3.4.5 Books and Book Chapter

Name of the teacher	**Title of the book/chapters published/Conference**	**Title of the proceedings of the conference**	**Name of the publisher/ LINK**
Prof. Y.P.Raiwani		An Intrusion Detection Model for CICIDS-2017 Dataset Using Machine Learning Algorithms	https://ieeexplore.ieee.org/document/10009400
Prof. Y.P.Raiwani	Artificial Intelligence and Speech Technology/	Text-based analysis of COVID-19 comments using natural language processing	https://link.springer.com/chapter/10.1007/978-3-030-95711-7_17
Prof. Y.P.Raiwani	Advances in Air Pollution Profiling and Control /	Improving the Performance of Classification Algorithms with Supervised Filter Discretization Using WEKA on NSL-KDD Dataset	https://link.springer.com/chapter/10.1007/978-981-15-0954-4_16
Prof. Y.P.Raiwani	Intelligent Communication, Control and Devices/	Performance Analysis of NSL-KDD Dataset Using Classification Algorithms with Different Feature Selection Algorithms and Supervised Filter Discretization	https://link.springer.com/chapter/10.1007/978-981-13-8618-3_52
Prof. Y.P.Raiwani		Evaluation of Network Intrusion Detection with Features Selection and Machine Learning Algorithms on CICIDS-2017 Dataset	https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3394103
Prof. Y.P.Raiwani	Advances in Computing and Data Sciences/		https://link.springer.com/chapter/10.1007/978-981-10-5427-3_38
Prof. M.M.S.Rauthan	"Efficient load Optimization method using VM Migration in Cloud Environment", Algorithms for Intelligent Systems,		https://books.google.co.in/books?id=PzItEAAAQBAJ&pg=PA83&source=gbs_toc_r&cad=3#v=onepage&q&f=false
Prof. M.M.S.Rauthan	"BEENISH: Balanced Energy-Efficient Network-Integrated Super Heterogeneous Protocol for Wireless Sensor Networks", Algorithms for Intelligent Systems		https://www.google.co.in/books/edition/Proceedings_of_Integrated_Intelligence_E/rworEAAAQBAJ?hl=en&gbpv=1&dq=BEENISH:+Balanced+Energy-Efficient+Network-Integrated+Super+Heterogeneous+Protocol+for+Wireless+Sensor+Networks%E2%80%9D,+Algorithms+for+Intelligent+Systems&pg=PA279&printsec=frontcover
Prof. M.M.S.Rauthan	"AntVMp: An Approach for EnergyEfficient Placement of Virtual Machines Using Max–Min Ant System", Algorithms for Intelligent Systems		https://link.springer.com/chapter/10.1007/978-981-33-4087-9_13

Prof. M.M.S.Rauthan	Algorithms for Intelligent Systems, "An Overview on Security Issues,Attacks, Challenges and Protocols in WSN		https://www.google.co.in/books/edition/Proceedings_of_Integrated_Intelligence_E/rworEAAAQBAJ?hl=en&gbpv=1&dq=Algorithms+for+Intelligent+Systems,+%E2%80%9CAn+Overview+on+Security+Issues,Attacks,+Challenges+and+Protocols+in+WSN&pg=PA269&printsec=frontcover
Prof. M.M.S.Rauthan	Abstract Model of Trusted and Secure Middleware Framework for Multi-cloud Environment		https://link.springer.com/chapter/10.1007/978-981-13-3143-5_38
Prof. M.M.S.Rauthan		An Efficient Junction-based Routing Table Maintenance Protocol for Vehicular Ad-hoc Networks	https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3403412
Prof. M.M.S.Rauthan		Virtual Machines Placement Using Predicted Utilization of Physical Machine in Cloud Datacenter	https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3394104#:~:text=In%20the%20current%20article%2C%20a,enhance%20the%20service%20level%20agreement.
Prof. M.M.S.Rauthan	Non-live Task Migration Approach for Scheduling in Cloud Based Applications		https://link.springer.com/chapter/10.1007/978-981-10-8660-1_9
Prof. M.M.S.Rauthan		A comparative analysis of multicast routing protocols in VANET for smart city scenario	https://ieeexplore.ieee.org/document/8365249
Prof. M.M.S.Rauthan		Analysis of various task scheduling algorithms in cloud environment: Review	https://ieeexplore.ieee.org/document/7943159
Dr. Prem Nath		Replication Scheme for Structured P2P System Applications in Wireless Mesh Networks	https://ieeexplore.ieee.org/document/9544948
Dr. Om Prakash	Advances in Intelligent Systems and Computing/ Attention Mechanism for Fashion Image Captioning Computational Intelligence Methods for Green Technology and Sustainable Development. GTSD 2020.		https://link.springer.com/chapter/10.1007/978-3-030-62324-1_9

Mixed-mode circuit simulations with 5 nm Node Nanosheet Transistors using TCAD

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***Abstract*— In this work, circuit designs with 5 nm node Nanosheet Transistors (NSTs) using a calibrated TCAD platform are presented. A three-stage ring oscillator (RO) with a frequency of 49.5 GHz is reported. The observed delay for NOT gate is 6.73 ps. A cross-coupled oscillator with 5 GHz oscillation frequency and its systematic design are reported. The calculated values of inductance and capacitance for 5 GHz cross-coupled oscillator are 600 pF and 1.69 pF, respectively.**

***Index Terms*—Nanosheet Transistor, TCAD Model, Ring Oscillator, Cross-coupled Oscillator**

I. INTRODUCTION

Semiconductor Technology as an art of repetitively creating fine structures with great precision has enabled our society to realize many interesting and useful ideas in physical form. These fine structures primarily include transistors and interconnects. Of these, the Transistors in the form of signal processing and memory elements have been a key driver behind the growth of the semiconductor industry. Also, the revolution in Information Technologies has been fuelling a historic growth in the Semiconductor Industry for the last few decades. The next revolution, at the footsteps, in data centers, cyberspace, cloud computing, Internet of Things, smart automobile and personal computing devices, etc. is expected to take the semiconductor industry to a much larger scale [1]. However, these prospects are not without challenges. Some of the great challenges are related to a huge amount of data, network connectivity, and time-bound decisions and responses. These challenges necessitate a technology with faster and smaller transistors at acceptable increments in cost [2]. Every new transistor technology is made possible by innovations in lithography, materials, and processes [3]. However, today's industry is looking for a new transistor device structure, also, to replace conventional transistor technology. The new device technology while offering better performance to power dissipation ratio can be acceptable only if it comes with minimal modifications to the existing CMOS process technology.

The Semiconductor Industry has placed its bet on Nano Sheet Transistors (NSTs) as an immediate successor to the current FinFETs based technology for beyond 7nm nodes [4]. NSTs have better performance due to a larger effective width per unit footprint area than conventional FinFETs [4], [5]. Also, the NSTs have been demonstrated using very few modifications in the existing manufacturing process [4]. Nanosheet transistors consist of horizontal sheets of silicon used as channels. Multiple sheets can be stacked for realizing a device and therefore, result in larger effective widths per unit footprint area in case of Nanosheet transistors. Nanosheet transistors use gate controls from all four sides i.e. Gate All Around (GAA) to mitigate the leakages at 5nm node and beyond [6].

NSTs being planar devices offer an advantage that their sheet width can be varied, continuously, for different power and performance requirements, without any additional process difficulty. This is a big advantage over conventional FinFETs technology. Further, the GAA NST FETs can be realized with a smaller spacing among sheets and parasitic capacitances can also be scaled down while allowing higher drive current. An NST device also has the flexibility to add the number of sheets to get required ON transistor currents [7].

II. DEVICE STRUCTURE AND CALIBRATION OF MODEL FOR SIMULATION PLATFORM

An N channel and a P channel Nanosheet Transistor of 5nm technology node [4], with three vertically stacked nanosheets and a GAA structure, are created as shown in Fig. 1. N channel device uses Silicon with (100) transport direction. P channel device uses Silicon-Germanium ($Si_{(x)}Ge_{(1-x)}$ with x = 0.5). The GAA structure for nanosheet channels is shown in Fig. 1. The values of important device dimensions and physical parameters used are listed in Table I.

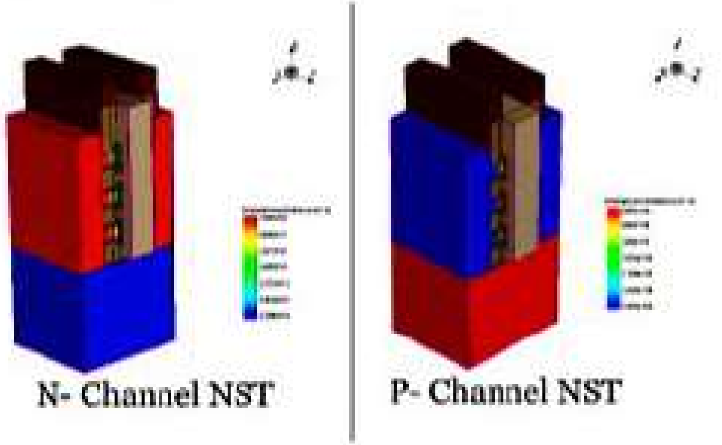

Fig. 1. Nanosheet Transistor (NST) with GAA.

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Mrs. Silky Jain Marwah
Executive Director
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Dr. Nishant Saxena
Conference General Chair
ICACCM 2020

Impact of Size, Latency of Cache-L1 and Workload Over System Performance:

Publisher: IEEE

Cite This | PDF

Rajesh Saha ; Yogendra Pratap Pundir ; Sarita Yadav ; Pankaj Kumar Pal   All Authors

Abstract:
In this paper, a system architecture modelled to check the impact of the size of cache-L1, latency of cache-L1 and M
workbench on performance parameter Miss Rate and IPS is presented. Gem5 simulation tool has been used to mod
system architecture and its configuration. Five applications of Mibench are basicmath, crc32, fft, stringsearch and Pa
which are used to evaluate the performance of the system. It is observed that performance of the system increases v
decrease in the latency and the increase in size of the cache-L1.

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I. Introduction

Any computing system consists of a central processing unit (CPU) with its peripheral. Generally used Instruction Set Architecture (ISA) for CPU are 0x86 architecture (mostly used in general purpose computer) and ARM architecture (mostly used in mobile, toys, automobile, equipment's etc.). Every general purpose computing processor has inbuilt cache memory to enhance the performance of the processor. These cache memory are categorized into different sections based on their latency like L1 (0.5-5ns), last level cache or LLC (10-20ns). In the early 80's, there was no existence of cache memory in processors. At that time, processors used main memory (DRAM) to access the data and instructions, which was very slow and more expensive. Starting of the 1980's this gap began to widen quickly which can be seen in [1]. Microprocessors clock speed raised but memory access times improved far less dramatically. Researcher at IBM discovered that most of the codes are nearly similar and extremely

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INTEGRATED INTELLIGENCE ENABLE NETWORKS & COMPUTING

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Arun Shekhar

presented the paper entitled

A Review of various digital modulation schemes used in wireless Communication

at the First International Virtual Conference on
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A Review of Various Digital Modulation Schemes Used in Wireless Communications

Arun Shekhar Bahuguna, Kuldip Kumar, Yogendra Pratap Pundir, Alaknanda, and Vishwanath Bijalwan

Abstract A variety of modulation schemes is used to fulfill the requirement of digital communication. There has been a mammoth work done on the study of various modulation techniques under different channel and environmental conditions. This paper gives a succinct review of the various digital modulation schemes used in wireless communication. If we want to go for extra information capacity, enhanced quality communication, faster system availability, and higher data security, then digital modulation plays a vital role in the field of communication and its application, although there are some constraints like available bandwidth, power level, inherent noise level of the communication system. As for the designers of digital wireless communication system, the highest priority is large bandwidth efficiency with low bit error rate (BER) while for the designers of hand-held cellular phones, the highest priority is power efficiency. From today's point of view, digital modulation techniques such as ASK, PSK, FSK, DPSK,QPSK, MSK, QAM, digital optical modulation, and multicarrier modulation play an important role in various wireless application. In this paper, we will discuss the various digital modulation schemes, its comparison and identifies the best possible modulation schemes for various application purposes.

