DEGIEN AND IMPLEMENTATION OF DIGITAL POWER FACTOR METER

This Project submitted in partial fulfillment of the requirements for the Award of Degree of Bachelor of Science of Electrical and Electronic Engineering.

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December 2018

CERTIFICATION

This is to verify that this project entitled "DESIGN AND EMPLEMENTATION OF DIGITAL POWER FACTOR METER" is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on.

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Dedicated

To

Our Parents & Honourable Teacher

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ACKNOWLEDGEMENT

First we express our heartiest thanks and thankfulness to omnipotent Allah for His perfect gift makes us conceivable to finish this venture effectively. We are thankful and wish our significant our obligation to Assistant Professor Dr. Md. Rezwanul Ahsan, Department of Electrical and Electrical Engineering, Daffodil International University, Dhaka. Profound hypothetical and equipment information and distinct fascination of our manager in this field affected us to complete this undertaking. His perpetual tolerance, insightful authority ,persistent support, consistent and vivacious supervision, productive analysis, profitable exhortation, perusing numerous substandard draft and adjusting them at all stage have made it conceivable to finish this venture.

We might want to offer our heartiest thanks to decent Head, Department of EEE, for his benevolent help to complete our undertaking and furthermore to other employees of the Department of Electrical and Electronic Engineering, Daffodil International University.

ABSTRACT

This paper identifies with the field of building up an electronics Digital power-factor (PF) meter to supplant the ordinary electrodynamic type. The plan depends on voltage to recurrence change and twofold rate increase methods. For the primary half estimating period, a flag relative to the pinnacle voltage Vm is connected to control the exchanging limit dimension of the comparator of the voltage to recurrence converter (VFC), while the contribution of the VFC is kept at reasonable steady dimension, hence delivering a yield recurrence conversely corresponding to Vm, which is considered and connected an information to a parallel rate multiplier (BRM). For the second half estimating period, a flag corresponding to the result of the pinnacle voltage and the power factor $Vm \cos(\phi)$, is connected to the VFC, while the starting dimension of the comparator is kept consistent. The VFC recurrence yield is then specifically relative to $Vm \cos(\phi)$. This is made accessible through gating system to the BRM recurrence input. The BRM recurrence yield is summed over a predetermined timeframe to give PF data.

CHAPTER 1

INTRODUCTION

1.1 General Introduction

Both little and medium-measure organizations in Bangladesh confront the Power Factor discipline which is being required by the supply experts for encroachment of statutory limits. From the power structure discernment this piece of industry is seriously dealt with due to budgetary objectives. Such endeavors run a few developments of eight hours consistently by day. All around, the power input is 11 kV three phase, which is communicated down to 440 V three phase through a delta-wye transformer of grade some place in the scope of 300 and 1000 kVA. The supply specialists present a kWh meter and a kVAh meter joining a kVA MD pointer. In this country a base power factor of 0.85 is mandatory on the HT side. Diverse parts of confirmation of the power factor, dimension of precision of the meters on moving weights with fluctuating power factors, and the legality of the discipline constrained on the ventures are discussed in this paper. Some convenient signs on the improvement of the Power Factor Meter are in like manner discussed.

1.2 Motivation

There are various advantages to be increased through power factor rectification. These advantages extend from diminished interest charges on your capacity framework to expanded load conveying abilities in your current circuits and by and large decreased power framework loses. Furthermore, the advantages of intensity factor redress aren't simply restricted to the monetary record; there are likewise tremendous natural advantages related with power factor amendment, which implies your organization is diminishing it's carbon impression and helping the environment.Normally the power factor in vast creating station with the entire load lies in the middle of 0.8 to 0.9. Anyway at times the power factor moves toward becoming slacking, so it is attractive to find a way to enhance the power factor in power frameworks. The accompanying strategies are the proficient techniques to enhance the power factor.

1.3 Purpose of this project

Object is the principle criteria for any task, without it one would wind up in a labyrinth. As we began our venture, our first target was to settle the objective. We have been pulled in to this sun based task with the goal that we can add to the general public. Numerous industry utilized power factor meter and vehicle have been put into work as both proto sort and pilot venture work. This paper is worried about the improvement of an advanced power-factor (PF) meter to supplant the electrodynamic type. Another strategy is played out a PF estimation; it depends on voltage-to-recurrence change and tallying methods. One voltage-to-recurrence converter (VFC) is utilized to change over the two DC signals into frequencies corresponding to Vm and Vm cos φ, where Vm is the pinnacle of the voltage flag and φ is the stage edge among voltage and current. A division plot is actualized to play out the advanced PF estimation.

1.4 Project Scope

To accomplish the destinations of the undertaking, a few extensions must be sketched out. The extent of this venture incorporates building up the power factor meter. Undertaking degree is the piece of venture arranging that includes deciding and archiving a rundown of explicit venture objectives, expectations, highlights, capacities, errands, due dates, and at last expenses. As it were, it is the thing that should be accomplished and the work that must be done to convey a venture.

1.5 Problem Statement

The computerized of Digital Power Factor Meter is described as the cosine of the point between the voltage and the current. It is a provoke regard. Further, the above is authentic just if both the signs, i.e. voltage and current,are sinusoidal. Besides, all discharge lights, for instance, fluorescent chambers, sodium and mercury lights, thyristor controlled devices, reconditioned motors, standard motors working at low loads, enrollment and roundabout section radiators, drenched reactors and welding loads are unavoidably non-coordinate burdens. Non-linearity causes sounds and improvement of the power consider turns a troublesome endeavor inside seeing music.

Also, voltage assortments and surges feature the inconveniences experienced owing to the extended element of sounds in streams with almost little augmentation in passed on control. From now on, the general power factor lessens.

Overall, it is seen that on national events, finishes of the week and around night time the voltage level augmentations. Frequently, a 10% extension is extremely ordinary. This has the effect of growing the charging streams and working the system at a low power factor. Cure contraptions which have been presented will by and large bomb due to deferred overvoltage. In the midst of under voltage assignment, the present measurements augment basically in this way do the adversities, thusly achieving an improvement in the impact factor.

In thyristor controlled devices, organize point control is commonly ordinary. Continually, the equipment is worked at 0.4-0.7 events the full load level. The edge of deferment is extremely sweeping, causing truncation of the present sine wave. Therefore, the consonant measurement winds up for all intents and purposes indistinguishable with that of the fundamental. The effect of smothers in course of action in like manner winds up enormous as the impedance is dependent upon the repeat. The power factor in establishments using such devices is regularly low, about 0.4-0.6. The discipline pulled in is high, and standard correction methodologies end up antiquated.

CHAPTER 2

OVERVIEW OF THE PROJECT

2.1 Introduction

Power factor is a vitality idea that is identified with power stream in electrical frameworks. To comprehend control factor, it is useful to comprehend three unique sorts of intensity in electrical frameworks. Power factor (PF) is characterized as the proportion of genuine capacity to add up to control, and is communicated as a rate (%). By and large, electrical frameworks are comprised of three segments: resistors, inductors and capacitors.Inductive hardware requires an electromagnetic field to work. Along these lines, inductive burdens require both genuine and responsive capacity to work. The power factor of inductive burdens is alluded to as slacking, or under 100%, in view of our capacity factor proportion. In most business and mechanical offices, a greater part of the electrical hardware goes about as a resistor or an inductor. Resistive burdens incorporate radiant lights, baseboard warmers and cooking stoves. Inductive burdens incorporate glaring lights, AC acceptance engines, bend welders and transformers.

