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OVERLOAD, OVER VOLTAGE AND UNDER VOLTAGE PROTECTION SYSTEM

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ABSTRACT

The system designed with microcontroller is quite useful for the house, because mostof the energy consumers at domestic side don't know the exact power consumption of their house hold electrical appliances like AC, water heater, Oven, TV, fan, etc. With the help this electrical instrument connected at the output of energy meter (in series with the meter and loads), power consumption of each and every electrical device can be identified independently, and according to that power can be saved considerably, which results reducedelectricity bill. Another important advantage of using this instrument is, in addition to the display of load current and line voltage simultaneously through LCD, control action is also implemented in the system, such that whenever the load current exceeds to its set value, or whenever the line voltage increases or decreases, immediately the microcontroller unit designed with ATMEL 89C51 energizes alarm and breaks supply to the house through relay,there by the electrical devices can be protected burning due to the over loads and voltage fluctuations.

The load monitoring cum control circuit designed here can act as electronic fuse, there by theconventional method of electro mechanical fuse generally connected at the output of energy meter can be avoided. In this method, due to any reason if the fuse is blown, it has to be connected with a suitable conducting wire, which doesn't have proper rating. This is a pain full activity and also consumes time, sometimes because of inappropriate rating fuse, electrical appliances may burn, to avoid all these problems, here in the load monitoring circuit, efficient control technology is implemented with auto facility, therefore whenever the load current exceeds to its set limit, supply will be disconnected automatically. In this condition if any accessible additional load is switched off from the switch board, automatically power will be resumed, this is called auto rest facility. The main feature of the system is that it can display the fault condition also through same LCD panel which is connected at the output port of microcontroller. Fault condition means, though the input supply is present and because of overloads and abnormal voltage levels output is disconnected, in this condition due to what reasonthe output supply has been failed, the reason must be displayed for the

ISSN: 2366-1313

benefit of energy consumer.

Keywords: ATMEL 89C51, LCD, Microcontroller

I.INTRODUCTION

The system designed with latest technology can provide better information aboutload current and line voltage, falls under the subject of electrical instrumentation technology, it can be used for many applications other then domestic front, it is also useful for industries and other organizations. The following are the main features included in the system.

- ❖ Displays the load current continuously in amps
- ❖ Displays the line voltage continuously in volts
- ❖ Control circuit activates the relay and breaks supply to the load when load current exceeds more then set value; set value is programmed for one amp. Set value can be adjusted to the required level through program, but since it is a prototype module the program is prepared for one amp as a cut off value, this is fixed it can not be changed.
- ❖ The same control circuit activates the same relay and breaks supply to the load when line voltage exceeds more then 240V AC. This feature protects the electrical devices burning due to the over voltages.
- ❖ Through the same control circuit, again supply can be disconnected when line voltage falls below 180V AC.
- ❖ Alarm will be energized during fault conditions.
- ❖ All fault conditions are displayed. For example when line voltage crosses more then 240VAC, immediately supply will be disconnected and alarm will be raised, in this conditionthe display shows “supply is out due to over voltage”.

With the above features we feel it is essential equipment and everyhouse or industry can adopt this system. Generally most of the electricity consumers more than 90%, they are not aware of their energy consumption about how the consumed energy is calculate

The important device used in this project work is microcontroller, it is playing major role, and therefore the project work mainly focuses about Micro controller and its architecture, because it is treated as heart of the project work. Today, there is no such instrument that can function without Micro controller. Micro controllers have become an integral part of all instruments. Many tedious from simple to dedicated tasksare left over to the controller for solutions.

CIRCUIT ANALYSIS

As per the block diagram the process begins from load current sensing circuit.This block is designed with current transformer (CT); the primary of this transformer must be connected in series with the load, means it is connected between the energy meter and load. The concept is to monitor the load current that is flowingthrough the CT primary.

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Depending on the current flowing, some voltage will be induced across CT primary and based on the CT ratio; amplified voltage will be appeared at secondary. The CT used in this project work is having 1: 50 ratio, means if the primaryis having 3 turns, secondary should contain 150 turns.

Generally CT primary contains very few turns, this means there should not be much voltage drop across the primary, if more voltage is induced at primary, there may be a lossin effective voltage that is applied to the load. There fore always CT primary contains only one turn in most cases. Now the output of the CT (secondary) rectified and filtered with the help of diode and capacitor, this smoothened DC voltageis adjusted to the required level and applied to the ADC (Analog to Digital Converter)for converting the analog information in the form of DC voltage proportionate to the current flowing through CT primary in to digital information. Here the ADC generatesproportionate digital data through 8 bits and itis fed to microcontroller. Based on thedigital data produced by the ADC, the microcontrolleris programmed to display the information through LCD panel.

Similarly, for measuring the line voltage PT (Potential Transformer) is used, this isa step down transformer and generates 6V AC at secondary. This voltage varies according to the primary voltage; this transformer is designed to deliver 6V at 220V input at primary. When the primary voltage increases or decreases according to that secondary voltage also varies proportionately. Here also the output of PT is converted in to pure DC, and adjustedto the required level through a potential dividing network designed with variable resistor (preset), then this analog voltage information proportionate to the line voltage is fed to the microcontroller through ADC. Based on this information, the microcontroller displays the line voltage through the same display.

