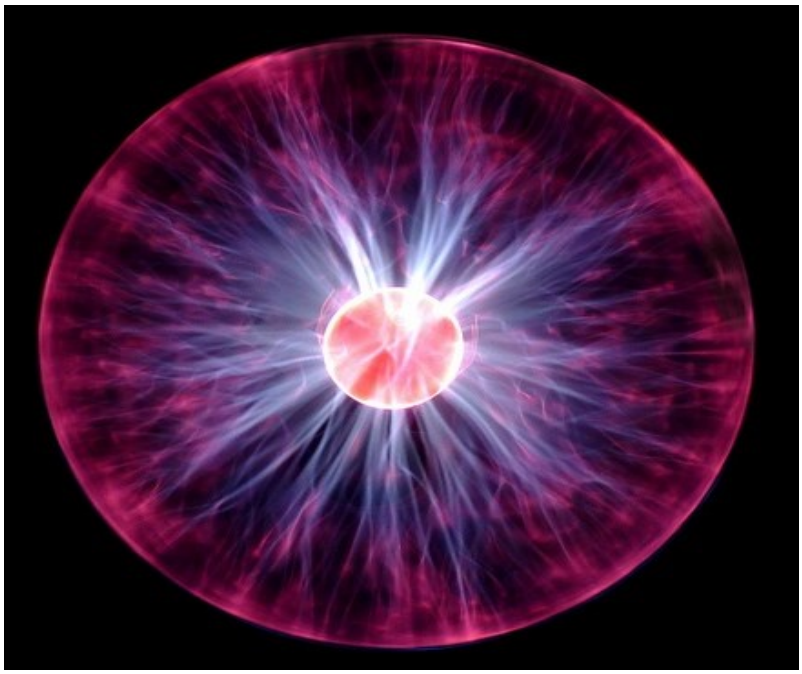
YEAR: 2020 - 21



ELECTROSPHERE

---- A Technical Magazine

Department of Electrical Engineering

AISSMS's Institute of Information Technology, Pune.

Volume IV

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About Department of Electrical Engineering

The Department of Electrical Engineering was established in 1999 at AISSMS, Institute of Information Technology, Pune. The department offers **B.E. in Electrical** and **M.E.in Power Electronics and Drives**. The department currently has 13 professional faculties, including 02 IEEE, 11 IE(I) and 13 ISTE members. In the department, near about 30 courses are offered, encompassing all areas of electrical engineering. Faculty and students are engaged in courses and research in the fields viz; power systems, control systems, power electronics, electrical machines, renewable systems and power quality. The department focuses on developing its strengths and aligning with the institutional priorities of IOIT.

The vision of the department is to contribute to the society by imparting quality education in the field of electrical engineering and prepares students to succeed in their professional career by inculcating in them high human values.

The department's mission is to develop innovative and socially responsible engineering professionals by delivering in-depth knowledge of electrical engineering.

Several small, medium and large projects have been sanctioned to department faculty in the last five years. This has led to the development of center of excellence in power quality.

Department faculty have been traditionally contributing to administrative activities both within and outside the Institute. Currently, 10 faculties are serving as chairman/paper setter/examiner at University. Several faculties from the department are currently serving as coordinators within the Institute.

The department endeavors to produce confident professionals tuned to real time working environment. Department Alumni have made excellent contributions in various fields like entrepreneurship, industry, and academics. A few illustrious who have distinguished themselves are Kalyani Abhyankar (Sr. Operations Engineer, Sacramento, California Area), Ruchi Muku Das (Infrastructure and Network Procurement, Unilever Asia Pvt. Ltd), Amol Manal (Controls Specialist at Lorik Tool & Automation Kitchener, Ontario, Canada) , Vishakha Chandhere (Founder, OrjaBox Pune, Maharashtra) , Lalit Ghatpande (Relay Setting Engineer, Synchro Grid Limited LLC).

The infrastructure and lab facilities are upgraded from time to time and provide a good practical learning and innovative environment for the students and researchers. There are about 07 laboratories just for the exclusive benefit of students of department of EE.
The department strives to provide a conductive environment for the students to develop analytical and practical skills and apply them to real world problems. To motivate the students, the department organizes regular training workshop.

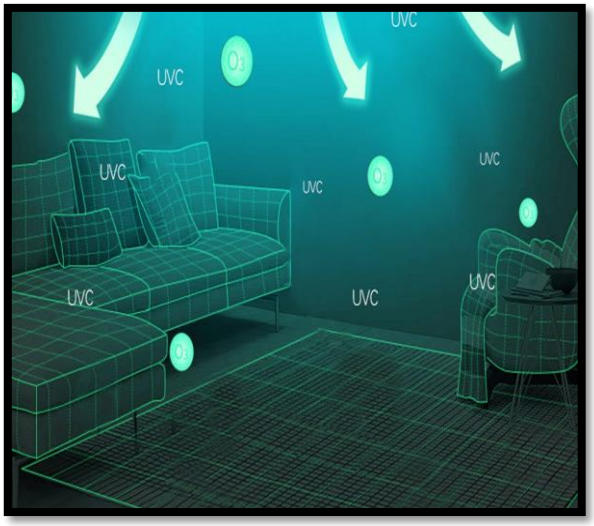
A competitive environment is fostered and development of leadership skills and team skills are also encouraged by means of the department professional body societies such as IEI, IEEE, ISTE, ISLE, REC, EESA which holds various co-curricular and extracurricular events, contests from time to time to bring out hidden talents.

Dr. A. D. Shiralkar
Head Electrical Engineering
electricaldept_hod@ aissmsioit.org

Technical Articles

Disinfection of room using UV-C light radiation robot

Prof. Saurabh Shingare
Aakash Akolka, Sourav Deshmukh, Pratiksha Dombale, Unmesh Supekar



In this current pandemic situation, where cleanliness, Sanitization are critically important and "0-contact/No contact" is need of mankind we provide a solution with 99% disinfection and 0 human contact where safety of every individual is guaranteed. Our robot uniquely possesses the 'Shadow area coverage' ability aiming our 'Illuminate To Eliminate' strategy

PROBLEM:

- Complete and total disinfection of the site to prevent the spread of wide range of infectious diseases,
- To avoid and minimize direct human contact in sanitization process in Covid-19 pandemic situation, Ensuring on-site safety of the sanitization authorities during disinfection of the biologically contaminated site.
- Cover and disinfect all the possible human touched spots to eliminate and neutralize the threat of infection including the blind spots and shadow regions of the conventional sanitization methods.

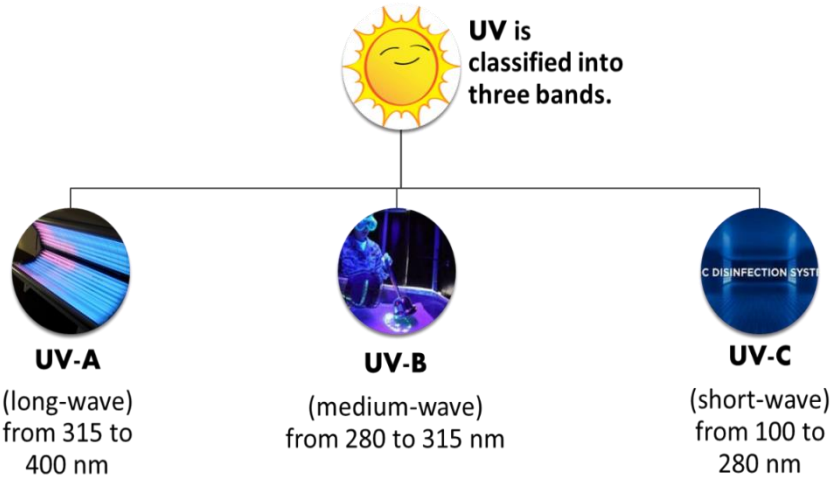
SOLUTION:

- UV PAUS, a Remotely operated Mobile App controlled wireless Robot. A complete & trustworthy sanitization solution based on certified UV-C Light sources capable of neutralizing the 100+ biological infectious bacteria and virus threats.
- Mobile App based joystick for wireless control of the robot ensuring safe distance and isolation of sanitization authority from biologically contaminated site. Live streaming into joystick for surveillance.
- A Compact, Travel-Friendly and Best in class sanitization solution Custom made for small cramped spaces.

Introduction to UV light:

UV light is an electromagnetic (EM) radiation wavelength ranging from 10 nm to 400 nm. It is shorter than visible light but longer than X-ray. UV radiation is present in sunlight and forms about 10% of the total amount of radiation emitted by the sun. Short ultraviolet light damages the DNA and kills germs where they meet. In humans, sunburn and tanning are common side effects of exposure to the skin in UV light, as well as an increased risk of skin cancer.

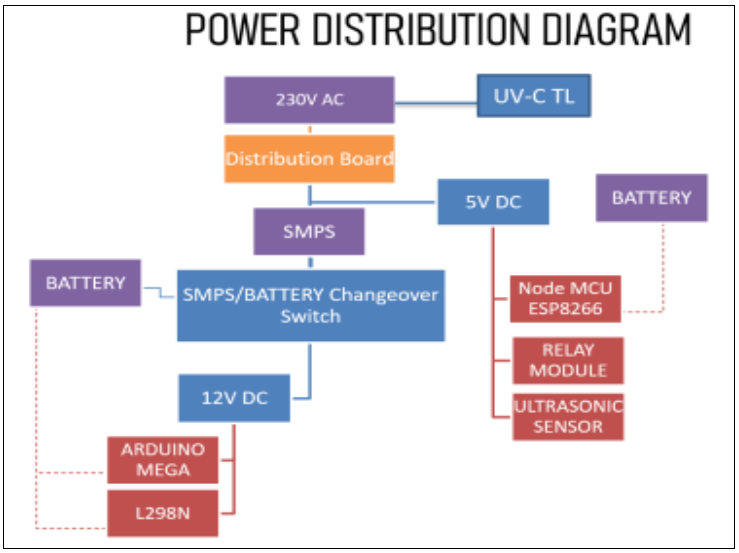
Classification of UV light

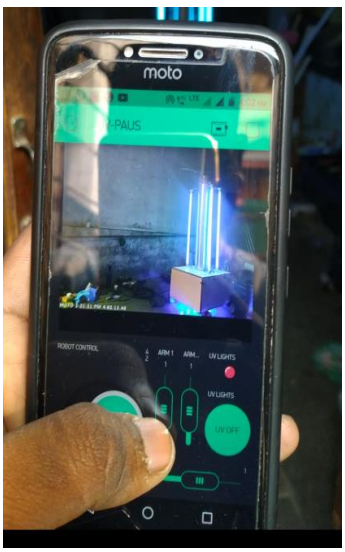


UV is a short wavelength ranges from 100 nm to 280 nm and it also called as germicidal ray. It is the ray of wavelength which absorbs and decomposes DNA (deoxyribonucleic acid), proteins and ozone layer. Therefore, we are using it for disinfection purpose in our project.

How UV-C kills bacteria and viruses?

- 250–270nm, is strongly and mainly absorbed by the nucleic acids of microbial cells.
- UVC causes damage to their RNA and DNA
- Leads to the formation of dimers between pyrimidine residues in the nucleic acid strands leads in deforming of the DNA molecule
- Causes defects in cell replication and lead to cell death afterwards.





Our Robot:

UV-PAUS (Programmed Automated UV sanitizer) is a totally remotely operated robot which consists of 6 UV-C luminaries with germicidal effects that helps to disinfect any surface with 360-degree coverage with effective disinfection time of 10-20 minutes for 200 to 400sq.mt area with no any waiting time after disinfection with main highlight of shadow area coverage.

It consists of ARDUINO MEGA as main controller and ESP-8266 as wireless modem and motor drivers for controlling the position of the entire robot of dimers between pyrimidine residues in the nucleic acid strands leads in deforming of the DNA molecule.
Causes defects in cell replication and lead to cell death afterwards.

Entrepreneurship Electrical Contractor

Prof. Sandip Raste

Electrical Supervisor (विद्युत पर्यवेक्षक)

↓

Electrical Contractor (विदयुत ठेकेदार)

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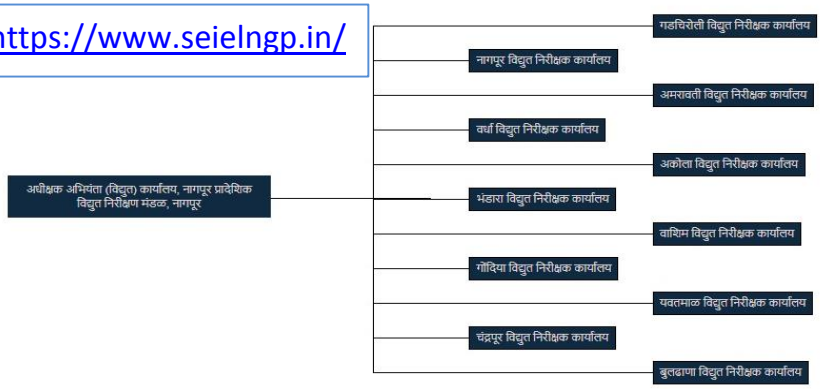
Electrical Tender

Online Application- Electrical Supervisor or Contractor

https://www.seielngp.in/



Electrical Supervisor - Documents

1. Domicile Certificate (Maharashtra)
2. Proof of 1 Year Experience of Electrical Project OR Work under Electrical Contractor (Experience Certificate & Muster Copy)
3. Address Proof (Voter ID , Passport, Adhar Card.)
4. Pan card
5. All Education Qualification Certificates
6. Photo (Size- 2*2.5 inch- White back group)-8 No.
7. Envelope 25cm *12cm- 02 No. (Rs.5/-Stamp)
8. Envelope 30cm*25cm –01No.(with your address, Rs.40/-Stamp)

IMP- All documents self attested and total 3 Copies all of above

Electrical Contractor - Documents

1. Approval of Firm Name
2. Contractor Application Annexure "N"
3. Adhar Card, Pan Card
4. Shop Act License
5. Bank Account Certificate Current
6. Megger Test Report, Annexure "S" & Voucher
7. Earth Tester Test Report, Annexure "T" & Voucher
8. Contractor & supervisor Details Annexure "U"
9. Annexure X and V
10. Annexure W and V or Y
11. Fee Receipt Rs.2200/- https://gras.mahakosh.gov.in/

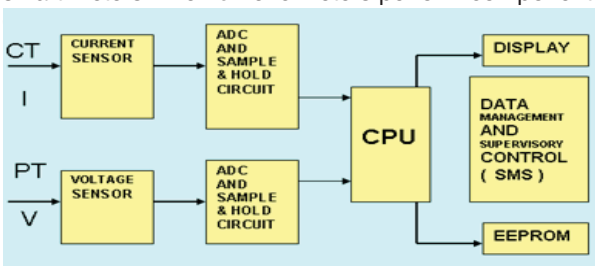
Electrical Contractor (विदयुत ठेकेदार) License

- Type License
  - Class A
  - Class B
  - Class C
    - Proprietor- self
    - Partnership
- https://maintenance.mahadiscom.in/RegistrationForm/- Mahavitaran
- https://eroc.mahapwd.com/eroc/siteregistration - PWD

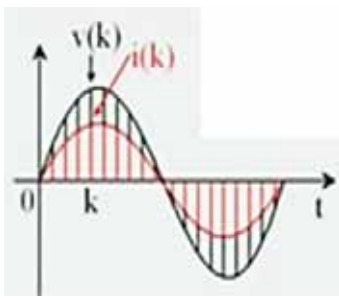
Prof. S. M. Bakre

Best Metering Practices in Power Sector

The great scientist Thomas Alva Edison developed first energy meter during late 19th century. It was electrochemical amperehour meter developed for DC measurements. Later Lord Ferrari developed metering system based on electromagnetic induction. These meters also called Ferrari meters are the first generation meters.During the later period, the concept of static meters emerged which are second generation meters. As the name indicates, the static meters comprises of static components such as Thyristors, SCR, UJT, BJT and MOSFET. The next generation of meters belongs to numeric meters which are the third generation meters. Unlike first two generations, the numeric meters are intelligent meters hence also called smart meters. The numeric meters perform component



checks various circuits connected to it in a sequential manner. During polling, if some problem is observed with components such as CTs, PTs, battery etc., the meter displays an error message.