Keywords BER · ASK · FSK · PSK · DPSK · QPSK · MSK · QAM · RZ · NRZ · OFDM · Power efficiency · Spectral efficiency · Constellation diagram

1 Introduction

Digital modulation schemes are used to modulate the digital data on to a carrier wave. It utilized the three characteristics of sinusoidal signal like amplitude, frequency, and phase. On the basis of these characteristics, various forms of modulated schemes

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Experiments in DIGITAL ELECTRONICS

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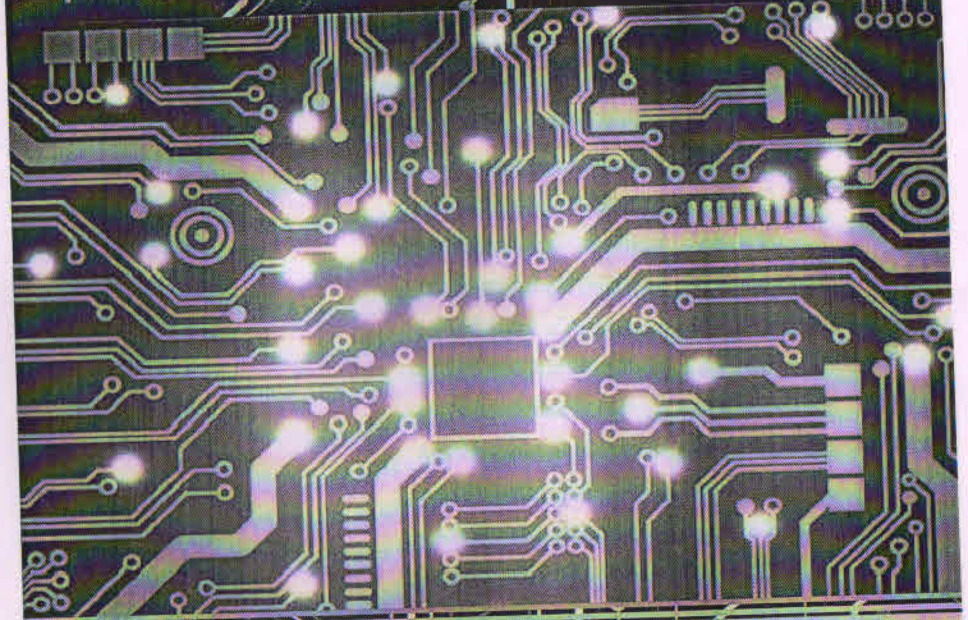

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Preface

Digital electronics circuits are the engines of cell phones, MPEG players, digital cameras, computers, data servers, personal digital devices, GPS displays, and many other consumer products that process and use information in a digital format. This experimental book elaborates on basic theories and experimental hands-on treatment of digital circuit design. This experimental book is suitable not only for basic theoretical concepts but also for laboratory work for B.E/B.Tech. Degree courses in Electrical/Electronics/computer-related disciplines, Diploma courses in Electrical/Electronics/computer-related disciplines, and postgraduate degree courses (M.Sc.) in Electronics and Master in Computer Application

This book covers most of the experiments in digital electronics. The digital circuits can be designed and constructed using standard digital integrated circuits (IC's) mounted on protoboards / breadboards easily assembled in the laboratory. In this book, a summary of the experiments is covered in nine sections. The brief theory given for each experiment is sufficient for students to understand an experiment and benefit from it. The lab experiments can be used in a stand-alone manner and can be accomplished by the traditional approach, with a protoboard / breadboard and TTL circuits. The operation of the integrated circuits used in the experiments is explained by referring to a diagram of similar components introduced in the experiments. Each experiment is presented informally, and the student is expected to produce a circuit diagram and formulate a procedure for verifying the operation of the circuits in the laboratory. Before going to the experimental work, this book provides the introductory part of the digital lab components, precautions for handling IC's, testing, troubleshooting, safety measures used in the laboratory, etc. This book contains nine sections of the experiments.

The first section deals with the experiments on **Digital Logic Gates.** This includes verifying the operation of basic gates, universal gates, exclusive-OR, and exclusive-NOR using ICs. The use of one input as a data control means enables/inhibits gates. The expanding gate input technique of the gate has lower input gate ICs. The second section deals with the experiments on the use of **Universal Gates** in digital logic circuits. Here we can verify the operation of all gates using universal gates.

The third section is experiments based on the **Simplification of Boolean Functions**. Verify Boolean laws, De-Morgan's and the duality theorems. Designing a circuit with universal gates that implement the given Boolean functions is also a part of this section. The fourth to sixth sections deal with **Combinational Logic Circuits**, consisting of the design of combinational circuits (adder/subtraction, code converters,

Chapter 17
Asbestos Free Braking Pads by Using Organic Fiber Based Reinforced Composites for Automotive Industries

Sandeep Kumar, Brijesh Gangil, K. K. S. Mer, Don Biswas and Vinay Kumar Patel

Abstract This book chapter focuses on the development in replacement of first generation brake materials (asbestos) by organic fiber based polymer composites. This replacement is necessary as the asbestos brake pads causes hazardous effects to the human being and environment. Many researchers report the several organic alternatives for asbestos in different journals. In this chapter, some of the best performed and eco-friendly compositions for brake materials are discussed. The uses of organic fibers and fillers such as flax, basalt, coconut, palm kernel shell, periwinkle shell, and pineapple leaf etc. are studied as an alternative to the asbestos based materials for braking pads. Different combinations of organic fibers with different binders like phenolic resin, polyester, and epoxy etc. are also studied and its influence on the behavior of brake pads is reviewed. Moreover, wear and friction coefficient are the two significant factors to be considered for suitability of any friction materials for braking pad application. Moreover, the influential rules and mechanism of braking conditions like pressure, velocity, and temperature on the friction and wear behaviors of organic reinforcing friction materials are summarized.

Keywords Brake pad · Organic fiber · Binders · Polymer composite · Material properties

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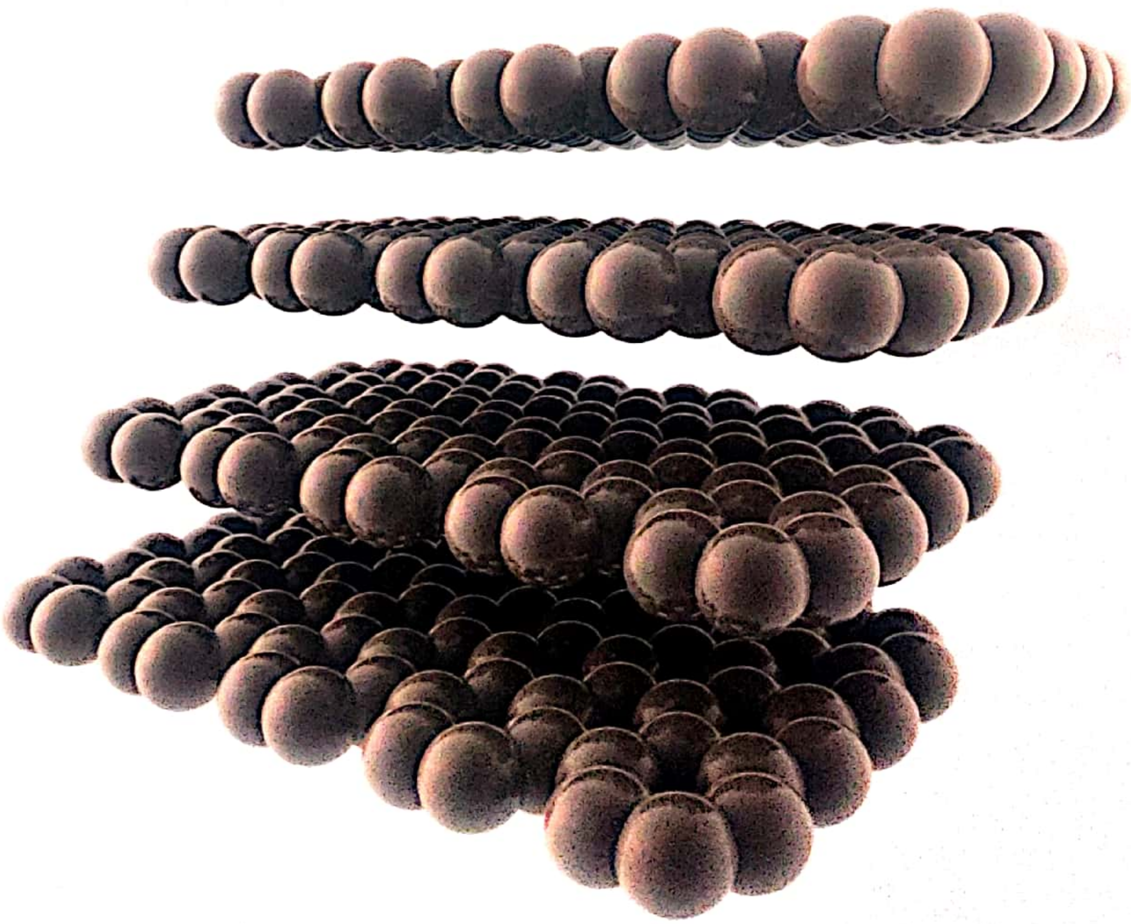
2D Functional Nanomaterials

Synthesis, Characterization, and Applications



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14

Piezoelectric Properties of $Na_{1-x}K_xNbO_3$ near $x = 0.475$, Morphotropic Phase Region

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14.1 Introduction

Certain materials have a property that on applying mechanical pressure, they accumulate charges on their surfaces and the produced charges are proportional to the applied mechanical pressure; this effect is known as the "Direct Piezoelectric Effect." This phenomenon was discovered by Pierre and Jacques Curie (1880) in quartz. The prefix "piezo" is a Greek word meaning "to press." Materials also show this phenomenon conversely, strain is produced by the applied electric field, known as "converse piezoelectric effect." Converse piezoelectric effect was discovered by Gabriel Lippmann (1881). Piezoelectric properties of materials depend on the crystal symmetry and the locations of ions in the crystal unit cell. There are 32 point groups of symmetry in all, which can be arranged in 7 basic crystal systems, viz., triclinic, monoclinic, orthorhombic, tetragonal, rhombohedral (trigonal), hexagonal, and cubic, in order of ascending symmetry. Of the 32 point groups of symmetry, 21 classes are non-centrosymmetric. Occurrence of non-centrosymmetry is a basic required condition for the existence of the piezoelectricity. Out of these 21 classes, 20 show piezoelectric effect, on which charges are accumulated on the crystal surfaces on applying the suitable amount of mechanical pressure, and one class, the point group (432) is not piezoelectric due to the other combined symmetry elements. Out of these 20 piezoelectric classes, 10 exhibit pyroelectric effect. The piezoelectricity is greatly influenced by the symmetry of the crystal. With the application of external mechanical force, a less symmetric crystal produces higher piezoelectricity.

In the piezoelectric substance, there is a linear relationship between the applied stress (X_{ik}) and the produced surface charge density (D_i), which can be expressed as,

$$D_i = d_{ijk} X_{jk}$$

where d_{ijk} are "direct piezoelectric coefficients." Conversely, with the application of an electric field E, the piezoelectric materials change their dimensions (they expand or contract), showing converse piezoelectric effect. The produced mechanical strain

2D Functional Nanomaterials: Synthesis, Characterization, and Applications, First Edition.
Edited by Ganesh S. Kamble.