2.2 Overall Concept of Our Project

ARDUINO mini pro is a open source plate form microcontroller base device. We use here ARDUINO mini pro because of its size small to use as any compact/device carry anywhere like pocket multi-meter that's why we chose it. It has six analog input pin and thirteen distolled pin. Now which the pin we are choose pin A and pin A1 to calculate the power factor by calculating main voltage & ampear. We make same c-code to calculate the process. In the process we using current transformer (CT) & power transformer (PT) and some resistance. Also we have a Liquid cristial diode (LCD) display (16*2) for show the value of the main AC voltage , Ac amplifier , and power factor. We have done some calculate between current and voltage .From this calculate come out the power factor value. Actually this is a power factor meter not a power factor correction device.
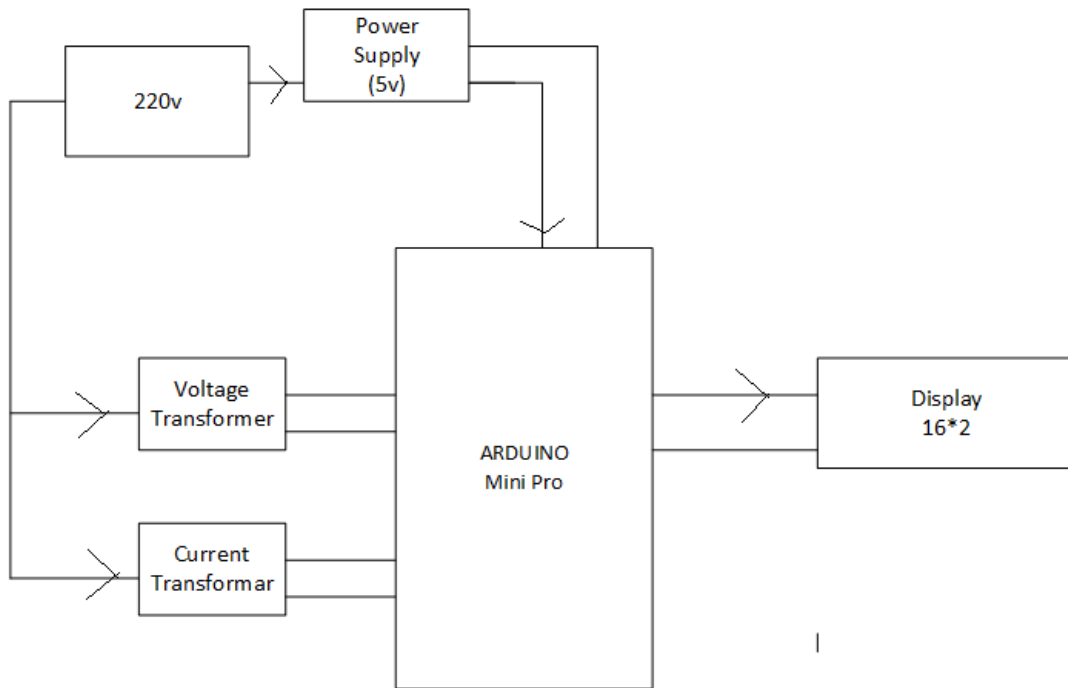
Fig 2.1:Block Diagram of Digital power Factor Meter

2.3 Arduino Mini pro

The first, good 'ol fashioned Arduino is open-source equipment, which implies anybody is allowed to download the structure records and turn their very own variant of the prominent advancement board. SparkFun has hopped on this chance and made a wide range of Arduino variations, each with their own one of a kind highlights, measurements, and applications. Presently one of those variations has arrived in your grasp; congrats! It's a wild world out there in microcontroller-arrive, and you're going to venture out from the superb – however now and then smothering – effortlessness of the Arudino Pro Mini. In this instructional exercise, we'll go over how to set up and utilize the 3.3V Arduino Pro Mini, everything from collecting the small Arduino to programming it.

2.3.1. Where to Use ARDUINO Mini Pro

All the ARDUINO ace smaller than normal sheets are well known due to simplicity of comprehension and application. Additionally the ARDUINO is an open source stage where one can get every related

datum and unique module schematics. In this stage one can alter the framework relying upon the need. There are numerous ARDUINO sheets available. They are accessible with different highlights and bundles. One can pick proper board contingent upon the need. There are few situations where PRO MINI is picked over other:

Case1: Where framework is lasting establishment. In changeless applications, the board just should be customized once and that is all. In those cases highlights gave like USB developer, I/O connectors and other supporting equipment is futile. The PRO MINI is explicitly intended for those frameworks. This board has just essential equipment sufficiently only for those applications.

Case2: For comfort. This board is one of littlest sheets of ARDUINO. With its solace size can be utilized in versatile applications.

Case3: With fundamental equipment the expense of board is extensive lesser.

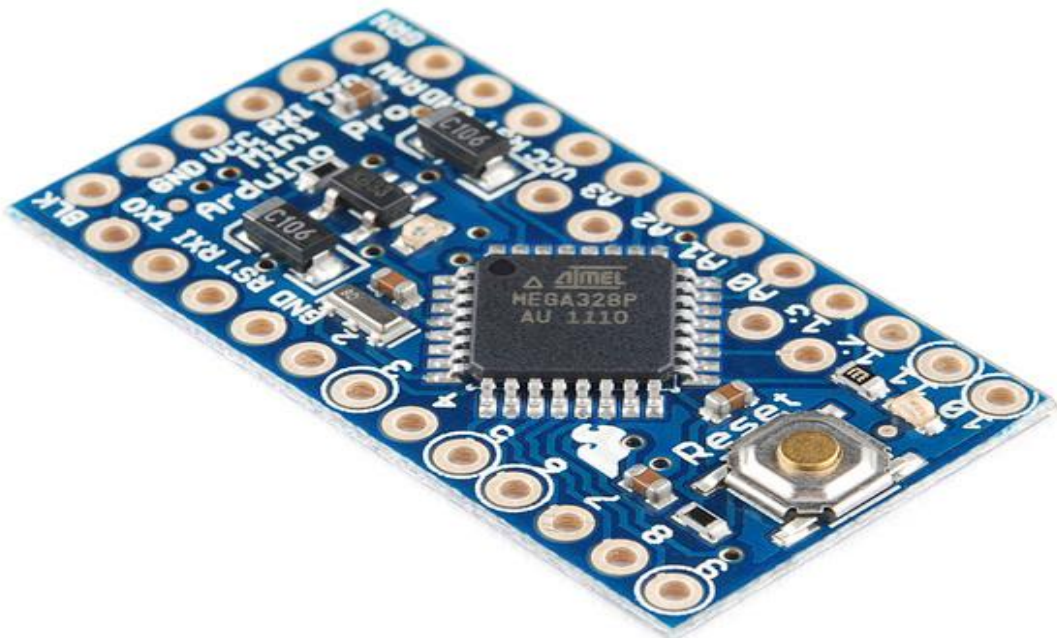Case4: With 32Kbytes memory the PRO MINI can oblige most application programs.

Fig 2.2:Arduino pro mini

2.4 Power Transformer

Power Transformer is an electrical gadget that changes over inbound power to a higher or lower estimation of voltage for explicit purposes. It is a noteworthy part in power framework to supply voltage in numerous countries. The two fundamental elements of the transformers are:

To supply current from source to goal

To control the voltage of the current

It comprises of a curl framework in the gadget that deals with the present stream inside an explicit range.

2.4.1 Use of Power Transformer

Time of electrical power in low voltage level is especially smart. Speculatively, this low voltage level power can be transmitted to the not exactly attractive end. This low voltage control at whatever point transmitted results in progressively essential line current which no ifs ands or buts causes more line adversities. In any case, if the voltage measurement of an influence is long, the current of the influence is diminished which causes decline in ohmic or I2R adversities in the system, decline in cross-sectional zone of the conductor i.e. decline in capital cost of the system and it furthermore upgrades the voltage course of the structure. Because of these, low measurement control must be wandered up for viable electrical power transmission. This is done by endeavor up transformer at the sending side of the power system sort out. As this high voltage power may not be appropriated to the clients explicitly, this must be wandered down to the perfect measurement at the not exactly alluring end with the help of endeavor down transformer. Electrical power transformer subsequently expect an irreplaceable activity in power transmission. Two winding transformers are usually used where extent of high voltage and low voltage is more significant than 2. It is monetarily astute to use auto transformer where the extent between high voltage and low voltage is under 2. Again a singular unit three phase transformer is more down to earth than a bank of three single stage transformers unit in a three phase structure. However, a single three phase transformer unit is to some degree difficult to transport and should be removed from organization in case one of the stage winding isolates.

2.5 Current Transformers

A present transformer (CT) is a sort of transformer that is utilized to gauge rotating current (AC). It creates a current in its auxiliary which is corresponding to the current in its essential. Current transformers, alongside voltage or potential transformers, are instrument transformers. Instrument transformers scale the vast estimations of voltage or current to little, institutionalized qualities that are anything but difficult to deal with for instruments and defensive transfers.The instrument transformers segregate estimation or assurance circuits from the high voltage of the essential framework. A present transformer gives an auxiliary current that is precisely corresponding to the present streaming in its essential. The present transformer displays an insignificant load to the essential circuit.

2.5.1 How to use current transformer

Current transformers are used generally to measure current and checking the movement of the power organize. Close by voltage drives, pay audit CTs drive the electrical utility's watt-hour meter on various greater business and mechanical supplies.

High-voltage current transformers are mounted on porcelain or polymer spreads to withdraw them from ground. Some CT structures slip around the bushing of a high-voltage transformer or electrical switch, which thus centers the transport inside the CT window.

Current transformers can be mounted on the low voltage or high voltage leads of a power transformer. From time to time a portion of a vehicle bar can be cleared to replace a present transformer.

Regularly, various CTs are presented as a "stack" for various vocations. For example, security devices and pay metering may use separate CTs to give isolation among metering and confirmation circuits and allows current transformers with different characteristics (exactness, over-trouble execution) to be used for the contraptions.

The load (stack) impedance should not outperform the foreordained most noteworthy motivation to keep up a key separation from the helper voltage outperforming the limits for the present transformer. The fundamental current rating of a present transformer should not be outperformed or the inside may enter its non

coordinate zone and finally inundate. This would happen close beyond what many would consider possible of the key portion of each half (positive and negative) of the AC sine wave in the basic and would deal the accuracy.

