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"POWER SAVER FOR INDUSTRIAL & COMMERCIAL ESTABLISHMENT"

Miss. Handore Saloni*1, Mr. Jadhav Rohit[2], Mr. Bhor Ashish[3]

BE Students, Department of Electrical Engineering, Savitribai Phule Pune University, Maharashtra, India

Abstract: *This project is used for the purpose of power saving for industrial and commercial establishment. Power factor is defined as the ratio of real power to apparent power. Where real power is the time integral of the instantaneous power measured over a full period and the apparent power is simply the product of the RMS voltage and RMS current measured over the entire period.*

The time lag between the zero voltage pulse and zero current pulse duly generated by suitable operational amplifier circuits are fed to two interrupt pins of the microcontroller where the program takes over to actuate appropriate number of relays at its output for bringing shunt capacitors into the load circuit to get the power factor till it reaches 0.95.

Keywords: *Microcontroller, Capacitor bank, Hall current sensor.*

Introduction

The project is designed to reduce the power loss in industries by power factor compensation through a number of shunt capacitors. This results in reduction in amount of electrical bill for industries and commercial establishments.

Power factor is defined as the ratio of real power to apparent power. This definition is often mathematically represented as KW/KVA, where the numerator is the active (real) power and the denominator is the (active + reactive) or apparent power. Reactive power is the non-working power generated by the magnetic and inductive loads, to generate magnetic flux. The increase in reactive power increases the apparent power, so the power factor also decreases. Having low power factor, the industry needs more energy to meet its demand, so the efficiency decreases.

In this proposed system the time lag between the zero voltage pulse and zero current pulse duly generated by suitable operational amplifier circuits in comparator mode are fed to two interrupt pins of the microcontroller. Microcontroller displays the power loss due to the inductive load on the LCD. The program takes over to actuate appropriate number of relays at its output to bring shunt capacitors into the load circuit to get zero power loss. The 8 bit microcontroller used in the project belongs to 8051 family.

Further the project can be enhanced by using thyristor control switches instead of relay control to avoid contact pitting often encountered by The project is designed to reduce the power loss in industries by power factor compensation through a number of shunt capacitors

This project is most important because it's used for the power saving by which electricity bill problem is minimize and the total bill is reduced. Generally it is useful for the industry and the commercial purpose because they are use heavy or high electricity consumption machine by which they also requirement of more power comparison than of others by which not enough power supply in the rural areas at all time so they feel difficulties but by the use of this project we reduced the power by mean of increase the value of power factor by use of capacitor in series.

which are reduced the reactive power and by which the power factor value is increased and the system efficiency is also increased.

Methodology

Power saver is a convenience and necessary tool for consumers whose are used high load in industries and commercial purpose, which are used by the reduced the reactive power .They use more energy compare than of they used previously by use of power saver. However, there is a problem faced by consumers because they use extra circuit for the energy saving.

The program takes over to actuate appropriate number of relays at its output to bring shunt capacitors into the load circuit to get zero power loss. The 8 bit microcontroller used in the project belongs to 8051 family. Further the project can be enhanced by using thyristor control switches instead of relay control to avoid contact pitting often encountered by The project is designed to reduce the power loss in industries by power factor compensation through a number of shunt capacitors.

LITERATURE SUREY

Literature referred for this topic was books, articles, government publications, newspapers, magazines, and internet and research papers mostly published in international journals. Major references for this research work are from the Guide Books for National level certification examination for Energy Managers and Energy Auditors conducted by Bureau of Energy Efficiency, Government of India.
As research topic is related with energy management at plant level utilities, energy management practices adopted by the industries, barriers to energy efficiency in industries, different books of renown authors from different disciplines like Energy management, performance assessment of utility equipment, energy efficiency barriers, energy audits, utility costing were referred. In order to get the complete understanding of energy management, literature scan was undertaken. To uphold the need of this study, the gap in the previous studies were identified through the review of literature which is divided into the following categories.