As shown in figure where, input signals received by the meter from CT and PT are chopped into samples. The samples of these signals at a particular instant are collected by Sample and Hold circuit. The phase difference between voltage and current is also found out. These values are analogue values. However, the processor of the meter accepts digital signals only. Therefore, the analogue signals are converted to digital form by Analogue to Digital Converter (ADC). The processor processes these input signals to find various parameters such as kVA, kWh, rkVAh and other parameters as shown in following expression.

The sinusoidal signals shown in figure are sampled as V_1, V_2, -----, V_n and I_1, I_2, -----, I_n. Then from these values, V_{rms}, I_{rms} and power W can be calculated, as follows.

Tariff

One way of classifying meters is on basis electricity tariff. In a power purchase agreement, tariff applicable to customers is mentioned. Various tariffs are HT, LT, ABT, TOD, Prepaid, kVAh etc. Accordingly various meters provided are HT meter, LT meter, ABT meter, TOD meter, prepaid meter etc.

$$Vrms = \frac{(V_1^2 + V_2^2 + \ldots + V_n^2)^{1/2}}{\sqrt{n}} = \frac{Vm}{\sqrt{2}}$$

$$Irms = \frac{(I_1^2 + I_2^2 + \ldots + I_n^2)^{1/2}}{\sqrt{n}} = \frac{Im}{\sqrt{2}}$$

$$W = \frac{V1I1 + V2I2 + \ldots + VnIn}{n}$$

$$\cos \emptyset = \frac{W}{Vrms \cdot Irms} = \frac{2Wload}{Vm\ Im}$$

In fact the same meter can be used for all tariffs. Basic meter for all above types is a numeric meter. Particular meter software is required to be installed. For example, TOD meter requires TOD software to be installed in the numeric meter.

The tariff applicable to a normal single phase customer is a twofold tariff. The two components of the electricity bill are kW and kWh. The kW is total connected load. It is the installed capacity on which certain fixed charges are applicable. The other component kWh indicates actual electricity consumed by the customer. The total billed amount is generated from summation of amounts towards kW and kWh charges.

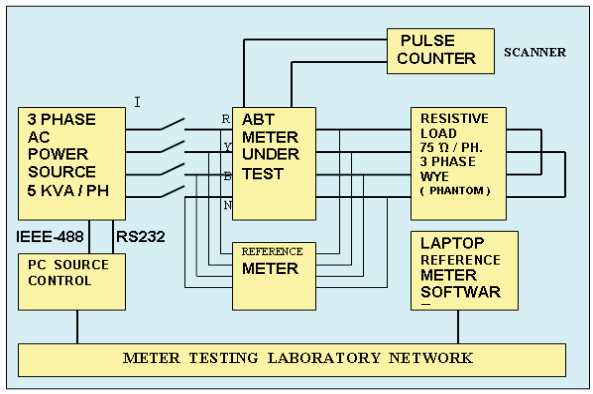
Meter Testing

Before putting in service, the meter requires conformation to certain tests. When the meter is manufactured, the two important tests are required to be conducted by the manufacturer - type tests and routine tests.The details of these tests are mentioned in a relevant standard, for example IEC 687, applicable for three phase meters. When the utility receives these meters, it has to test these meters at testing laboratory. The two main tests to be conducted are: dial test and accuracy test. In case of dial test, it is decided whether the meter is fast, slow or normal. This test is carried out on basis of 'revolutions per kWh' concept. During the days of electromechanical meters, there was a trend to measure revolutions of aluminum disc per unit. In the meanwhile, traditional electromechanical meters were replaced by static and numeric meters belonging to new generations. The aluminum disc was replaced by static (i.e. non-moving) components. In order to measure 'revolutions per kWh', the blinking LED is provided at front side of the meter. These blinking pulses are measured by using device called scanner. Basically scanners are pulse counters.

The other important test to be carried out by owner of the meter (usually utility) is an accuracy test. The accuracy of the meter is the percent deviation in kWh recording between the meter to be installed and a standard reference meter at full load and unity power factor. Usually the accuracy class of meter installed at consumer is 0.2 or 0.5. The 0.2 class meters are more accurate compared to the meters having 0.5 class accuracy. In fact, 0.1 class meters are the most accurate meters.These meters are used for precision measurements. For instance the standard reference meters are 0.1 class.

Lab setup

The figure shows a laboratory set up for conducting dial test and accuracy test. The setup comprises of test bench,scanner, standard reference meter, test load and of course meter to be tested.



The meter to be tested is connected in series with a standard reference meter. The conditions of full load and unity power factor are generated using the instrument called dimmerstat. The scanner is installed in front of blinking LED of the meter. When one kWh is recorded by the meter, number of blinking pulses recorded by scanner is noted. These are compared with meter specifications and it is decided whether the meter under test is fast, slow or normal.

Generally, Gyro meters or Zera meters are used as standard reference meters. In order to test 0.2 class meter, the reference meter having 0.1 accuracy class is used. For testing of 0.5 class meter, the reference meter having 0.2 accuracy class is generally used. The figure shows test bench on which the meters are mounted for testing. Usually a facility to mount 16 meters for simultaneous testing available. The bigger size benches having a capacity to test 32 numbers of meters are also available.

The Standard reference meter

The figure shows a standard reference meter. As name indicates, this is a standardized reference meter used for testing of accuracy of our meter. This meter has got an accuracy of 0.1 class. It is connected in

series with the meter to be tested. The Zera reference meter is portable and can be taken even outdoors for testing purpose.

Specifications of meters

The general specifications of three phase energy meters are discussed below.

1. Standard

Various standards are applicable to three phase numeric sampling energy meters. The IEC 687 is one of the main standards applicable to numeric meters. The other standards applicable to numeric meters are American National Standard Institution (ANSI) and Central Board of Irrigation and Power (CBIP).

2. Class of accuracy

The meters having class of accuracy of 0.2 and 0.5 are provided at metering installations. The 0.2 class meters are provided at EHV metering installations. The 0.5 class meters are provided at HT and LT locations.

3. Amperage

Amperage of the meter is its rated current. The Amperage of CT operated meters is usually 1A and 5A. The meters provided at EHV installations are 1 Amp meters. The three phase HV and LV meters are rated for 5 Amps. This is to state here that the amperage of single phase whole current meter is 5-30A and that of three phase whole current meter is 10-40A.

I_{min} and I_{max}

The minimum amount of current (I_{min}) the meter should record is 0.1% of its rated current. Obviously 1A meter should record a minimum, 1 miliampere (i.e. 0.1% of 1 Ampere) current. I_{max}, on other hand, is the maximum current the meter is supposed to record. As per IEC 687 standard, meter should record a maximum of 200% of its rated current. Accordingly 1 Ampere and 5 Ampere meters should record a maximum of 2 Ampere and 10 Ampere currents respectively.

4. Voltage rating

The voltage rating of three phase meter is 63.5 V. This is a rated phase to neutral voltage.

5. Configuration

The three phase meters are available in two configurations- 3 phase 3 wire and 3 phase 4 wire. In a normal practice, 3 phase 4 wire meters are recommended.

6. Display parameters

The parameters exhibited on the display of the meter are called as display parameters. The following parameters are displayed on scrolling mode -

Three voltages	kVA Maximum Demand (kVA MD)
Three currents	Number of resets
kWh	Date and time
kVAh	Frequency
rkVAh (Lead and Lag)	

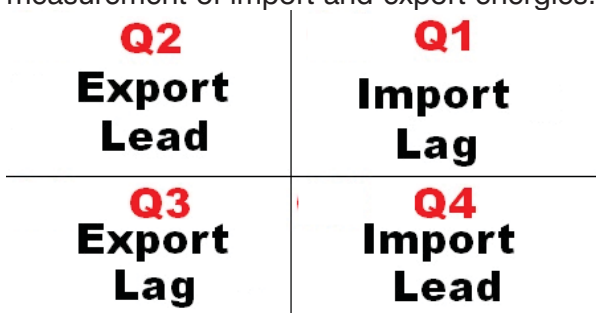
7. Report Generation

As per specifications, meter should be able to generate reports based on meter software and computer software. The reports based on meter software are - current data, billing data, load survey data and tamper data.

Meter should also generate reports based on EMS - voltage profile, load profile, energy audit, overvoltages, interruptions, maximum and minimum voltages and currents.

Four Quadrant Meters -

The Four quadrant meters perform simultaneous measurement of import and export energies.



As shown in figure, the four quadrants are as follows.

First quadrant (Q1) – Import Lag

Second quadrant (Q2) – Export Lead

Third quadrant (Q3) – Export Lag

Fourth quadrant (Q4) – ImportLead

TOD Meters

Before studying TOD meters let us understand what TOD tariff is all about. The TOD tariff is based on demand-supply relationship. It is well known fact that the electricity cannot be stored economically. Therefore, it is generated as per demand. During night period,more quantum of electricity can be made available. The sources such as wind mill generation are there in full swing during nighttime. The demand however is lesser. During morning and evening time, the demand is at its peak. As a result, there is stress on generation. Sometimes exceeding demand results into forced load shedding.

The above situation can be avoided by offering scheme based on incentives and disincentives on the consumption of electricity. This is the basic concept of TOD tariff. During night period when availability is more, the customers are given incentives to consume electricity. On the other hand, they are penalized while consuming electricity during morning and evening peak periods.

TOD Shifts

Time slot	Shift / duration
A	22.00 to 06.00
B	06.00 to 09.00
C	09.00 to 12.00
B	12.00 to 18.00
D	18.00 to 22.00

TOD meter is one of the main types of numeric meters. For such a meter, 24 hours of the day are divided into four shifts. Accordingly, the incentives / disincentives are given to the consumer. See the table.

ABT Meters

The term ABT stands for Availability Based Tariff. It is basically a numeric meter in which ABT software is installed. As a result the meter works on ABT tariff. Now let us understand the concept of ABT tariff. Whenever there is rising demand for electric power beyond installed capacity, the system frequency starts falling below its rated value. In this way, there is an inverse relationship between load and frequency. During peak hours there is rise in load and as a result, fall in frequency as stated above. This may result in tripping generators in a cascade manner. Because of the grid disturbance as described above, the power supply to the part of grid gets interrupted and some area goes in dark. Efforts are taken from time to time to avoid such grid disturbances. The main parameter to be controlled is frequency. If the frequency is maintained at its rated value with permissible deviation, the grid disturbance can be avoided. There are two ways by which the frequency can be controlled.

1. Providing frequency based protection such as UFR and FTR protection.

2. Providing frequency based tariff i.e. ABT Tariff.

The frequency based tariff proposes to impose an additional charge called Unscheduled Interchange (UI) thereby exercising grid discipline against over drawl of power. The customer or licensee has to pay the UI charge additionally on his routine bill. The billed amount is worked out as under. (Other charges/duties are not taken in consideration).

Billed amount = Fixed Charges + Energy Charges + UI charge

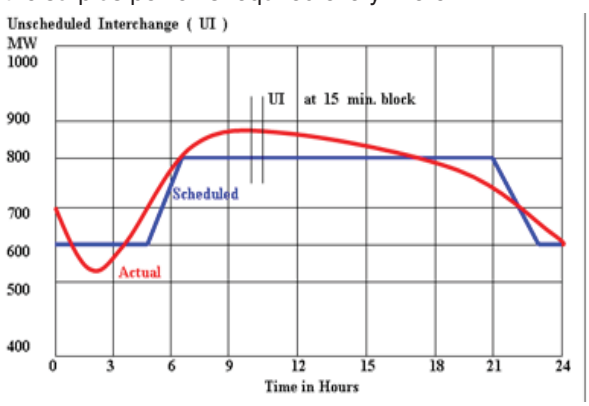
The fixed charges are based on installed capacity. These charges are fixed irrespective of consumption of electricity. The Energy charges are billed against actual consumption of electricity. It is also called a true energy charge. In order to pay minimum UI charge as possible, the customer or licensee would maintain frequency at the rated value. For this purpose he would be required to adhere to the schedule given to him. Now let us understand how ABT mechanism works.

The ABT mechanism

At receiving end, the ABT meters are installed at distribution licensee and some customers. These people are given a schedule for consumption of power for the period of all 24 hours a day, one day in advance. The schedule comprises of target in the blocks of 15 minutes. On the next day, the review is taken between scheduled and actual consumption. The deviation between scheduled and actual consumption is called UI i.e. Unscheduled Interchange. Now the next step is to find frequency at which the UI has occurred. There is an inverse relationship between frequency and UI. If frequency is nearer to the rated frequency, the UI is lesser. However if the frequency is less, higher UI is required to be borne by the customer or licensee. The UI charge is worked out on per kWh basis usually in the intervals of 15 minutes.

In this way over drawl of power at lower frequency would be very expensive. As such the customer tries to maintain a schedule given to him and that too at rated frequency. The cumulative effect of this behavior of customer results in improving stability of the grid.

ABT tariff is also applicable to generation companies in a similar way as that of distribution licensees as discussed above. The target for generation is given for all 24 hours of the day in blocks of 15 minutes. The UI charges are payable in case the actual generation is trailing behind the schedule. It should be however noted that, at present generally no UI is applicable in case of exceeding the scheduled generation. This is because the surplus power is required everywhere.



