Automatic Power Factor Improvement

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INTRODUCTION

Low power factor occurs large copper losses, poor voltage regulation and reduce handling capacity of the system. At low power factor KVA rating of the equipment has to be made more, making the equipment larger and expensive. Power factor improvement is important because at high, medium and low power factor the current distortion levels tends to fall into low THDI ≤ 20% ,medium(20%<THDI≤50%)and high(THDI >50%) respectively[2].For the low power quality high financial loss per incident occurs that are given below.

Power Factor Equation

When RMS values of voltage and current are taken into account, the power equation is given as

$$P = |V|\,|I| \cos(\theta) \text{ ---------- (1)}$$

The parameter P, commonly called the average power, is also known as real or active power. Watt is the fundamental unit of both instantaneous and average power but due to the minuteness Therefore reactive power is given by

$$Q = |V|\,|I| \sin(\theta) \text{ ----------(2)}$$

In a simple series circuit where Z is equal to R+ j X we can substitute |I||Z| for |V| in equations (1) and (2) to obtain

$$P = |I|2|Z| \cos(\theta) \text{ ----------(3)}$$

$$Q = |I|2|Z| \sin(\theta) \text{ ---------- (4)}$$

Keeping in view

$$R = |Z| \cos\theta$$

and

$$X = |Z| \sin\theta$$

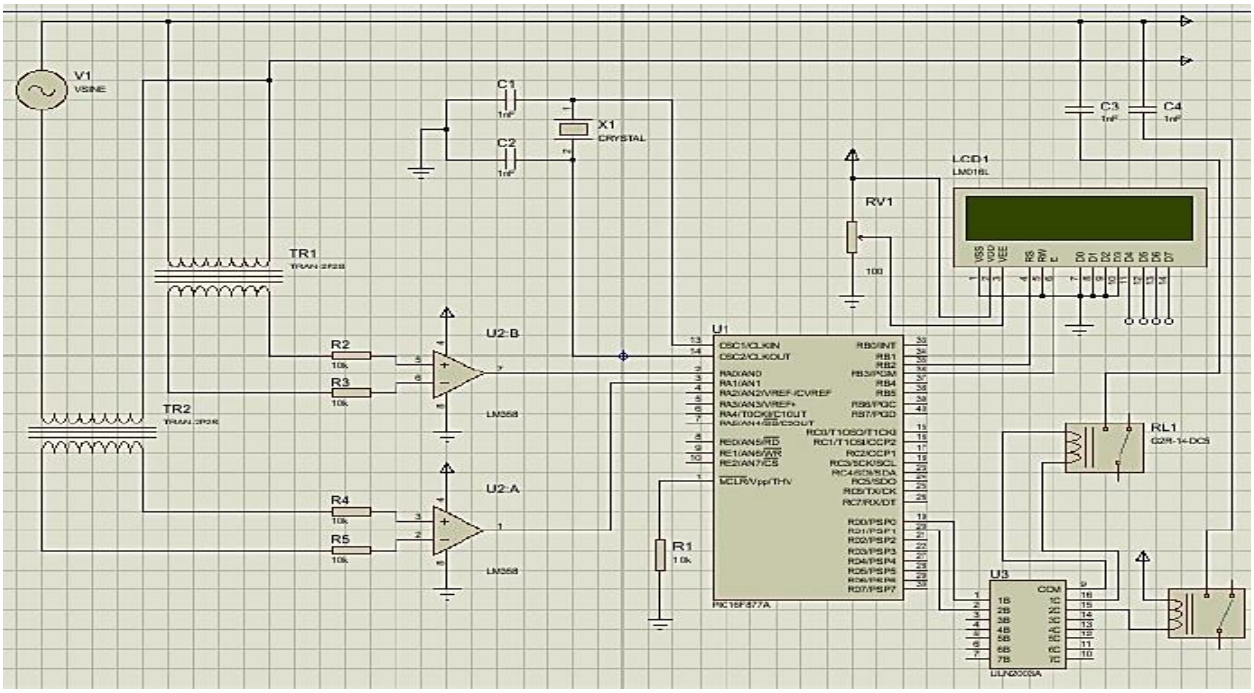
Above equations offer another method of calculating power factor since we witness that $QP = \tan\theta$

$$\cos(\theta) = \cos(\tan\text{-}1\ Q/P)$$

Components Table

S No	Name	Values	Pieces
1	Resistor	1K,1M,4K	4
2	Capacitor	3uF	2
3	Variable Resistor	1k	1
4	Relay	44XL	2
5	LCD	LCD16X2	1
6	Microcontroller	16PF877A.	1
7	Voltage Source	5V	2
8	Output	Oscilloscope	1
9	Amplifier	LM350	2

Circuit Diagram



Power Factor Formula

$$\text{Power factor} = \frac{P}{S} = \frac{EI_p}{EI} = I_p/I = \cos\theta$$

Conclusion

Reactive power compensation is known as a crucial factor in the design and operation of any power system. In this project, it will be the future works to determine the switching loss and the ways to minimize it. Even though, the implemented project is made only for single phase load, hence in future, it can be implemented for three- phase load.