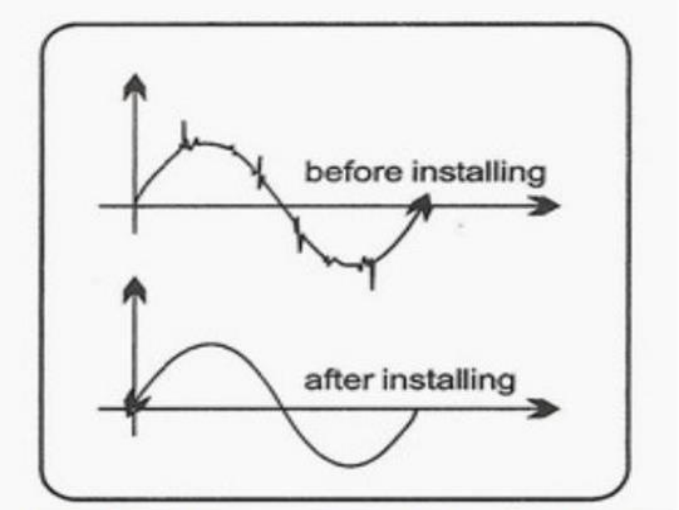
A lot of research has been done on the dynamic power reduction with the use of DVFS techniques. However, as technology continues to shrink, leakage power will become a dominant factor. Power gating is a commonly used circuit technique to remove leakage by turning off the supply voltage of unused circuits. power gating incurs energy overhead; therefore, unused circuits need to remain idle long enough to compensate this overheads. A novel micro-architectural technique for run-time power-gating caches of GPUs saves leakage energy. Based on experiments on 16 different GPU workloads, the average energy savings achieved by the proposed technique is 54%. Shaders are the most power hungry component of a GPU, a predictive shader shut down power gating technique achieves up to 46% leakage reduction on shader processors. The Predictive Shader Shutdown technique exploits workload variation across frames to eliminate leakage in shader clusters. Another technique called Deferred Geometry Pipeline seeks to minimize leakage in fixed function generator unit by utilizing an imbalance between geometry and fragment computation across batches which removes up to 57% of the leakage in the fixed-function geometry units. A simple time-out power gating method can be applied to non-shader execution units which eliminates 83.3% of the leakage in non-shader execution units on average. All the three techniques stated above incur negligible performance degradation, less than 1%. The Home Energy Saver energy assessment tool allows consumers to conduct a do-it-yourself home energy audit and provides specific recommendations to help lower household energy consumption and utility costs. By entering a

zip code, users get estimates for typical and efficient homes in their area. The estimates break down **energy consumption by "end use". End uses reported** by Home Energy Saver include heating, cooling, water heating, major appliances, small appliances, and lighting.

Scope of Project

It is known that the electricity that comes to our homes is not stable in nature. There are many fluctuations, raise and falls, and surges/Spikes in this current. This unstable current cannot be used by any of the household appliances. Moreover, the fluctuating current wastes the electric current from the circuit by converting electrical energy into heat energy. This heat energy not only gets wasted to the atmosphere, but also harms the appliances and wiring circuit

Power Saver stores the electricity inside of it using a system of capacitors and they release it in a smoother way to normal without the spikes.



Household Power Saver - Schematic Diagram

PROPOSED WORK

In project of power saver we use the Microcontroller C 8051. A microcontroller (sometimes abbreviated **µC, uC or MUC) is a small computer on a single** integrated circuit containing a processor core, memory, and programmable input/output peripherals. Program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a typically small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications.

EEPROM (also written E^2PROM and pronounced **"e-e-prom", "double -e prom", "e-squared", or simply "e-prom") stands for Electrically Erasable**
Programmable Read Only Memory and is a type of non-volatile memory used in computers and other electronic devices to store small amounts of data that must be saved when power is removed, e.g., calibration tables or device configuration. When larger amounts of static data are to be stored (such as in USB flash drives) a specific type of EEPROM such as flash memory is more economical than traditional EEPROM devices

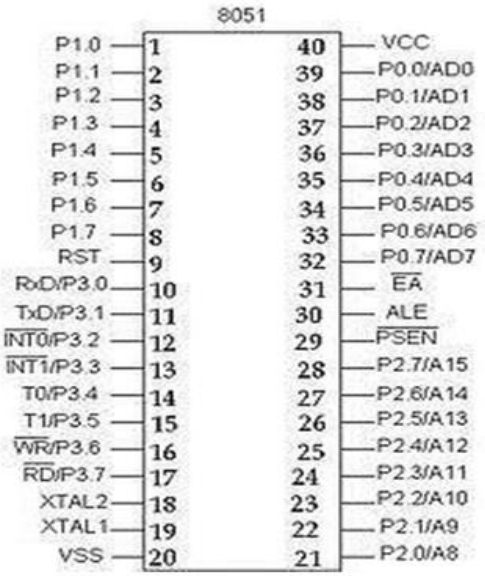


Fig.- 1.1. Microcontroller IC-8051 ULN2003 is a high voltage and high current

Darlington array IC. It contains seven open collector Darlington pairs with common emitters. A Darlington pair is an arrangement of two bipolar transistors.