(S_{ij}) on applying electric field (E_k) can be related as,

$$S_{ij} = d_{kij}E_k = d^*_{ijk}E_k$$

$$d^*_{ijk} = S_{ij}/E_k$$

where d^*_{ijk} are known as the "converse piezoelectric coefficients." The sign of the produced surface charge D_i and mechanical strain S_{ij} depends on the applied mechanical pressure and electric field directions, respectively. All ferroelectric materials show piezoelectric effect, but all piezoelectric materials may not show ferroelectric effect. Ferroelectric materials exhibit hysteresis loop, between polarization and applied field. The polarization (P) vs. applied field (E) plot (PE hysteresis loop) of an ideal ferroelectric material is shown in Figure 14.1. On gradually increasing the applied electric field, the polarization also increases gradually and reaches to saturation (P_{sat}). P_{sat} is the maximum polarization attained by the specimen (Figure 14.1). Now with decreasing electric field, polarization decreases and, at the zero applied electric field, there is some residual polarization, known as the "remnant polarization" (P_r). The residual polarization in specimen can be reduced by increasing the strength of the applied electric field in reverse direction, i.e. by changing the polarity of the electric field and increasing its strength. The reverse electric field at which polarization of the material specimen becomes zero is defined as the "coercive field" (E_c). At the coercive field (E_c), polarization crosses the E-axis with increasing field magnitude value in the reverse direction, Figure 14.1.

The longitudinal mode is the most common operated mode in piezoelectric ceramic actuators, where the resultant strain is measured in the direction parallel to the applied field, and the coupling is via the piezoelectric coefficient d_{33}. When a field is applied toward the symmetrical axis, but the resultant strain produced is measured perpendicular to the applied field, the coupling is via the coefficients d_{31} and d_{32}. These modes are often used in piezoelectric sensor applications.

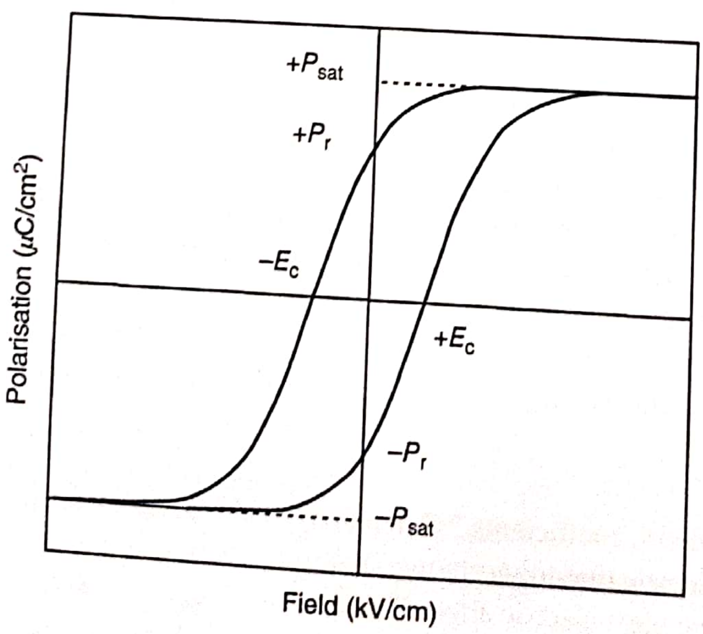

Figure 14.1 Typical PE (hysteresis) loop for a ferroelectric material.

Lead-based materials, e.g. lead zirconate (PZ), lead titanate (PT), etc., and their solid solutions, e.g. lead zirconate titanate (PZT), have been reported to exhibit high piezoelectric properties. However, the environmental concerns led the researchers to look for lead-free ceramics. Perovskite sodium-potassium niobate ($Na_{1-x}K_xNbO_3$), (x = 0 to 1) system has been quite attractive in the search of lead-free transducer ceramics [1]. Sodium-potassium niobate (NKN) system exhibits several phase transitions, in a certain temperature range, 600 and −200 °C [2–5]. At room temperature (RT), Voudsen [6] suggested that NKN have orthorhombic structure with a perovskite subcell but the perovskite units of monoclinic structure [6, 7]. Mixed binary or ternary solutions show extremal physical properties near certain compositions, known as morphotropic phase boundary (MPB). PZT ceramics show excellent piezoelectric properties near MPB [8, 9]. The dielectric and structural measurements on $Na_{1-x}K_xNbO_3$ ceramics show morphotropic phase boundary, near the compositions with $x = 0.175$ [10], $x = 0.32$ [11], $x = 0.475$ [12], and $x = 0.500$ [2, 13, 14], indicating technologically potential electrophysical properties near these compositions. NKN system has one most interesting property of its actuating performance at comparatively high fields, which has been characterized by large strain S, and can be expressed as d^*_{33} (S_{max}/E_{max}) [15].

Piezoelectric materials may be applicable in resonators, watches, and ceramic filters; surface acoustic wave (SAW) filters; ultrasonic transducers, delay lines, fish finders, and diagnostic acoustic devices, underwater acoustic devices, underwater microphones, and speakers. Piezoelectric materials are also used in generating high voltage for ignition and in transformers. There is a wide scope of research in the field of ferroelectrics and piezoelectrics to explore materials' properties, materials' manufacturing, techniques and applications, etc.

The present study is focused on the composition dependence of piezoelectric properties of NKN system, near equimolar (Na, K) morphotropic niobate compositions. $Na_{1-x}K_xNbO_3$ ($0.465 \leq x \leq 0.485$) ceramic samples were prepared by solid-state reaction route using double sintering. To investigate the piezoelectric properties, near $x = 0.475$, measurement of remnant polarization, coercive field, converse piezoelectric coefficient (d^*_{33}), and polarization current were carried out in the prepared samples.

14.2 Experimental Procedure

Ceramic pellets of $Na_{1-x}K_xNbO_3$, ($0.465 \leq x \leq 0.485$), were prepared using the conventional solid-state reaction method. The raw materials, Na_2CO_3, K_2CO_3, and Nb_2O_3, with purity better than 99.9% (from Merck KGaA, Germany) were dried at 200 °C for two hours to remove moisture and weighed in stoichiometric ratios. The method used to prepare the different compositions was similar to that described in a previous study [14]. Sintered pellets were electroded, with air dryable conducting paste of silver, in metal–insulator–metal (MIM) configuration, for piezoelectric measurements. Polarization and piezoelectric parameters were measured using a ferroelectric-(PE loop tracer) and piezometer (AixACCT Systems, GmbH).

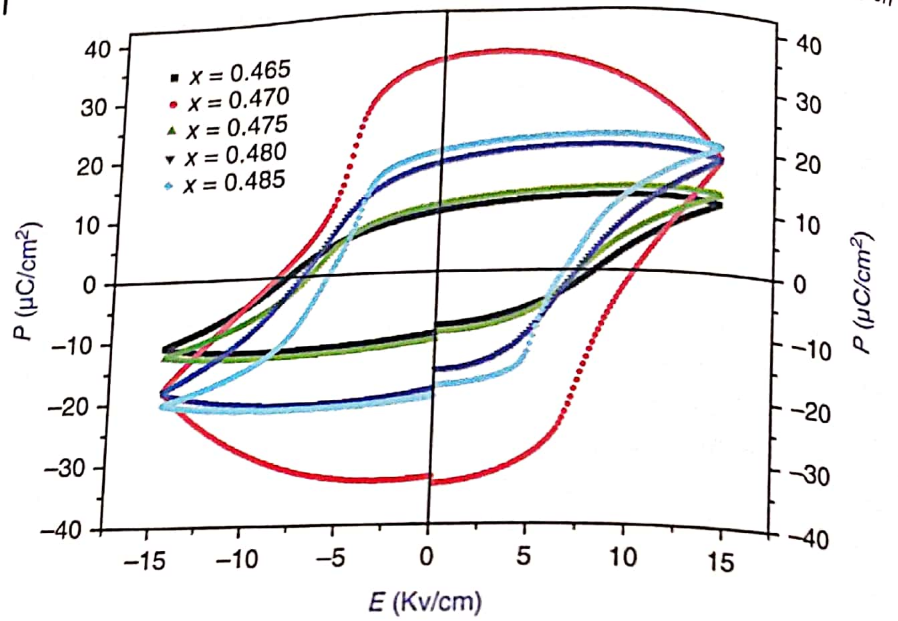

Figure 14.2 Polarization–electric field loop for prepared $Na_{1-x}K_xNbO_3$ samples, at 14 kV/cm.

14.3 Results and Discussion

The measured P–E hysteresis loops at RT, for unpoled $Na_{1-x}K_xNbO_3$ samples, with the application of 14 kV/cm field, at frequency 1 Hz, are shown in Figure 14.2. All the NKN prepared samples show PE hysteresis and confirm the ferroelectric nature. Figure 14.3 shows the variation of strain (%) with applied field. Figure 14.4 shows the variation of remnant polarization (P_r) and coercive field (E_c) in the prepared NKN ceramics with composition (x). The value of remnant polarization in the $Na_{1-x}K_xNbO_3$ ceramics was found to be 17.75 μC/cm² for the composition with $x = 0.485$, which decreased to 10.21 μC/cm² for $x = 0.475$. Further, with increasing x, value of the remnant polarization was found to decrease. This may be related to the increased distortion in the lattice parameters due to MPB in the NKN system, near $x = 0.475$. The coercive field (E_r) value was also observed increasing from 6.66 to 9.74 kV/cm, as x decreases from 0.485 to 0.470, in the NKN ceramics; further on decreasing x, the coercive field was found to decrease, Figure 14.5. Due to the increment in distortion in the cell by decreasing the volume of switchable domains, the coercive field value also increases [16]. The shape of the hysteresis loop (P–E loop) was found depending upon the microstructure, defects, stress, and preparation methods [17–19].

The variation of converse piezoelectric coefficient (d^*_{33}) with composition (x), at RT, in NKN ceramics is shown in Figure 14.5. For the composition, with $x = 0.485$, value of conversed piezoelectric coefficient was found 336 pm/V, which decreased to 202 pm/V, for $x = 0.475$, and suddenly increased to 314 pm/V, for $x = 0.470$, and thereafter continuously decreases with decreasing x. Figure 14.6 shows the variation of polarization current with x in NKN compositions. The anomalous rise in the d^*33 value, at $x = 0.470$, may be due to the structural change with composition.

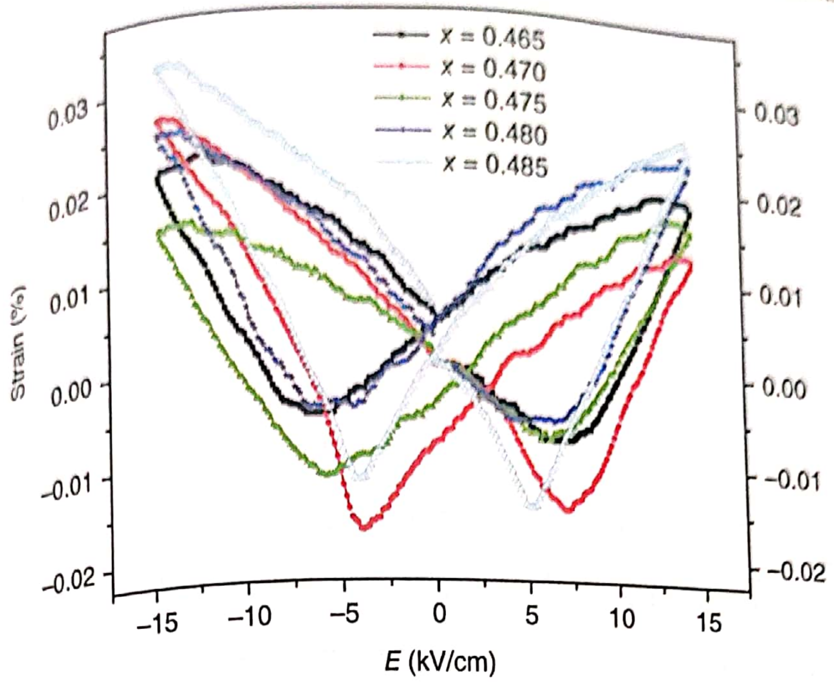

Figure 14.3 Variation of strain (%) with applied field (kV/cm), in $Na_{1-x}K_xNbO_3$ ceramic pellets.