2.6 LCD

A liquid valuable stone introduction (LCD) is a dimension board appear or other electronically adjusted optical device that uses the light-tweaking properties of liquid pearls. Liquid valuable stones don't release light explicitly, rather using a background enlightenment or reflector to make pictures in shading or monochrome. LCDs are open to indicate optional pictures (as in a comprehensively helpful PC appear) or settled pictures with ignorant substance, which can be appeared concealed, for instance, preset words, digits, and seven-area appears, as in a propelled clock. They use a comparable basic development, on the other hand, really optional pictures are contained a broad number of little pixels, while distinctive exhibits have greater segments.

LCDs are used in a wide extent of employments including LCD TVs, PC screens, instrument loads up, flying machine cockpit appears, and indoor and outside signage. Little LCD screens are ordinary in helpful client contraptions, for instance, electronic cameras, watches, calculators, and mobile phones, including PDAs. LCD screens are in like manner used on purchaser devices things, for instance, DVD players, PC diversion devices and tickers. LCD screens have replaced overpowering, huge cathode bar tube (CRT) appears in pretty much all applications. LCD screens are open in a more broad extent of screen sizes than CRT and plasma appears, with LCD screens available in sizes going from minor propelled watches to enormous TV input.

Fig 2.3: Display

2.7 Resistor

A resistor is an electrical part with two terminals that is used to limit or deal with the flood of electrical stream in electronic circuits. Its inspiration is to diminish current stream and also cut down the voltage levels in its general locale or part of the circuit. A resistor is expected to control the genuine load on the system, inferring that it experiences power and dissipates it as warmth, thusly reasonably reducing the proportion of intensity spilling out of it by express aggregates.

The resistor is a champion among the most basic portions in an electronic circuit as it empowers the originator to unequivocally control the proportion of current and voltage gushing at explicit domains in the circuit. Thusly, it is a level out need to ensure that fragile electronic sections, for instance, composed circuits (ICs) get the correct proportion of force that they require and nothing more, as a wrong load frequently prompts debasement or totally burnout of ICs.

Fig 2.4: Resistor

2.8 Capacitor

A capacitor is an electrostatic structure in which applying a settled voltage to it will gather a settled charge on each side, with the charge toward one side being equivalent and inverse to the charge on the opposite side. The proportion of the connected voltage to the collected charge is the capacitance.

The most straightforward conceivable capacitive structure is a couple of parallel metal plates with an encasing pushed between them, yet they can come in numerous shapes and sizes.
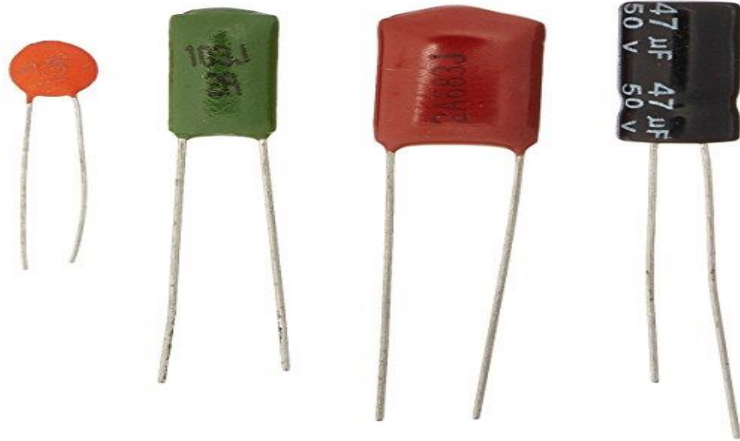
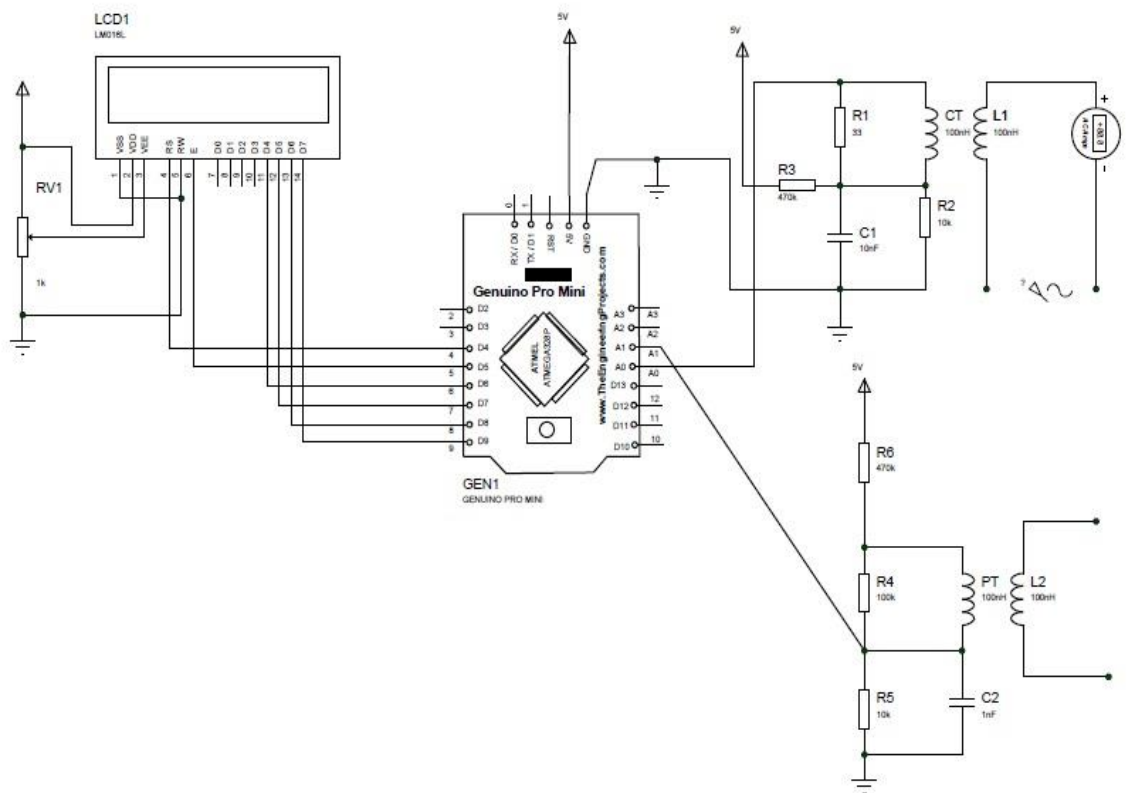Fig 2.5: Capacitor

2.9. Schematic diagram of the project

Fig2.6: Schematic diagram of the project

CHAPTER 3
COMPONENTS OF THE PROJECT

3.1 Introduction

ARDUINO mini pro is a open source plate form microcontroller base device. We use here ARDUINO mini pro because of its size small to use as any compact/device carry anywhere like pocket multi-meter that's why we chose it. It has six analog input pin and thirteen distolled pin. Now which the pin we are choose pin A and pin A1 to calculate the power factor by calculating main voltage & ampear. We make same c-code to calculate the process. In the process we using current transformer (CT) & power transformer (PT) and some resistance. Also we have a liquid crystal display (LCD) display (16*2) for show the value of the main AC voltage , Ac amplifier , and power factor. We have done some calculate between current and voltage .From this calculate come out the power factor value. Actually this is a power factor meter not a power factor correction device.

3.2 Bulb Holder

A globule holder is a contraption that holds a handle. The globule holder is the place the handle fits. The image underneath shows a handle holder from a rooftop light.

3.2.1 What Is A Bulb (Lamp) Holder?

The globule fits into the knob holder, the knob holder 'holds' the globule.

The globule holder contains the electrical association from the supply to the knob. The metal end of the knob comes into contact with the supply when the globule is in a bad way into the knob holder.

The picture underneath shows 3 unique sorts of electrical contacts.
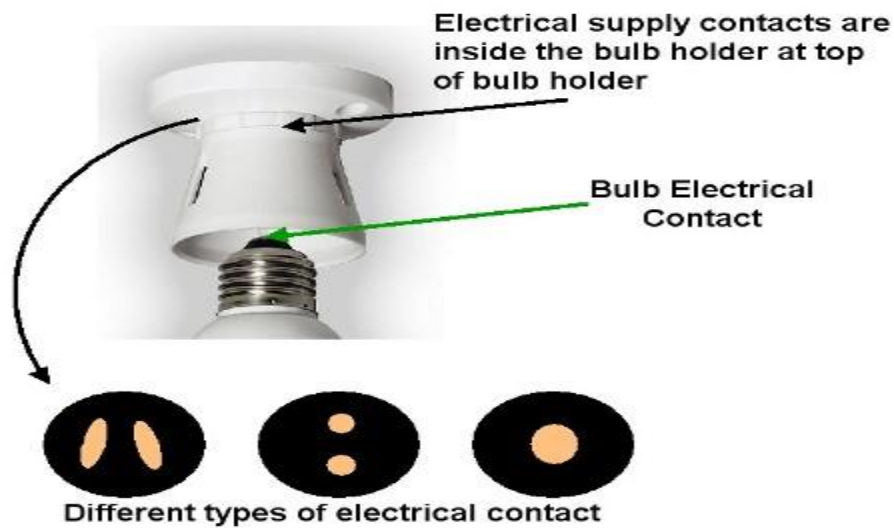
Fig3.1: Bulb Holder

The electrical contacts are inside the bulb holder at the top of the bulb holder.