ULN2003 belongs to the family of ULN200X series of ICs. Different versions of this family interface to different logic families. ULN2003 is for 5V TTL,

Detail of Components:-

AT89s52 micro-controller

The whole processing of the device is done by a micro-controller. The micro-controller 89s52 is a small but powerful micro-controller from Microchip. The AT89S52 is a low-power, high-performance CMOS 8-bit micro-controller with 8Kbytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful micro-controller which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset CMOS logic devices. These ICs are used when driving a wide range of loads and are used as relay drivers, display drivers, line drivers etc. ULN2003 is also commonly used while driving stepper motor. Refer StepperMotor interfacing using ULN2003. Each channel or Darlington pair in **ULN2003** is rated at 500mA and can withstand peak current of 600mA. The inputs and outputs are provided opposite to each other in the pin layout. Each driver also contains a suppression diode to dissipate voltage spikes while driving inductive loads. In above circuit diagram of automatic power factor controller, current transformer is used to get current wave form from of load current and current transformer also step down ac current.

LM358 is used as a comparator in this circuit. similarly voltage transformer is used to get current wave form and fed this wave to LM358 comparator. LM358 is used as zero crossing detector in this project. After LM358 both current and voltage waveforms are fed to PIC16F877A microcontroller. PIC16F877A microcontroller measures zero crossing detectionand power factor by measuring time difference between current and voltage wave form. Time difference between current and voltage waveform is used to measure power factor using pic microcontroller.

For more details on how pic microcontroller measures power factor and done power factor measurement calculation, check following article. Ihave explained working on power factor measurement project in this article.PIC16F877A microcontroller calculate power factor and take necessary actions based on power factor. Relay driver ic UNL2003 is connected with microcontroller and which is used to drive relays. Microcontroller sends high signal to relay driver IC whenever power factors falls less than 0.9. ULN2003 turn on relays which in return connects capacitor banks with the load. First of all the phase difference between voltage and current waveforms are measured and then power factor is calculated. In case of low power factor capacitors are added to improve it.

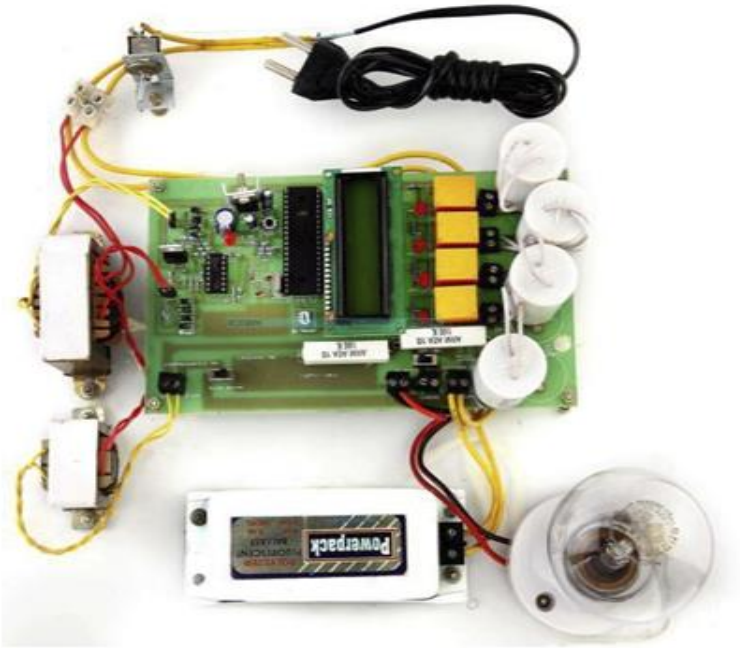


Fig.-1.2 Hardware Circuit of Power Sollution

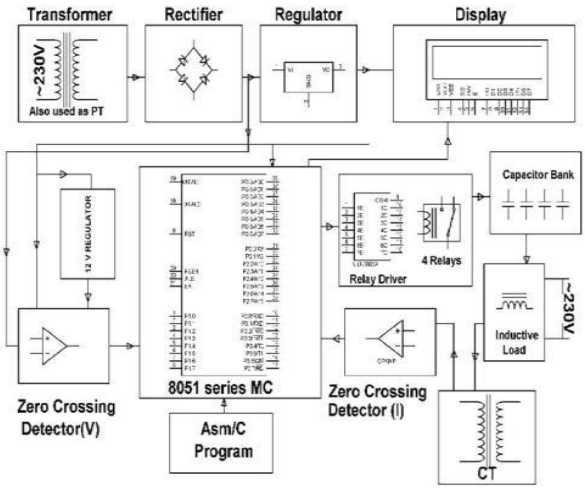


Fig.-1.3. Block Diagram of Power saver

It can be conclude that power factor correction techniqes can be applied to the industries, power system and also household to make them stable and due to that the system becomes stabel and efficiency of the system as well as the appratus increases the use of microcontroller reduces the costs.

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