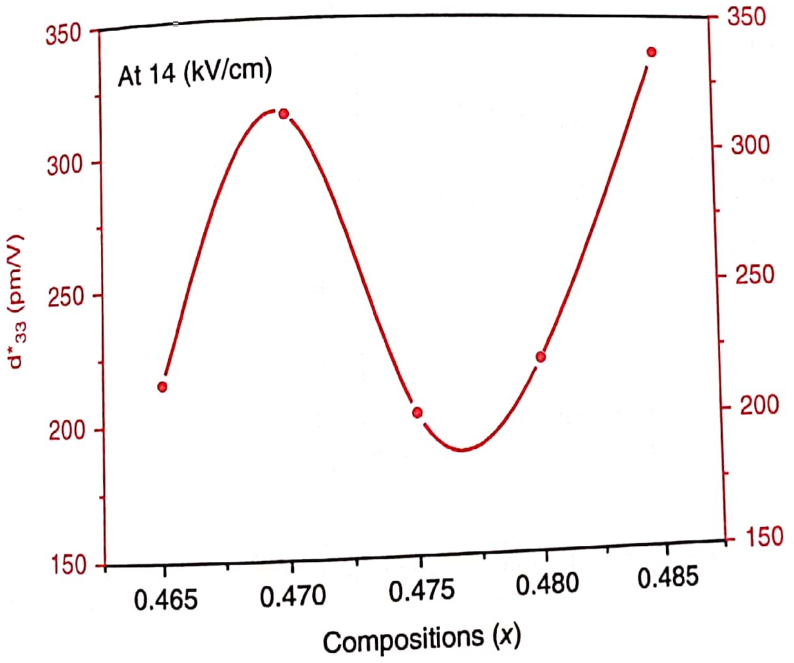

Figure 14.4 Variation of P_r and E_c with composition (x) in NKN ceramics.

near the MPB. P–E loops [20, 21] and piezoelectric parameters mostly depend on crystal symmetry, grain size, and density of ceramics [21, 22]. In the piezoelectric materials, the grain boundary is a low permittivity region; therefore, its polarization may be quite low. The numbers of grain boundaries decrease as grain sizes increase and, with larger grains, the remnant polarization increases [20]. The preparation method affects the grain boundary properties and morphology of the NKN ceramics. The space-charge accumulation is affected by the grain boundary resistivity [23–31].

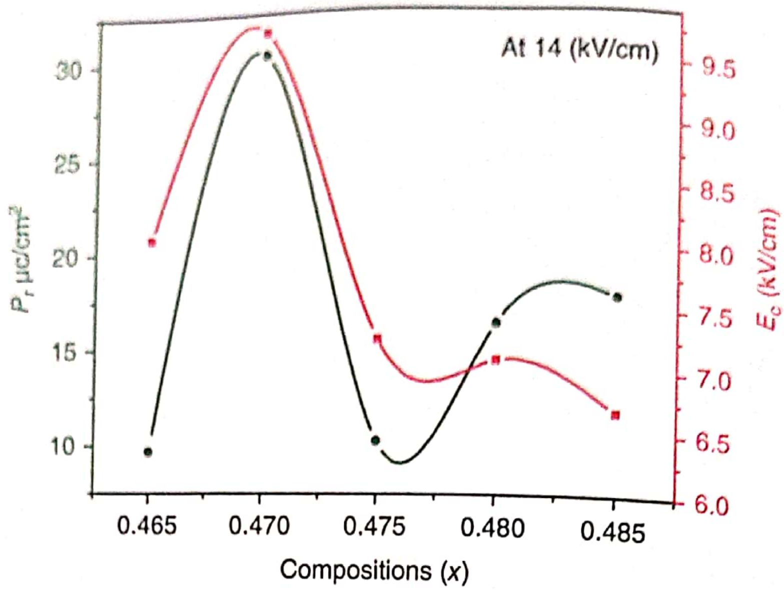

Figure 14.5 Composition (*x*) dependence of converse piezoelectric coefficient (d^*_{33}) in NKN ceramics.

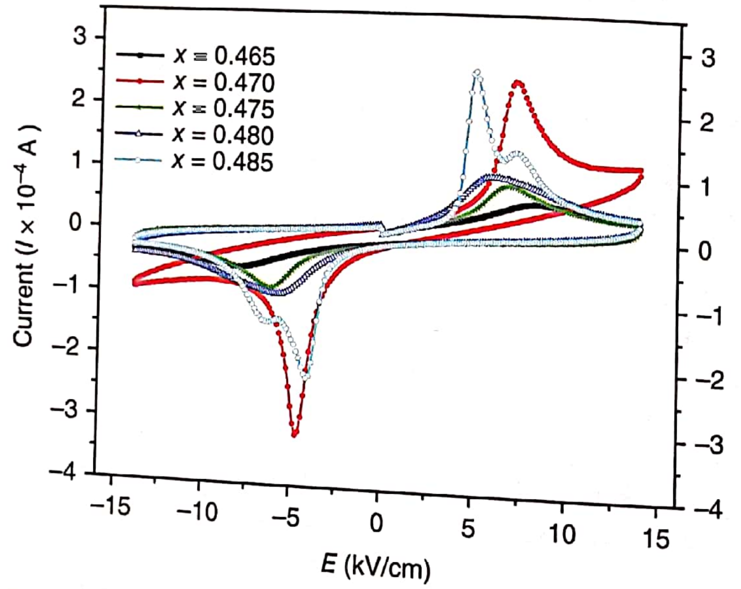

Figure 14.6 Variation of polarization current and applied electric field, in NKN ceramics, at 14 kV/cm.

The piezoelectric properties may be controlled by the controlling the grain size and the grain boundary resistivity, using the preparations method. The present observations show that ceramic processing conditions, structure, and composition (*x*) greatly influence the ferroelectric properties of the NKN system.

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Annealing Temperature-Dependent Optical Properties of $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ Thin Films

Prashant Thapliyal, Alok S. Kandari, Vijendra Lingwal, N. S. Panwar, and G. Mohan Rao

Abstract Tantalum (Ta) and titanium (Ti) metal targets were sputtered to deposit $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ composite thin films onto the quartz and P/boron–silicon (1 0 0) substrates by direct current (DC) magnetron sputtering in the oxygen environment at room temperature (RT). The as-deposited films were followed by the annealing in the temperature range from 500 to 800 °C for 90 min. X-ray diffraction results indicated the formation of Ta_2O_5 structure of annealed thin films. Optical measurements were performed by UV-Vis spectrophotometer, and obtained transmittance versus wavelength plot was used to determine the refractive index (n), extinction coefficient (k), and optical energy band gap (E_g) of the film material. The optical parameters derived from transmittance (T) measurement were observed varying with annealing temperature. The refractive index of prepared $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ thin films, at 550 nm, was observed decreasing from 2.21 to 2.14, and E_g from 4.27 to 3.88 eV, with increasing annealing temperature. The extinction coefficient associated with the absorbance was observed decreasing with the increasing wavelength.

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Keywords DC magnetron sputtering · Refractive index · Optical band gap · Extinction coefficient

1 Introduction

Transition metal oxides have been very demanding as the high dielectric materials for large-scale integration of capacitors into high memory devices. Among these oxides, Ta_2O_5 (tantalum pentoxide) has been reportedly observed one of the most popular dielectric material, as it is widely applicable in the fields of optical and electronics [1–3]. Many more applications of Ta_2O_5 thin layers were reported in the different fields, e.g., in optics as a highly transparent and refracting material [4], in optoelectronics as catalysts [5, 6], in silicon solar cells as anti-reflective coatings [7] and optical waveguides [8, 9].

The impact of substrate heating and post-deposition annealing has been reported and improved microstructure, better quality of the film [10], increased packing density, reduced oxygen vacancy, and defect density of film [11] were observed. Not only annealing, but also the doping of metal oxides (e.g., TiO_2 or ZrO_2) into Ta_2O_5 has the potential to enhance the electrical properties of pure Ta_2O_5 considerably [12–14]. Dielectric constant of pure Ta_2O_5 was observed drastically improved with the doping of 8% (mole) TiO_2, in case of bulk [15] and annealed films [16]. In this report, $(Ta_2O_5)_{0.965}$— $(TiO_2)_{0.035}$ thin films were deposited on the quartz ($n = 1.51$, $T = 92\%$) and semiconducting silicon substrates by DC sputtering of the Ta and Ti metal target in the presence of oxygen. This report demonstrates the annealing effect onto the observed structural and optical properties of the deposited film material.

2 Experimental

Using the reactive DC magnetron sputtering, (Ta_2O_5)—(TiO_2) composite thin films were deposited on optically polished quartz and p-silicon (1 0 0) substrates, at room temperature. The substrates (quartz and silicon) were rinsed with the help of deionised water, acetone, and hydrogen fluoride (HF) to get the clean surface, followed by the ultrasonication for 5 min. The cleaned and dried substrates were loaded in the vacuum chamber for deposition. The metal targets (star shaped Ta and solid Ti) of equal dimension (2 inch diameter, and 1 mm thickness) and same purity (99.99%) were used for sputtering. High purity (>99.999%) oxygen and argon gases were employed as the reactive and sputtering gases, respectively. An ultimate pressure of 1×10^{-5} mbar was achieved before starting the deposition. The distance between the sputtering target assembly and film depositing substrates is kept 50 mm, during the deposition. The sputtering conditions were established by keeping the working pressure of 5×10^{-3} mbar, along with 2.5×10^{-4} mbar oxygen partial pressure. The as-deposited thin films were then annealed in ambient air, at the temperature ranging from 500 to 800 °C, for 90 min. The DC power of 45 W was applied for depositing the films.

Crystal structure using X-ray diffractometer (make: PANalytical, model: X'PERT PRO), composition using a scanning electron microscope with energy dispersive X-ray (SEM-EDX) (make: CARL ZEISS, model: MA15/EVO18), and X-ray photo-electron spectroscopy (XPS) (Kratos Axis Ultra DLD) and thickness (~280 ± 10 nm) using spectroscopic ellipsometer (make: SENTECH, model: SE800) have been analyzed of the prepared thin films. UV and visible spectrophotometer (UV-Vis) (Specord S600-212C291) was used to draw the transmission spectrum of the prepared films, in the wavelength range of 190–1000 nm, with a resolution of 0.5 nm. The optical coefficients were calculated using the optical transmittance plot and Swanepoel's envelope method. The optically measured thickness (~260 to 280 nm) of the prepared films was found consistent with the results obtained from spectroscopic ellipsometer.

3 Results and Discussion

XRD peaks of the prepared $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ thin films, indicating the formation of orthorhombic Ta_2O_5 structure, have been shown in Fig. 1. With the annealing at and above 700 °C, the crystal structure was observed formed, as shown in Fig. 1. The obtained diffraction peak positions and corresponding (h k l) values were found consistent with reported results [17–19].

Figure 2 shows the observed EDS spectrum from SEM-EDS measurements of prepared $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ films, deposited at RT. The characteristic peaks of the detected elements may be seen in the EDS spectrum.