The different types of bulb holder electrical contact will 'match' the electrical contact on the bulb.

The screw fitting in the image would have a bulb holder with a single electrical contact – the right hand electrical contact.

The electrical contact is usually made from copper.

3.3 Filament bulb

A fiber light is just one more name commonly used for the vintage Edison lights.Those age globules are made to look like the main Edison handle made over 100 years earlier.The word Filament itself insinuates the wire or string inside the handle which enlightens when you turn it on.

Fig3.2: Filament bulb

These are a part of the names makers and customers use to call those globules;

Filament handles, Edison Bulbs, Antique Bulbs, Vintage Bulbs, Nostalgic Bulbs, Original Bulbs, Squirrel Cage Bulbs, out-dated handles, and retro handles. Every last one of those names basically mean a comparable thing! There are moreover uncommon shapes, sizes, and fiber structures those handles come in. Globe, Tubular, Radio, Standard, and Edison are a bit of the shapes. Squirrel Cage, Quad Loop, Hairpin, Spiral are a part of the fiber structures.

Quad loop Filament   Spiral Filament   Hair Pin Filament   Squirrel Cage Filament

Fig3.2.1:Filament

3.3.1 Design

The LED fiber involves various course of action related LEDs on a direct substrate, suggested as Chip-On-Glass (COG). These direct substrates are made of glass or sapphire materials. This straightforwardness empowers the created light to disperse impartially and reliably with no impedance. A despite covering of yellow phosphor in a silicone sap folio material adherents the blue light created by the LEDs into white light. Debasement of silicone clasp, and spillage of blue light are arrangement issues in LED fiber lights. A market knowledge provider alerts that LED fiber light makers in China more often than not use low quality silicone to cut costs; it may wind up delicate after 200 hours of action, causingthe fiber structure to split and break the LED string.

Fig3.2.2:Bulb

Positive points of interest of the LED design are potential higher efficiencies by the use of more LED makers from lower driving streams. An imperative preferred standpoint of the arrangement is the straightforwardness with which close full "around the world" (360°) lighting up can be obtained from assortments of strands.

3.4 Resistor

A resistor is an unapproachable two-terminal electrical section that executes electrical restriction as a circuit part. In electronic circuits, resistors are used to reduce current stream, change hail levels, to disconnect voltages, tendency powerful segments, and end transmission lines, among various livelihoods.

Resistors are essential parts of electrical frameworks and electronic circuits and are all inclusive in electronic equipment. Valuable resistors as discrete fragments can

be made out of various blends and structures. Resistors are furthermore realized inside fused circuits.

The electrical limit of a resistor is shown by its restriction: ordinary business resistors are created over an extent of more than nine solicitations of degree. The apparent estimation of the resistance falls inside the amassing flexibility, exhibited on the portion.
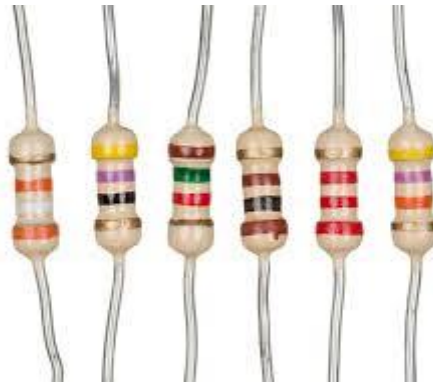
Fig3.3: Resistor

3.5 Capacitor

A capacitor is a uninvolved electronic section that stores essentialness as an electrostatic field. In its most clear edge, a capacitor contains two coordinating plates separated by a securing material called the dielectric. The capacitance is direct in respect to the surface zones of the plates, and is conversely comparing to the separation between the plates. Capacitance in like manner depends upon the dielectric unfaltering of the substance segregating the plates.

The standard unit of capacitance is the farad, consolidated. This is an immense unit; progressively fundamental units are the microfarad, abbreviated µF (1 µF =10-6F) and the picofarad, diminished pF (1 pF = 10-12 F).

Fig3.4:Capacitor

Capacitors can be created onto coordinated circuit (IC) chips. They are usually utilized related to transistors in unique irregular access memory.

Substantial capacitors are utilized in the power supplies of electronic gear o fall types, including PCs and their peripherals. In these systems,the capacitors smooth out the amended utility AC, giving unadulterated, battery-like DC.

Fig3.4.1:Capacitor

3.6 Breadboard:

A breadboard is a solderless device for passing model and test circuit plans.This makes it humble to use for creation transitory models and exploring different avenues regarding circuit plan. Therefore, solderless breadboards are likewise well known with understudies and in innovative training.A stripboard (Veroboard) and comparative prototyping printed circuit sheets, which are utilized to construct semi-changeless welded models or unique cases, can only with significant effort be reused. An collection of electronic frameworks might be prototyped by operating

breadboards, from little unassuming and advanced circuits to surface focal control units.
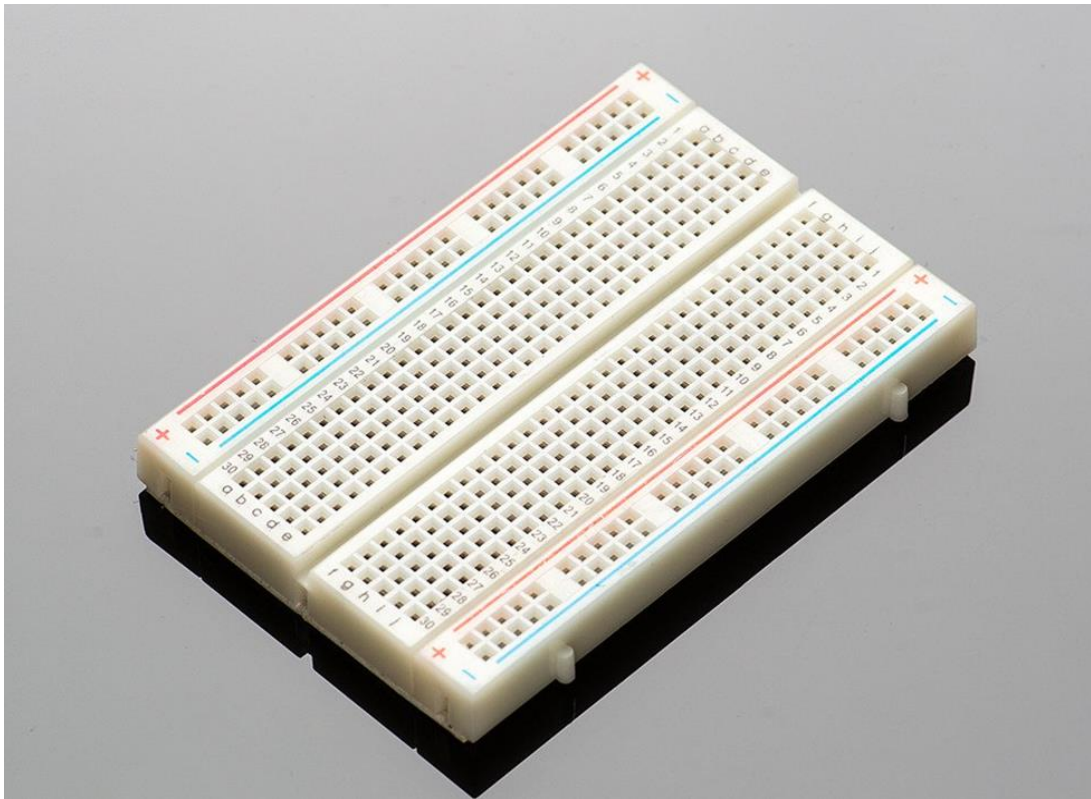
Fig 3.5: Breadboard

3.7 Arduino Mini Pro

3.7.1 Introduction

Arduino is an device for appearing well and good and control a better amount of the physical world than your personal computer. It's an open-source physical figuring stage dependent on a orthodox forward microcontroller board, and an progress situation for composing programming for the board. Arduino can be developed to create intuitive articles, taking contributions from an assortment of switches or sensors, and controlling an assortment of lights, engines, and other physical yields. Arduino Projects can be remain solitary, or they can speak with programming running on your PC. The sheets can be amassed by hand or bought preassembled; the open-source IDE can be downloaded for nothing. The Arduino programming dialect is an execution of Wiring, a comparative physical registering stage, which depends on the Processing sight and sound programming condition.