Scheduled and actual consumption

International Journal Paper

International Journal of Scientific Research in Engineering and Management (IJSREM)
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DESIGN AND IMPLEMENTATION OF A FIVE LEVEL INVERTER FOR REDUCTION OF SWITCHES AND REDUCING THD

Ms. Suchitra Ittam[1], Mr. Prashant Mahajan[2]

[1]*Student, Dept. of Electrical Engineering, AISSMS IOIT, Pune, Maharashtra, India*
[2]*Professor, Dept. of Electrical Engineering, AISSMS IOIT, Pune, Maharashtra, India*

Abstract - Multilevel inverters have been widely used in industrial and electric vehicle derives because of their numerous advantages such as reduced total harmonic distortion (THD), lower voltage stress on switches compared to the classical two-level inverter. Also, multilevel inverters can operate with lower switching frequency compared to the classic two-level topologies. Recently, the single-phase multilevel inverters have become popular for low-voltage applications such as UPS, photovoltaic (PV) system. However, there are two main issues in these single-phase multilevel inverters: One is a large number of active switches, and another is neutral-point or flying capacitor voltage balancing problem. Use of large number of switches is the main drawback of conventional inverter designs. This paper presents a micro-controller based five level single-phase inverter design, using reduced number of switches i.e. six switches and lower THD. The design is simulated using MATLAB Simulink software.

Key Words*: *Multilevel Inverters, THD, MATLAB Simulink

1. INTRODUCTION

Multilevel inverters produce a step-wise waveform that has lower total harmonic distortion so it is close to sinusoidal waveform. A multilevel inverter is such an inverter that is used as an alternative to high power conditions and medium voltage in industrial applications. Nowadays some inverters have got much attention because of their structural characteristics in the electrical power industry. The purpose of using a multilevel inverter in industrial applications is to generate high output power from medium and low-voltage sources. Sources like batteries, super capacitors, and solar farms are medium or low voltage sources. One of the main features of the multilevel inverters is the improved output voltage and current quality in terms of harmonic distortions. The total harmonic distortion (THD) of the output waveform is reversely proportional to the number of output voltage levels. However, as the number of output voltage increases, the number of circuit elements as well as the conduction power losses increase. Therefore, the number of voltage levels is generally limited to five levels in most practical applications. Different five-level inverter topologies can be found in the literature. A new design of five-level voltage source inverter for high-power applications is presented in [1]. The proposed approach will make use of the redundancy switching states to balance the flying capacitor voltages in the proposed inverter. A Five-Level quasi Z-source (QZS) based neutral point clamped (NPC) for photovoltaic (PV) applications are presented in [2]. This inverter circuit is formed by integrating a dual quasi Z-source with a T-type arm and a diode clamped arm. Ref [3] proposes and analyses a 5-level inverter topology with a single DC source and a buck DC-DC converter in order to reduce the number of independent DC voltage sources. In the proposed topology, the specific input DC voltage is supplied through a single DC and a single-input single-output DC-DC converter. As the proposed topology uses a buck stage, one of the capacitors voltages, which is supplied by DC-DC converter, can be controlled. It is important to emphasize that the DC-DC converter used in the proposed topology is a partial-scale converter reducing its cost and size in comparison with the full-scale ones. A forward-mode five-level inverter is presented in [4] which combine the features of the conventional multilevel converters and forward topology. The converters can transfer high dc voltage into regulated sinusoidal voltage with low THD at arbitrary frequency. A comparative study between the two-level inverter and five-level inverter to convert super-capacitive energy for PMSM Load is discussed in [5]. In this context, super-capacitive sources are used as input sources to analyze the response of multilevel inverters to integrate with the super-capacitive energy storage devices in any system. The PMSM loads are used to compute the time response in the simulation environment. Numerical computational analysis of super-capacitive storage with different types of loads, to measure the response of five-level inverters that can be integrated with lightning energy storage systems is discussed in [6]. It shows the response of five level inverter connected with various loads as RL Load, Permanent Magnet Synchronous Machine Load and Grid. The five-level inverter has been integrated with super-capacitive storage to measure the response of inverter with super capacitor and also to measure the variation in super capacitor for various load. Paper [7] treats the design and realization of a new five-level single-phase inverter structure controlled by a microcontroller-based digital strategy. The proposed topology needs less number of switches and carrier signals and THD of the proposed topology is less compared to conventional topologies.

In comparison with conventional two-level inverter, multilevel inverter provides more than two levels of voltage to achieve high power, smoother and less distorted alternating voltage by using several semiconductor switches and lower level DC voltages as input. Among the available types of multilevel inverter topologies, the H-bridge multilevel inverter requires less number of power switching components, has higher efficiency and has simpler circuit layout. Paper [8] presents a five-level multilevel inverter with reduced switching count, discussing its design features which contribute to less switching losses and Total Harmonic Distortion for motor drives. A new single-phase five-level voltage source inverter (VSI) topology is developed in [9]

by using two-level unit and three-level unit with coupled inductor. The proposed topology can reduce the number of active switches as well as DC sources compared with the conventional single-phase five-level VSI topologies. A space vector pulse width modulation (SVPWM switching technique) is presented in [10] wherein a five-phase voltage source inverter (VSI in order to reduce THD and low order harmonics with fundamental voltage amplitude fixation). Subspace election for determination of switching time is based on smallest triangle which is surrounding the reference vector vertex. In this method, the zero vectors will be eliminated in large amplitude modulation index. Genetic algorithm (GA) is utilized in optimization process to find the best applying time sequence in switching pattern for minimizing THD and switching losses.

Paper [11] presents two control methods for single-phase five level inverter: staircase modulation (SM) and pulse width modulation (PWM). All control methods realize voltage balancing for the inverter capacitors. The control strategies presented for SM allow a minimal number of switching transitions from one state to another. The case when one capacitor is discharged in a half period and it is charged in the other half period and the other is charged in a half period and it is discharged in the other half period achieves minimal THD.

2. OVERVIEW OF MULTILEVEL INVERTERS

Multilevel inverters provide many advantages compared to the classic topologies such as lower voltage stress on switching devices and better harmonic content in the output voltage waveform. Also, multilevel inverters can operate with lower switching frequency compared to the classic two-level topologies and maintain the capability to provide output current waveform with less total harmonic distortion (THD), which has a positive impact on the energy conversion efficiency due to the decreased switching losses. Fig-1 shows the classification of multilevel inverters.

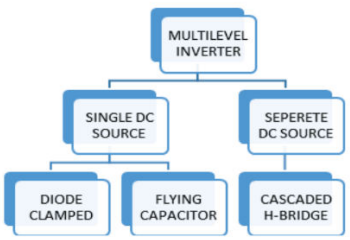


Fig-1: Classification of multilevel inverters

The most attractive features of multilevel inverters are as follows:

a) They can generate output voltages with extremely low distortion

b) They can operate with a lower switching frequency

c) They generate smaller common-mode (CM) voltage, thus reducing the stress in the motor bearings

The most popular multilevel inverter topologies are diode clamped multilevel inverter (DCMLI), flying capacitor multilevel inverter (FCMLI), and Cascaded H-Bridge multilevel inverter (CHBMLI).

Diode Clamped Multilevel Inverter (DCMLI)

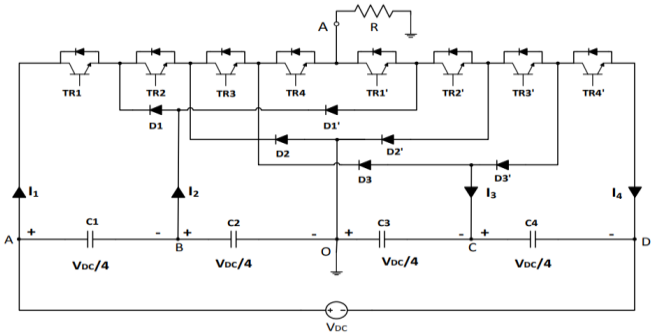


Fig-2: Five-level DCMLI leg topology

The five-level leg topology of DCMLI, depicted in Fig-2, is considered to investigate the capacitors' voltage imbalance problem. The operation of this power converter is based on the series connection of different number of capacitors with the load. When TR1, TR2, TR3, TR4 are conducting, the capacitors C1, C2 are connected in series with the load providing an output voltage with value equal to VDC/2. To obtain an output voltage with a value of VDC/4, the switching devices TR2, TR3, TR4, TR1' are turned on and the capacitor C2 is connected in series with the diode D1 and the load. Using the capacitors C3 and C4 correspondingly, the negative half-period of the multi-stepped waveform can be composed. [12]

Flying Capacitor Multilevel Inverter (FCMLI)

The five-level FCMLI topology shown in Fig-3 is deployed to study the non-desirable voltage distribution on the flying capacitors of the converter. By turning on switches TR1, TR2, TR3, TR4 the output voltage is equal to half of input voltage.

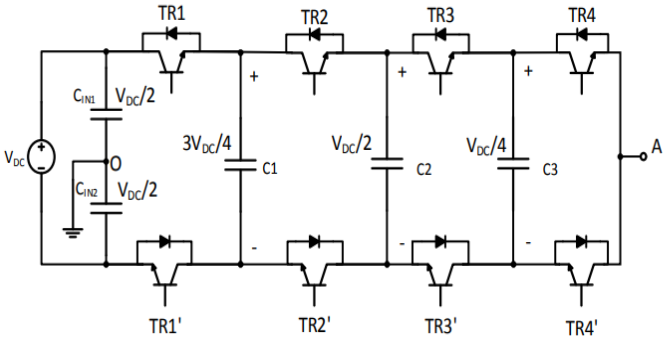


Fig-3: Five-level leg topology of a FCMLI and the output voltage waveform respectively.

To produce an output voltage with a value equal to (VDC/4) switches TR1, TR2, TR3, TR4' can be used (VAO=VCIN1-VC3), causing the charge of the capacitor C3. Another switching combination to produce the same voltage level is by turning on TR2, TR3, TR4, TR1'switches (VAO=VC1-VCIN2) causing the discharge of C1, or to turn on the switches TR1, TR3, TR4, TR2'(VAO=VCIN1+VC2-VC1) causing the charge of C1 and the discharge of capacitor C2. Switching patterns to produce

zero and the negative voltage levels can be acquired similarly, and they are mentioned in [12].

Cascaded H-Bridge Multilevel Inverter (CHBMLI)

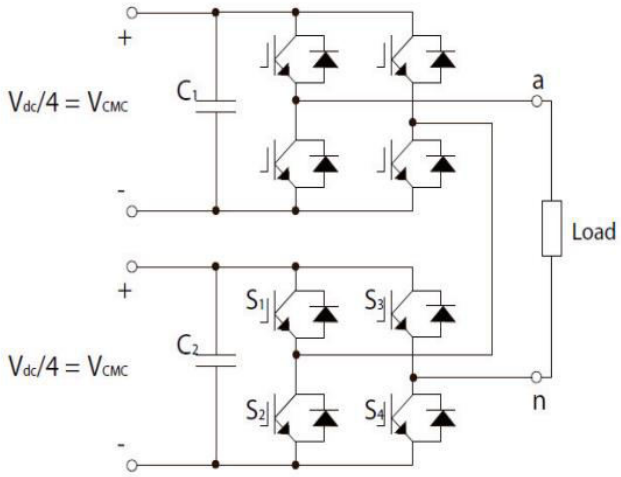


Fig 4: Circuit diagram of cascaded H-Bridge multilevel inverter

In H-bridge inverter it uses more than one DC sources. Every inverter generates output at different levels. The output voltage is the sum of all voltage levels generated by each cell. The number of levels in output voltage is = 2n+1 Where 'n' is the number of input sources. Especial feature of this inverter is that it requires lesser no of switches than diode clamped multilevel inverter. Fig-4 represents the circuit diagram of cascaded H-Bridge multilevel inverter [13].

3. LITERATURE SURVEY

Tekale Anil A. et al [2] states that a Five-Level inverter are gaining attention, exertion are being directed toward attenuating the device count for increased number of output levels. A novel topology for Five-Level inverter has been proposed in this paper to attenuate the device count. The operating principle of the proposed topology has been illustrated and mathematical formulations suiting to output voltage, source currents, voltage stresses on switches, and power losses have been eliminate. Comparisons of the proposed topology with existing topologies acknowledge that the proposed topology significantly reduces the number of power switches and associated gate driver circuits.

Durga Prasad G et al. [3]studied A symmetrical MLI with reduced power semiconductor devices has been discussed in this paper where the required number of levels can be easily achieved by duplicating one source, active and passive switch in LGM. The performance of the topology is trustworthy as it operates only one high frequency switch for each level generation. The topology is simulated to observe the performance for R, and RL loads; and the results show that the percentage THD reduces to an acceptable standard.

G. Lourds Sajitha and C. R. Balamurugan [4] examines the novel DC link coupled VL quasi Z source based reduced switch multilevel inverter. The proposed circuit has two combinations of switches that is low and high frequency switches. The VL Quasi Z Source inverter is connected in between these two switches. To analyze this circuit two references with PDPWM strategies with triangular carriers are used for generation of gate signal for switches. The proposed circuit is operated in three modes namely over modulation, under modulation and normal modulation region.

G. BhaskarRao et al [5] proposed a novel SC-based cascaded multilevel inverter. Both 9-level and 13-level circuit topology are examined in depth. Compared with conventional cascaded multilevel inverter, the proposed inverter can greatly decrease the number of switching devices. A single carrier modulation named by symmetrical PSM, was presented with the low switching frequency and simple implementation.

John N. Chiasson et al [6] studied how to reduce harmonic distortion for a multilevel inverters. In this paper, the seven level inverter scheme with harmonics reduction was demonstrated. The harmonic reduction was achieved by selecting appropriate switching angles. The functionality verification of the seven level inverter was done using MATLAB.

4. PROPOSED FIVE LEVEL INVERTER

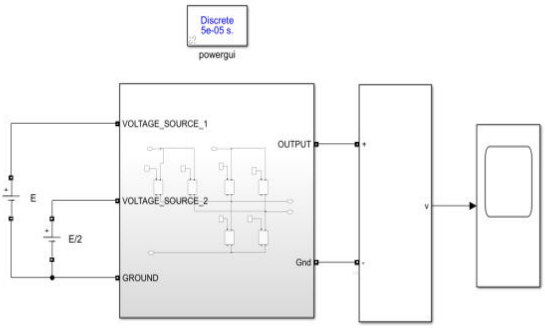


Fig-5: Block Diagram of a proposed five level inverter

This paper mainly focuses on designing a micro-controller based single-phase five level inverter. The system is simulated using MATLAB Simulink software Tool. Fig 5 represents the block diagram of proposed system. The converter consists of two DC sources E1 = 34V and E2 = E1 / 2 and 6 switches, each switch is composed of a MOSFET transistor and a diode; the MOSFET switches are used because of its fast switching capability.