The display section is designed with two rows LCD panel, each row can display16 characters, in the first row line voltage will be displayed, similarly in the second rowload current will be displayed. Whenever any fault occurs, the fault information will be displayed in short form. The ADC used in this project work is having 8 channels, means it is having 8 analog inputs, out of 8 here only two channels are used for reading the line voltage andload current. The input signal is usually an analog voltage called as Vin, and the outputis binary number. The maximum voltage applied to the ADC input should not exceed more then 5V DC. Generally in any instrument, fast responding chips are preferred; means the conversion time should be as less as possible, this is called ADC speed and defined as time to convert. Conversion time means, how much time the ADC takes to convert the analog information into digital. This time depends up on the clock signal that is generated externally and fed to ADC.

The clock signal generator block is designed with 555 timer IC, this chip generates a chain of perfect square pulses at 10 KHz approximately. This block is designed as free running oscillator configured in “astable” mode of operation.

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In this mode of operation, the frequency can be varied very linearly by varying the value of preset connected externally to the Rt pin of internal oscillator. The detailed descriptions of all above blocks are provided in following chapters.

The most important device used in the project work is microcontroller, the chipused here is having 32 I/O lines, and therefore active devices like ADC and LCD both are interfaced with the single chip. In fact these two devices required more I/O lines when compared with other devices, there by this chip is selected.

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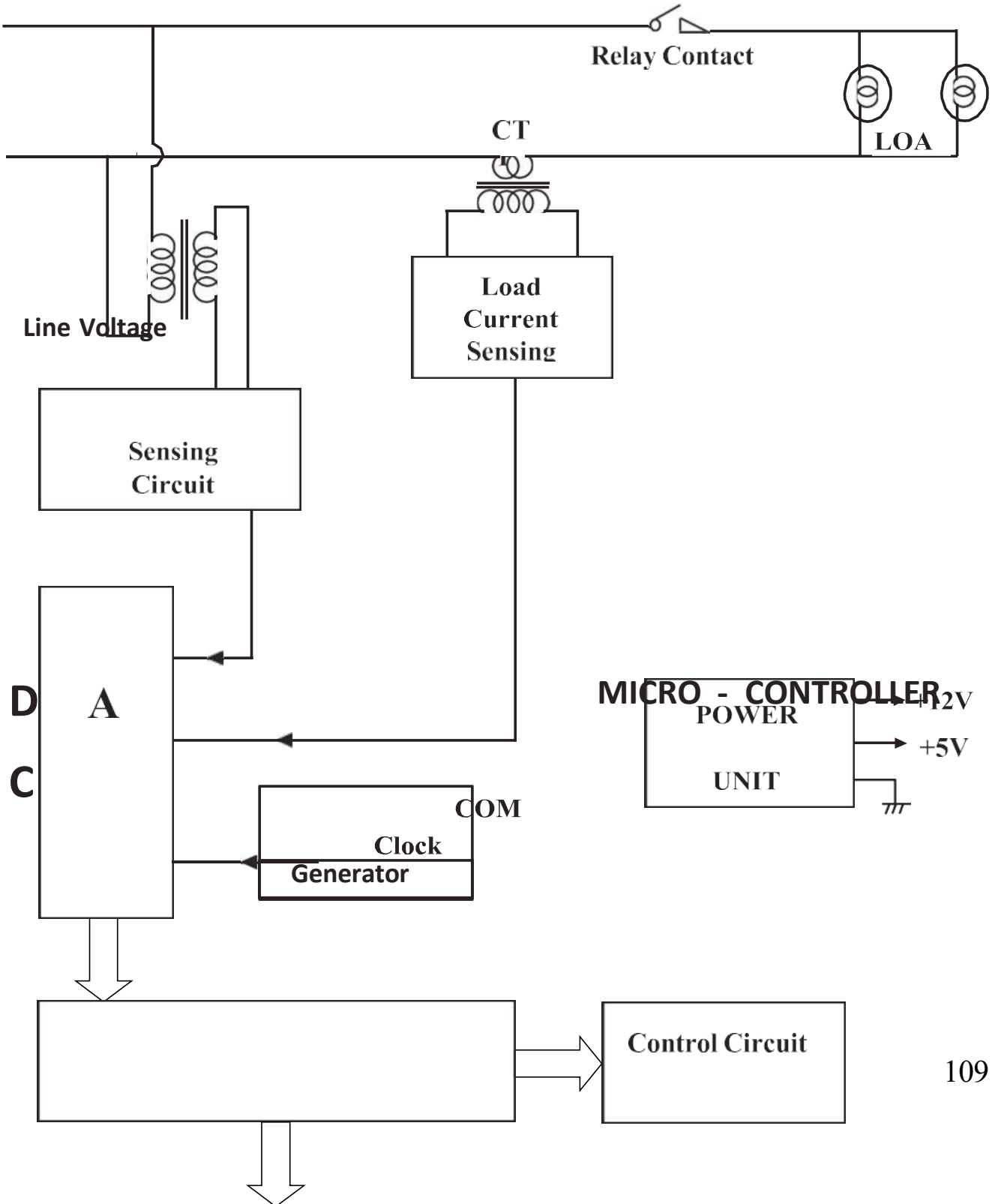