3.7.2 Arduino Pin Diagram

A typical example of Arduino board is Arduino Uno. It contains of ATmega328- a 28 pin microcontroller.
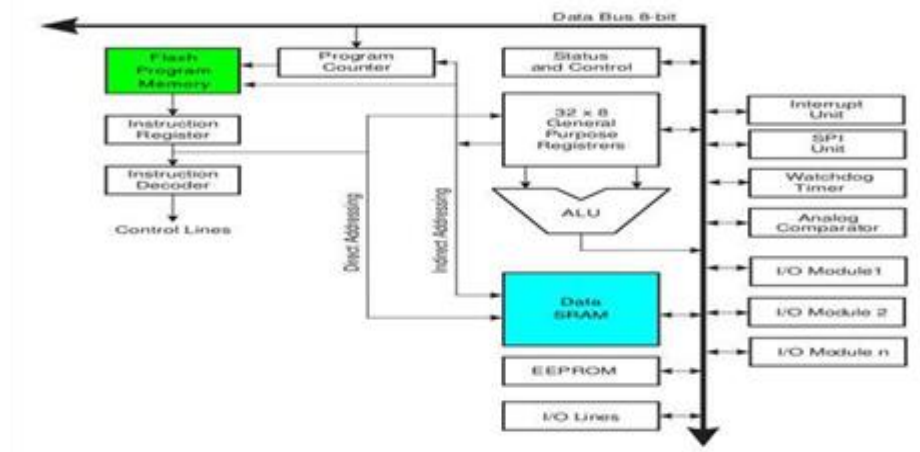
Fig 3.6: Arduino Uno Pin Diagram

Arduino Uno comprises of 14 advanced info/yield pins (of which 6 can be utilized as PWM yields), 6 simple sources of info, a 16 MHz precious stone oscillator, a USB association, a power jack, an ICSP title, and a change catch.

Power Jack: Arduino can be control either from the pc finished a USB or through outer source like connector or a battery. It can work on an outside supply of 7 to 12V. Power can connected remotely through the stick by giving voltage reference through the IORef stick.

Advanced Inputs: It comprises of 14 computerized inputs/yield sticks, every one of which give or take up 40mA current. Some of them have unique capacities like pins 0 and 1, which go about as Rx and Tx separately , for sequential correspondence, pins 2 and 3-which are outside interferes with, pins 3,5,6,9,11 which gives pwm yield and stick 13 where LED is associated.

Simple data sources: It has 6 simple info/yield sticks, each giving a goals of 10 bits.

Are: It gives reference to the simple data sources

Reset: It resets the microcontroller when low.

3.7.3 Five Steps to Program an Arduino

Projects written in Arduino are known as portrayals. An essential portray comprises of 3 sections

1.   Declearation of Variables
2.   Initialization: It is written in the setup () work.
3.   Control code: It is written insider savvy () work.

The outline is spared with .into augmentation. Any tasks like checking, opening an outline, sparing a draw should be possible utilizing the catches on the toolbar or utilizing the apparatus menu.

The draw ought to be put away in the sketchbook catalog.

Picked the correct board from the apparatuses menu and the sequential port numbers.

Tap on the transfer catch or picked transfer from the instruments menu. Hence the code is transferred by the boot loader onto the microcontroller.

3.7.4 Few of Basic Arduino functions are

Advanced Read (stick): Reads the computerized an incentive at the given stick. Computerized Write (stick, esteem): Writes the advanced an incentive to the given stick. Stick Mode (stick, mode): Sets the stick to info or yield mode. Simple Read (stick): Reads and returns the esteem. Simple Write (stick, esteem): Writes the incentive to the stick. Sequential. Start (baud rate): Sets the start of sequential correspondence by setting the bit rate.

3.7.5 Working Principle

Arduino is an open source microcontroller which can be effectively modified, eradicated and reconstructed at any moment of time. Presented in the Arduino stage was future to give a diffident and simple path for specialists, understudies and experts to make gadgets that cooperate with their condition utilizing sensors and actuators. In view of basic microcontroller sheets, it is an open source figuring stage that is utilized for developing and programming electronic gadgets. It is additionally equipped for going about as a small PC simply like different microcontrollers by taking sources of info and controlling the yields for an assortment of hardware gadgets.

3.8 Power Transformer(PT)

The Power transformer is a one generous of transformer, that is used to transfer electrical drive in every part of the electrical or electronic circuit between the generator and the delivery primary circuits.

A transformer is an electrical gadget which is utilized to exchange control starting with one circuit then onto the next through electromagnetic induction.The control exchange is went with without recurrence change. In an electronic framework, the term control transformer is utilized to give various AC supplies of a few voltages and suitable estimations of flow from people in general power supply. And furthermore used to signify to transformers with a 500KVA rating or more noteworthy.

The Power transformer is a one sort of transformer, that is utilized to move electrical vitality in any piece of the electrical or electronic circuit between the generator and the conveyance essential circuits. These transformers are utilized in circulation frameworks to interface venture up and venture down voltages. The basic kind of intensity transformer is fluid inundated and the life expectancy of these transformers is around 30 years. Power transformers can be ordered into three sorts dependent on the reaches.
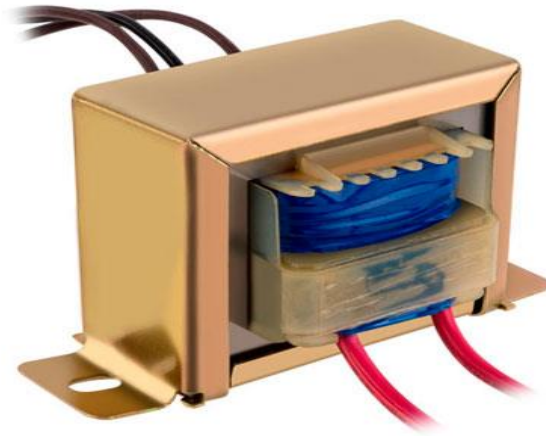
Fig 3.7: Power transformer

3.8.1 Power Transformer Design

The minimum of the power transformer is structured with steel which is covered by expanses. It is settled into either a center sort or shell type. The frames of the transformer are wound and associated utilizing electrodes to make three 1-stage or one 3-stage transformer. Three 1-stage transformer requires each bank disengaged from the extra and in this way offer coherence of administration when one bank flops. A solitary 3-stage transformer, regardless of whether the shell or center sort, won't work even with one bank out of administration. The 3-stage transformer is reasonable to make and it has a littler impression, and capacities nearly with higher productivity.
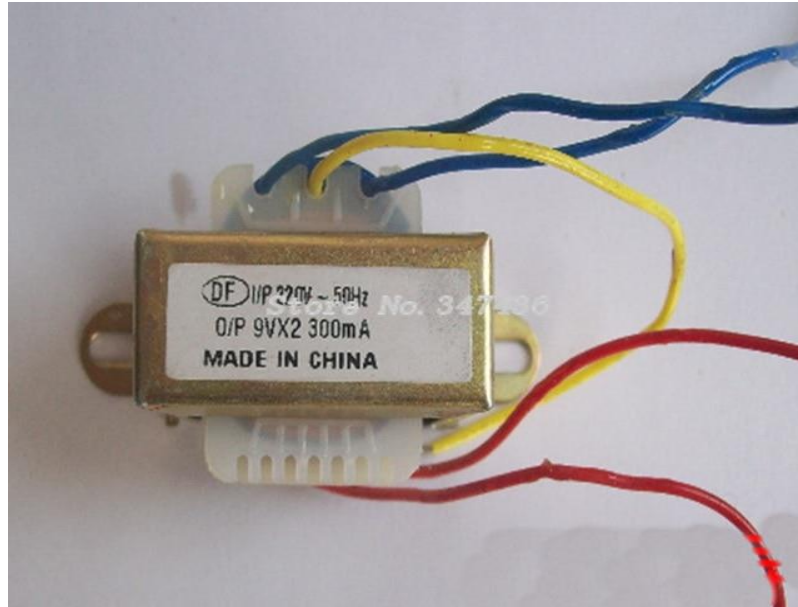
Fig 3.7.1: Digien of Power Transformer
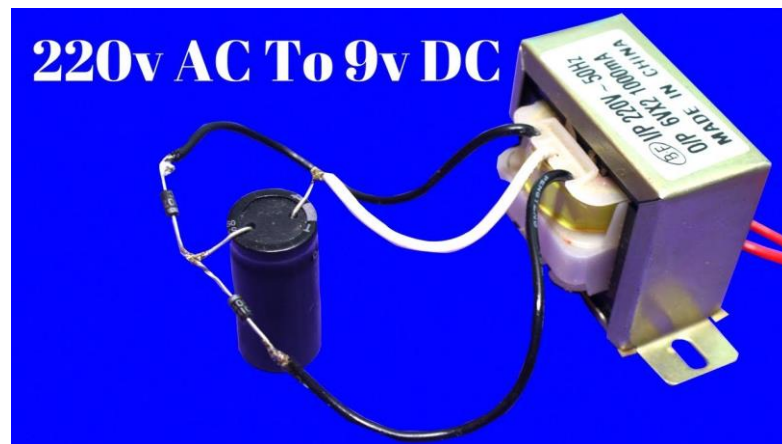
Fig 3.7.2: 220v AC Power Transformer

The minimum of the transformer is invested in a fire retardant securing oil inside a boiler. The studio over the oil tank lets for the expanding oil to fall into it. The bushings of the tank allow for conductors to painstakingly enter and leave the tank without animating the external shell. The power transformer can be worked past its little evaluating as long as it remains inside the 65ºC ascent of the temperature. To permit the above ostensible task, transformers are worked in with fans that cools the center of the transformer to a point underneath the showed temperature.