Operation Mode:

The aim is to determine the values that can be taken by the output voltage 'Vab' for the different possible states of the static switches, and to show the sequences of the switches conductions 'ti'. For an N-level converter, we have N possible operating sequences to generate the N voltage levels. Particularly for five levels there are five sequences of operation. The connection function Fki translates the open or closed state of the switch ki :

Fki= 1 if k switches are closed

0 if k switches are opened

5. SIMULATION AND RESULTS

The proposed inverter power system is composed of six MOSFET switches. Each switch is controlled by the adequate pulse sequence in order to product wave voltage with five levels and of 50 Hz frequency. The input supply for each DC source is respectively 12V and 6V. The system is implemented in MATLAB Simulink environment. Fig 6 shows the waveform of the voltage obtained at the inverter output. Fig-7 illustrates the trigger signal of 6 MOSFET switches.

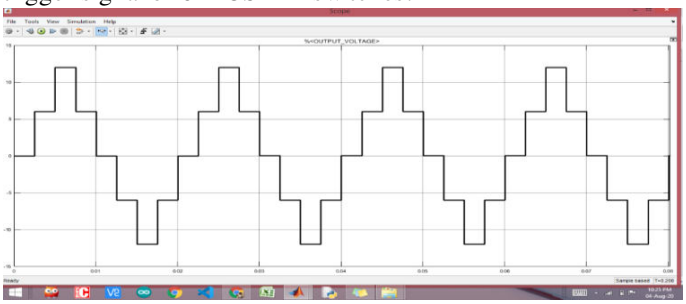


Fig-6: Typical output voltage waveform of a multilevel inverter

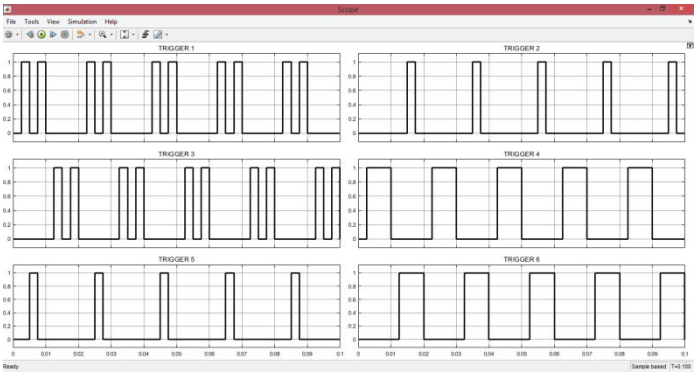
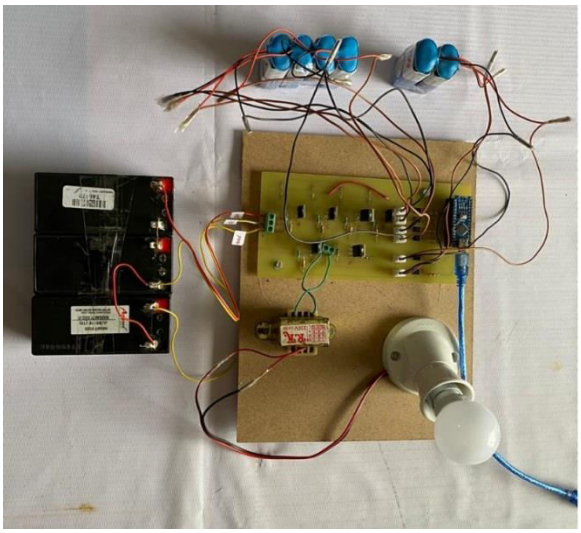
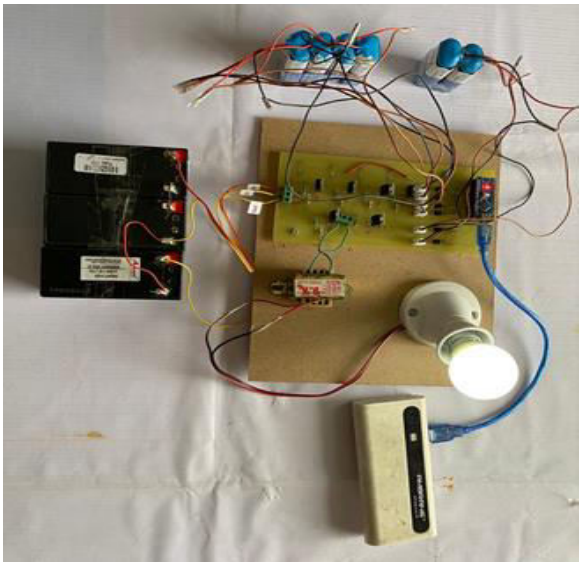


Fig-7: Trigger Output waveform

6. EXPERIMENTAL SET-UP



(a)Initial State without power supply connection



(b) After supplying power to controller circuit

Fig 9: Experimental Set-up of a proposed five level inverter.

7. CONCLUSION

Multilevel Inverters (MLI) are capable of providing limits to various parameters such as electromagnetic interference (EMI), total harmonic distortion (THD), Voltage stress on the switches and dv/dt problems etc. Multilevel inverters are now enhancing their horizons in variety of fields of applications. They are mostly preferred in industries for medium voltage (MV) and high voltage (HV) applications such as FACTS, HVDC, PV systems, EV, UPS and other industrial drive applications. A micro-controller based multilevel inverter topology is proposed in this paper. The software implementation of the five-level multilevel inverter is successfully completed with the help of control circuit in MATLAB Simulink tool. It is observed that the proposed topology is significantly successful in reducing the count of number of switching devices, capacitor voltage balancing, manufacturing cost etc. Simulation results conclude that a high-quality output voltage waveform is generated with lower order of THD. The proposed system design is also verified experimentally and the results are as stated above.

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Artificial Neural Network based Virtual Energy Meter

Dinesh Pansare
Electrical Engineering Department
AISSMS IOIT, M.E. II Year
Pune, India
pansaredinesh74@gmail.com

Tejashree Mule
Electrical Department
AISSMS IOIT, M.E. II Year
Pune, India
tejashreemule18@gmail.com

Nikita Markad
Electrical Engineering Department
AISSMS IOIT, M.E. II Year
Pune, India
nikita104markad@gmail.com

Prof. Dr. Ashpana Shiralkar
Electrical Engineering Department
AISSMS IOIT
Pune, India
ashpana.shiralkar@aissmsioit.org

Prof. Dr. Shashikant Bakre
Electrical Engineering Department
AISSMS IOIT
Pune, India
shashikant.bakre@aissmsioit.org

***Abstract* - The concept of working of virtual meters has been emerged after evolution of IoT technology and cloud computing. In the meanwhile, the neural network models based on Python have also been emerged. In this paper, the concept of artificial neural network based virtual energy meter have been put forward. The logical AND gate based anomaly for virtual meter is presented. Secondly, using neural network based regression method, the novice method for power factor correction have been introduced. The computation of errors and adjustment of synaptic weights has been conducted using Python 3.0 version.**

Keywords- Apparent Power (S), Artificial Neural Networks (ANN), Power factor, Real Power (P), Reactive Power (Q), VirtualEnergy Meter

I. INTRODUCTION

The concept of working of virtual meters has been emerged after evolution of IoT technology[1].The design of virtual meter is based on IoT technology and cloud computing. The IoT sensors are provided at current Transformers and voltage Transformers to sense the currents and voltages received from IoT sensors. These quantities are taken to the processing unit which is installed at monitoring station. The monitoring station is location in-specific. These signals are further processed using sample and hold circuits as the working of virtual meters is based on sampling. Further these signals are converted to digital form through an AD Converter. Thus the microprocessor gets currents and voltages in form of digital input. These signals are further processed to compute RMS values of voltage current and power. The basic parameters are current, voltage and power whereas the derived parameters are power factor, energies and demand. The data communication takes place from IoT sensors to the monitoring station where the server is installed [2]. The communication takes place through the Internet media. The advantages of virtual metal over conventional meter are that the virtual meter can be read anywhere from the world. Secondly, the cost of virtual meter is lesser. Moreover the report generation is quick and simple. Figure 1 shows a load curve generated on 30th December 2020 by the virtual meter pertaining to 33 kV Waluj Feeder emanating from 400 kV Waluj substation.

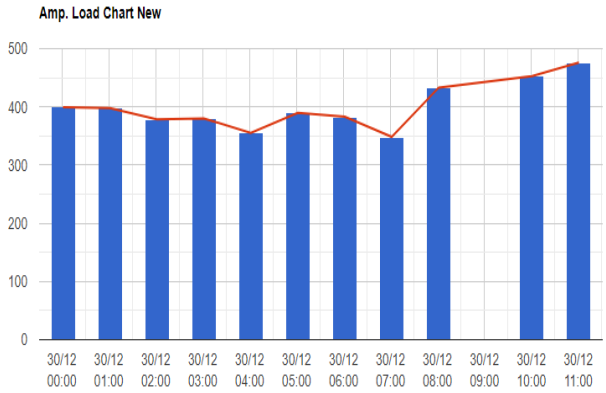

Fig. 1. Load Curve Generated by Virtual Meter

The data communication from IoT sensors to Monitoring Station takes place in the following manner.

1. The working of virtual meter is based on client-server based communication. The journey of information starts from monitoring station which acts as a server. It sends start command to the client which is situated as IoT sensors at electrical installations. On receipt of start command, the client starts sending data to the server. The monitoring station may be thousands of kilometres away from the electrical installation. The data communication takes place through internet media. However the Optical Fiber Cable (OFC) can also be used as a wired media.
2. The addressing is analogues to postal system. The letter (data) is send to the receiver(i.e. Monitoring server) through his postal address (IP Address).
3. IP address is a dot quad address specified in 123.45.67.89 format. Each component of the network is having unique IP address. For example, data center, router, computer, mobile phone have different IP addresses. The IP address is allocated by the agency called Internet Service Provider (ISP). Thus IP address

is a shipping address at which the information reaches its destination. The server stores number of websites. Therefore it is possible to have access to the website through IP address of a server.

4. It is difficult to remember IP address of every entity. This issue is resolved by providing domain name which is easy to remember. The IP address corresponds to domain name. For example, the domain name and IP address of some services are given below-

TABLE I. DOMAIN NAME & IP ADDRESS

Name of service	Role	Domain name	IP address
33KV Waluj feeder	Client	waluj33kv.com	218.62.123.138
Monitoring station	Server	cmsserver.com	46.120.144.27

5. DNS Server – DNS Server is a huge phone book. The DNS server is similar to telephone directory comprising of domain name and corresponding IP address. The overall procedure is as follows- a. the user enters domain name. b. the DNS Server finds corresponding IP address. c. after getting IP address, the web browser sends data request to the monitoring station.

6. The data comprises of huge information in form of zeros and ones. This data is divided into number of packets. The size of each packet is 6 bits. Each packet is assigned an IP address. This is analogous to the postal envelop having address and sequence number. Each packet takes its path in a network to reach user. Once received, all the packets are reassembled as per sequence number. In case some packet is not received, the request is send by receiving end to resend the same.

7. The transmission of packets is based on rules of communication called protocols. Some main protocols are TCP/IP (For data transport), http/https (For web access) and RTP (for live video streaming and VOIP calls) .

II. THE NEURAL NETWORK BASED APPROACH

Neural network is the network of neurons. These neurons may be biological neurons as of human brain or artificial neurons as software abstracts. Thus an Artificial Neural Network (ANN) is taking shape under artificial intelligence. In ANN, the connections of biological neurons are modeled as weights. All inputs are modified by weights (e.g. multiplied by weights) and then added. Finally, an activation function controls output [3].

ANNs are massively parallel computing systems comprising of large number of processors having interconnections as inspired by BNNs. The ANN modelling can be made feasible by using state of art hardware such as VLSI, microcontroller or PC based monitoring systems[4].

III. THE NEURAL NETWORK BASED AND GATE

As has been seen, the input to virtual meter is received from CT Sensor and PT Sensor which are basically IoT sensors. In order to receive data, the status signals CTS and PTS should be available (HIGH or 1). The data would not be received in case the status is LOW or 0. This anamoly can be monitored by the Neural Network based AND gate, in order to have healthy status, the AND output should be High (1). Here, the software abstraction is used because there are large number of Sensors at electrical installations. As such the conventional hardware abstraction of AND gates would not be speedy and accurate[5].

The difference between actual output and desired output is called as error. Obiviously, the error should tend to zero[6]. The error is calculated using one of the following three methods-

1. Mean Square Error (MSE) = $(i_1-o_1)^2 + (i_2-o_2)^2+\ldots\ldots\ldots+ (i_n-o_n)^2$
2. Root Mean Square Error (RMSE)=$\text{sqrt}((i_1-o_1)^2+(i_2-o_2)^2\ldots+(i_n-o_n)^2)/n$
3. ArcTan Error (ATE)=$\arctan^2((i_1-o_1)+(i_1-o_2)+\ldots\ldots.(i_n-o_n))/n$

TABLE II. AND SELECTION SCHEME

Inputs		Ideal Output	Actual output	Error	Error square
a	b	i	o	|i-o|	$(i-o)^2$
0	0	0	0.2	0.2	0.04
0	1	0	0.3	0.3	0.09
1	0	0	0.4	0.4	0.16
1	1	1	0.5	0.5	0.25
MSE=0.54		RMSE=0.0.734			

The neural network is formed from the combination of hidden layer, input layer and output layer comprising of neurons connected by weights. The output obtained through interaction between nodes and weights is called as actual output. The difference between actual output and ideal output is called as an error. The error is minimized through successive iterations of weights. The various errors namely MSE and RMSE are calculated as shown in Table II. The neurons are trained in such a manner as to minimize these errors [7].

The neural network can be created in such a way that signals x1 and x2 form input layers and signal y, an output layer. The hidden layer between input and output layers comprises of the AND logic. The output signal y indicates the healthy status (1) or unhealthy status (0)[8].

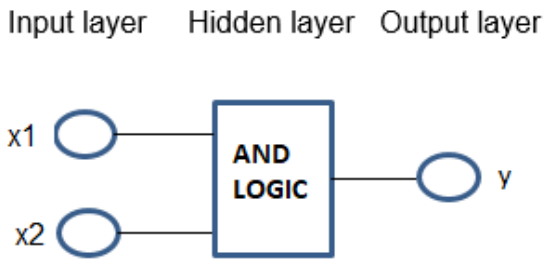

Fig. 2. ANN based AND Model for system anamoly

The data given in truth table is a training data. The training data is used to train the neural networks. This is done by continuous execution of iterations till the desired output is obtained. The inputs, outputs and iterations are stored in a file called CSV file. The CSV files are very large in size. Gradient is the rate of change of error with respect to the weight (de/dw). From the graph based on gradient, a lowest possible error at a particular weight can be found out.

