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USING THE PIC18F458, CONDUCT RESEARCH ON ELECTRICAL DATA MONITORING, CONTROLLING, AND POWER FACTOR CORRECTION

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ABSTRACT
Recent years have seen a significant increase in the number of computer devices, power electronics, and high voltage power systems, which has led to a significant decline in the quality of the power supplied by the ac system. There are considerable electrical loads that are multiplely inductive in nature in the bulk of commercial and industrial installations across the nation. This causes a lagging power factor, which is punished by the electricity board. PFC is in charge of this situation. Absorbing the reactive power generated by a load is the process of power factor modification. This can be achieved manually by switching capacitors in the case of steady loads, but as loads become more variable and dispersed, it becomes more difficult to maintain a high power factor by manually switching capacitors on/off in proportion to load variation within an installation. When an APFC panel is used, this restriction is lifted. In this study, the power factor at the load is measured by a PIC microcontroller, which then activates the necessary capacitors to take into account reactive power and bring the power factor closer to unity.

Keywords: Power factor, PIC, Hardware, load, industry

INTRODUCTION
In recent years, numerous researchers have been successful in developing accurate and trustworthy solutions for digitally monitoring electrical power. Attempts were made using various methods, such as a microprocessor, a linear or non-linear ADC, and so on. A simple approach to digitally realising active and reactive power was tried in this work. This method is based on the generation of three values using an analogue circuit, which are proportional to Vm, Im, cos, and sin. Multiplication with a microcontroller yields Vm Im cos, which is active power, and Vm Im sin, which is reactive power. The PIC18F458 microcontroller is used in this project to demonstrate a simple method for measuring active and reactive power digitally. As previously mentioned, this project uses a microcontroller PIC18F458 to demonstrate a simple method for measuring active and reactive power digitally. In large-scale industries, PLC and SCADA panels also perform this role. These

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panels are incredibly costly and can handle a huge amount of space. However, in contrast to PLC and SCADA panels, the circuits we produce are much less costly and take up less space, and this circuit is used not only in small businesses but also in homes.

2. LITERATURE SURVEY

BACKGROUND STUDY:

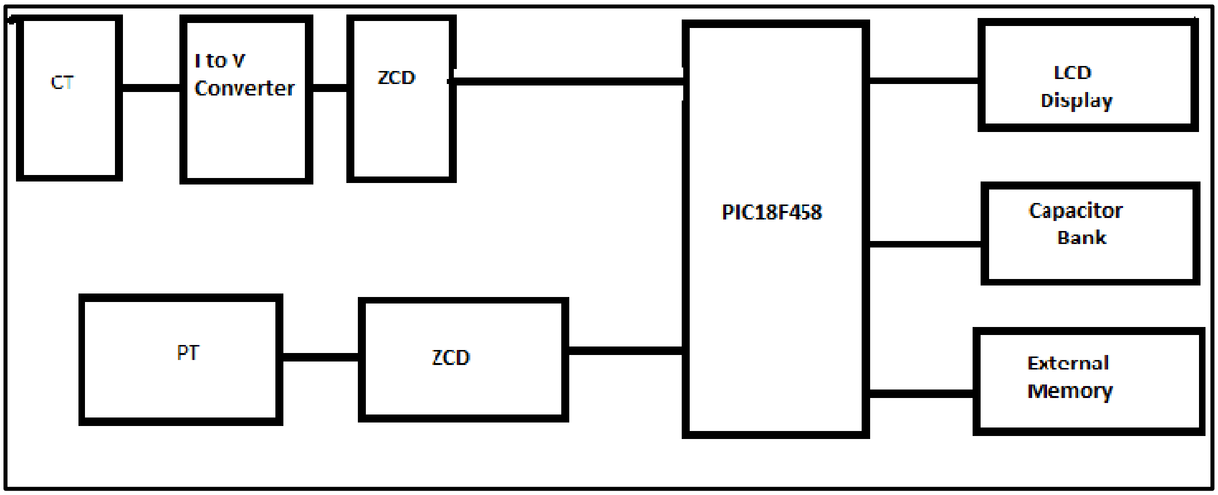

Fig.1 Working Block Diagram

3. WORKING PRINCIPLE

The device uses a PIC18F458 microcontroller to boost its power factor.
Consider a conventional three-wire power grid, where the steady-state voltage and current signals are sinusoidal in character. As a result, the current and instantaneous voltage
i(t) are:v (t) = Vm Sin (wt)
i(t) = Vm Sin(wt+ø)
where Vm is the line voltage peak value, Im is the line current peak value, and is the line voltage and line current phase angle (leading or lagging)..

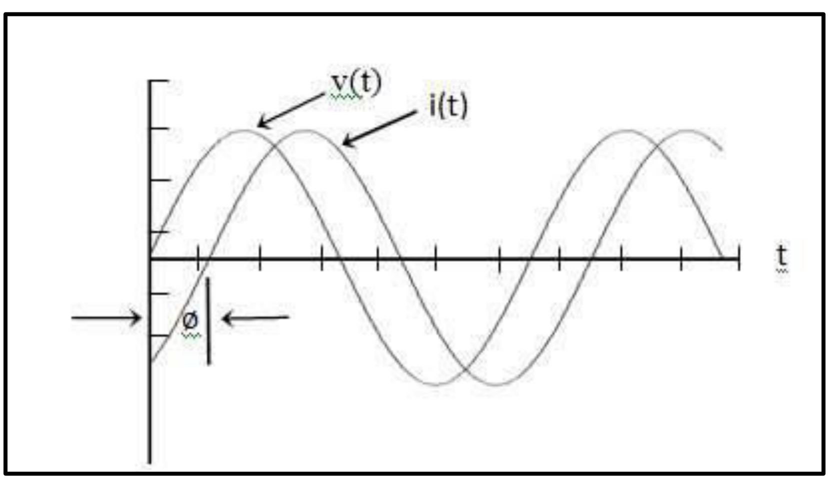

Fig 2 Voltage and Current waveforms

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4. REQUIRED COMPONENTS

PIC18F458:

The PIC, or Peripheral Device Controller, an 8-bit microcontroller, was introduced by Microchip Technology Corporation in 1989. This microcontroller only featured a little amount of data memory and a few hundred bytes of on-chip ROM for the software. Because they are 8-bit processors, the CPU can only handle 8 bits of data at once. Among these are the PIC families 12xxx, 14xxx, 16xxx, 18xxx, 19xxx, and 20xxx. A number of new instructions are included in the 16-bit PIC18XXX instruction. Having 40 pins, the PIC18F458 is a microcontroller.

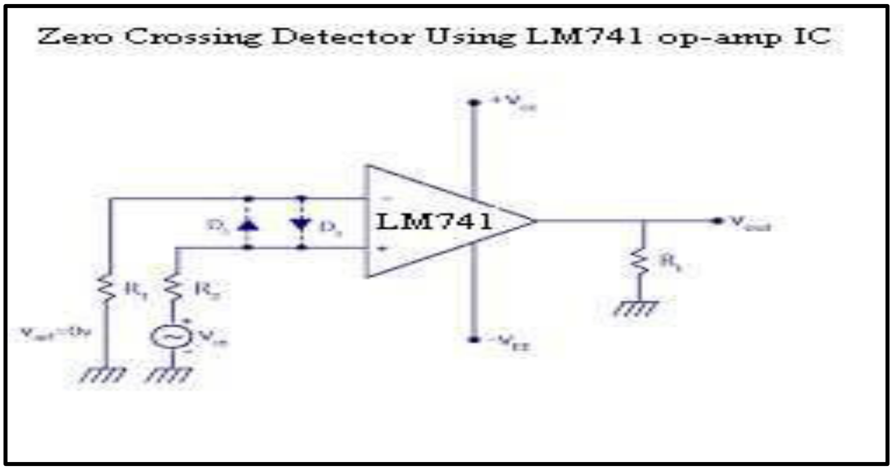

Fig 3 construction diagram for ZCD

5. Current to voltage converter

It creates a voltage that is equivalent to the supplied current. You'll need this circuit if your measuring equipment can only calculate voltages and you need to measure current output. A straightforward resistor circuit can be utilised to convert an instrument or data acquisition module (DAQ) whose input impedance is many orders higher than the converting resistor. However, the following op amp circuit should be utilised if your instrument's input impedance is low in comparison to the conversion resistor.