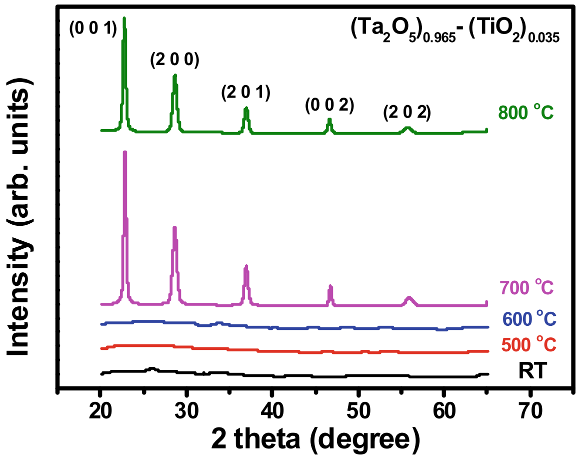

Fig. 1 XRD peak patterns of $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ thin films, annealed at different temperatures

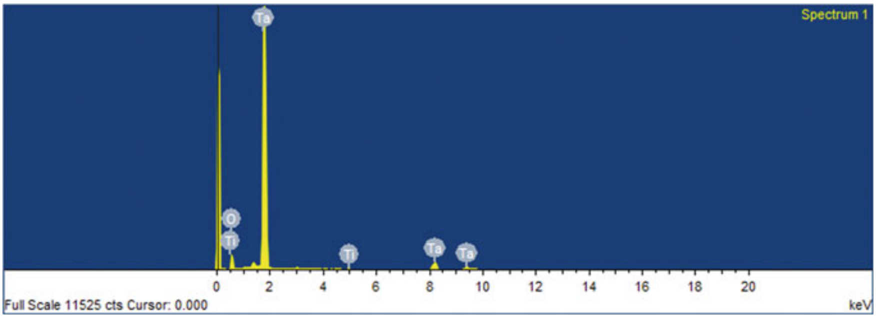

Fig. 2 SEM-EDS spectrum of $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ thin films

The atomic percentage and weight percentage information obtained from SEM-EDS measurements are summarized in Table 1. Composition (x) of the prepared $(Ta_2O_5)_{1-x}$—$(TiO_2)_x$ thin films may be determined with the help of atomic percentage. Also, the XPS measurements were found supporting the SEM-EDS results, as shown in Fig. 3.

Figure 3 shows the measured XPS survey spectrum of the deposited $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ films. In the spectrum, elemental characteristic peaks were observed at about 26–29 eV, 230–240 eV, 454–465 eV, and 530 eV, corresponding to tantalum Ta 4f, Ta 4d, titanium Ti 2p, and oxygen O 1 s, respectively [19, 20].

Figure 4 shows the plot of transmittance vs wavelength of $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ thin films, for the different annealing temperatures. In the spectra, for the wavelength above 400 nm, the transmittance of the prepared samples was observed

Table 1 Composition (x) of the prepared $(Ta_2O_5)_{1-x}$—$(TiO_2)_x$ films

x	Ti (Atomic %)	Ta (Atomic %)	O (Atomic %)	Ti (Weight %)	Ta (Weight %)	O (Weight %)
0.035	0.53	37.94	61.53	0.32	87.18	12.50

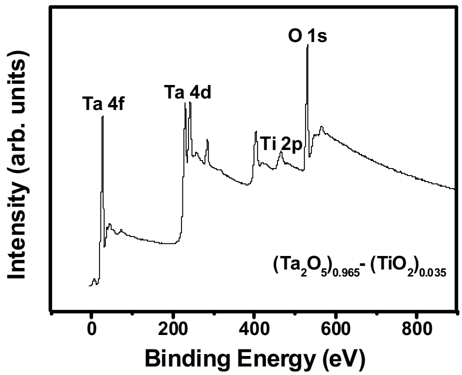

Fig. 3 XPS survey scan spectrum of $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ thin films

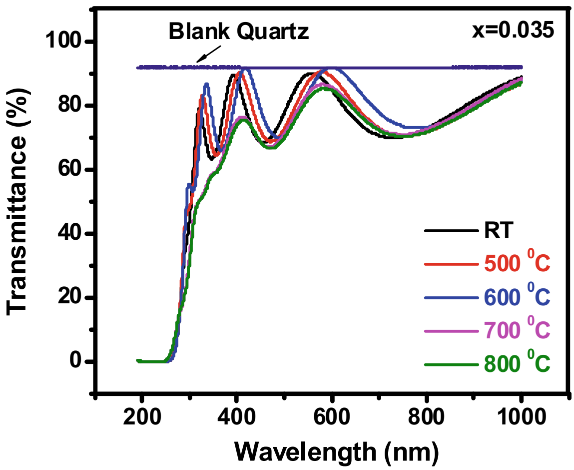

Fig. 4 Transmittance spectra of $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ thin films, annealed at different temperatures

increasing with annealing temperature up to 600 °C. Above 600 °C, the transmittance was observed decreasing with increasing annealing temperatures. This decreased transmittance at the higher annealing temperatures (>600 °C) may be attributed to the increase of oxygen deficiency [21, 22] and trap concentration [23] in the deposited films. A sharp decreasing optical transmittance strand was observed nearly 300 nm, which was found shifting toward the higher wavelength with increasing annealing, significantly at the higher temperatures (>600 °C). The observed sharp absorption edge signifies the direct transition from valence to conduction band and leads to the photon–electron interaction.

The refractive index (*n*) and extinction coefficient (*k*) of the prepared $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ films, annealed at different temperatures, were calculated by Swanepoel's envelop method [24], using the transmittance spectra. Generally, decreasing behavior of both the n and k was observed with increasing the wavelength, for the prepared films, as shown in Fig. 5. The value of *n*, at 550 nm, was found decreasing from 2.21 to 2.14 with the increasing annealing temperature, Fig. 5a, which may be attributed to release of internal stress and crystallization upon annealing [4]. At 550 nm, the extinction coefficient (*k*) was found decreasing with increasing the annealing up to 600 °C, and it was observed increased for further annealing (>600 °C), as shown in Fig. 5b. Due to the loss of the oxygen content at the higher annealing temperature (>600 °C), more absorption occurs and thus increased extinction coefficient was observed [22], in the deposited films.

Optical energy band gap (E_g) can be derived from the optical transmittance plot, by using Tauc's equation [25, 26]. Among the drawn plots of α^2, $\alpha^{1/2}$, $\alpha^{2/3}$, and $\alpha^{1/3}$ with respect to hν, Tauc's equation was observed satisfied by the plot of α^2 versus hν, which leads to the photon–electron interaction. The optical band gaps were illustrated by using the straight line portion of the plot of α^2 versus hν, intersecting the energy axis while extending, Fig. 6. α^2 versus hν plots of $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ films, for different annealing temperatures have been shown in Fig. 6a–e. The value of E_g was

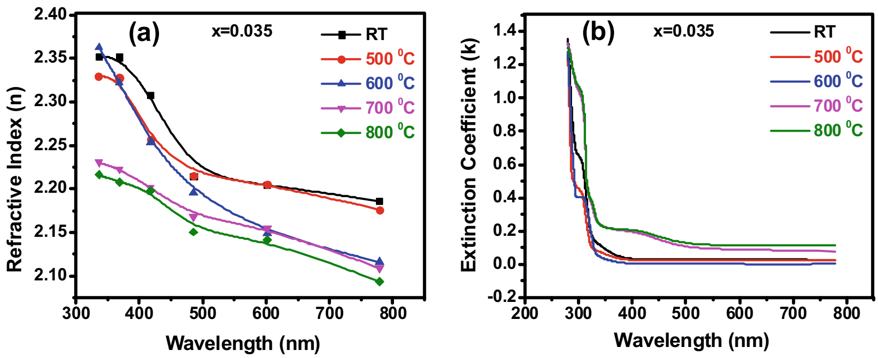

Fig. 5 Plots showing the variation of **a** refractive index, **b** extinction coefficient with wavelength for $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ thin films, annealed at different temperatures

observed decreasing from 4.27 to 3.88 eV with increasing annealing temperature, which may be due to the phase separation [27] and improved crystallization [21].

4 Conclusions

Ta and Ti metal targets placed in a single target holder were sputtered in oxygen environment to deposit $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ films, onto the both sides optically polished quartz and p-Si (1 0 0) substrates, at ambient temperature. The as-deposited films were annealed in the temperature range from 500 to 800 °C. X-ray diffraction results indicated formation of Ta_2O_5 structure of the annealed films. Transmittance, refractive index, extinction coefficient, and energy band gap were measured and observed depending on annealing temperature. For the amorphous films, with increasing the annealing temperature up to 600 °C, the transmittance was observed increasing, while it was observed decreasing for the crystalline films (>600 °C). This decreased transmittance above 600 °C may be caused by the loss of oxygen in the film. The value of n, at 550 nm, of prepared $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ thin films, was found decreasing from 2.21 to 2.14 with the increasing annealing, which may be by virtue of the released internal stress, resulting the reduced density of the deposited films. Optical energy band gap of the $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ films, was observed decreasing from 4.27 to 3.88 eV with increasing annealing. The extinction coefficient was observed, generally, decreasing with increasing wavelength. Also, for the prepared $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ thin films, the extinction coefficient was observed decreasing with the increasing annealing temperature of the amorphous films (up to 600 °C), while for the structured films, i.e., films annealed at and above 700 °C, it was found increasing with the increasing of annealing temperature.

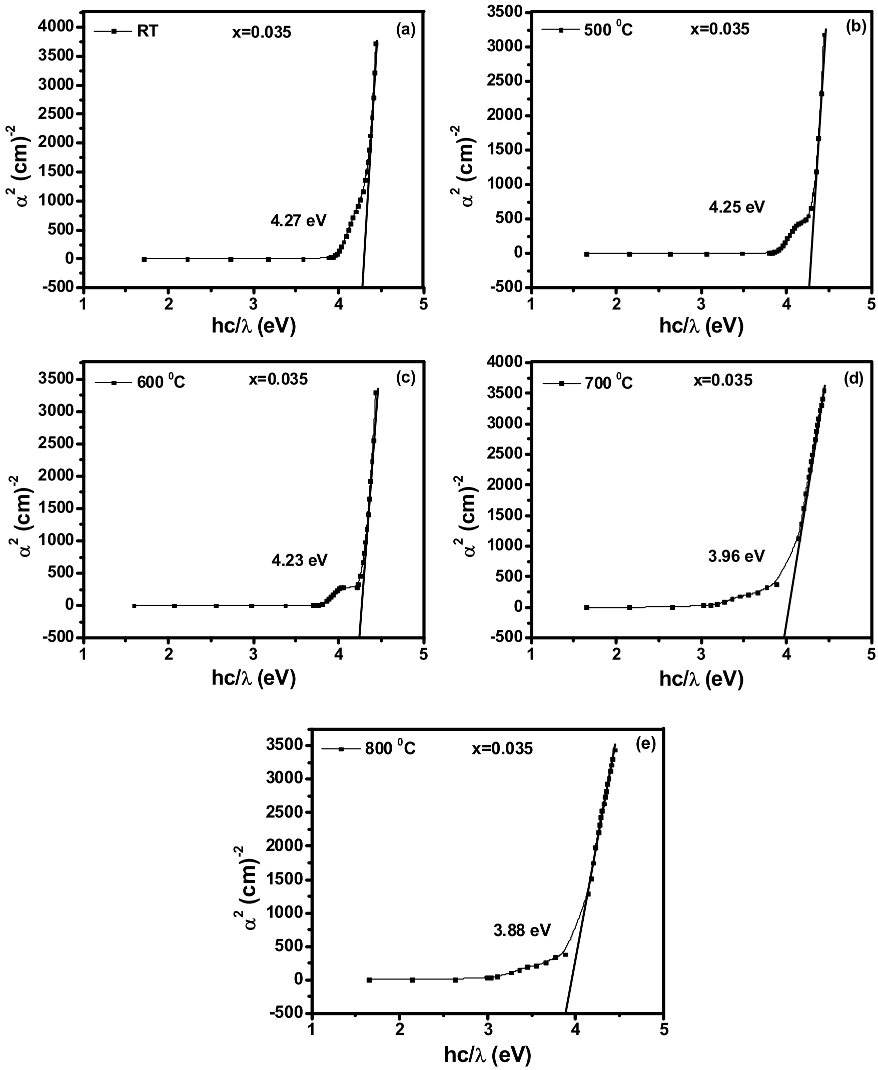

Fig. 6 α^2 versus hν plots for $(Ta_2O_5)_{0.965}$—$(TiO_2)_{0.035}$ thin films, deposited at **a** RT and annealed at **b** 500 °C, **c** 600 °C, **d** 700 °C, **e** 800 °C.