IV. POWER FACTOR IMPROVEMENT USING ANN BASED REGRESSION

It is possible to include bias at input layer. Input x_0 having weight w_0 can be taken in input layer such that w_0=b which is bias. Linear model can be developed by plotting y and x. The perfect linear model can be developed by y=x i.e. a line having slope 1 and passing through origin.

The sample data received from virtual meter is furnished in Table III. The values of current, real power, reactive power and import export energies are given at the interval of one hour. The corresponding values of power factor (cos(Ø)) can be easily calculated. If we plot pf (Y axis) and Q (X-axis), various coordinates would be obtained. As per trend shown by these coordinates, the line can be drawn approximately passing through these points. Some of the points would be outside the line. The perpendicular distance between actual location of coordinate and line is called an error. The error can be negative or positive depending on its location above or below the line. The general equation of line y=mx+c can be applied and values of slope and intercept on Y axis can be determined. The line equation now becomes pf=m.Q+c which can be expressed in terms of neural network model having input value Q, weight m, intercept c as bias function and output y.

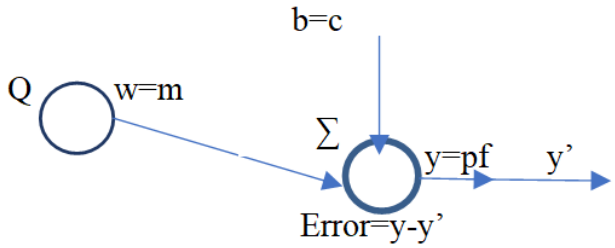

Fig. 3. ANN Model for linear regression

The value of y so obtained is compared with desired value of power factor, y'. Usually the desired value is unity. The weight is adjusted so that the error is minimised. By adjusting weights, we are minimizing error. Through an adjustment of weights, the reactive power is compensated. This is achieved through a back propagation or gradient descent method.

Table III shows virtual meter data taken on 33 kV Waluj feeder on 30th December 2020. It shows limited parameters viz. date, time current, real & reactive power and import & export energies. The power factor is calculated using Python programming language. The results of computation of power factor are plotted in Table IV [9].

TABLE III. VIRTUAL METER DATA

DtTm	Amp	Mw	Mvar	MwhI	MwhE
30/12 00:01	399.6	22.87	2.14	514481.44	0.03
30/12 01:01	397.8	22.70	1.96	514504.44	0.03
30/12 02:01	378.4	21.75	1.53	514526.63	0.03
30/12 03:01	380.0	21.87	1.65	514548.91	0.03
30/12 04:01	355.4	20.49	1.26	514570.66	0.03
30/12 05:01	389.6	22.34	1.51	514592.22	0.03
30/12 06:01	382.9	21.51	0.90	514614.44	0.03
30/12 07:01	348.4	19.49	0.42	514635.56	0.03
30/12 08:01	433.1	24.14	2.29	514658.09	0.03
30/12 10:00	452.7	24.95	3.63	514707.56	0.03
30/12 11:00	476.0	25.57	3.66	514732.78	0.03

TABLE IV. COMPUTATION OF POWER FACTOR

MW	MVAR	TAN (Ø)	(Ø)	COS(Ø)
22.87	2.14	0.093	5.31	0.995
22.70	1.96	0.086	5.91	0.994
21.75	1.53	0.070	4.00	0.997
21.87	1.65	0.075	4.29	0.997
20.49	1.26	0.061	3.49	0.998

The power factor is calculated for different values of real and reactive power. In order to apply the method of regression, the coordinates are plotted between MVAR (X axis) and COS (Ø)(Y axis) as shown in figure 4.

From these points a generalized line can be plotted that covers maximum number of coordinates.

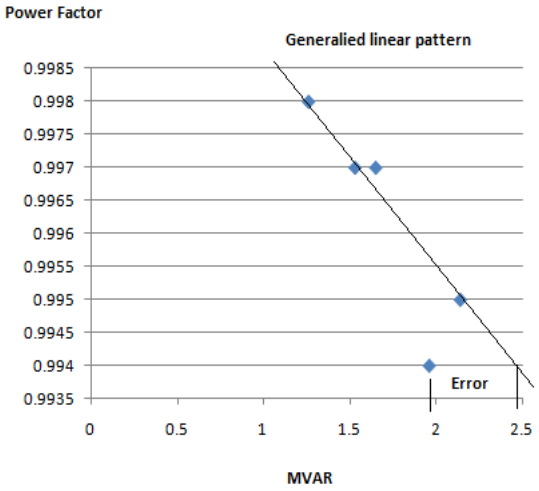

Fig. 4. Generalised Linear Pattern

In order to determine slope, locate any two points on line, let P1 (1.2, 0.9985) and P2 (2.5, 0.994),

Slope can be calculated by taking division of difference of y coordinates to that of corresponding x coordinates.

Thus, Slope m= (0.9985-0.994)/ (1.2-2.5)

= - 0.0045/1.3= -0.0034

In order to determine intercept on Y axis locate point P3 (1.75, 0.9965).

The line equation Y=mX+c gives 0.9965=-0.0034*1.75+c , Thus c=1.002 i.e. Y axis intercept.

In this way, the generalised equation of lines becomes Y=-0.0034.X+1.002 [11][12].

Now let us find out MVAR required for unity power factor. Consider that Y=1. Substituting this value in equation of line, the value of X comes out to be 0.588 MVAR. If this value is added to an existing MVAR, the power factor can be improved to unity. Therefore it is required to provide additional MVAR for system improvement. Of course the decision regarding addition cannot be taken on basis of a small sample size. It is required to conduct measurements for a longer period at different loading conditions and calculate MVAR. The procedure will be remaining the same as described above [13].

The linear regression method is based on linear model. The method is easy and simple to implement. However it involves lot of approximations. Mostly the systems are non-linear. However it gives rough idea regarding system improvement. The cost of maintaining unity power factor and more in number of cases. Using linear regression methods, the MVAR required can be found out at some other value of power factor nearer to unity so that the cost of providing additional MVAR comes down [14][15].

V. CONCLUSION

The concept of neural network virtual power meter is discussed in this paper that offers number of significant features. The virtual meter mainly works on two input parameters- current and voltage. The availability of these parameters can be ascertained by providing neural network based AND gate. The ANN based AND gate is based on software abstraction which is beneficial compared to the conventional hardware circuits.

Secondly, in this paper the novice method of system improvement has been implemented for maintaining unity power factor. With a sample example of data taken through a virtual meter for 33 kV Waluj feeder emanating from 400 kV Waluj substation, the MVAR required to maintain a unity power factor has been computed. The ANN based linear regression method used in this case study is found to be appropriate.

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The New National Education Policy–2020: Some Actionable Points

P B Mane* and S M Shaikh**

The New Education Policy (NEP)–2020 has been talked about a lot since its approval by the Union Cabinet of India on 29th July, 2020. The policy seems to change the complete education system scenario. The purpose of the education system is to develop good human beings capable of rational thought and action, possessing compassion and empathy, courage and resilience, scientific temper, and creative imagination, with sound ethical moorings and values. It aims at producing engaged, productive, and contributing citizens for building an equitable, inclusive, and plural society as envisaged by our Constitution [1]. Reformation is always resisted and when it's the education sector it's even more severe. There are too many factors and domains involved in this field and encouraging them on a specific track is difficult. Therefore the onus of the success of NEP–2020 lies in its execution and implementation. However, the question of its successful implementation has long been debated. This article highlights the actionable points on the part of the Government, Higher Education Institute's (HEIs), and other stakeholders.

As per the NEP–2020 [1] some of the major problems faced by higher education system in India and the policy's vision to include key changes to the current system are given in the Table-1:

An attempt has been made to propose suggestions for the effective implementation of the NEP–2020. The suggestions are based on the experience of the authors in the field of engineering education.

It has been observed that the students taking admission for professional courses like engineering in particular lack critical thinking, soft skills, and problem-solving abilities. These students are good at rote learning and not clear with concepts that hinder and limit its applicability.

** Principal, AISSMS Institute of Information Technology, Kennedy Road, Near RTO, Pune- 411001 (Maharashtra). E-mail: principal@aissmsioit.org.*

***Assistant Professor, Department of Electrical Engineering AISSMS Institute of Information Technology, Kennedy Road, Near RTO, Pune- 411001 (Maharashtra). E-mail: saba.shaikh@aissmsioit.org*

- To develop holistic individuals, it is essential that an identified set of skills and values will be incorporated at each stage of learning, from pre-school to higher education (reference NEP–9.1.2); it is suggested to incorporate ethic based activities in teaching-learning at all levels right from pre-schools to universities to HEIs. The outcome of this would be the enhanced skills and values in students.
- Paragraph 11.7 of NEP–2020- in this context is suggested the mandatory inclusion of art and culture-based activities in the syllabus with appropriate credits. This would result in inculcating the Indian culture and values amongst students and also promoting Indian art forms at all levels.
- Paragraph 11.8 of NEP–2020 deals with credit-based courses and projects in the areas of community engagement and service, environmental education, and value-based education. For this, it is suggested to create awareness and conduct surveys for identifying the needs of the community and issues related to the environment. A pool of experts from industry, business, artists, crafts person, etc. in the local areas and to give project-based/case-study-based assignments/surveys for solving these issues with the help of NGOs should also be identified.
- As per point 11.12 of NEP–2020, HEIs will focus on research and innovation by setting up start-up incubation centers, technology development centers, centers in frontier areas of research, greater industry-academic linkages, and interdisciplinary research including humanities and social sciences research. It is hereby recommended to link or connect at least one local MSME industry with each educational institute. This may be accomplished with the help of organizations like CII, MCCIA, and DCC. Also, a Mentor-Mentee Scheme may be formed to guide and support the education institutes. This scheme is in place with many professional colleges but must be extended to include all HEIs.
- Paragraph 12.4 stresses the need for High-quality support centers and professional academic and career counseling to be made available to all

Table 1: Steps Proposed in NEP –2020 to Overcome the Major Problems Faced by Higher Education System

Major problems currently faced by the higher education system in India	Steps proposed in the NEP–2020 to overcome the major problems
(a) a severely fragmented higher educational ecosystem;	a) moving towards a higher educational system consisting of large, multidisciplinary universities and colleges, with at least one in or near every district, and with more HEIs across India that offer medium of instruction or programmes in local/ Indian languages;
(b) less emphasis on the development of cognitive skills and learning outcomes;	(b) Moving towards an innovative pedagogy that will have teaching learning methods such as experiential /collaborative/project based learning.
(c) a rigid separation of disciplines, with early specialization and streaming of students into narrow areas of study;	(c) moving towards faculty and institutional autonomy;
(d) limited access particularly in socio-economically disadvantaged areas, with few HEIs that teach in local languages	(d) revamping curriculum, pedagogy, assessment, and student support for enhanced student experiences;
(e) limited teacher and institutional autonomy; inadequate mechanisms for merit-based career management and progression of faculty and institutional leaders;	(e) reaffirming the integrity of faculty and institutional leadership positions through merit appointments and career progression based on contributions and achievements in teaching, research, and service;
(f) lesser emphasis on research at most universities and colleges, and lack of competitive peer reviewed research funding across disciplines	(f) establishment of a National Research Foundation to fund outstanding peer-reviewed research and to actively seed research in universities and colleges;
(g) suboptimal governance and leadership of HEIs;	(g) governance of HEIs by highly qualified independent boards having academic and administrative autonomy;
(h) an ineffective regulatory system;	(h) "light but tight" regulation by a single regulator for higher education;
(j) Large affiliating universities resulting in low standards of undergraduate education.	(i) increased access, equity, and inclusion through a range of measures, including greater opportunities for outstanding public education; scholarships by private/philanthropic universities for disadvantaged and underprivileged students; online education, and Open Distance Learning (ODL); and all infrastructure and learning materials accessible and available to learners with disabilities.

students, as well as counselors to ensure physical, psychological, and emotional wellbeing. To cater to this need, it is advised to establish counseling cells in all HEI and conducting a psychometric test for all new entrants in higher education to make them aware of their strengths and weaknesses. This shall be more effective if there is a mandatory appointment of a psychologist in all HEI. The psychologist shall take effective measures by gauging the students in the institute.

- As per point 12.7, India will be promoted as a global study destination providing premium education at affordable costs – to achieve this, one must first identify Premium Indian universities that can compete with global universities. Also, the Ministry of foreign affairs must provide the

list of countries with whom India has signed MoUs for education. No doubt then, the outcome of an increase in foreign revenue generation will be achieved as more foreign students will take admissions in Indian universities.

- The backbone of the education system is the teachers or faculty members, therefore as per point no.13.5 incentivizing the excellence of faculty is very much needed to keep the faculties motivated and give their best. Excellence should be further incentivized through appropriate rewards, promotions, recognitions, and movement into institutional leadership. One of the ways of recommended would be by making performance-based appraisals mandatory to all the private institutes and also defining policies for punitive action against teachers not performing their duties. Also at present, professional college teachers do not undergo any formal teacher training before joining in at the level of assistant professor. Although of late it has been declared by AICTE that professional college teachers having less than 5 years' experience need to mandatorily take up an 8-week teacher training module by NITTTR-Kolkata. However, while in the job this type of training becomes difficult and is not given enough time and attention as is desired. Thus, it is recommended that such training be made mandatory for all aspiring to work as teachers in professional colleges.
- This policy aims to overcome the social status hierarchy associated with vocational education as per paragraph number 16.4. It should be mandatory for all professional colleges to start vocational courses so that these schools get benefitted from the infrastructure made available by professional colleges.
- For transforming the Regulatory System of Higher Education (para 18.4) it is recommended to establish a single National Accreditation Council (NAC) so that Institutes can get them self-accredited from any agencies appointed by NAC [Either NAAC or NBA].
- One of the important points in the NEP–2020 is reviving agricultural education with allied disciplines (paragraph 20.3). It is advised to set up agriculture technology cells in all Professional HEI to boost agriculture and also agro-economy.
- This pandemic situation and technological innovations have taught us that integrating technology with education is inevitable. Paragraph 23.3 highlights its importance. This should be incorporated by extensive use of educational software as an ERP system to monitor and analyze multiple aspects of academics.

Fig 1. New Format for HEI as per NEP– 2020 [1, 2]

Fig.1 clearly shows a student has the option of multiple entries and exit as per the NEP and at each level of his/her graduation he/she will be awarded a certificate as mentioned in the figure. But this has jeopardized the fate of all the Polytechnics or colleges offering diploma in engineering courses. Currently, as per recent data of NIRF, there are about 689 diploma colleges and 767 engineering colleges in Maharashtra alone. In this regard, it is suggested that these diploma colleges be either merged or upgraded to engineering colleges as this would increase the total number of degree institutes. Thus, helping in increasing the gross enrolment ratio (GER) as well.