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SUPPLY

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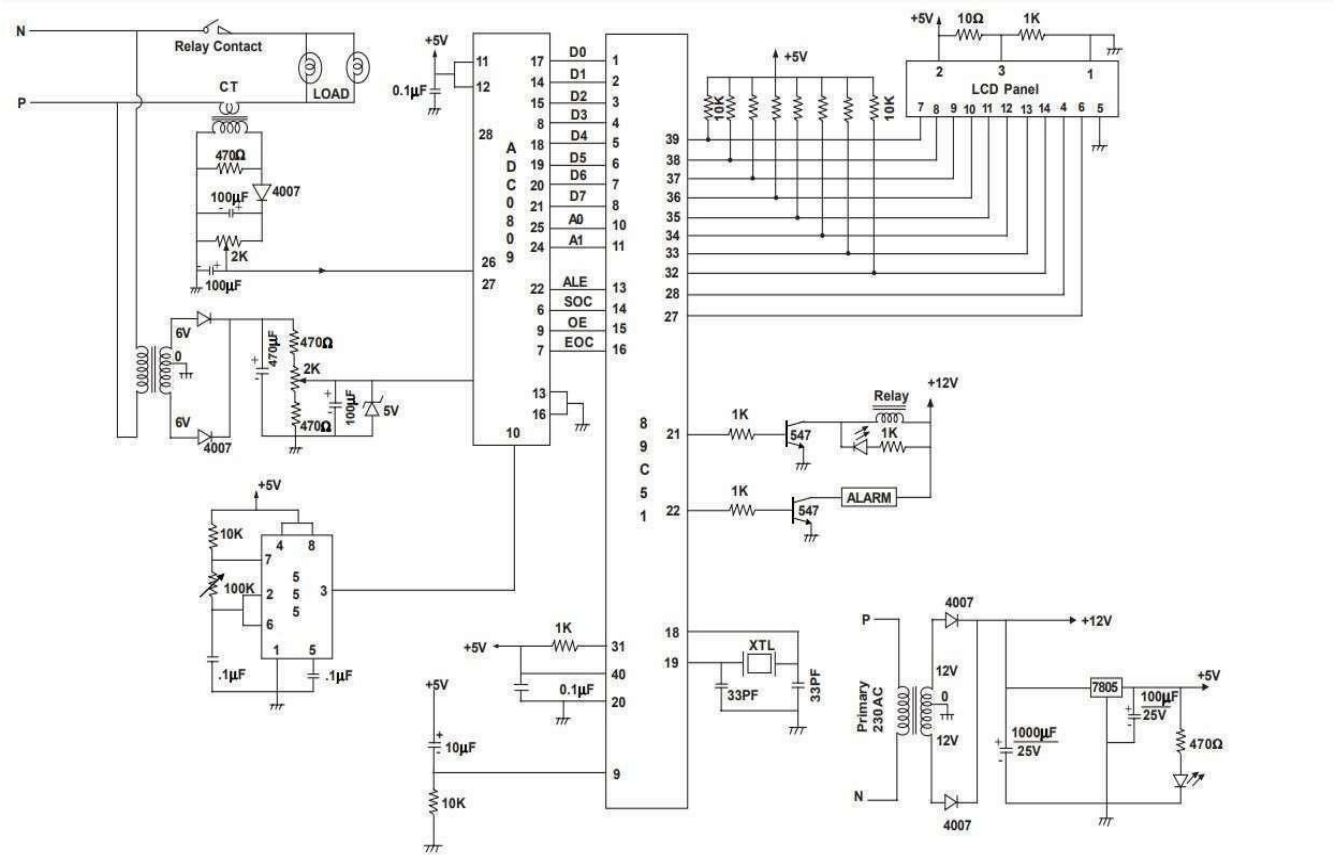
LCDPANEL

Fig 1: Block Diagram Of Over-Load Over-Voltage And Under-Voltage Protection System For House With Digital Monitoring



OVER LOAD, OVER VOLTAGE AND UNDER VOLTAGE PROTECTION SYSTEM FOR HOUSE - WITH DIGITAL MONITORING

Fig 2: Circuit Diagram of Over-Load Over-Voltage And Under-Voltage Protection System For HouseWith Digital Monitoring

II.CONCLUSION

The protection circuit can be used to protect the costly electrical appliances from abnormal conditions like sag, swell, under voltage and over voltage and avoid appliances being affected from harmful effects. It is an inexpensive of components used for while distributing the power supply, it is used to protect loads form undesirable over and under line voltages as well as surges caused due to sudden failure resumption of mains power supply

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