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Contents

Photovoltaic Power System with Battery Backup and Grid-Connection to Reduce Grid Dependency During Peak Demand Hours and Power Cuts

Vishal Rohilla, R. C. Rohilla, Prashant Thapliyal, Don Biswas, and Gambhir Singh Kathait

Abstract Sun is considered as best and cleanest renewable energy source. This energy can be converted into electrical energy using array of solar cells. The generated electrical energy thus can be utilized to run the electrical appliances. Running these electrical appliances inevitably depends on the availability of utility grid. Sometimes the geographical, environmental and societal conditions affect the availability of utility grid; that's why the battery backed inverters are becoming one of the must have amenity at homes and offices. In the present research work, we have converted this battery backed inverter to the solar PV powered battery backed system in order to reduce grid dependency for charging the batteries and reducing the utility bill. The system is designed, tested and installed for a 2 BHK house situated in civil hospital complex, Panipat at Latitude 29.401, Longitude 76.971 and Elevation 232 m, in the Haryana State of Northern India. Panipat city is in the National Capital Region (NCR) and have capability to represent approximately 1.6 million houses in the entire region including states Punjab, Haryana, Delhi, western part of Uttar Pradesh State and Eastern part of Rajasthan State. Total energy demand for peak hours i.e. from 6:00 PM to 10:00 PM for total 4 h comes out to be 2250 Wh/day. So, the system was designed according to 2250 Wh/day. System's cost was, Rupees Sixty Thousand Four Hundred (Rs. 60,400/-). System is working without losing power on a single day and producing electricity. Normally, the billing without installing the system was approximately, Rupees One Thousand Four hundred (Rs.1,400/-) for 350 units (1 unit = 1 kWh).

Keywords Battery backed · Charge controller · Design · Peak demand hours · PV · Photovoltaic solar · Utility grid

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1 Introduction

Sun is a readily available source of renewable energy. It spreads life giving energy on every creature in the solar system. Due to its abundance and availability to all without any bias, it is considered to be the best and cleanest renewable energy source also, as it is available to everyone so, he/she is free to utilize according to needs and capabilities. Using the photo voltaic technology one can harness its capability of producing electrical energy. The generated electrical energy thus can be utilized to run the electrical appliances designed to make life and living comfortable.

In the present scenario, electrical energy for the consumers is provided through utility grid so, the availability of electrical energy for running the loads/appliances that one has, inevitably depends on the availability of utility grid in the vicinity of house/work place. Sometimes, the geographical, environmental, and societal conditions affect the availability of utility grid.

According to government of India and ministry of power , electrical energy requirement of country was 12,74,595 MU and the availability was 12,67,526 MU for the year 2018–19. Total deficit was only 0.6%, while calculating the deficit total installed capacity was considered it doesn't include the power stations running in under capacity mode. So, in real time this deficit is far more [1]. However, it has been seen that housings in the planned localities as well as housings near to them witness the frequent power cuts. That's why the battery backed inverters are becoming one of the must have amenity. Power cuts and unavailability of grid, this situation is not limited to the unplanned housings but also in Planned housing societies, Metro cities, Small cities, Towns as well as in Villages. It may be due to lack in the demand and supply ratio, faults in distribution system and many other known and unknown causes. System is designed and installed at the location within the Panipat city, Haryana State of Northern India. While designing the proposed solar PV system it has been kept in mind that, the grid is mostly unavailable during the peak demand hours in summer season i.e. from 6:00 PM to 10:00 PM in the evening. It is the time when most of the people arrive from their workplace to home and they get relax, entertainment, cook meals, and start their sleep in the night. Since, it becomes dawn and tually night during these hours most of the lightening, cooling, and entertainment appliance came up in the operation mode so, electricity demand gets increased by many folds.

As far as the Indian power sector is concerned, the power generation is first from thermal (Coal, Gas and Oil) 64.1%. Second is from other renewable sources 20.8%. Third is the hydro power (renewable) 13.1% and at last from nuclear 2.0% [1].

Thermal power generation is a costly technology. Hence, the electricity generated is costly in terms of price per unit of consumption. This cost ultimately incurred from the consumers. With the advancement in technologies in the distribution system, "Smart Grid" concept is now in starting phase of its adaptation. One of the attribute is that, the user will be charged for the consumption according to demand and supply ratio. Price of electricity will vary throughout the day and in the peak demand hour's, consumers have to pay more price for the consumption.

Solar Photovoltaic energy production technology is now matured enough and commercialized [2]. Many design strategies like hybrid, standalone and grid connected as well as optimization of system components have been proposed in literature [3]. Our work is to demonstrate the system based on the use of existing methods, tools, and techniques to reduce the dependency on grid and further, bring down the utility bills. Hence, the residents may adopt the proposed system, and get benefited from our design.

2 Methodology

2.1 Solar Resource Assessment

First thing is to assess the solar resources available throughout the year at that place where the system is to be installed. This can be done through meteorological data that is being made available in public domain by many government agencies of the world like, Ministry of New and Renewable Energy India, NREL, Department of Energy US and many more international solar alliance [4–7]. Data collected from the ground station or the form the Meteosat satellite [8]. Some well-known online tools and software are also available like pvgis, VAISALA, solargis, nrgsystems, PVSYST, homer etc. [9–14]. Some have inbuilt applications to find the Latitude, Longitude and Elevation of that place and use them for assessing the availability of solar radiations throughout the year for different tilt angel of solar panels.

The system is designed, tested and installed for a 2 BHK house situated in Civil hospital complex, Panipat at Latitude 29.401, Longitude 76.971 and Elevation 232 m, in the Haryana state of Northern India [9], which is in the National Capital Region [15]; and have the capability to represent the entire region including states Punjab, Haryana, Delhi, western part of Uttarpradesh state and Eastern part of Rajasthan state. Solar resource availability was assessed by PVGIS online [9] and PVGIS-SARAH dataset, which have used images capturing the solar surface irradiance and cloud albedo from Meteosat satellite to construct this data set [16].

2.2 Optimum Solar Tilt Angle

PV panels to capture maximum solar radiations can be mounted either on sun tracking platform with capability to track sun by change one axis, two axis or fixed. Sun tracking arrangement is costly, so that, in our design we have not used it. Instead we have chosen to mount PV panels fixed at an optimum tilt angle. For optimizing, the tilt angle findings of several researchers have been reviewed; and concluded the simplest way to choose it [17, 18]. We found that sum of Latitude angle of that place and 5° i. e. $34.4^{\circ} \pm 4^{\circ}$ is optimum for winters as well as summers [19]. The found angle

Table 1 Monthly Global horizontal irradiation (kWh/m^2) data obtained Minimum in any month of a year at optimum tilt angle

SARAH data set year for selected location	Monthly global horizontal irradiation (kWh/m^2) minimum	At optimum tilt angle 34.4° ± 4°	Month of minimum global horizontal irradiation (kWh/m^2)
2005	108	155	January
2006	105	157	December
2007	111	165	December
2008	105	155	December
2009	108	153	January
2010	85.6	113	January
2011	107	150	January
2012	97.8	141	December
2013	101	141	January
2014	93.5	127	January
2015	82.7	109	January
2016	94.7	130	January

gives Global horizontal irradiation above 1 kWh/m^2 as per calculations from PVGIS online tool Table 1 summarizes the obtained values .

The observed data conform the feasibility of operation of the system throughout the year. Solar resource availability varies from 109 kWh/m^2–165 kWh/m^2. Year wise variations in minimum resource availability varies from 82.7 kWh/m^2 to 111 kWh/m^2.

2.3 Load Estimation

Next step is to estimate the load of appliances, a small 2 BHK house with appliances is summarized in Table 2. It is chosen because it represents the maximum number of housings and the minimum load requirements in the entire NCR region. Temperature in summers may go up to 45 °C when fans are needed and in winters goes below up to 12 °C when no need of fans only lightings are required.

Total energy demand of a day is coming out to be 8,953 Wh. the maximum load at any time is 670 W. Total energy demand for peak hours i.e. from 6:00 PM to 10:00 PM total 4 hours comes out to be 2250 Wh/day. So, the system was designed according to 2250 Wh/day.

Table 2 Estimation of load of appliances to be run. TL = Tube light (22 W); LE1 = Led B22 Bulb (10 W); EF = Exhaust Fan (50 W); CF = Ceiling Fan (75 W); MC = Mobile Charger (10 W); TV = Television Set (100 W); STB = Set Top Box (20 W); LE2 = Led B22 Bulb (8 W)

Time	Appliances in																									
	Kitchen			Bed room 1				Bed room 2				Drawing/Living room						Toilet/Bathroom		Lobby/Dining room			Entrance		Balcony	Total power
	TL	LE1	EF	TL	LE1	CF	MC	TL	LE1	CF	MC	TL	LE1	TV	STB	CF	AS	LE2	EF	TL	LE1	CF	TL	LE1	LE1	
6	0	10	0	0	10	75	10	0	10	75	10	0	10	100	20	75	0	8	0	0	10	75	0	10	0	458
7	0	10	0	22	0	75	0	22	0	75	0	0	10	100	20	75	0	8	0	0	10	75	0	10	0	340
8	22	0	50	22	0	75	0	22	0	75	0	22	0	100	20	75	0	8	50	22	0	75	0	0	0	638
9	22	0	50	0	0	75	0	0	0	75	0	22	0	100	20	75	0	8	50	22	0	75	0	0	0	586
10	22	0	0	0	0	75	0	0	0	75	0	0	0	100	20	75	0	8	0	22	0	75	0	0	0	472
11	0	0	0	0	0	75	0	0	0	75	0	0	0	0	0	75	40	0	0	0	0	75	0	0	0	340
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	75	0	0	0	115
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	40
14	0	0	0	0	0	75	0	0	0	75	0	0	0	0	0	75	40	0	0	0	0	0	0	0	0	265
15	0	0	0	0	0	75	0	0	0	75	0	0	0	100	20	75	0	0	0	0	0	75	0	0	0	420
16	0	0	0	0	0	75	0	0	0	75	0	0	0	100	20	75	0	0	0	0	0	75	0	0	0	420
17	0	0	0	0	0	75	0	0	0	75	0	0	0	100	20	75	0	0	0	0	0	75	0	0	0	420
18	0	0	0	0	0	75	0	0	0	75	0	0	0	100	20	75	0	0	0	0	0	75	0	0	0	420
19	22	0	0	0	10	75	0	0	10	75	0	22	0	100	20	75	0	8	0	0	0	75	0	0	10	502
20	22	0	50	22	0	75	0	22	0	75	0	22	0	100	20	75	0	8	50	22	0	75	0	10	10	658
21	22	0	50	22	0	75	0	22	0	75	0	22	0	100	20	75	0	8	50	22	0	75	22	0	10	670
22	22	0	0	22	0	75	0	22	0	75	0	22	0	100	20	75	0	8	0	22	0	75	22	0	10	570
23	0	10	0	0	0	75	10	0	0	75	10	0	10	100	20	0	0	0	0	22	0	75	22	0	10	539

(continued)

Table 2 (continued)

Time	Appliances in																								Total power
	Kitchen			Bed room 1				Bed room 2				Drawing/Living room						Toilet/Bathroom		Lobby/Dining room			Entrance		Balcony	
	TL	LE1	EF	TL	LE1	CF	MC	TL	LE1	CF	MC	TL	LE1	TV	STB	CF	AS	LE2	EF	TL	LE1	CF	TL	LE1	LE1	
0	0	0	0	0	0	75	10	0	0	75	10	0	0	0	0	0	0	0	0	0	0	0	0	10	0	180
1	0	0	0	0	0	75	10	0	0	75	10	0	0	0	0	0	0	0	0	0	0	0	0	10	0	180
2	0	0	0	0	0	75	10	0	0	75	10	0	0	0	0	0	0	0	0	0	0	0	0	10	0	180
3	0	0	0	0	0	75	10	0	0	75	10	0	0	0	0	0	0	0	0	0	0	0	0	10	0	180
4	0	0	0	0	0	75	10	0	0	75	10	0	0	0	0	0	0	0	0	0	0	0	0	10	0	180
5	0	0	0	0	0	75	10	0	0	75	10	0	0	0	0	0	0	0	0	0	0	0	0	10	0	180
																									Total	8,953

2.4 Inverter Selection

Inverter is required to convert DC voltage stored in the batteries to AC voltage similar to the voltage that comes to a house from Utility Grid, so that appliances may function smoothly. Inverters with high efficiency greater than 90% are readily available in the market. Keeping in view the efficiency, availability in market and system voltage, 1100 VA Single Phase inverter with option to connect 24 V battery bank with efficiency greater than 90% (assumed 93%) was purchased from old appliances market due to cost constraints.