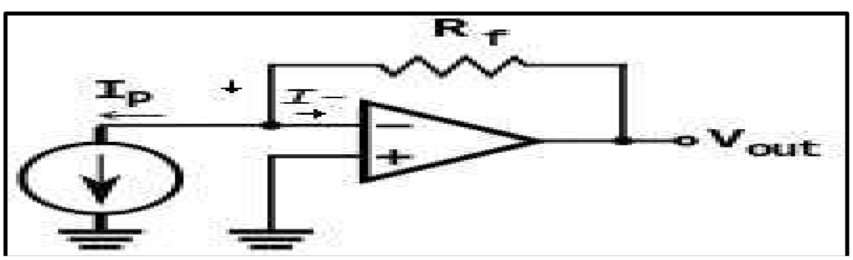

Fig: 4 I to V Converter

6. Potential Transformer:

A potential transformer is a transformer that steps down voltage. It is used to determine AC voltage by stepping down AC voltage. A potential transformer is utilised in this project to lower the voltage from 220V AC to 5V AC. Possible Transformers' secondary windings have fewer turns than their primary windings. As a result, it lowers AC voltage using the formula for turns ratio shown below.

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Vs/Vp = Ns/Nv

Instrument transformers that are coupled in parallel include voltage transformers (VT), also referred to as potential transformers (PT). They are designed to place a negligible demand on the testing supply, and they have a perfect voltage ratio and phase relationship to enable exact secondary connected metering.

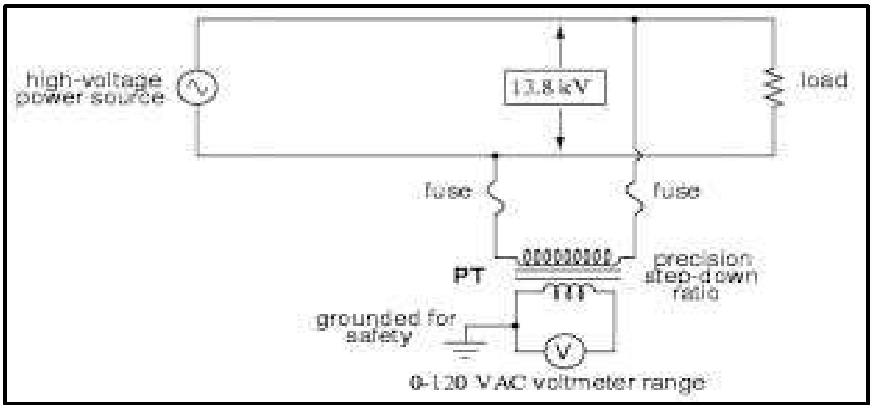

Fig: 5 Circuit diagram of PT

7. *CURRENT TRANSFORMER:*

A CT transformer generates an AC in its secondary that is equivalent to the AC current in the primary. Current transformers, VTs, and PTs are all types of instrument transformers that can do calculations. An instrument transformer called a current transformer is one whose secondary current, under typical working conditions, is equal to the main current and deviates from it by a small angle. It is used in conjunction with measuring or protective instruments. When a current is too large to compute directly or the circuit's voltage is too high, a current transformer could be used to create an independent, lower secondary current that is equivalent to the primary circuit's current. The processing of the induced secondary current can subsequently be done in measurement instruments or electronic equipment. Additionally, the primary circuit is undisturbed by the current transformers. The most important feature of electronic devices is also division of the primary and secondary circuits. Electronic devices frequently employ current transformers for metering and safety relays. They are also used in the electrical power business.

