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A Review Paper on Automatic Power Factor Detcetion and Correction

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***Abstract*-The conception of conserving electrical energy is not new to us,it is widely recognized that electrical energy is being wasted in many forms , such as copper loss,iron loss but these are hard to compensate.Because of the fact that most loads are inductive in nature reactive energy is wasted. So, the required energy is can be utilized in which the energy can have the major correction toform a power factorIn simple words power factor can be defined as how far the energy provided has been utilized. And in technical terms it is defined as the ratio of active power to the apparent power .In this paper we do a study of a prototype for automatic power factor correction using some capacitor bank which helps in increasing the power factor which is done by reducing reactive power. In this project load power factor can be increased by Arduino microcontroller. Current and voltage transformer are also used for sampling of the circuit current and voltage for measuring the power factor.**

***Keywords*- Power factor, reactive power, capacitor bank,arduino.**

I.INTRODUCTION

Most loads in modern electrical distribution systems are inductive but not enough to serve the people according to the generation .In order to reduce he energy losses we have to make up the losses which are wasted by means of reactive power generation. The huge of industries may consume larger amount of power in rating of kilowatt. Such condition recognized as lagging power factor in power system which can be defined as the ratio of active power to apparent power.

If the term power factor is maintained at a nominal value then the energy losses can be reduced. For power factor improve using capacitor bank to compensate the reactive power. The power factor may vary depending the rating of the load which are connected to supply mains. If we connect a less amount of inductive load, then the power factor less. if the load resistive then the power factor is maintained at unity. If we switch on the capacitor according to the load variations at correct time then the power factor can be maintained at constant.

1. Power factor

Power factor (PF) is defined as the ratio of the real power(P) to apparent power (S), or cosine (considering waveform to be purely sinusoidal) the phase angle between the current and voltage waveforms. PF = Real Power / Apparent Power. Here real power is useful power consumed by load. Reactive power is non useful power in the sense that it is not consumed by load but it is used to generate Magnetic field. This total power is the power supplied through the power mains to produce the required amount of real power.

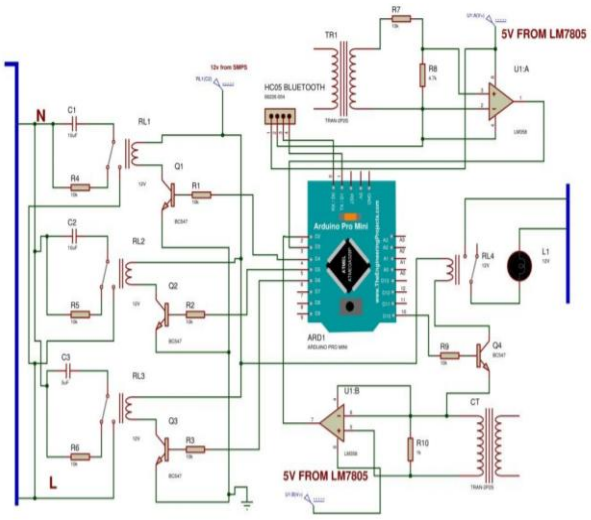

Fig. 1 Circuit diagram for implementation.

II. POWER FACTOR CORRECTION

Power factor can be improved by providing leading kVar to the load, for which purpose capacitor banks are emploload side. However in severe cases of low power factor. it is advisable to isolate the load Power factor improvement can be defined as process of correcting the lagging current by producing leading current or (leading kVar) so that the angle between voltage and current reduces. When the power factor is normal it is close to

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unity, however when it is less then .90 to .65 them optimization is needed .The process is done by connecting capacitor bank which is controled using arduino based relay switching. Power factor can be improved by few methods such as installed capacitor banks in parallel, synchronous condenser and phase advancer. There are fundamentally two ways of controlling power factor.

- Active pfc.
- Staticpfc.

1. Active Pfc- In this technique non energy storing devices are not used, to be more precise devices like misfits, BJTs and IGBTs are used . There is a wide range of topologies for active pfcs and electronic/power supply designers are able tourist circuits with differnts modes of operations and different challenges as technology evolves.

2. Passive Pfc-clearly as the name of the method suggests this technique uses passive devices like inductor and capacitor , or there combinations .Genrally this method can correct power factor to .7 -.85.Examples of this type of filter is capacitor input filter (also known as pi filter) which is used to remove low frequency signals.

III.WORKING

First of all we have to measure the power factor of the load before doing anything to increase it. In power system analysis for this many methods are used but in this study we use current transformer and potential transformer. The above circuit is the zero-crossing detector circuit. Usually we will have a sine waveform in a supply. In order to measure a power factor,. So, in order to calculate the time period, we need to convert the sinusoidal waveform into square waveform. This can be achieved using the zero-crossing detector circuit using the Op-amp circuit.

We have used potential transformer and its output is given to the rectifier circuit to convert the AC signal into pulsating dc signal and its given to the op amp terminals the output of the op amp is feed to Arduino microcontroller for the voltage signal. The same circuit is repeated for the current signal using the current transformer and its output is fed to the Arduino microcontroller. Both the current and voltage signals are feed to EXOR gate in order obtain a single square waveform to give to the Arduino microcontroller.

Arduino then measures the width of the pulse and power factor is obtained using appropriate mathematical formulation, which is coded into the arduino using the IDM environment .Arduino switches to relays which triggers capacitve banks as per the requirement of the load.

Fig. 2 Flowchart of the power factor improvement.

IV.MERITS OF IMPROVED POWER FACTOR

- Improving power factor leads to low copper losses.
- Size of line links is reduced.

Voltage regulation is maintained which is necessary for normal operation of transformer.

V. CONCLUSION

This project provide one of the technique used to overcome power losses due to low power factor improve by using arduino microcontroller platform the system is made automatic detector of PF lag/lead condition. Again by using capacitor bank the THD is reduced compared to relay based switching and various load condition system would make a cost effective solution for automatic power factor improvement in industrial environment. For measuring phase difference EXOR gate was used for finding the phase difference between voltage and current analysis of power factor changes over period using data logging methods.

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