Inverter has to supply the power in the cabling to which load is connected. There may be 2% power loss is assumed so, inverter output energy should be 2% greater than 2250 Wh/day i.e. 2296 Wh/day.

Calculated Input Energy to the inverter from Battery Bank = (Inverter output energy/inverter efficiency) = (2296/0.93) = 2468.81 Wh/day.

2.5 Battery Bank Design

Output voltage of Battery Bank was chosen as 24 V. Some of the energy from battery to inverter may get lost this was assumed to be 2%.

Output energy from battery was calculated to be (2468.81/0.98) = 2519.20 Wh.

Capacity of battery is the ampere hour (Ah) capacity and depends upon the output energy required, output voltage and the depth of discharge of battery(DoD). DoD was assumed as 50%.

= (Energy required × Day of Autonomy)/(output voltage × Depth of Discharge)

= (2519.20 × 1)/(24 × 0.50) = 209.93 Ah.

In the market, 12 V/ 200 Ah lead acid batteries are readily available at fair price. Since, the output voltage was chosen as 24 V so, two batteries of 12 V 200 Ah each were connected in parallel to achieve the 24 V, 200 Ah.

Battery will be charged via Solar panels through charge controller and in absence of solar energy can be charged through utility grid. Battery charging system for solar photovoltaic system is different from conventional charging system. Because, energy harvested from solar panels is neither provide constant charging current nor the constant voltage. Therefore, a charge controller is required.

Total energy required at input of the battery bank depends on how efficiently the battery bank gets charged from its lowest state of charge to full charge.

We have assumed the Lead Acid Battery bank as 70% efficiency [20].

So, input energy = (Output energy/efficiency)

Input energy = (2519.20 Wh/70%) = 3598.85 Wh.

Table 3 Specifications of charge controller

Nominal battery voltage	24 V
Maximum battery current rating	30–50 A
Input PV voltage range, Voc	40–85 V
Power conversion efficiency	>96%
Charge regulation	Four stage charging algorithm: bulk, absorption, float and equalization
Float voltage	27 V
Reverse current flow protection	Yes
PV High voltage charging disconnect and its recovery	Yes
PV high current regulation	If battery current $\geq$ 30 A

2.6 Charge Controller Selection

Battery charging can be controlled via two types of technologies available one is Pulse-Width Modulation (PWM) technology and another is Maximum Power Point Tracking (MPPT) technology. Both the technologies have their own benefits and drawbacks. In MPPT, there is a programmable chip which is usually used to switch on the DC-DC convertor according to the algorithm and fused into chip. When solar panel output voltage is higher than the required DC voltage, the DC-DC convertor takes high DC voltage at input and maintain a required constant lower DC voltage at the output. This extra voltage is converted into the current. When the solar panel output voltage decreases below the required voltage, the DC-DC converter takes lower DC voltage at input and convert it into higher DC voltage by compensating the current.

Charge controller also works as a reverse blocking system that prevents the flow of charge from battery to solar panels. MPPT charge controller was chosen in this system. However, cost of MPPT charge controller is higher than PWM Charge controller. But due to its various advantages like efficiency, battery life enhancement feature and availability at affordable price,makes it a popular controller. The MPPT charge controller with capability of controlling the battery charging via solar panel as well as via grid was selected in our system. Specifications of charge controller are summarized in Table 3.

2.7 Solar Panel Estimation

Solar panels need to be connected with battery bank via charge controller so, there will be some energy loss in wires from panel to charge controller, charge controller

Table 4 Specifications of solar panel provided by manufacturer

Cells type	Poly crystalline
Capacity	315 W
Voltage at Max Power (Vmax)	36.75 V
Open Circuit Voltage (Voc)	45.25 V
Current at Max Power (Imax)	8.58 A
Short Circuit Current (Isc)	9.29 A

to battery bank and within the charge controller itself. We have assumed the cabling loss is 2% in either direction.

Energy at the charge controller output after 2% cable loss = (3598.85 Wh/0.98) = 3672.30 Wh.

Input energy required to the charge controller from solar panel side = (3672.30 Wh/charge controller efficiency) = (3672.30 Wh/97%) = 3785.87 Wh.

Solar panel output required at input of charge controller after 2% cable loss = (3785.87/0.98) = 3863.14 Wh.

Output of Solar panels while assuming 5 h of sunshine = (3863.14 Wh/5 h) = 772.62 W.

Module retarding factor due to panel soiling, shading, mismatch and temperature difference were assumed as 30%.

So, module output power required = (772.62 W)/(100 − 30)% = 1103.75 W.

Module aging factor was also considered as 10%.

Final module power required = (1103.22 W/90%) = 1226.39 W.

Four solar panels of 315 W each were chosen to provide the required energy from the available choices in the market. Specifications of solar panel as provided by manufacturer summarized in the Table 4.

3 Results and Discussion

The block diagram representation of the system is summarized in Fig. 1. Four solar panels of 315 watt each are connected with wire in parallel to achieve final module power required at the input of charge controller as per calculations. All connections with solar panels were constructed by 6 mm^2 copper wire, charge controller in this system works as master for all the system components solar panels, battery bank, inverter mains input and AC mains (grid input). Battery bank is connected parallel to both charge controller and inverter. Inverter mains input comes from charge controller which is being utilized to charge batteries if not fully charged, via grid, in case of absence/insufficient solar power. Inverter output is connected with the load. The designed system is similar to the popularly known retrofitted system as propagated by the charge controller manufacturers [21, 22]. According to the specifications, it is easy to connect with battery backed inverter system. The actual designed system is depicted in Figs. 2, 3, 4 and 5. System is working without losing power on a single

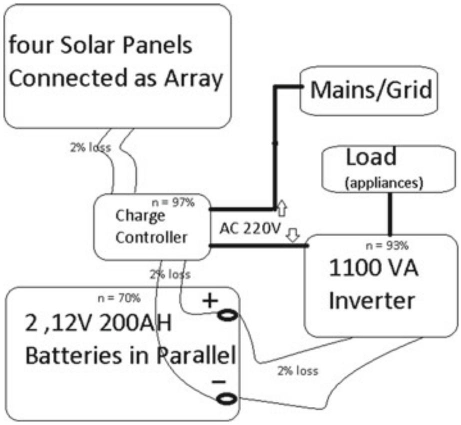

Fig. 1 Block diagram representation of the designed system

Fig. 2 Installed system (inverter and batteries)

Fig. 3 Solar Charge Controller

day and producing electricity. Daily, at the time of peak demand hours, the house owner himself switches off the mains/grid.

The installed system can provide three fold benefits in terms of power saving. The first benefit, it doesn't require power from utility grid to charge batteries. second

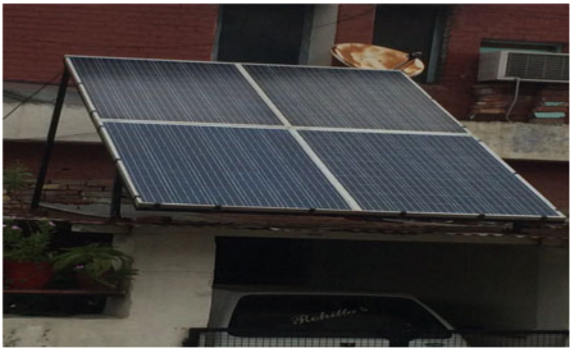

Fig. 4 4 Solar panels connected in parallel of 315 Watt each

Fig. 5 Solar panels mounted at optimum angle

benefit, during day time surplus energy can run the electrical appliances or fed to the grid. third benefit, it can run the electrical appliances during peak hours and power cut. Hence, the system is capable of reducing the monthly electricity bill. The money saved can be accounted for the recovery of the cost of installed system.

4 Conclusions

The designed system for Assessment of electricity savings utility bills is reviewed. In Panipat city the electricity distribution and its monthly billing is maintained by Uttar Haryana Bijli Vitran Nigam (UHBVN). It's official website contains latest orders and circulars that governs the tariff and charges for the computation of monthly electricity bills [23]. The monthly savings of electricity by utilizing the designed system comprises of electricity generated from the solar panels during 5 sun shine hour (electricity used in charging batteries and surplus power, power delivered to load during 4 peak demand hours).

Savings =(3598.85Wh + 2250Wh) = 5848.85 Wh

Approximately, 6 kWh/day and in a month it comes out to be 180 kWh.

Table 5 Actual cost of the system

Sr. No.	Material/Equipment	Charges in Rupees
1.	1100 VA inverter	2,000
2.	Two batteries of 12 V, 200 Ah	22,000
3.	Charge controller 24 V	3,500
4.	4 Solar Panels of 315 W each	29,900
5.	Other expenses (cables, stand and labor)	3,000
	Total	60,400

Normally the billing without installing the system was approximately Rupees, One thousand Four hundred (Rs. 1,400/-) for 350 units (1 unit = 1 kWh). After installing the system monthly electricity bill is now approximately Rupees, Five Hundred (Rs.500/-). Clearly it leads to savings of approximately Rupees One thousand (Rs.1,000/-).

Actual cost of system is summarized in Table 5.

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Proceedings of Integrated Intelligence Enable Networks and Computing pp 279–286 | Cite as

BEENISH: Balanced Energy-Efficient Network-Integrated Super Heterogeneous Protocol for Wireless Sensor Networks

Pradeep Rana, Rohan Varma, M. M. S. Rauthan & Varun Barthwal

Conference paper | First Online: 24 April 2021

518 Accesses

Part of the Algorithms for Intelligent Systems book series (AIS)

Abstract

The good news is developing interest on Wi-Fi sensor networking in the last years. The introduction of the energy-efficient way common process is among the key handles of Wi-Fi sensor networking. Many unusual protocols consider two–three energy levels of noodles. Heterogeneous actually had levels of strength. In the heterogeneous, there are true levels of energy. Analyzing the amount of energy in a large level by consuming cluster and communication energy. We keep your proposal of BEENISH project. According to BEENISH, he states that the nodes have some energy levels WSN. Basic for the remainder energy levels of nodes, cluster heads are determined here. It performs greater than the present clustering process for heterogeneous weight, according to the reaction of the simulation. Our project for long-term stability is. Existence as well as more effective principles (DEEC) than developed and advanced.

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Proceedings of Integrated Intelligence Enable Networks and Computing pp 269–278 | Cite as

An Overview on Security Issues, Attacks, Challenges and Protocols in WSN

Pratyush Panwar, Rohan Verma, M. M. S. Rauthan & Varun Barthwal

Conference paper | First Online: 24 April 2021

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Part of the Algorithms for Intelligent Systems book series (AIS)

Abstract

Wireless sensor network (WSN) is among the latest technologies that promise an emerging future in diverse fields due to its unique capabilities which are to monitor and gather data from different environments by sensors deployed at remote locations. A secure network is a vital necessity of every application. Securing the sensor network that is wirelessly connected becomes an immensely demanding affair because of the limited resources it possesses. The functionality of such networks can be influenced by numerous security threats. In this review paper, a brief description about various security requirements and constraints in a WSN is discussed along with the types of attacks in different layers. Focus is also given on the strengths and limitations of some popular WSN security protocols to enable application designers to choose the appropriate protocol for their applications.

Keywords

Sensor | Security challenges | Constraints | Attacks | Security protocol

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Chapter 13
AntVMp: An Approach for Energy-Efficient Placement of Virtual Machines Using Max–Min Ant System

Varun Barthwal, Man Mohan Singh Rauthan, and Rohan Varma

1 Introduction

Climate change is a critical issue that should be addressed to avoid the problem of global warming. Internet technology is also a major factor in climate change due to the rapid growth of cloud infrastructure and cloud services. Cloud infrastructure consists of servers or PMs, networking equipment, storage units, and cooling devices. It emits the huge amount of carbon traces and heats while processing user requests. These requests are processed in PMs using the virtualization mechanism. VMs execute the user requests when hosted in PMs in virtualization; therefore, a suitable mechanism is required for hosting the VMs inside the PMs. The mapping must be done so that PMs exhibit minimum consumption of energy, as the resources related to memory, and computation requires electrical energy for the processing of user requests. Therefore, for processing, the more request the more energy is required.