3.8.2 Power Transformer Specifications

Power transformers can be planned as either a solitary stage or a three stage shape.There are various essential determinations to distinguish while scanning for power transformers. The determinations of intensity transformer incorporate a greatest power rating, most extreme auxiliary current rating, greatest voltage rating and o/p type. Power transformer details chiefly incorporate

Phase is 3Ø

Frequency if 60Hz,50Hz

Primary Voltage is 22.9 kV

Secondary Voltage is 6.6/3.3 kV

Tap Voltage 23.9-R22.9-21.9-20.9-19.9kV

Vector Dd0, Dyn11,etc

3.8.3 Power Transformer Applications

Power transformers can change starting with one voltage then onto the next at high power levels. These transformers are utilized in different electronic circuits and furthermore accessible in different sorts and applications.

The uses of the power transformer incorporate the transmission and circulation of electrical power These transformers are generally utilized by power plants, mechanical plants and conventional electric service organizations,

Power transformers are utilized in the high voltage transmission system to venture up and venture down the voltage. These transformers are commonly utilized with the end goal of transmission of overwhelming burdens.

These transformers are enormous in size contrasted and appropriation transformers, that are utilized in delivering station and transmission substation. Power transformers are utilized in the transmission n/w. So they don't associate specifically interface with the purchasers. So stack variances of transformer are less.

These transformers are utilized as a stage up gadgets for transmission, with the goal that the I2r misfortune can be diminished to a predefined influence stream.

Power transformers are fundamentally intended to utilize the center part for most extreme and will work especially close to the knee purpose of the B-H bend. This brings down the mass of the center to a great degree. Normally, control transformers have the relating copper misfortunes and iron misfortunes at higher load.

Thus,this is all about power transformer construction, power transformer conditions and claims. We hope that you have got a better kind of this concept. Also, any requests about this concept or power transformer circuit diagram, please give your response by observing in the comment section below.

3.8.4 Use of Power Transformer

Age of electrical power in low voltage level is mainly cost effective.Theoretically,this low voltage level power can be transmitted to the less than necessary end. This low voltage control whenever transmitted outcomes in more projecting line current which in reality causes more line troubles. Be that as it may, if the voltage dimension of a power is expanded, the current of the power is decreased which causes decrease in ohmic or I2R misfortunes in the system,reduction in cross-sectional zone expense of the framework and it additionally enhances the voltage control of the framework. On account of these, low dimension control must be ventured up for productive electrical power transmission. This is finished by venture up transformer at the sending side of the power framework arrange. As this high voltage power may not be dispersed to the customers straightforwardly, this must be ventured down to the ideal dimension at the less than desirable end with the assistance of venture down transformer. Electrical power transformer in this manner assumes an essential job in power transmission. Two winding transformers are commonly utilized where proportion of high voltage and low voltage is more noteworthy than 2. It is savvy to utilize auto transformer where the proportion between high voltage and low voltage is under 2. Again a solitary unit three stage transformer is more savvy than a bank of three single stage transformers unit in a three stage framework. However, a solitary three stage transformer unit is somewhat hard to transport and must be expelled from administration in the event that one of the phase winding breaks down.

3.8.5 Working Principle

Transformer has two or more separate coil winding placed on a common magnetic core. But the primary coil winding is responsible for supplying the alternating current (AC) with supplied frequency and it produces magnetic flux in the same frequency in magnetic core.

Then the flux linkage to the secondary coil winding also changes at the same frequency resulting in induced e.m.f of the same frequency to the secondary coil winding. But the direction of induced e.m.f in the secondary coil winding opposes the causes of producing the alternating flux by the primary coil winding.

3.8.6 Construction of a Power Transformer

Transformer has several applications for use. So transformer design, types and its accessories is depend upon its size, application and the location. Now there are some components and accessories of a transformer.

1.Steel Tank (Body)

2.Core

3.Coil Winding

4.Conservator

5.Breather

6.Thermometer

7.Vent Pipe or Pressure Relief

8.Valves

9.Buchholz Relay

10 Tap Changing Switch

3.8.7 Various Types of Power Transformer

A power transformer has several types like two winding transformer, three winding transformer and the auto transformer. Besides the auto transformer and the power transformer there are a great verities of special transformer. It includes the following,

1.The winding Transformer

2.Furnace Transformer

3.Rectifier Transformer

4.Regulating Transformer

5.Mining Transformer

6.Current and Voltage Transformer

7.Traction Transformer

8.High Voltage Testing Transformer

9.High Frequency Transformer

10.Short Circuit Testing Transformer

11.Communication Transformer

12.Control and Domestic Transformer.

3.9 Current Transformer(CT)

A current transformer (CT) is a type of transformer that is used to degree interchanging current (AC).It produces a current in its secondary which is proportional to the current in its primary.

Instrument transformers scale the huge estimations of voltage or current to little, institutionalized qualities that are anything but difficult to deal with for instruments and defensive transfers. The instrument transformers segregate estimation or assurance circuits from the high voltage of the necessary framework. A present transformer gives an optional current that is precisely corresponding to the present streaming in its essential. The present transformer introduces an immaterial load to the essential circuit.

Flow transformers are the flow detecting units of the power framework and are utilized at producing stations, electrical substations, and in mechanical and business electric power dispersion.

•Insulation from High Voltages and Currents

•Isolation from other systems
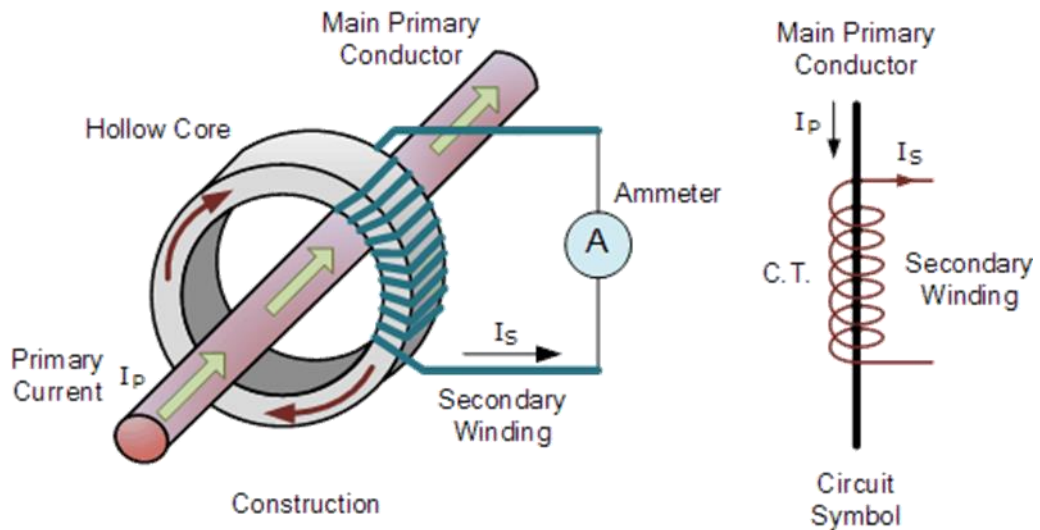
•Safety

•Standardization

•Accuracy (Ratio & Phase)

Fig 3.8: Current Transformer

The Current Transformer(C.T),is a type of "instrument transformer" that is intended to deliver a rotating current in its secondary winding which is corresponding to the current being estimated in its essential. Flow transformers decrease high voltage flows and give a helpful method for securely checking the real electrical flow streaming in an AC transmission line utilizing a standard ammeter. The vital of activity of a major current transformer is marginally not quite the same.

Not at all similar the voltage or power transformer observed, the present transformer contains only a solitary or not a lot of turns as its basic winding. This basic winding can be of both a single dimension turn, a twist of uncompromising wire collapsed over the inside or just a channel or transport bar set through a central hole as showed up.

As a result of this sort obviously of activity, the present transformer is much of the time implied too as a "plan transformer" as the fundamental winding, which never has more than a not a lot of turns, is in course of action with the present passing on conductor giving a load.

The optional twisting be that as it may, have countless turns twisted on an overlaid center of low-misfortune attractive material. This center has an expansive cross-sectional region with the goal that the attractive transition thickness made is low utilizing a lot littler cross-sectional territory wire, contingent on how much the current must be ventured down as it endeavors to yield a steady current, free of the associated load.

3.9.1 Types of current transformers: wound, toroidal and bar

There are three types of basic current transformer. These are wound, toroidal and bar.

Wound Current Transformer : Wound current transformer is one kind of transformer where the transformers essential winding is physically associated in arrangement with the conductor.

Toroidal Current Transformer : It is also a current transformer that conveys the present streaming in the system is strung through a window or gap in the toroidal transformer.

Bar-type Current Transformer : This type of transformer is also very essential . It is used for various purposes.

