show "DEVICE ON" message. If output is high then the preset value then the controller show "DEVICE OFF" message. In this project message is displayed through LCD. As device on then relay get ON else relay get off.

IV. SOFTWARE INTERFACING

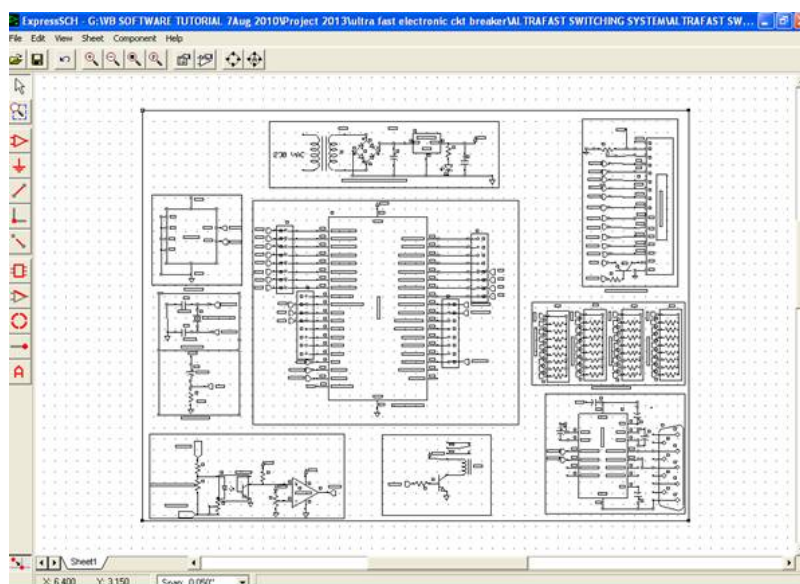## 4.1 Express SCH(Schematic design software)

Fig 2-Circuit Designing Of Ultra Fast Acting Electronic Circuit Breaker By Using Express SCH

Express SCH software used for Circuit designing. By using this software we can make schematic diagram [3]. Basically with help of this software we design connection of the each and every part of this project then we implemented on hardware. It is also useful to have datasheets for all of the special components such as diodes, transistors, ICs, sensors, etc.

4.2 PCB ARTIST
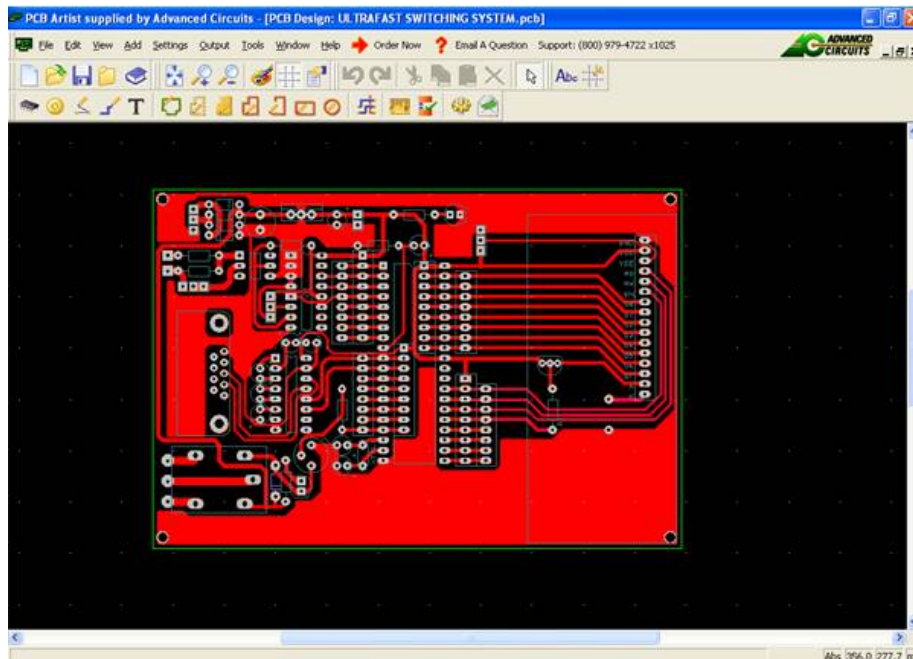

Fig 3-Designing Of PCB

Printed Circuit Boards Basics:-
PCB's are the base of any electronic devices, and therefore intellectuality of PCB layout tools can be a crucial skill. Both analog and digital circuits used in PCBs depending on the application and types of circuits. More complicatedcircuits take more thought in the layout and design because the circuit is more susceptive to component placement and the lengths of the connections between them.
The process for PCB design is to first create a list of parts use in the circuit [4], and then take the footprint of the component from libraries available. After taking footprint, then connect that component by track.

4.3 KEIL µ VISION
The µVision IDE from Keil combines project management, make facilities, source codeediting, debugging, and simulation in onepowerful environment. The µVision development platform in which quickly create embedded programs that work. The µVision editor and debugger are integrated in a single application that provides embedded project development environment. This software is an integrated development environment(IDE),which integrated a text editorto write programs [5], a compiler and it will convert source code to hex file.

Fig 4- Programming Through μ Vision

V. CONCLUSION

In this system instantaneous tripping of load takes place in case of overload condition. This system has been a great advantage compared to the conventional circuit breakers with longer tripping time. Time taken by the circuit breaker to break the circuit is approximately 0.023 sec.

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