PRIORITY BASED LOAD SHEDDING AND AUTOMATIC POWER FACTOR CORRECTION

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ABSTRACT
In power system, the main issue is power quality and load management. Most of commercial and industrial loads are inductive in nature causes lagging power factor. The improvement of power factor is important for industrial as well as domestic area. By using APFC panel we can overcome the lagging power factor problem. The designing of load priority is the combination of both random and fixed priority. This is used to achieve optimal load shedding.

KEY WORDS: Power factor, APFC, Capacitor bank, Load shedding, Priority, Arduino.

INTRODUCTION

Electrical power system is the major source to provide energy to use for residential, commercial, industrial and agricultural purposes. Now days the demand of power is increasing day by day. The difference between demand and supply causes consumers to suffer from the unwanted load shedding. Also the quality of power is poor because of heavy industrialisation. Which causes heavy losses in power system.

Power factor is most important constraint in power system. Were apparent, active and reactive power are three forms of power .were apparent power is total power supplied by the load.Active power is power consumed by the load and reactive power is power which drawn as by the passive element such capacitor and inductor .this is causes due less efficient use of electrical equipment's. To compensate this capacitor bank can be added into the system and up to sufficient limit we can improve the power factor of the system [1].

Due to poor and inefficient power use the harmonics currents in the utility. It is very well known that these harmonic currents causes several problems such as unstable, increasing heat,noise and reduce the capability of the line to provide the energy.

Also the priority based load shedding will help us to improve the system stability and reliability .highest priority consumers will be feed continuously and low priority consumers will get disconnected from the system [2].

PROBLEM STATEMENT

Load control provides an effective means of alleviating voltage collapse. For example the cascading failure of the North American power system in august 2003 could have been avoided by tripping a relatively small amount of load in the Cleveland [3]. An electrical load that operates on the ac power requires the apparent power, which consists of teal power plus reactive power. The presence of reactive power causes the real power to be less than the apparent power and so the electric load has power factor less than one. The cascading failure of the system will collapse the system and complete shutdown will take place. But priority based load shedding will help to avoid such conditions [4].

BLOCK DIAGRAM

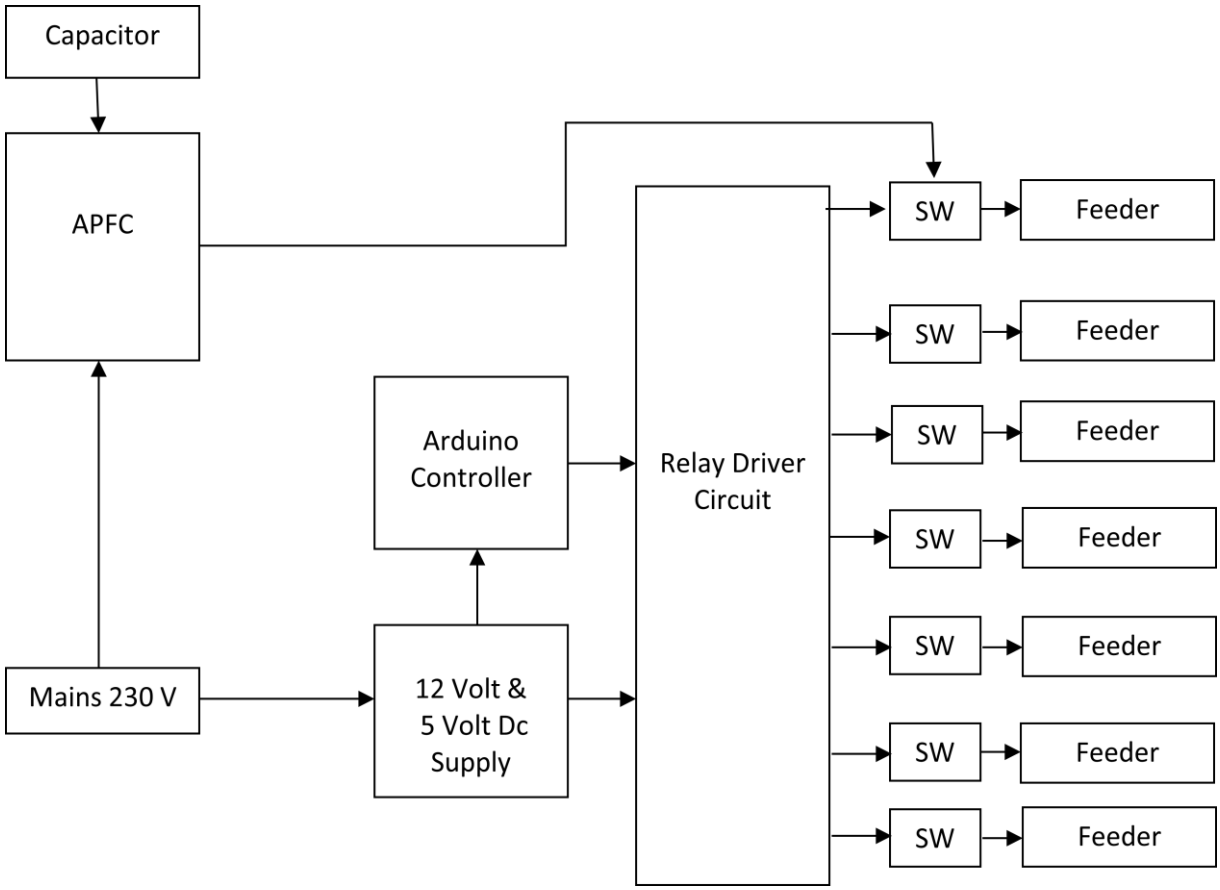


Figure no 1: Block Diagram of APFC and PBLS.