Types: Bar,Wound and Window

Fig 3.8.1: Bar type current transformer

Fig 3.8.2: Wound type current transformer

Fig 3.8.3: Window type current transformer

3.9.2 Types

Based on the function performed by the current transformer, it can be categorized is follows:

1.Measuring current transformers: It is used for the measurement of energy, current and power.

2.Protective current transformers: These current transformers are used as the defense equipments such as trip coils, relays, etc.

Based on the function construction, we can also be classified as follows:

3.Bar Type. This type contains of a bar of appropriate size and material making an integral part of the transformer.

4.Wound Type. This type has a main meandering of ore than one full turn wound over the core.

5.Window Type. This sort has no primary winding. The secondary wind of the CT is put around the present streaming conductor. The attractive electric field made by flow coursing through the conveyor initiates flow in the optional winding, which is utilized for estimation.

3.9.3 Handheld Current Transformers

Transformer has two or more dispersed coil winding placed on a common magnetic core. But the primary coil winding is responsible for supplying the alternating current (AC) with supplied frequency and it produces magnetic flux in the same frequency in magnetic core.Then the flux linkage to the secondary coil same frequency subsequent in encouraged e.m.f of the same frequency to the secondary coil winding. But the direction of induced e.m.f in the secondary coil winding opposes the causes of producing the alternating flux by the primary coil winding.

But the primary coil winding is responsible for supplying the alternating current (AC) with supplied frequency and it produces magnetic flux in the same frequency in magnetic core.Then the flux linkage to the secondary coil twisting also changes at the same frequency resulting in induced e.m.f of the same frequency to the secondary coil winding. But the direction of induced e.m.f in the secondary coil winding opposes the causes of producing the alternating flux by the primary coil winding.

Fig 3.8.4: Handheld Current Transformers

A present transformers essential curl is constantly associated in arrangement with the primary conductor offering ascend to it likewise being alluded to as an arrangement transformer, or a couple of wound essential turns, for the most part for low current proportions.

High voltages will result from open circuiting the optional circuit of an invigorated In the following instructional exercise about Transformers we will see what happens when we interface together three individual transformers in a star or delta design to create a bigger power transformer called a Three Phase Transformer used to supply 3-stage materials.

3.9.4 Working principle

The present transformer is an instrument that is utilized to change over a huge current into an auxiliary side of a little current dependent on the guideline of electromagnetic enlistment. The present transformer is made out of a shut center and winding. It has few turns on one side of the winding and is hung on a circuit that should be estimated. In this way, it regularly has all the present coursing through the circuit, and the quantity of turns of the auxiliary side winding is more. In the estimating instrument and the assurance circuit, the present transformer is constantly shut in the work, so the impedance of the estimating instrument and the defensive circuit arrangement loop is little, and the working condition of the present transformer is near the short out. The present transformer is to change over a substantial current to an optional side current to quantify the auxiliary side.

In power age, power transmission, circulation and electrical cables, the flow estimate is wide, from a few to a huge number of security. So as to encourage

estimation, assurance and control, it should be changed over into a moderately uniform current. Furthermore, the voltage on the circuit is commonly higher, for example, coordinate estimation is extremely risky. The flow transformer ACTS as a flow transformer and an electrical segregation.

For the pointer type ammeter, the optional current of the present transformer is for the most part ampere review, (for example, 5A, and so on.). For computerized instruments, the testing signals are for the most part milliampere (0-5v, 4-20ma, and so on.). The auxiliary current of small scale current transformer is milliampere, which is the extension between the fundamental transformer and the testing.

Miniaturized scale current transformer is additionally called "instrument current transformer". The "instrument currenst transformer" has the implying that the multi-current transformer utilized in the research center is more than the accuracy momentum transformer, which is commonly used to extend the instrument go.

The present transformer is like the transformer, which depends on the standard of electromagnetic acceptance. The transformer changes the voltage and the present transformer changes the current. The twisting of the present transformer is known as a winding; The twisting of an estimating instrument is known as an optional injury.

The present proportion of the current I1 and the optional twisting I2 of the present transformer is known as the genuine current proportion K. The present proportion of the present transformer in the evaluated current proportion is the appraised current proportion of the present transformer, which is communicated by Kn.

The capacity of current transformer (CT) is to change over a lot of current into an auxiliary current with a littler esteem, which can be utilized for security, estimation and different purposes. In the event that the transformer is a present transformer of 400/5, it can change over the current of 400A to the current of 5A.

3.10 (16*2) LCD Display

LCD (Liquid Crystal Display) screen is an electronic showcase module and locate a wide scope of utilizations. A 16x2 LCD show is extremely fundamental module and is normally utilized in different gadgets and circuits. A 16x2 LCD implies it can show 16 characters for each line and there are 2 such lines. In this LCD each character is

shown in 5x7 pixel network. This LCD has two registers, to be specific, Command and Data. We utilized here the inherent library capacity of Arduino coding condition.
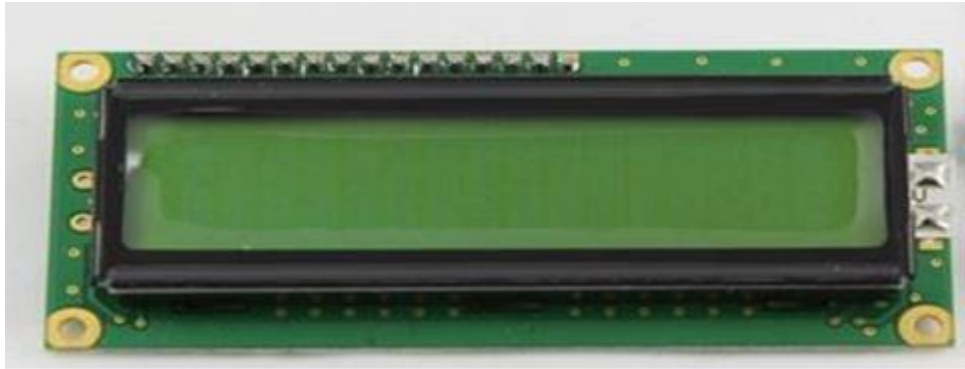

Fig 3.9: LCD Display

Conditions of issue, the strong and the fluid. LCD utilizes a fluid gem to deliver a noticeable picture. Fluid precious stone showcases are super-thin innovation diversions. LCD's innovations permit showcases to be a lot more slender when contrasted with cathode beam tube (CRT) Technology. Show screen that are commonly utilized in PC, TVs, PDAs and convenient video.

Fluid gem show is made out of a few layers which integrate two enraptured board channels and anodes. Light is expected from a central point on a layer of fluid gem. This mix of hued light with the grayscale image of the precious stone (framed as electric flow moves through the gem) figures the hued picture. This picture is then shown on the display.

3.10.1 Working principle

The standard behind the LCD's is that when an electrical flow is connected to the fluid precious stone atom, the particle will in general untwist. Accordingly somewhat light is permitted to pass the captivated glass through a specific region of the LCD. In this way that specific territory will wind up dim contrasted with other. The LCD deals with the standard of blocking light. Though building the LCD's, a replicated mirror is orchestrated at the back. The overall area of the LCD must be covered by a typical anode or more it ought to be the fluid costly stone issue.
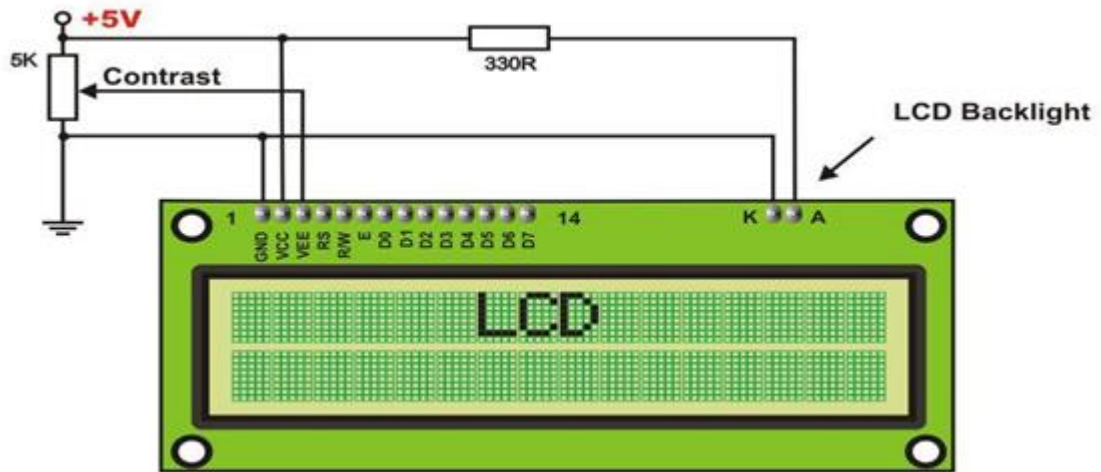
Fig3.9.1: 16*2 LCD Display

