# Use of Cloud Computing in Power Factor Improvement

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## 1. Introduction

Electrical energy is consistently in considerable interest for mechanical use. The expansion in utilization of inductive and nonlinear loads in the business will influence the PF estimation of the framework and subsequently, it diminishes the effectiveness of the power system. The major portion of the loads in the industries is highly inductive in nature such as power transformer, induction motor, welding machines, AC/DC drives, arc furnaces, lighting ballasts, fluorescent lighting's, electronic controls and computers [1]. The circuit capacity to accomplish useful work in a specific time is called real power measured in kilowatts (KW) whereas the voltage multiplied with current is called apparent power measure in terms of kilo voltamperes (KVA).

## 2. Power Factor

For an AC load the average power is given by $Pavg = VICos\ \phi$, where Φ is the phase angle. The term cosΦ is known as Power Factor. One of the popular concepts that used to explain the concept of real, reactive and apparent power is by using the "beer analogy" [2], the amount of beer flowing into the mouth to the maximum amount which can be poured into the beer glass can be assumed as real power and the beer glass can be assumed as apparent power. When the glass tipped to get the beer flowing into the mouth, the yeast (assumed as reactive power) will reach the mouth first and create a delay or lag in beer to mouth timing. The more yeast, the more delay or lag for the beer to flowing into the mouth, It also applied to the power the more reactive power, the more lag occurred and lower the power factor.

### 2.1. Need of Power factor Correction

The consumption of energy is something that every society has to deal with. Lots of concepts have developed with the purpose of saving money in utility bills. The purpose of this thesis is to learn the way of PFC work in a system and to provide a system of PFC to reduce reactive power value which will lead to increase power efficiency and maximize power saving with low cost and practical.

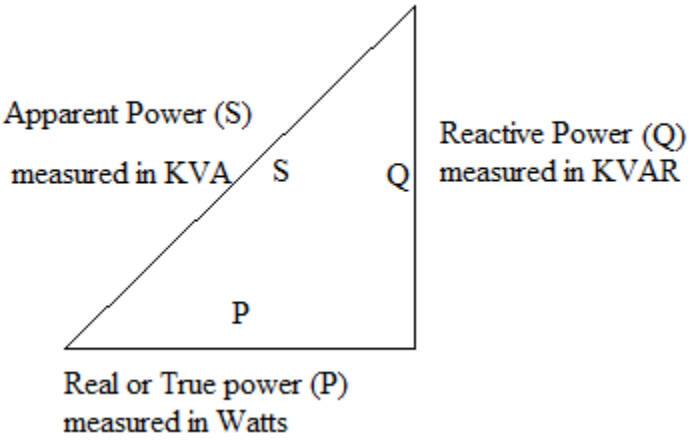


**Fig 1: Power Triangle**

AC operated electrical loads needs apparent power, which comprises of useful power and reactive power. The actual power consumed by the load is known as Real power. The power that consistently bobs to and fro among source and load is known as reactive power and it is the repeated effect that happens when AC passes through an inductive load [3]. This reactive power which is extra makes the true power to be less than the apparent power, thus, which makes the PF less than unity.

### 3. Real-Time Data Monitoring (RTDM)

RTDM makes it possible to review, evaluate, and modify the data on software and a database. It permits data administrators to evaluate the complete processes and functions executed on the data in real time, or through graphical charts and bars. RTDM helps in supervision of the consumption and use of data across a complex computer network.

### 4. Cloud Computing

Distributed computing is a model utilized for supporting all inclusive, suitable, on demand organize access to an open pool for configurable figuring assets that can be immediately provisioned and free with least administration work or customer and specialist co-op interface [4].