If the above points are implemented and Government takes appropriate measures to ensure effective implementation of NEP–2020 then India shall definitely redeem its position as '*Vishwaguru*'. It won't be long when foreign nationals would be vying for admissions in India as the new education policy will improve the standard of Indian education with these incredible changes and assist in the holistic growth of an individual. It would certainly boost the economy and overall image and name of the country would be recognized far and wide.

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Single Axis Solar Tracker System Using Arduino

Vijaykumar kamble, Piyush Gaikwad, Sushant Londhe, Advait Kulkarni, Nishikant Khangar

***Abstract*— The energy demand of country is increases with respect to the growth and development. Along with this energy generation should be eco-friendly and from the renewable energy sources. Solar energy plays an important role as a primary source of energy, especially for rural area. This paper aims at the development and explain the process of track the sun and attain maximum efficiency using Arduino Uno for real time monitoring. There are different methods for tracking system but this paper focuses on single axis solar tracker as it has advantages of simple design, easy to operate, less cost, less maintenance and good efficiency. This system consists of three subsystem 1) mechanical system- platform for tracking system 2) electrical system- PV system, stepper motor 3) control system-Arduino, LDR, motor drive. The performance of the system has been tested and compared with static solar panel. This project describes the design of a low cost, solar tracking system.**

Keywords— LDR, Arduino, DC motor, Gearbox mechanism, Photovoltaic (PV) panel, Solar tracker.

I. INTRODUCTION

We all knows that how electricity is playing vital role in our day-to-day life. Everyone is dependent on electricity. All the production houses, industries, research centre, etc. requires electricity to fulfil our needs and for development purpose. But in today's life the use of electricity is one of the essential. There are many sources to produce electricity but it is very important that the sources we are using are environmentally clean and doesn't cause any pollution. So, we have an abundant and inexhaustible source of energy which is most useful for generation of electricity and we call it as Solar Energy. Solar energy is free of cost and almost available in every part of the world. We have solar energy then why we are using fossil fuels. This fuel tends to very harsh impact on not only the environment but on human being also regarding respiratory diseases. Therefore, many researchers are working on photovoltaic system and how the efficiency can be improved. By using fix solar panels electricity can be produced but as we know that the position of earth is not fix at every time hence fix panels cannot grasp the solar rays at every point in day time. In most of things we are using in day-to-day life there is existence of sun. The water we drink, the food we eat all are obtained from sun only. Plant uses sunlight to produce oxygen as well as food also for themselves and for us. Solar tracker is also already in nature in the form of flower named as Sunflower. As sunflower moves according to the direction of sun. Therefore, to overcome this problem solar tracking system is required to move the panel according to the position of rays facing to panels. As sun rises at east and sets at west so solar panels will move themselves accordingly and gives maximum output for day than fix solar panels.

II. LITERATURE SURVEY

Photovoltaic Education Network [1] focuses in this paper that getting the maximum power from solar panel is the main goal of increasing the efficiency. The project is nothing but the implementation and simple design with affordable price for single axis solar tracker. There is a comparison of solar tracker with fixed solar panel so we can get a proper table showing the difference, how solar trackers are giving more output than fixed one. The whole project is mainly composed of light dependent resistor, solar panel, DC motor, dish and ball joint, sensor module and electronic circuit. Hardware and Electronics are the two parts of the project. In hardware there is presence of solar panel, DC motor with gearbox mechanism and LDR sensor module. In electronic part there is presence of one commanding device like Arduino, raspberry-pie, microcontroller, etc. Solar irradiance is the most important part for proper extraction of solar energy from solar collector or photovoltaic (PV). Solar collector should always place normal with respect to incident radiation for maximum extraction of energy from sun. To follow the sun path, solar collector moves accordingly with the help of solar tracker. Due to this the solar collector keeps the orientation at an optimal tilt angle. In this project position of the sun has sensed in two phases in first phase the LDR sense the solar light and moves accordingly. In second phase if there is presence of dusty or cloudy whether then tracking system stops the movement and stays in the position. The energy efficiency of photovoltaic panel is improved by solar tracking system. Solar tracking system is more efficient and reliable than fixed solar panel.

O.V. Singh et.al [2] in their research paper elucidates that due to improved performance of solar panels the design requirement of tracking system is increasing day by day. In the period of morning and evening solar collector extract the solar rays at an acute angle. In case of fixed solar panel, the energy output is less as sun rays will move continuously. Hence, to improve the work of solar collector there is need to enhance the mean radiation intensity and solar tracking system is most commonly used for it. This paper is having two parts first one is pseudo code development and second one is hardware. In this proposed work two signals from two sensors are matched. LDR (Light dependent resistor) has been utilized as a light sensor. The sensors are divided

by separator. If solar collector is not normal to sun, then there will be shadow on single side of LDR. For supervising the rotation of motor through relay Arduino works as a great operator. Arduino handles the data received by LDR. Arduino works as a sending and operating device which sends the data input from LDR to DC motor through relay for the confirmation of the solar panel is normal to side of sun.

Ashok Kumar Saxena et. al. [3] in their research paper explained about the solar tracking controller design and parameter monitoring. Paper is focusing on the solar tracking design and controller capacity to receive photovoltaic and meteorological data. To control tracking system and data monitoring microcontroller is used as an electronic controller. In Design section, their focused on the fully automatic and simple to operate system. For this, they provide 4 pwm signal to stepper motor and program required to operate system is stored in EPROM. For tracking they had implemented both open and close loop strategies and system also monitor parameter Isc, Voc, Pm etc for load and batter management. Close loop strategy is used to tracking solar panel from home position to maximum position and again back to home position and open loop strategy is used to monitoring data.

Yasser M. Safan et. al. [4] in their research paper explained about the different types of solar tracking system and mainly focused on the maximum output power of the panel during the day with the minimum required driving energy. It uses PID controller to track the Sun rays. This design or system also focus on the maintaining a maximum possible solar radiation incident normal to the solar panel due to which output power generation increases. There are different types of tracking system mentioned according to number of axis or based on degrees of freedom and movement capability for example: single axis solar tracker, dual axis solar tracker another classification is active solar tracker, passive solar tracker and hybrid solar tracker. In this paper, design of hybrid solar tracker is explained. For which both open loop and close loop strategies are used. Sun sensor tracking errors are comes in open loop strategy. To feedback sun position and proper alignment data of axis close loop strategy is used. There are three main subsystems explain for construction 1) mechanical system- Aluminium solar tracker structure. 2) Electrical system- PV system, two stepper motor 3) control system- microcontroller, motor drive and sensor.

Mohamed I. Abu El-Sebah [5] in their paper explains about photovoltaic (PV) systems and how to improve their efficiency has been discussed. The main input to photovoltaic systems is the solar radiation, which cannot be manipulated and has a variable intensity based on daily and seasonal variations. To manipulate these perturbations, a solar tracking system could be used. The solar tracking system improves the photovoltaic system output power by maintaining a maximum possible incident solar radiation normal to the PV panels. The main problem in sun tracking process is that it may lead to less efficient system due to the high-power consumption in driving the tracking system. There are mainly two types of solar trackers based on degrees of freedom and movement capability; single-axis solar tracker and dual-axis solar tracker. Another classification as an active solar tracker and passive solar tracker based on the tracking technology and drive type also exists. Active solar trackers may be classified according to their control type into open-loop controlled, closed loop-controlled, and hybrid controlled solar trackers.

S. Gupta et.al. [6] in their paper elucidates that as shortage of energy resources aims the scientists to utilize the solar energy generating the electric power, they found that photovoltaic cell is the generating unit of electricity that would be studied to maximize the output power and its system can be developed. Performance of solar photovoltaic cell is associated with its material, size, ray's intensity and atmospheric conditions. The voltage-current curve at various incident radiation (measures along the day time) when a resistive load is connected to the solar cell. They recorded the readings of curve at mid-day time when the incident radiation energy consumption around the world. They conclude that the current amount generated by a solar cell depends on its efficiency, its size (surface area) and the intensity of sunlight striking the surface. Literature review includes several methods and techniques reported for maximum power point tracking (MPPT) until 2007 replaced by fixed solar systems. All researches aim to maximize the gain output power from solar system to keep sun rays perpendicular on the solar panel along the day time. Comparison between them is investigated which interested system costing, fasting technique and most efficient techniques connected dc converters.

Ayushi Nitin Ingole et.al. [7] in their research paper focuses the importance of using solar energy. The demand of electrical energy is increasing year by year due to globalization. The increase in demand of electricity gives an impact on the loss of main resources available to produce electrical energy. Human beings have explored more ways and technologies for the production of electrical energy using the renewable energy resources. The energy which is generated using natural resources which are freely available in nature is called as renewable energy. Solar energy is the most suitable among all. Because it is available abundant in nature free of cost. So, it makes sense to use solar energy for generating electricity. Also, solar energy is environment friendly since it does not create any pollution like fossil fuels. Solar energy is available in the

form of solar radiations. Solar radiations from the sun is absorbed by the solar panels and converted into DC electric energy. Solar energy has a great potential for conversion into electrical energy in Malaysia because it has very high solar radiation levels.

Deepthi S. et. al. [8]in their research paper mentioned about the types of single axis tracking systems. A Single axis tracking system is an ideology of continuously rotating the solar panel towards the sun's direction from east to west, by continuously tracking the sun's position throughout the day. There are three types of single axis tracking system: Horizontal single axis tracking system, Vertical single axis tracking system and Tilted single axis tracking system. In the Horizontal system the axis of rotation is kept horizontal with respect to the ground, and the face of the module is kept parallel to the axis of rotation. In the Vertical system the axis of rotation is kept vertical with respect to the ground and the face of the module is kept at an angle with respect to the axis of rotation. In the Tilted tracking system, the axes of rotation are kept between horizontal and vertical axes and the face of the module is kept parallel to the axis of rotation, similar to the Horizontal tracking system. The single axis tracking system consist of two LDR's. One LDR is placed on the east side of the solar panel and the other one is placed on the west side of the solar panel. Depending on the intensity variation of the sun rays falling on both the LDRs, the panel is rotated. As the day progresses, the intensity falling on the west side LDR increases and the controller rotates the solar panel towards west direction.

III. Methodology

The single axis solar tracking system rotates from east to west keeping the face of the solar panel towards the sun throughout the day. This is achieved using two LDRs and a servo motor interfaced with Arduino. Servo motor is coupled to the panel through an axle. One LDR is placed at the east side of the panel and the other one is placed at west side. LDR is an active sensor which senses light intensity and its resistance increases with increase in the intensity of light. LDRs acts as input, sensing the intensity of the sun. As the intensity falling on the west side LDR increases than the east side LDR (as the day progresses, the sun will be rotating towards west), the servomotor will rotate the panel towards west direction. An assembly language is utilized and saved into Arduino to achieve the rotation as stated earlier. The software part of the system can be split into two parts. The first part is initial positioning. Prior to powering up the system, the panel must be set towards the east, after the sunset and before the next sunrise. The second part deals with the actual movement of the panel, this is the heart of the program. Once the initial position of the panel is set, it is ready to align itself more preciously by continuously tracking the sunlight intensity. The compiled program controls the whole hardware operation.

IV. Coclusion

Single Axis Solar Tracker tracks the solar rays more than the fixed solar panel. Generally, up to 20% extra power can be produced per annum using a variable elevation solar tracker investigated the effect of one-axis east-west tracking on solar radiation received by a PV panel compared to fixed installation. To get maximum power at output system is able to track and follow the sun intensity. Besides this, low speed DC geared motor has been used for neglecting motor speed parameter hence the system focuses only tracking of sun intensity.

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Professional Chapter

IE (I) and ISTE:

Prof. V. P. Kuralkar- coordinator

Department of Electrical Engineering has professional chapters namely The **Institution of Engineers IE(I)** and **Indian society of technical education (ISTE)**, the headquarters of IE(I) is at Kolkata.

The aim of establishing these chapters is to conduct various technical as well extracurricular activities for students to develop the overall personality of the students apart from the academics. Financial help is also provided by these chapters to the students. These activities provide a platform for the personality development of the students and also help to bridge the gap between the academics and the industries.

1) Under these chapters' various technical activities such as paper presentation, project competition, model making, technical quiz etc are conducted. These activities enhance the technical skills as well as verbal and communication skillset of the students.
2) Workshops (PLC, Programing, electronics, microprocessor etc.) are also conducted for the students and are sponsored by the chapters. These workshops are conducted by highly proficient and skilled industrial experts.
3) Expert lectures, technical demonstrations, industrial visits, tutorials, special technical talk sessions, career guidance lectures, mock interviews, group discussions are also some of the activities organized under these chapters.

IEEE Students Chapter:

Dr. A. D. Shiralkar - coordinator

Institute of Electrical and Electronics Engineers (IEEE), is the world's largest professional association. It is dedicated to advancing technological innovation and excellence for the benefit of humanity. IEEE and its members inspire a global community through IEEE's highly cited publications, conferences, standards, professional and educational activities.

IEEE students Chapter, AISSMS IOIT was formed in the year 2014. It is dedicated to serving the purpose of helping its members to enrich their technical knowledge and expertise. Currently, 30 students are active members of the branch volunteering various activities and 160 students are members. The main focus of this branch is to conduct technical, social, and techno social activities such as webinars, expert lectures, workshops, hands on sessions, and competitions, etc. for students of all branches. It also creates awareness and encourages students to utilize the benefits of IEEE membership, including competitions, and international conference grants.

Department Activities

Power Quality cell

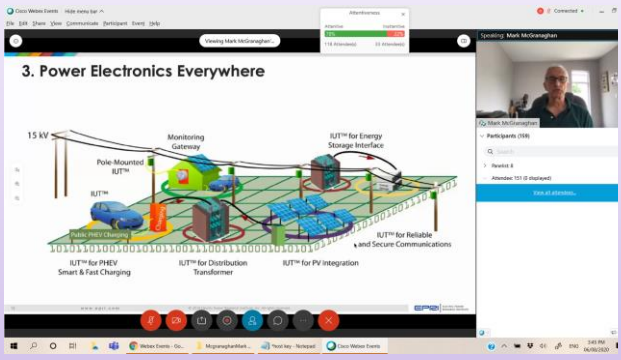
Prof. Sachin Shelar

POWER QUALITY (PQ) CELL ESTABLISHED IN 2017 AIMS TO PROVIDE HANDS-ON EXPERIENCE TO THE STUDENTS AND HELP VARIOUS INDUSTRIES FOR SOLVING THE PROBLEMS RELATED TO ELECTRICAL POWER QUALITY.