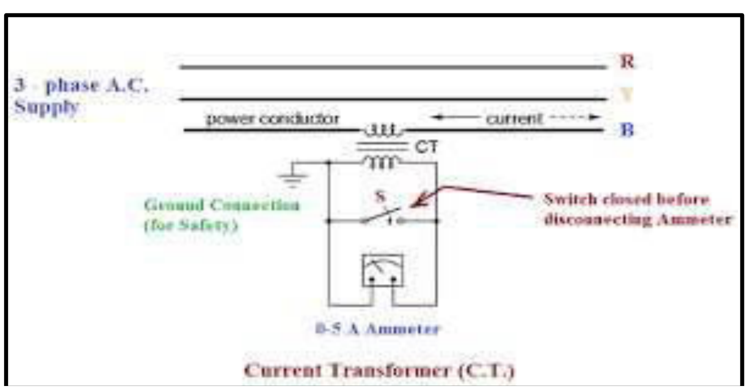

Fig 6 Circuit diagram of CT

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8. LCD (LIQUID CRYSTAL DISPLAY):

The display type found in laptops and other compact computers is LCD. LCDs enable displays to be substantially thinner than CRT technology, along with LED and gas-plasma technologies. Compared to LED and gas-display screens, LCDs consume far less energy since they reflect light rather than emit it. An LCD is made using a passive matrix or active matrix display grid. An active matrix LCD is also referred to as a TFT display. The intersections of a grid of conductors are where the pixels in a passive matrix LCD are placed. Two conductors on the grid are used to send a current to monitor the light for any given pixel. In an active matrix, a transistor is positioned at each pixel intersection, requiring less current to control a pixel's luminance. As a result, the current in an active matrix monitor can be switched on and off more often, speeding up the process of refreshing the image .

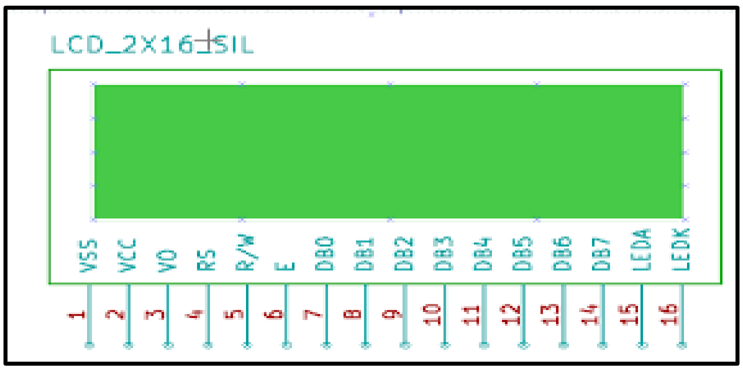

Fig1.7 Pin diagram of LCD

8.1 ADVANTAGES:

1) Simple in construction.
2) Cheap in cost.
3) Real time data can be monitored.
4) Continuous data can be stored and read as per requirement in future.
5) It can be used for domestic as well as small scale industries

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8.2 DISADVATAGES:

1) It cannot be used for large scale industries**.**
2) Only limited data can be monitored.

8.3 APPLICATION:

1) Measurement of active power
2) Measurement of reactive power
3) Measurement of power factor
4) Power factor correction
5) Reactive power compensation
6) Storage of data

CONCLUSION

Create a power factor correction device using a PIC18F458 microcontroller to help boost power factor, minimise excessive current flow, and lessen harmonics in the system. enhancing system performance and reducing excessive energy expenditures. Both home and commercial environments are suitable for using it. A fairly straightforward methodology for measuring active and reactive power digitally is shown in this presentation. There are many different industries where this strategy can be used. The circuit's purpose is to display the networked load's active and reactive power. PIC18F458 is used to perform calculations. The system may be tested using PROTEUS under various loading scenarios, and the MATLAB simulator has demonstrated linear behaviour under such circumstances.

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