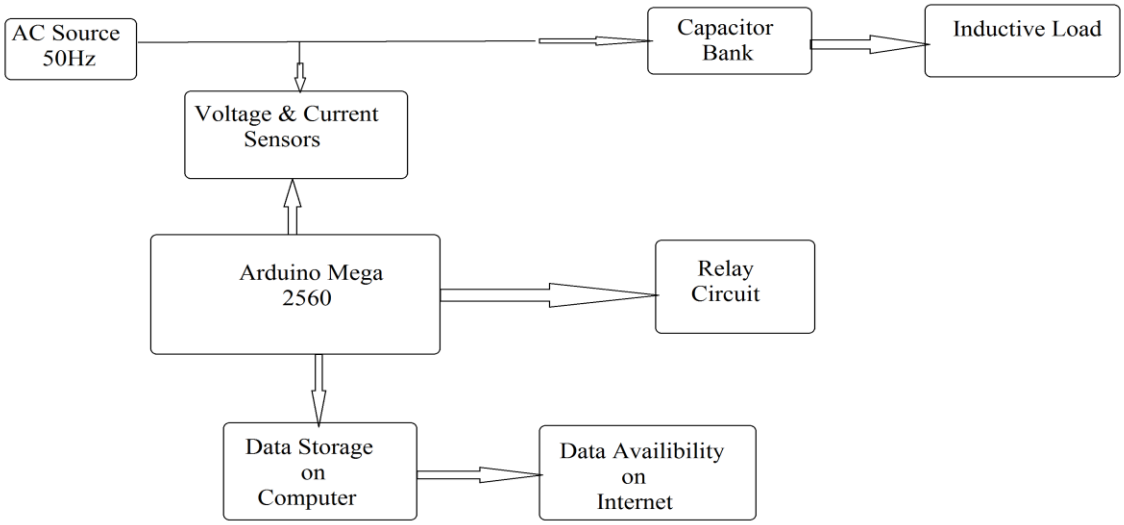


**Fig. 2: Data Monitoring using Arduino**

**4.1 Cloud Characteristics:**

1. **On demand for Self-service**: Cloud services allow the user to run computing capabilities independently which include server time and network storage. Therefore, abolishing the requirement for a moderator. The user can manage this automatically and access the mandatory resources as required deprived of needing human interaction through every service provider.
2. **Resource Pooling**: According to the user's request various cloud resources such as storage, memory, and processing plus network bandwidth are shared to make available for multiple users via a multi-tenant model. Therefore, the Private cloud may offsite at a place controlled by the vendor or the supplier may permit clients to insist on common server locations [5].
3. **Broad Network Access:** Irrespective it is an end-user platform or not, users gain from the cloud and be able to control them via standard mechanisms.
4. **Measured service:** Resources optimization and control is accomplished automatically in the cloud with the aid of metering capability, consistent with the category of providing service storage, processing, bandwidth, and lively user accounts. It offers transparency between the cloud dealer and customers by monitoring, controlling, as well as usage of reporting resource for the used service.
5. **Rapid Elasticity**: Resources delivered in the cloud may be dynamically and elastically assigned and released. This feature offers automatically scalability designed for further resources on request. This is one of the cause that the number of Denial-of-Service attacks are reducing, as firms using suitable cloud accounts which are no longer vulnerable.

**4.2 Cloud Delivery Models**:

There are mainly three major layers which form the operational principal of cloud computing:

1. **Infrastructure as a Service:** It offers user managed and accessible resources as services. Major computing resources such as processing, storage, networks can have some abilities of IaaS. In IaaS, data and applications are controlled by user whereas operating system and development environment are selected according to the demand of VMs. The main responsibility for network, storage and server settings are provided by the provider. Administrators are the main objectives for this layer. In IaaS cloud user controlled the security issues whereas the cloud provider delivers minimum security responsibility.
2. **Platform as a Service:** This layer provides platform which offers computational resources where applications and services are technologically advanced and hosted. In PaaS, data control is done by the user while applications and services are VMs. In PaaS main security threat is that on the identical server users are mixed and a hacker could access another firm VMs.
3. **Software as a Service:** In this model applications are offered as a facility to clients who access it using the Internet. Since it hosted off-site user doesn't have to retain or support it. But,

when the supplier or service provider chooses to modify it the user cannot control. The cloud provider shares control of data with customers it is supplier duty to manages applications, storage, server, network and services. The cloud provider provides security responsibility [6].

### 4.3 Cloud Deployment Models

There is mainly four type of deployment models for cloud computing. These are Public, Private, Community and Hybrid.