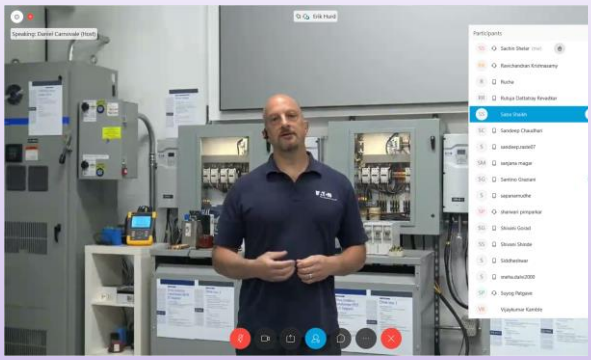
Consultancy offered
3,74,060/-

New Power Quality Analyser Purchased
Elspec Pure BB

Visit to Fuji Electric Pvt. Ltd. (Hadapsar)



Webinar on PQ by Mark McGranaghan (EPRI USA)



"Power Quality Demonstrations" by Dan Carnovale (EATON USA)

Techno-Social Activity (Power Quality Audit)

MSETCL 132 kV Markal Substation

MSETCL 400 kV Jejuri Receiving End Substation

Madhav Capacitors Pvt. Ltd.

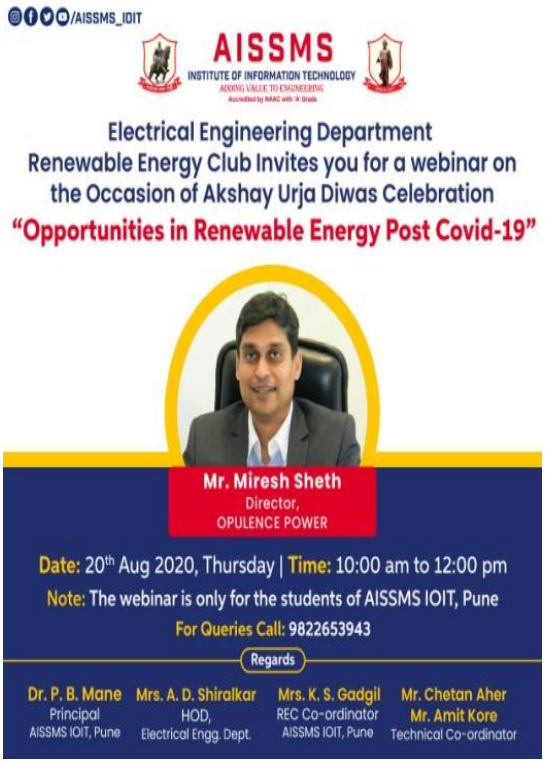
REC:

Prof. K. S. Gadgil - coordinator

The department of electrical engineering established the **Renewable energy club (REC)** in 2007 under the guidance of the then HOD Mrs. M. H. Dhend. The club was initially funded by **MEDA (Maharashtra Energy Development Agency)** and MNRE (Ministry of New and Renewable energy sources).

The club was established to enhance the knowledge of students about renewable energy sources and carry out various activities like energy conservation drives, poster competitions, quizzes, slogan competitions etc.

The students of the department carry out energy conservation drives and also celebrates Akshay Urja diwas on 20th August every year.



Electrical Engineering Students' Association(EESA)

Prof. Sujata Powniker- coordinator

EESA provides platform for the development of all rounded individual through co-curricular and extra-curricular activities and which positively impact students' emotional, intellectual, social, and inter-personal development. EESA not only renders forum for students to approach real world tasks but also develop innovative, socially responsible Engineers with High Human Values.

Wide and diversified range of EESA Extracurricular & Co-curricular activity involvement allows students to link academic knowledge with practical experience, thereby leading to a better understanding of their own abilities, talents, explore various fields and career goals.

Selection Process

In Electrical Department SE, TE, BE students are members of Electrical Engineering Students' Association. Students nominate themselves for various post of the EESA committee. Under the guidance of Head of the Department, Senior Faculties & EESA coordinator, interview rounds are conducted for various posts of EESA committee to select committee members and further they execute Cultural, Technical & Sports activities throughout the academic year.

EESA Committee Role
General Secretory
Joint General Secretory
Treasurer
Technical Head
EESA Event Coordinator
Renewable Energy Club Coordinator
Sports Secretary
Executive Members Sports Section
T and P Coordinator
Study Circle Coordinator
Library In-charge Study Circle Coordinator
Cultural Event Coordinator

By working together with other individuals, students learn to negotiate, communicate, manage conflict, and lead others. Taking part in these out-of-the-classroom extracurricular and cocurricular activities helps students to understand the importance of critical thinking skills, time management, and academic and intellectual competence.

EESA conducts various activities **for the students, by the students** such as 2 days Enthusia activity, Techno social activities, Cultural, Social activity and Sports event to showcase their talent by performance and execution which also increases their self-confidence, skills.

EESA team also enthusiastically participates in Alacrity tech fest, mesmerizes audience with dynamic performance of the skit and delivers social message to mark good change in the system.

Each year EESA receives overwhelming response for social activities such as Tree Plantation, Social awareness drive, Food-clothing Donation campaign, Blood Donation Drive, Fort-Hill cleanliness drive.

EESA builds foundation milestone for the students by offering the opportunity to broaden their horizons, learning new skills and meeting peers, experts, mentors who can further help to succeed in the real world

Puzzles and Quiz

जोड्या लावा (Match the Pair)….

(संदीप चौधरी, सहाय्यक अधिव्याख्याता, विद्युत अभियांत्रिकी विभाग)

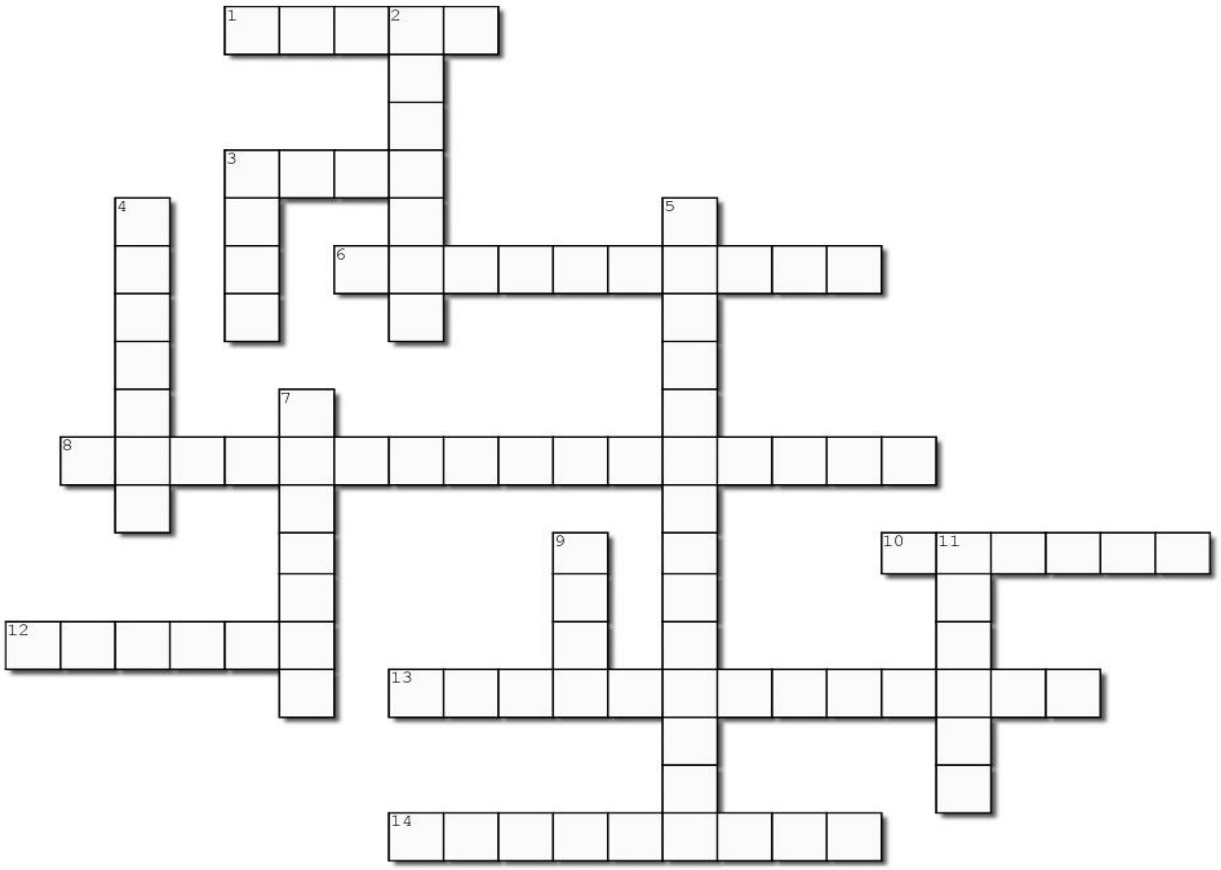
भिऊ नकोस मी तुझ्या पाठीशी आहे	Analog Meters replaced by Digital/smart Meters
चोर सोडून सन्याशाला फाशी	Integration of Solar and wind plant
टिटवी देखील समुद्र आटवते	Subsidy for renewable energy
करावे तसे भरावे	Cascade tripping and Blackout
खाऊन माजावे टाकून माजू नये	Hype in electricity Bills
एका म्यानेत दोन तलवारी राहू शकत नाहीत	kVAH Billing
नाकापेक्षा मोती जड	Backup Protection
चार दिवस सासूचे चार दिवस सुनांचे	Lack of awareness about usage of electricity
असतील शिते तर जमतील भुते	Selecting oversized motor

Answer:

भिऊ नकोस मी तुझ्या पाठीशी आहे	Backup Protection
चोर सोडून सन्याशाला फाशी	Hype in electricity Bills
टिटवी देखील समुद्र आटवते	Cascade tripping and Blackout
करावे तसे भरावे	kVAH Billing
खाऊन माजावे टाकून माजू नये	Lack of awareness about usage of electricity
एका म्यानेत दोन तलवारी राहू शकत नाहीत	Integration of Solar and wind plant
नाकापेक्षा मोती जड	Selecting oversized motor
चार दिवस सासूचे चार दिवस सुनांचे	Analog Meters replaced by Digital/smart Meters
असतील शिते तर जमतील भुते	Subsidy for renewable energy

Cross word Puzzle on Electrical Engineering

Prof. S. M. Shaikh

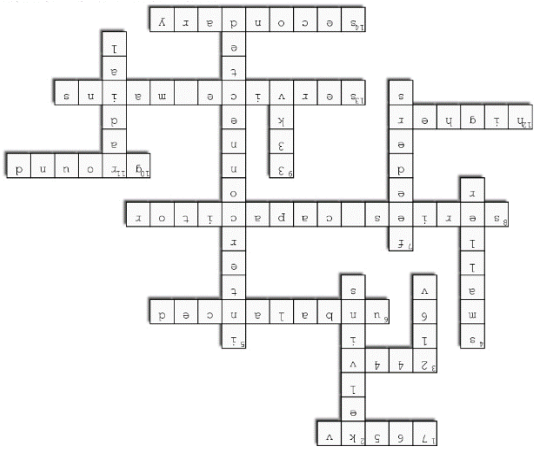


Across

1. What is the highest possible transmission voltage in India?
3. If the voltage of the system is about 230 V, then what would be the highest permissible voltage?
6. Which type of loads use 3 phase 4 wire ac system of distribution?
8. Which equipment is used for EHV lines to improve power transferability?
10. In equipment grounding, the enclosure is connected to .....wire
12. Line efficiency increases for _____ transmission voltages.
13. Name the cable which connects the distributor to the consumer terminals
14. Pole mounted sub stations are used for..... distribution

Down

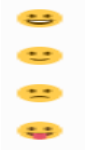
2. The most economical area of conductor is that for which the total annual cost of transmission line is minimum. Which law stat
3. If the voltage of the system is about 230 V, then what would be the lowest permissible voltage?
4. Greater the power factor the _____ is the volume of copper required.
5. Which distribution system is energized by two or more generating stations or substations?
7. Which component connects the substation to the area where power is to be distributed?
9. Single bus-bar arrangement in substations is used for voltage is less than.....
11. What is the main type of distribution system in India?



TECHNICAL PUZZLE ON IT

Prof. K.S. Gadgil, Prof V.P. Kuralkar, Prof. V.S. Kamble

1. **What was the first emoticon ever used?**



A.
B.
C.
D.

2. **What technology is used to record cryptocurrency transactions?**
   A. Digital wallet
   B. Mining
   C. Block chain
   D. Token

3. **What tool would you use to reduce the digital image size?**
   A. Filter
   B. Brush
   C. Rotate
   D. Crop

4. **Why is Big Data important?**
   A. Because it is structured
   B. Because it may be analyzed to reveal patterns and trends
   C. Because of its complexity
   D. Because of its size

5. **What kind of malware is designed to take advantage of a security hole before it is known?**
   A. Zero-day exploit
   B. Virus
   C. Ransomware
   D. Trojan horse

6. **Making a compressed digital archive might produce what type of file format?**
   A. PDF
   B. JPEG
   C. ZIP
   D. MP3

7. **What does acronym FOSS stand for?**
   A. Free and Open-Source Software
   B. Full Option Sensor System
   C. Follow-On Support Service
   D. Fiber Optics Science System

8. **What technology is used to make telephone calls over the Internet possible?**
   A. Bluetooth
   B. Ethernet
   C. NFC
   D. VoIP

9. **What is the term for text that automatically continues from one line to the next?**
   A. Word processing
   B. Word wrapping
   C. Word flowing
   D. Word binding

10. **What does it mean to uncloud?**
   A. Organize cloud storage
   B. Remove all files from the cloud
   C. Print a file from the cloud
   D. Delete a cloud service account

11. **Which computer language is the most widely used?**
   A. C#
   B. Swift
   C. PHP
   D. Java

12. **Approximately, how much data exists in the digital universe today?**
   A. 2.7 megabytes
   B. 2.7 gigabytes
   C. 2.7 zettabytes
   D. 2.7 terabytes

13. **Which tech buzzword is closely related to Artificial Intelligence (AI)?**
   A. Virtual reality
   B. Machine learning
   C. Cryptocurrency
   D. Micro services

14. **Which of the following is an important step towards the paperless concept?**
   A. Doxing
   B. Digitizing
   C. Debugging
   D. Downloading

15. **What was the first cross-platform PDF software?**
   A. Adobe Acrobat
   B. Foxit Phantom PDF
   C. Nitro Pro
   D. Able2Extract Professional

Ans: 1(B) 2(C) 3(D) 4(B) 5(A) 6(C) 7(A) 8(D) 9(B) 10(A) 11(D) 12(C) 13(B) 14(B) 15(D)

Electrical Safety Quiz

Prof. Shubhangi Landge

1. **The most dangerous place to use electrical equipment is?**
   A. indoors.
   B. outdoors.
   C. near water.
   D. near other electrical equipment.

