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COMMERCIAL POWER SAVER PROJECT

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***Abstract*— Our project proposes to minimize the energy consumption and thus reduce the power loss in industries and establishments by making use of a number of shunt capacitors. This substantially reduces the electricity bill in industries and establishments. The power factor is also known as the ratio of real power to apparent power. It is also represented as KW/KVA, in the equation KW stands for the active or real power whereas KCA stands for reactive + active or apparent power. The power generated by inductive as well as magnetic loads in order to create a magnetic flux is known as reactive power which is a non-working power. An increase in the reactive power increases the apparent power, thus decreasing the power factor. With low power factor there is an increase in the need of energy to meet industry demands, this decreases the efficiency. Our system works by feeding the time lag between zero voltage pulse and zero current pulse produced by suitable operation amplifier circuit working in comparator mode to 2 microcontroller pins. The time lag between voltage and current is displayed on a LCD screen. The project program controls the working and actuates required number of relays from the output that will get shunt capacitors into load circuit in order to get power factor until it reaches unity.**

Keywords*— Power factor correction, Atmega microcontroller, Power saver, Efficiency, Power loss.

I. INTRODUCTION

Unlike in direct current circuits, where only resistance restricts current flow, in current circuits, there are other circuit aspects that determine current flow; Although these are similar to resistors, they do not consume power, but load the system with reactive currents; For example, in a DC circuit where current multiplied by voltage gives watts, an equivalent here gives only VA. Like resistance, these are known as "reactions". The reactance is either due to inductance or capacitance. The current drawn by induction reverses the voltage while the voltage drawn by capacitance reverses the voltage. Almost all industrial loads are inductive in nature and hence the lagging watts draw current, which unnecessarily loads the system with none work. Since capacitive currents are leading in nature, loading the system with capacitors destroys them.

II. LITERATURE SURVEY

References to this subject include books, articles, government publications, most of them are published in newspapers, magazines, the internet, and research papers international journals. The key references to this research work are from the guide Books for Energy Manager and National Certificate Examination for Energy Auditors conducted by the Bureau of Energy Efficiency, Government of India.

Research topics include plant-level utility, as mentioned with energy management practices adopted by industries, barriers to energy efficiency Various books by well- known authors in various fields like industries, Energy Management, performance appraisal of utility equipment,energy efficiency Barriers, energy audits, utility costs were referred.

The work of material scan was undertaken to get complete information on energy management. To sustain the need for this study, gaps between previous studies were identified through a review of the literature which was later divided into categories. Much research has been done on dynamic power reduction using DVFS techniques.

However, as technology declines, power outages will become a major factor. Availability of unused circuits Power gating can be a commonly used circuit technique to prevent leakage by turning off the voltage. Power gating consumes overhead energy; So, the circuits that were not used to compensate for these overheads had to be idle for a long time. New micro- architectural technology for GPU's run-time power-getting cache saves leakage energy.

Based on experiments on 16 different GPU workloads, the quality energy savings achieved by the proposed technique is 54%. Shadows are a power-hungry component of the GPU, with predictable shader pack-up power gating techniques reducing leakage on shader processors by up to 46%. The predictive shader shutdown technique takes advantage of the workload difference in the frame to eliminate leaks in the shader cluster.

Another technique, called Deferred Geometry Pipeline, seeks to reduce leakage in fixed-function generator units and to reduce leakage in batches using an imbalance between geometry and fragmentation calculations, eliminating leaks up to 57% in fixed-function geometry units. A simple timeout power gating method is commonly applied to non-shader execution units to eliminate an average of 83.3% leakage in non-shader execution units. All three of the above techniques result in a negligible reduction in efficiency, but 1%.

The Home Energy Saver Energy Assessment Tool lets customers conduct home energy audits on their own and provides specific recommendations to help reduce household energy usage and utility costs. By entering the zipper code, users get an idea of the typical and functional homes in their area.

Approximate energy consumption is broken down by "end-use". The latest uses reported by Home Energy Saver include heating, cooling, water heating, major appliances, small appliances, and lighting.

III. METHODOLOGY

Power saver may be a convenient and necessary tool for consumers who are used high load in industries and commercial purposes, which are employed by the reduced the reactive power. They use more energy compared to if they used previously by use of power saver.

However, consumers are facing a problem as they use additional circuits to save energy. The shunt capacitor undertakes a program to activate the appropriate number of relays at its output to induce zero power loss in the load circuit.

The 8-bit microcontroller utilized in the project belongs to the 8051 family. Further the project is often enhanced by using thyristor control switches rather than relay control to avoid contactpitting often encountered by the project is meant to scale back the power loss in industries by power factor compensation through several shunt capacitors.

A. Hardware Requirements:

- TRANSFORMER (230 – 12 V AC)
- VOLTAGE REGULATOR
- RECTIFIER
- FILTER
- ATMEGA328
- OPTO-ISOLATOR (MOC3063)
- PUSH BUTTONS
- LCD
- LM339
- CURRENT TRANSFORMER
- INDUCTIVE CHOKE
- SHUNT CAPACITOR
- LED
- 1N4007 / 1N4148
- RESISTOR
- RELAY
- CAPACITOR

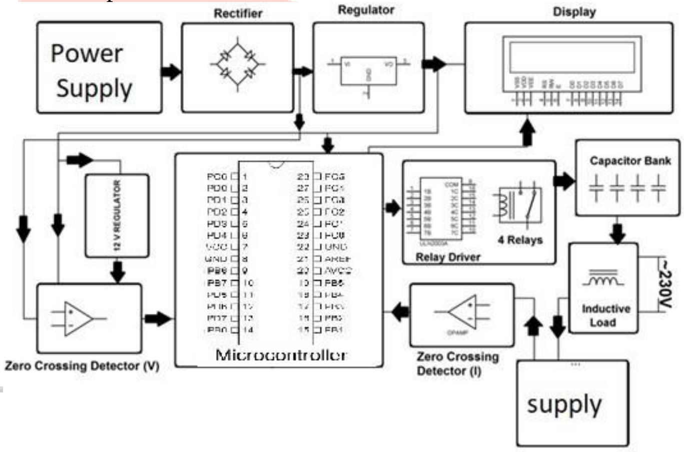
B. Software Requirements:

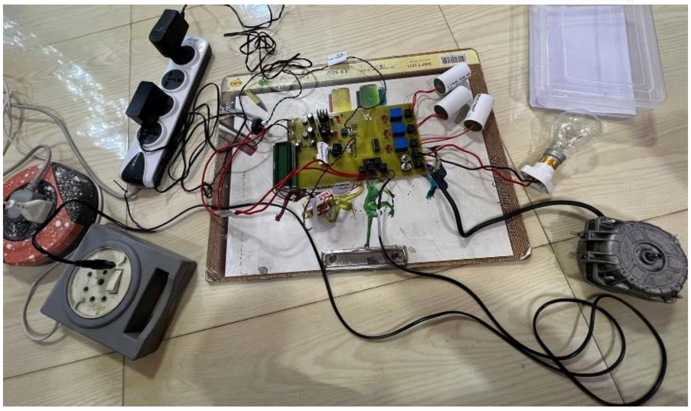
- EMBEDDED C
- ARDUINO IDE

IV. IMPLEMENTATION

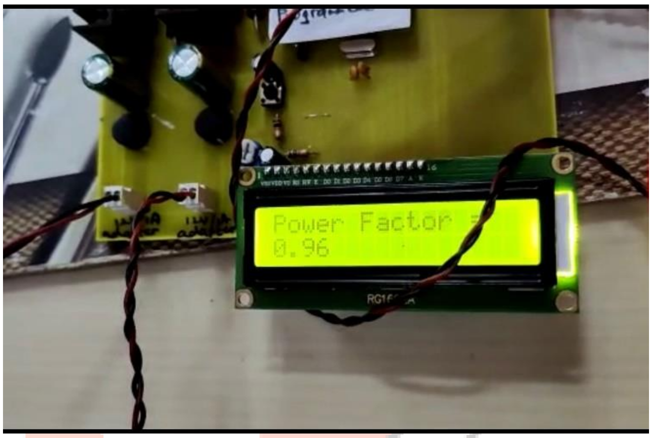
Our circuit consists of a DC power supply unit, zero voltage crossing detectors, microcontroller, LCD display, optoisolator, SCR, and Capacitor. Let us see how it operates. The needed DC power supply for the Microcontroller and the other peripherals is supplied by the DC supply.

For the calculation of the facility factor by the Microcontroller, we have digitized voltage and current signals. The voltage signal from the mains is taken and it's converted into pulsating DC by bridge rectifier and is given to a comparator which generates the digital voltage signal. Similarly, the present signal is converted into the voltage signal by taking the drop of the load current across a resistor of 10 ohms. This A.C signal is again converted into the digital signal as the final voltage signal. Then the digitized voltages and current signals are given to the micro-controller. Then, the time difference between the zero crossing points of the current and the voltage is calculated by the microcontroller which is directly proportional to the power factor and determines the range where the power factor lies. Micro-controller sends information regarding the time difference between current and voltage and power factor to the LCD display to display them, counting on the range it sends the signals to the optoisolators that successively turn on back-to-back connected SCRs (power switches) to bring the capacitors in shunt across the load. Thus, the specified numbers of capacitors are connected in parallel to the load as needed. By this, the power factor is going to be improved.





Power Factor Test Layout: We have a layout with a supply source of 230v, one lamp, 2 numbers low-value resistors of 10R/10W for measuring current, and choke, which are all connected in the series. Capacitors are connected in parallel while SCR switches are used to switch the inductor to improve the voltage. A CT is employed at the primary side which is connected to the common point of the resistors. The other point of the CT goes to one of the common points of supply. The current transformer is connected across to the left 10R/10W and thus, the drop is proportional to the current which is sensed by it to develop increased voltage at its primary. This voltage is given to the present sensing circuit. While no inductors are switched the voltage drop across both 10R/10W are the same. This voltage drop is proportional to the leading current. Thus, the primary voltage from the CT provides a leading current reference to the current sensing circuit. The microcontroller-based control circuit thus receives zero current references and compares with the zero voltage reference for calculating their time difference. Microcontroller output develops the logic for an appropriate number of port pins to feed to optocouplers to help to switch SCRs for the inductor in parallel to the inductive load that is the capacitor. So counting on the time difference required no. of SCR switches are switched, thereby switching inductor till the voltage is corrected.



V.CONCLUSION

One of the main merits of our proposed system is the simple designand its high effectivity for energy saving with low implementation cost and high efficiency. Also, the main advantages of the systemare the low cost of implementation and the high savings of power consumption levels. Also, it may be implemented for old buildingswithout any special needs of additional electrical installation.

It can be concluded, that the power factor correction techniques can be applied to the industries, power system and also household to make them more stable. Thus, due to that the system stability, efficiency as well as the apparatus increases. The use of microcontroller reduces the prices.

VI. RESULTS

The automatic power factor correction by using capacitive load banks is very efficient as it decreases the cost by reducing the power drawn from the supply.

Thus, the specified numbers of capacitors are connected in parallel to the load as needed. By this, the power factor is going to be improved (value coming as close to unity as much as possible).

Further the project can be intensified by using thyristor control switches in place of relay control so that contact pitting is avoided which is often resulted by switching of capacitors due to flow of high rush current.

VII. ACKNOWLEDGMENT

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