1. **Public Cloud:** It is generally used for public, individuals or societies. Various service providers who provide public cloud are AWS, Microsoft Windows Azure, Google App Engine, and Salesforce.com. IaaS is provided by companies like IBM's BlueCloud. Windows Azure Services platform, Amazon's SimpleDB cloud hosting, Google's App Engine, S3 Simple Storage, and Cloud Front are various application layer provided by PaaS. Public cloud is organized at a data center through a service provider providing multiple clients [7]. Several features contain scalability, development, pay-as-you-go, maintenance, upgrades, shared hardware setup, innovation and software setup. Cost savings is a big benefit from these sharing resources. Dynamic licensing, shared infrastructure provisioning and remote hosting are solid reasons for cloud acceptance. While using public cloud infrastructure maintenance is not a big issue for organizations. The main concern of the provider is to keep up maintenance and security.
2. **Private Cloud:** This cloud is also called internal cloud generally committed to one particular organization in which private networks are internally hosted, Further data separation might be needed among different sectors to assure data security. This cloud may contain access via business partners, commercial workplaces, resellers, intranet vendors. Generally, this cloud employs virtualization technology which lies within the native data center.
3. **Community Cloud:** This type of cloud has an infrastructure which is surrounded by different organizations. It can be accomplished by a single or by several groups, or through a third party and retained at on or off sites. With the help of VPN users may connect with each others via a shared private network [8].
4. **Hybrid Cloud:** This cloud consist of internal and external clouds. It is a sythesis of at least two diverse cloud foundations that persevere one of a kind elements, notwithstanding, these are bound gathered by indistinguishable or select innovation that permits information and application mobility. Public or community cloud declines use of organizational private cloud fetching a hybrid cloud. In a public cloud, organizations can run non- essential 13 applications while in a private cloud sustaining only sensitive applications and data [9].

### 4.4 Impacts of Cloud Computing on Electrical Systems

Cloud computing is liked an internet service that you don't need to download or store any data on your local drive. Basically, it is not something dissimilar than a web page. The impacts of cloud computing

on electrical systems are listed below [10]:

- Flexibility:
- Teamwork
- Ease of access

## 5. Conclusion

The work explains the different aspects of power factor correction. There can be number ways for that. Cloud computing is one of the methods for the same. The advantage of cloud computing have been discussed in detail.

## References

[1] Aparna Sarkar"Automatic Power Factor Correction by Continuous Monitoring" International Journal of Engineering and Innovative Technology (IJEIT) Volume 4, Issue 10, April 2015.

[2] Dr. Subhi R. M. Zeebaree, Hajar M. Yasin "Arduino Based Remote Controlling for Home: Power Saving, Security and Protection" International Journal of Scientific & Engineering Research, Volume 5, Issue 8,pp. 266- 272, August 2014.

[3] M. S. A. El-Moniem, H. Z. Azazi, and S. a. Mahmoud, "A current sensorless power factor correction control for LED lamp driver," Alexandria Eng. J., vol. 53, no. 1, pp. 69–79, March 2014.

[4] Murad Ali" Design and Implementation of Microcontroller-Based Controlling of Power Factor Using Capacitor Banks with Load Monitoring" Global Journal of Researches in Engineering Electrical and Electronics Engineering Volume 13 Issue 2 Version 1.0, 2013.

[5] Somnath Saha, Tushar Tyagi, Dhananjay V. Gadre "ARM® Microcontroller based Automatic Power Factor Monitoring and Control System" Texas Instruments India Educator Conference, 2013.

[6] Moataz Soliman, Tobi Abiodun, Tarek Hamouda, Jiehan Zhou, Chung-Horng Lung "Smart Home: Integrating Internet of Things with Web Services and Cloud Computing" IEEE International Conference on Cloud Computing Technology and Science 2013

[7] N.Barsoum," Programming for PIC microcontroller for power factor correction", in Proc. 1st Asia Int. Conf. Modelling & Simulation, pp.19-25, 2007.

[8] M. Nagarajan and K.Kandasamy," Optimal Power Factor Correction for Inductive Load Using PIC", Procedia Eng, vol. 38, pp.737-744, 2012.

[10] M.Ravindran, V.Kirubakaran," Electrical Energy Conservation in Automatic Power Factor Correction by Embedded System", in Scientific & Academic Publication, 2012.