2. **You discover the electrical cord on a drill has been damaged and some of the cord's insulation is missing. You should?**
   A. wrap tape around the damaged spot to prevent electrical shocks.
   B. check to see if the drill still works.
   C. tag the drill out of service and notify the department responsible for equipment maintenance.
   D. make sure that the cord does not come in contact with the floor.

3. **The safest ladder to use around electricity is?**
   A. wood.
   B. fiberglass.
   C. aluminium.
   D. a step stool.

4. **The earth, water, concrete and the human body are all conductors of electricity**
   A. True
   B. False

5. **The effects of an electrical shock on the body depend upon all of the following EXCEPT**:
   A. current.
   B. path.
   C. duration.
   D. body weight.

6. **Injuries from electricity can include which of the following?**
   A. electric shock that may or may not result in electrocution.
   B. falls.
   C. burns.
   D. all of the above.

7. **Flexible cords can be used in the workplace:**
   A. as a substitute for permanent wiring.
   B. if they are run behind walls to reduce the chance of abrasion and damage.
   C. if heavy or extra heavy duty cords are needed for temporary purposes.
   D. if any obvious splices are repaired with electrical tape.

8. **It is the responsibility of all employees to understand and use electrical safety every day.**
   A. True
   B. False

9. **A person qualified to perform electrical work must possess:**
   A. Skills/techniques to distinguish live parts from other parts of electrical equipment.
   B. Skills and techniques to determine the nominal voltage of exposed live parts.
   C. Knowledge on the use of PPE, insulating and shielding materials, and insulated tools.
   D. All of the above.

10. **Electrical injuries are commonly caused by:**
   A. Unsafe equipment or installations
   B. An unsafe environment.
   C. Unsafe work practices.
   D. All of the above

11. **Current flow from hand to hand is called:**
   A. Step potential
   B. Touch potential.
   C. Amperage
   D. None of the above.

12. **Electrical shock can cause damage to tissue, muscle, and internal organs.**
   A. True
   B. False

13. **Cord and plug equipment should have a three prong plug or be double insulated**
   A. True
   B. False

14. **Grounding conductors are usually black in colour.**
   A. True
   B. False

15. **Ground fault circuit interrupters compare the amount of current going in to electrical equipment and the amount of equipment returning.**
   A. True
   B. False

Ans: 1(C) 2(C) 3(B) 4(A) 5(D) 6(D) 7(C) 8(A) 9(D) 10(D) 11(B) 12(A) 13(A) 14(B) 15(A)

Prominent Alumni

Prof. Sujata Powniker- Alumni Coordinator

Department of Electrical Engineering	
Kalyani Abhyankar Sr. Operations Engineer Sacramento, California Area	https://www.linkedin.com/in/kalyani-abhyankar-b181aa16/
Aanchal Ravindran Senior Consultant at Infosys Limited	https://www.linkedin.com/in/aanchal-ravindran-949bbb42/
Ruchi Muku Das Infrastructure and Network Procurement, Unilever Asia Pvt. Ltd	https://www.linkedin.com/in/ruchidas/
Priyanka Venugopal Kronos Functional Analyst at Costco Wholesale Bothell, Washington	https://www.linkedin.com/in/priyanka-venugopal-8b98103/
Amol Manal Controls Specialist at Lorik Tool & Automation Kitchener, Ontario, Canada	https://www.linkedin.com/in/amolmanal/
Juili Apte Optical design Engineer Germany	https://www.linkedin.com/in/juili-apte-a6b00715/
Vishakha Chandhere Founder, OrjaBox Pune, Maharashtra, India	https://www.linkedin.com/in/vishakha-chandhere-597a7914/
Tanu Jain Quality Assurance Architect at Effivity Technologies Pvt. Ltd., United Arab Emirates	https://www.linkedin.com/in/tanujainpmp/
Aniruddha Narkhede Engineer II at PECO, an Exelon Company Renewable Energy & Grid Integration | Smart Grid, BESS & Power Systems Studies Philadelphia, Pennsylvania	https://www.linkedin.com/in/aniruddhanarkhede/
Lalit Ghatpande Relay Setting Engineer at SynchroGrid Limited LLC (Passed PE Exam) Bryan/College Station, Texas Area	https://www.linkedin.com/in/lalit-ghatpande-eit-37175565/
Akshay Apte Power Supply Calibration Engineer at Ford Motor Company Dearborn, Michigan	https://www.linkedin.com/in/akshay-apte-93410a53/
Kshitija Kadam Electrical Engineer Dallas, Texas	https://www.linkedin.com/in/kshitija-kadam-80b21978/
Mayuri Deulkar RF Design Engineer at Ervin Cable Construction LLC Kansas City, Missouri USA	https://www.linkedin.com/in/mayurideulkar/
Navil Smith Senior Specialist for Gas Compliance & Regulatory Strategy, Con Edison Bronx, New York	https://www.linkedin.com/in/navil-smith-6a9a3357/

Snehal Kor Associate Analyst at Mastercard Pune, Maharashtra, India	https://www.linkedin.com/in/snehal-kor-7a7b5aa9/
Snehal Maskare Electrical Project Engineer at Honeywell Automation India Ltd Pune Area, India	https://www.linkedin.com/in/snehal-maskare-0a097b5a/
Amol Dubal Process Engineer at Asahi India Glass Limited (AIS) Rewari, Haryana, India	https://www.linkedin.com/in/amol-dubal-95a138110/
Sameer Gilbile Network Administrator at TCS Pune, Maharashtra, India	https://www.linkedin.com/in/sameer-gilbile-016a68124/
Raji Raju Program Delivery Lead at carsales.com.au Clayton South, Victoria, Australia	https://www.linkedin.com/in/rajimraju/
Sheetal Vij Head Of Quality Assurance at AlphaSense, Inc. Espoo, Southern Finland, Finland	https://www.linkedin.com/in/sheetal-vij-665a46a8/
Rupam Pathak Senior Data Engineer at The Scottish Government United Kingdom	https://www.linkedin.com/in/rupam-p-6bb81435/
Archana Achhra Senior Analyst at Accenture UK Newcastle upon Tyne, United Kingdom	https://www.linkedin.com/in/archana-a-91419650/
Asha Koshy Senior QA Technical Lead at Parametric Technology Corporation Kalyan Area, India	https://www.linkedin.com/in/asha-koshy-7088ba58/
Rashmee Doshi Senior Test Lead at Xoriant Pune. Sr.Manager - Sourcing & Development	https://www.linkedin.com/in/rashmee-doshi-48432b22/
Pradnya Joshi Cummins India Ltd. Pune Area, India	https://www.linkedin.com/in/pradnya-joshi-40b01a143/
Karnika Singh Senior Software Analyst at CSC New Delhi	https://www.linkedin.com/in/karnikasingh/
Supriya Deshpande Deputy Manager, Business Development, Business Development, Mahindra Susten Mumbai, Maharashtra, India	https://www.linkedin.com/in/supriya-deshpande/
Prachi Pawar Assistant Engineer (Electrical) at Public Works Department, Government. Of Maharashtra	
Sonam Pirgal Senior Engineer at John Deere Pune, Maharashtra, India	https://www.linkedin.com/in/sonam-pirgal-7567544b/
Snehal Rakhasiya Sr QA Analyst at Quagnito Solutions Pvt Ltd	https://www.linkedin.com/in/snehal-rakhasiya-83a30856/
Amol Patil Electrical Design Engineer, New York Engineers	https://www.linkedin.com/in/amol-patil-4b5a18122/
Priyanka Gulame CTR Manufacturing Ltd	https://www.linkedin.com/in/priyanka-gulame-782150104/

Student Corner

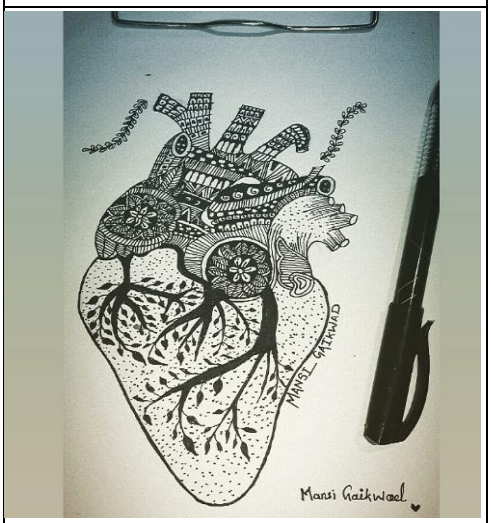
Sketch

Ketan Sawakare (TE)

Master Pratik Lokhande (TE)

Miss Mansi Gaikwad (SE)

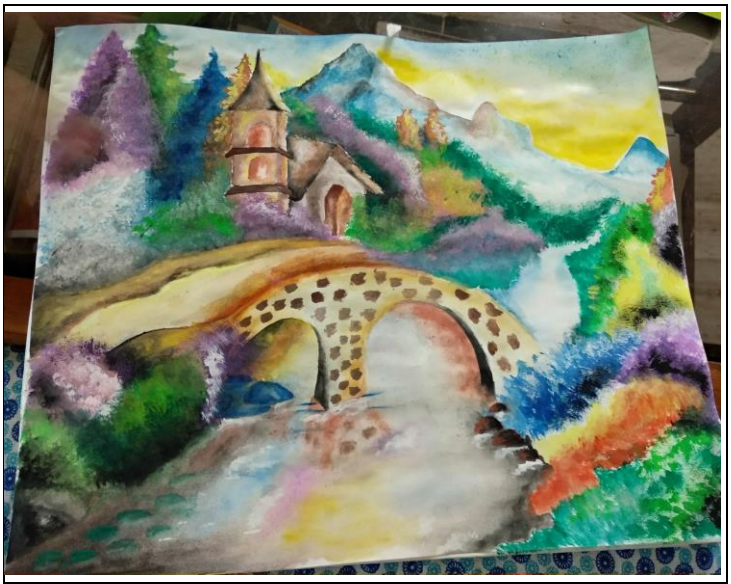
Miss Mansi Vazarkar (TE)



Miss Mansi Gaikwad (SE)

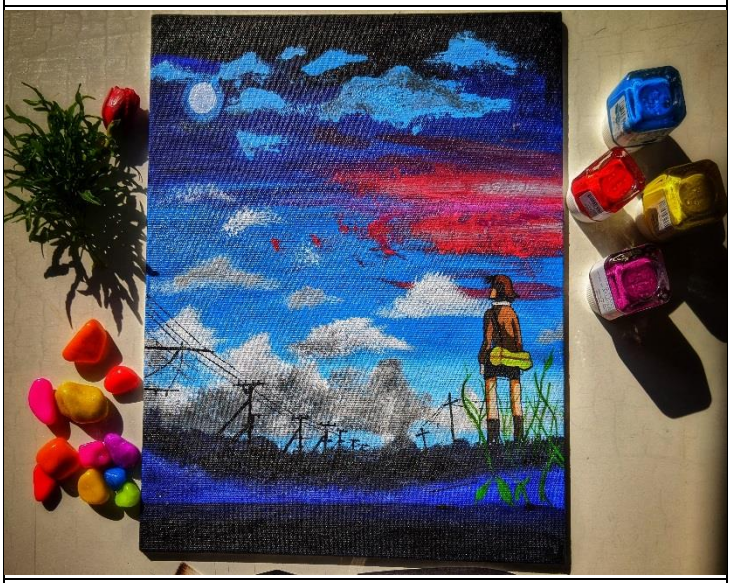
Miss Mansi Vazarkar (TE)

Painting



Miss Mansi Vazarkar (TE)

Miss Srushti Kokulwar (SE)



Miss Srushti Kokulwar (SE)

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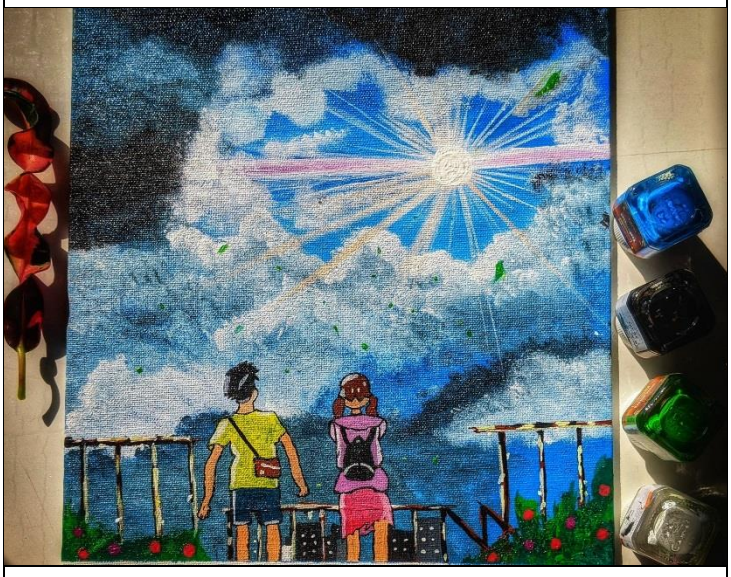


Miss Srushti Kokulwar (SE)

Miss Sayli Surve (TE)

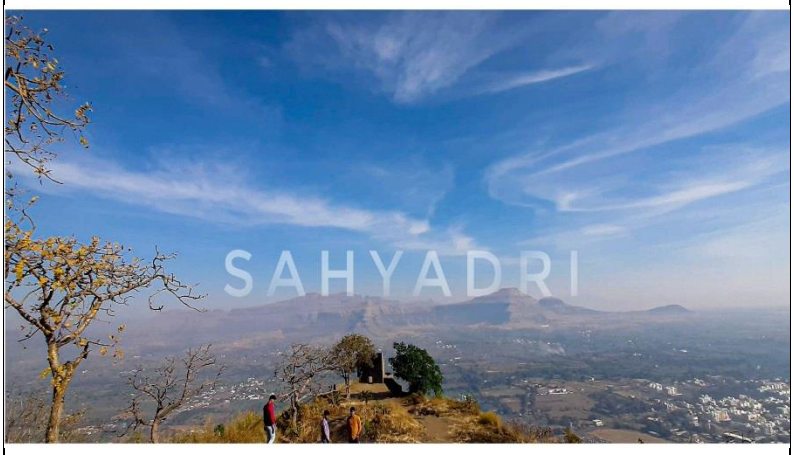
Photographs

Master Nikhil Gangnelu (TE)

Master Pratik lokhande (TE)

Master Nikhil Gangnelu (TE)

Master Pratik lokhande (TE)



Master Pratik lokhande (TE)

Master Nikhil Gangnelu (TE)

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Magazine Editor:

Atharva Taware
(Student-T. E. Electrical)

Magazine Editor:

Mr. Sandip Raste
(Assistant Professor)