WORKING PRINCIPLE

To avoid the crises in power system, we have to follow the following two methods. Which will help to improve the power system stability.

One method is to improve power quality. It can be improved by use of capacitor bank. Normally the source provides the apparent power to the transmission lines distribution network and the load centres which is given by

$$S=VI$$

The power consumed by the load is said active power. Which is mathematically given by

$$P=VI\cos\phi$$

In kW. Reactive power is another power which continuously flows in the circuit in opposition to apparent power .which causes the active power became less than the apparent power .it is given by

$$Q= VI\sin\phi$$

Which is measured in kVAR.

The power factor of the system should be unity which is an ideal condition. It is possible when there is only purely resistive load on the network. But such condition never comes because about 90% of load is an industrial load and which consists heavy inductive loads. Such as compressors, arc furnaces, induction

motors etc. Mostly inductive load causes to poor power factor .by improving power factor we can improve the system efficiency.

We can improve the power factor by using capacitor bank. In this project we are design the system which can add the capacitor automatically according the load condition .if the power factor of the system is unity then no capacitor is going to add in the circuit, but if the power factor is lagging then microcontroller calculate the phase difference between the voltage and the current and simultaneously adds the capacitor. Hence the power factor of system get improves [5].

Automatic load shedding is another option to compensate the demand. When the generating power is less than the demand then low priority loads will get automatically disconnected from the circuit. This will help to manage the demand and supply. To manage the load shedding we had used the arduino 2560 that sense the power consumption of overall system. To limit the power and the priorities of the load to maintain the consumption [6].

RESULT

Capacitor Size Calculation

1. First step is to determine current (old) KVA and PF.
   Current power factor $p.f_1 = 0.89$.
   Current Choke KW = 40W.
2. Then to calculate KVA
   Reactive Power KVA = KW / $p.f_1$.
   $KVA_1 = 40 / 0.89 = 44.94$ VA
3. Current KVAR of system
   $KVAR_1 = [KVA_1^2 - KW^2]^{1/2}$
   $KVAR_1 = 20.5$ VAR
4. Desire power factor of system
   Desire power factor $p.f_2 = 0.97$
5. New KVA for desire power factor
   $KVA_2 = 40 / 0.97 = 41.23$ VA
6. New KVAR
   $KVAR_2 = [KVA_2^2 - KW^2]^{1/2}$
   $KVAR_2 = 10$ VAR
7. KVAR of the capacitor to be installed is
   $KVAR_{cap} = KVAR_1 - KVAR_2$
   $KVAR_{cap} = 10.5$ VAR
8. Capacitor in Farads
   $C = KVAR_{cap} / (2\pi fV^2)$
   $C = 10.5 / (2*\pi*50*400^2)$
   $C = 2.0889 * 10^{-3}$ F
   The nearest standard size would be installed, probably 2.5 MFD.

Here we take the value of time difference between voltage and current by converting them to pulse the value of count1 and value of count2. This will give ratio between time gap and time period [7]. And angle is calculated as

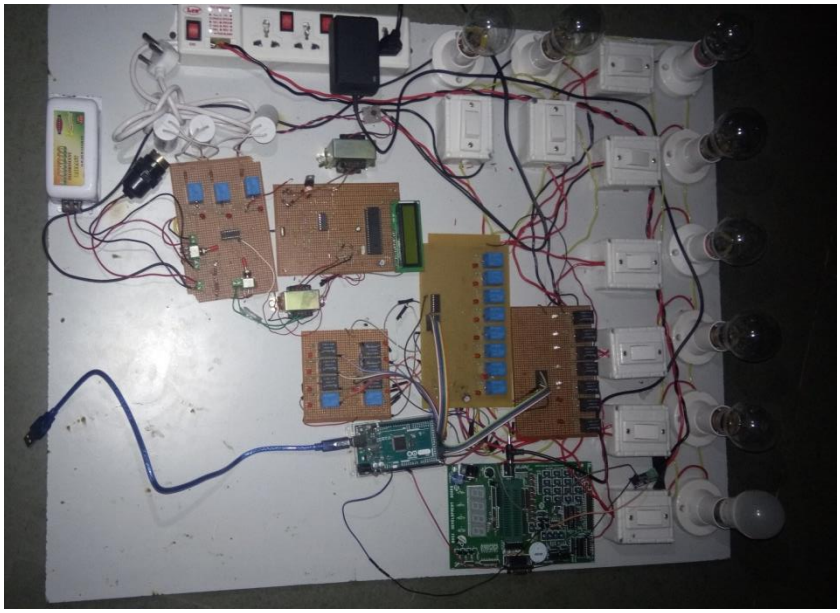
Angle = (count2 / count1) / 360.
Power Factor = cos (Angle).

FUTURE ENHANCEMENTS

The priority based load shedding can be used for industrial load management by formulation utilizes integer programming technique for minimizing the electricity costs. The load management can change the cost cure of electricity bill and demand management [8], [9].

CONCLUSION

The system is able to analyse priority of load and power available to distribute among the load on basis of priority and requirement of load. On basic data of power availability system monitor the load shedding. With load management system also improve the power factor of load to reduce losses [10].



Photograph no 2: APFC and PBLS.

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