At the point when there is no current, the light goes through the front of the LCD it will be replicated by the mirror and skiped back. As the anode is associated with a battery the current from it will cause the fluid valuable stones between the basic plane terminal and the cathode formed like a square shape to untwist. Along these lines the light is delayed from going through. That exact rectangular zone looks perfect.
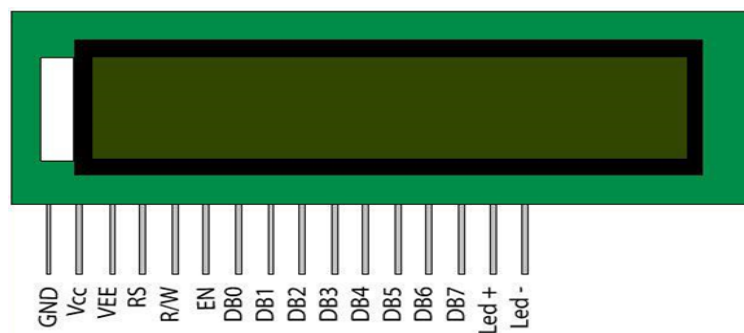
3.10.2 Pin Diagram

Fig 3.9.2: 16*2 LCD Pin Diagram

CHAPTER 4

RESULTS AND DISCUSSION

4.1:Result

4.1.1Measuring Voltage Current and Power factor

We have making digital power factor meter.We measured here voltage,current and power factor metet by using Digital power factor meter.For measuring practically,we have used a value of voltage,current and power factor of a house,we have also used digital power factor meter to measure it.For this esperiment we have used Filament bulb and Fan etc.The value of this experiment is same whice we have measured by the digital power factor meter(buy from market) and our own digital power factor meter there may same difference.for examplethe value of current,voltage and power factor are respectively 1.22A,229.3V and0.99 PF,when we have measured it by merkect digital power factor meter.On the other hand the value of current.Voltage and Power Factor are 1.22A,232.22v and 0.89pf whene we have measured it by our own project system.we can see that all the value are about same.The price of digital power factor meter is 3000Tk in market but our making Digital power factor meter is only 2600Tk.It is less costly than the market digital power factor meter.So the meter,we have made much cost efficiency and good.We may use this meter at any required place very easily.

Table 4.1:Compear the Project With Redimate Power Factor Metre

Redimate Power Factor Meter				Our Final Project		
Load	Current (I)	Voltage (V)	Power Factor (PF)	Current (I)	Voltage (V)	Power Factor (PF)
1 Filament Bulb	1.22A	229.3	0.99	1.22A	232.22v	0.89
1 Fan	0.98A	233.7v	0.96	0.98	232.89	.89
1 Fan +1 Filament Bulb	1.9A	232.7v	1.00	1.9A	231.5v	0.97
1 Energy Bulb	0.70A	233.4v	0.69	0.70A	233.48v	0.61.
1 Fan +1 Energy Bulb	1.30A	233.7v	0.94	1.30A	232.5v	0.90

Table 4.2: Component of Data Sheet

SL No	Components	Code/Value	Quantity
1	Arduino mini pro		1
2	Power transformer (PT)		1
3	Current transformer (CT)		1
4	LCD		1
5	Resistor		9
6	Capacitor		2
7	Filament bulb		1
8	Breadboard		1
9	Bulb Holder		1

Table 4.3: Price List

Components	Code/Value	Quantity	Unit Price	Estimated Cost
Arduino mini pro		1 Pcs		900.00
Power transformer (PT)		1 Pcs	150	150.00
Current transformer (CT)		1 Pcs	1000	1000.00
LCD		1 Pcs		450.00
Resistor		9 Pcs	3	27.00
Capacitor		2 Pcs	3	6.00
Filament bulb		1 Pcs	20	20.00
Breadboard		1 Pcs	50	50.00
Bulb Holder		1 Pcs	15	15.00
Total Cost				=2621.00

4.2. Discussion

There are various types of power factor meter in market,but most of thos are very costly.By making this project we may get such kind of meter very easily and it will be cost efficient.There is no scope tp show any wrong value in this meter.It may be cost efficient for people if we sell this product in the market.The size ifown system is small.To be understood about this project very nicely to people,we have designed it largly.
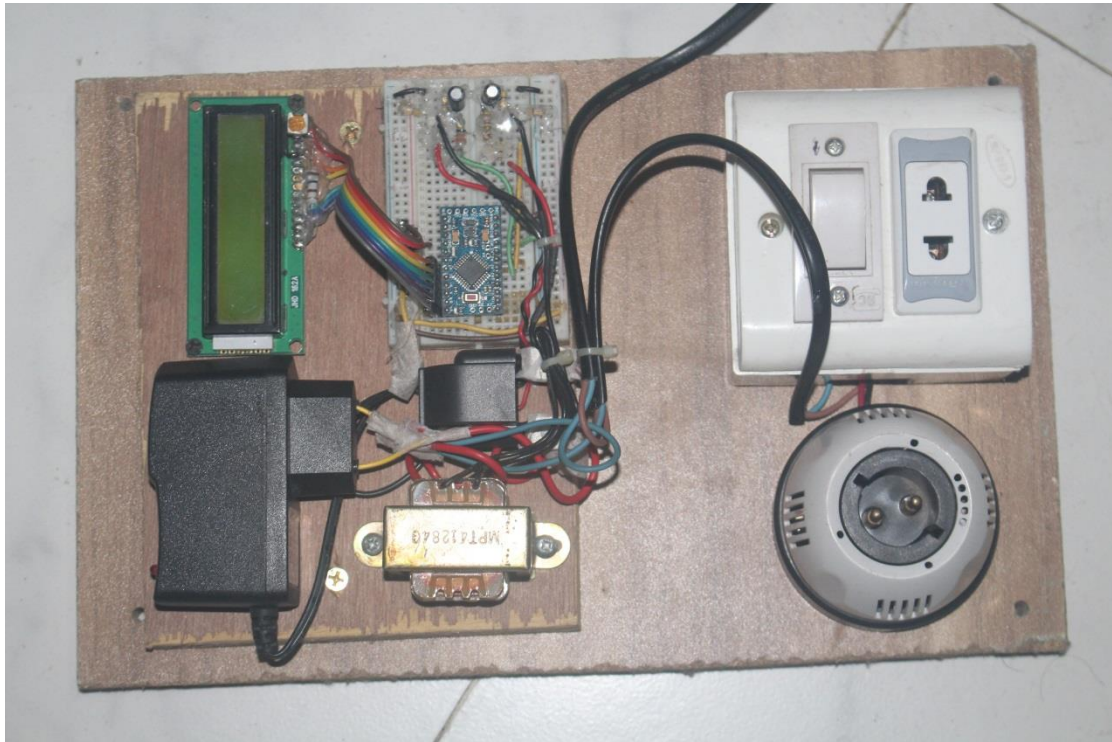
4.1: Photograph of design And implementation digital power factor meter

4.2: Photograph of design And implementation digital power factor meter

CHAPTER 5
CONCLUSIONSION

5.1 Conclusion

In this project, we develop a general purpose of digital power factor meter that can monitor power factor,voltage & current. The project is successfully developed and met the stated objectives. The system can connect power supply to AC and measuring to voltage current & power supply.

In this work power factor is computed by static capacitors approach and FACTS controllers approach theoretically & verified the results by simulation. The simulation results are noted. In comparison, it is found that the FACTS controller approach is better than the static capacitor approach for power factor correction. Hence the FACTS controllers methods can be implemented for the power factor improvement in both transmission & distribution lines effectively.

5.2 Limitations of the Work

The working procedure of this project is very easy but we are facing some limitation for doing this project. Such as coding problem, program writing, connecting to PCB board, commend following,current,voltage measuring etc.

5.3 Future Scopes

The future implementations of the project are very great considering the amount of time and resources it saves.In this work, an attempt has been done for measuring power factor, current, voltage of the digital power factor meter driving AC power supply.

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APPENDIX A

Programming code

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(4,5,6,7,8,9);
int pin = 13;
float rads = 57.29577951;
float degree = 360;
float frequency = 50;
float nano = 1 * pow
float pf;
float angle;
float pf_max = 0;
float angle_max = 0;
int ctr;
void setup()
{
 pinMode(pin, INPUT);
 Serial.begin(9600);
 lcd.begin(16, 2);
}
void loop()
{
for (ctr = 0; ctr <= 4; ctr++)
{
angle = (((((pulseIn(pin, HIGH)) * nano)* degree)* frequency);
// pf = cos(angle / rads);

if (angle > angle_max)
{
angle_max = angle;
pf_max = cos(angle_max / rads);
}
}
```

```
if (angle_max > 360)
{
angle_max = 0;
pf_max = 1;
if (angle_max == 0)
{
angle_max = 0;
 pf_max = 1;
}
Serial.print(angle_max, 2);
Serial.print(",");
Serial.println(pf_max, 2);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("PF=");
lcd.setCursor(4,0);
lcd.print(pf_max);
lcd.print(" ");
lcd.setCursor(0,1);
lcd.print("Ph-Shift=");
lcd.setCursor(10,1);
lcd.print(angle_max);
lcd.print(" ");

angle = 0;
angle_max = 0;
}
```