In our proposed work, we presented a method for hosting VMs into fewer numbers of PMs to manage the consumption of energy. We have implemented an ant-based solution (AntVMp) for the offline placement of VMs and compare the work with the best fit and worst fit heuristic-based approaches. Simulation-based experiments have been performed to validate the methods in terms of energy consumption and the number of active PMs. The placement of VMs in a cloud datacenter is the key activity and to minimize the EC it must be applied in such a way so that minimum numbers of PMs are required for the placement. In a cloud datacenter, minimum EC can be

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Cloud Computing: Overview and Research Issues

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Abstract — **The computational world has become very large and complex. Cloud is an emerging technology in the world of Information Technology. Cloud computing offers IT capabilities as services. Cloud based services are on demand, scalable, device independent and reliable. Cloud computing is built on the virtualization concept. Virtualization separates hardware from software and has benefits of server consolidation and live migration. In this paper we present an overview of cloud computing and also describe about its key technology "virtualization". We are also presenting research challenges in cloud computing.**

Keywords—Cloud Computing, Virtualization; Virtual machine.

I. INTRODUCTION

IT resources have become more powerful, cheaper, and can be accessed from anywhere due to Internet and also the processing and storage technologies development. Cloud computing is the latest evolution of computing for hosting and delivering services over the Internet. Cloud computing is not a new idea, after launching of the Amazon EC2[1], cloud computing buzz began in 2006. Cloud computing delivers application and IT capabilities as a service over the Internet using third party. Resources (CPU, storage etc.) are delivered as general utilities that are leased and released by user over Internet in pay-as-you-go and on demand basis. It is very attractive for business owners who can start from small and increase resources only if there is rise in service demand. Many different businesses and organization have adopted the concept of the cloud computing. Cloud computing enables consumer and businesses to use application without installation and they can access their files on any computer through Internet. Cloud computing delivers software (application) as a service, infrastructure as a service, and platform as a service. Examples are Amazon's EC2 [1] Google's App Engine [2], Microsoft Azure [3], IBM SmartCloud [4] etc. The definition of cloud computing is standardized by NIST (National Institute of Standards and Technology) [5] as,

"Cloud computing is a model for enabling convenient, on demand network access to a shared pool of configurable computing resources (e.g., networks, server, storage, application, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction".

Cloud model is composed of five essential characteristics: On-demand self service, Broad network access, Resource pooling, rapid elasticity and measured service. It consists of three service models and four deployment models which are defined and agreed in the NIST.

Essential characteristics:

- ***On-demand self service***: It ensures that a consumer can one-sidedly provision computing capabilities such as server time and network storage automatically without requiring human interaction with each service provider.
- ***Broad network access:*** It gives access to capabilities available over the network through standard mechanisms.
- ***Resource pooling:*** It pools computing resources to serve multiple consumers. Different physical and virtual resources dynamically assigned and reassigned according to consumer demand. Examples of resources include storage, processing, memory, and network bandwidth.
- ***Rapid elasticity***: It is used to elastically provision and release capabilities or resources. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.
- ***Measured service:*** Cloud system control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). For both, the provider and consumer of the utilized service, resource usage can be monitored, controlled, and reported, and also provide transparency.

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Advantages of Cloud Computing

Most often, what makes organizations consider the cloud is the reduced cost. As customers are charged per execution-hour or gigabyte of storage, they do not need to worry about hardware maintenance and upgrade costs or the additional cost that comes with underutilized physical systems. The use of virtualization allows for easy scalability, whether by duplicating instances or by changing the amount of CPU and memory available on a virtual machine. Mobility has several advantages. The location and placement of resources in the cloud is not a factor in accessing the information. A benefit is that the execution environment and data can be placed closer to the location of highest demand. The cloud computing environment moves the administration of the physical systems to the cloud provider, creating a central administration of cloud services. This allows customer's IT departments to focus on their organizations solutions. Most cloud providers have several locations where they host customer data. This distributed approach to resources creates system redundancy. If portions of the resources go down, it will have minimal affect on the other resources.

Disadvantages of Cloud Computing

The biggest operational disadvantage is the lack of interoperability between providers. This has occurred mainly as organizations have built their cloud and are keeping the structure, architecture, and framework private. Even though many cloud providers' market 99% or more service availability, many applications are not well suited for use in the cloud. Two application types include those of high-availability and real-time environments. When data is stored on the cloud, there is an expectation that it is frequently backed up to alternate locations. This is not always the case. Organizations that do not have separate and distinct data back-up locations from the cloud provider alternate locations for back-up data are at risk of losing their business data and potentially customers if things go wrong. The biggest concerns with the cloud are security and privacy.

II. CLOUD COMPUTING MODEL

[A] Service Model

In cloud computing everything is provided as a service (Xaas). Services may be in the form of hardware, software, storage, platform, infrastructure database and many more.

NIST presented three major categories of services, known as service model which are given below:

1. Software as a service (Saas): Software (application) is delivered over Internet. Software, which runs on provider's cloud infrastructure, is delivered to multiple clients (on demand) through web browser over the Internet. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings. Examples are: Google Docs and Salesforce.com.

2. Platform as a service (Pass): Platform is provided to the client to build (develop, test, deploy) the applications. The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications. Examples are Microsoft Azure and Google App Engine.

3. Infrastructure as a service (Iaas): It offers users elastic on demand access to resources (server, storage, networking) through service API. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications and possibly limited control of select networking components such as host firewalls. Cloud providers typically bill Iaas service on a usage basis, cost reflects the amount of resources allocated and consumed. Amazon EC2 is good example of Iaas.

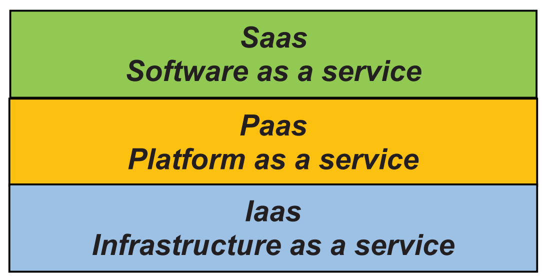

Figure 1.1 Service Model

[B] Deployment Model

NIST has given four deployment models which decides the user criteria means under which model who can access the services. Deployment model is shown in figure 1.2.

1. Public Cloud: Cloud infrastructure is provided to the public, it is a mega scale infrastructure. Public cloud run by the third parties e.g. Amazon, Google which provides their services to users via Internet. A public cloud is available for public as pay-as-you-go manner, not limited on the basis of users.

2. Private Cloud: It is also known as internal cloud. Cloud infrastructure is provisioned by a single organization which has full control over the applications run on infrastructure for specific use. Private cloud has no restriction of network bandwidth, security.

3. Hybrid Cloud: It is composition of two or more distinct cloud infrastructure. It allows, an organization can run some application on internal infrastructure and other can be run on public cloud. Hybrid cloud environment has multiple internal and/or external providers. It offers more flexibility than both public and private cloud.

4. Community Cloud: cloud infrastructure is provisioned by a specific community. Multiple organizations make cloud infrastructure and share it. They also share policies, requirements and values. Cloud infrastructure is hosted by third party vendor or could be hosted by one of the organizations within community.

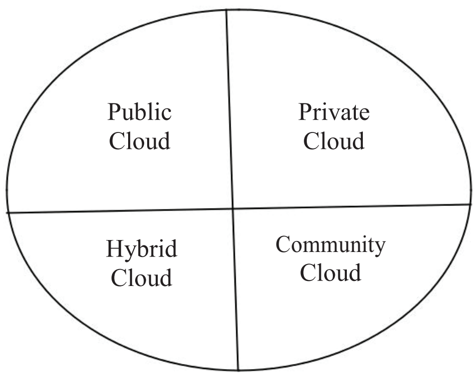

Figure 1.2 Deployment Model

III. VIRTUALIZATION: THE KEY TECHNOLOGY OF CLOUD COMPUTING

Virtualization technology was developed by IBM in 1960 to maximize the utilization of hardware resources. The powerful and expensive mainframe computers were underutilized. Virtualization is the abstraction of the physical resources needed to complete a request and underlying hardware used to provide service. It splits up a physical machine into several virtual machines.

Virtual Machine

A virtual machine can be defined as, **"*It is a software implementation of a computing environment in which an operating system or program can be installed and run*".** [6] Virtual machines run operating systems add sometime called virtual server. A host operating system can run many virtual machines and shares system hardware components such as CPUs, controllers, disk, memory, and I/O among virtual servers[7]. Virtualization runs the entire virtual machine including its own operating system, called guest operating systems on another operating system, called host operating system. The real machine is essentially a host system with no virtual machines. The real machine operating system accesses hardware components by making calls through a low-level program called the BIOS (basic input/output system).

History

Virtual machines have been in the computing community for more than 40 years. Melinda Varian [8] introduces virtual machine technology, starting with the Compatible Time-Sharing System (CTSS). Varian described the creation, development, and use of virtual machines on the IBM OS/360 Model 67 to the VM/370 and the OS/390. In 1973, Srodowa and Bates [9] demonstrated how to create virtual machines on IBM OS/360s. The 1980s and early 1990s brought distributing computing to data centers. Centralized computing and virtual machine interest was replaced by standalone servers with dedicated functions: email, database, Web, applications. The virtual machine was created on the mainframe. It has only recently been introduced on the mid-range, distributed, x86 platform. Technological advancements in hardware and software make virtual machines stable, affordable, and offer tremendous value, given the right implementation. Virtualization provides increased efficiency and a reduction in physical resources. It can be defined as [10], "Virtualization is a framework or methodology of dividing the resources of a computer into multiple execution environments, by applying one or more concepts or technologies such as hardware and software partitioning, time-sharing, partial or complete machine simulation, emulation, quality of service, and many others." Examples of popular virtualization software are VMware ESX / ESXi [11], Virtual PC [12], Xen [13], and Microsoft Hyper-V [14], KVM [15], Virtual-Box [16]. VirtualBox and KVM are commonly associated with linux environments. Virtualization has ability to run multiple operating systems concurrently on single physical host as shown in Figure 1.3 and Figure 1.4. Virtualization technology organizes the computing resources flexibly and it unscrambles the hardware and software architecture dependency. Virtualization technology also facilitates resource sharing, cost efficiency, fault tolerance, application isolation, portability. Virtualization products differentiate themselves by how they virtualize the environment. There are several different ways environments can be virtualized. These virtualized environments are being monitored and executed by a software component that manages all virtual machine executions known as the virtual machine monitor or hypervisor. The main advantage of virtualization is to provide better resource utilization by running multiple VMs on a single physical host. The main advantage of virtualization is to provide better resource utilization by running multiple VMs on a single physical host. Virtualization provides benefits of consolidation and virtual machine migration. Virtual machine migration avoids the process level problem such as residual dependencies [17], a process dependency on its original (source) node. It has many benefits like load balancing, energy saving. Virtualization provides benefits of consolidation and virtual machine migration. Virtual machine migration avoids the process level problem such as residual dependencies [17], a process dependency on its original (source) node. It has many benefits like load balancing, energy saving. Hypervisor separates the hardware resources and provide the virtual machines (VM). VMs act like real physical machines; they use their virtual hardware resources. The hypervisor is also commonly referred to as a host (or dom0 of Xen nomenclature). The virtual machines are referred to as guests (or domU's for Xen, where U is an integer larger than 0, each referring to a different virtualized guest). VMware and Xen provide the capability to live migrate virtual operating systems through the tools VMotion and XenMotion respectively.

Types of Virtualization

There are two main types of virtualization:

Server Virtualization

This is the most common type which splits up a single physical server into several virtual servers. In server virtualization, virtual machine can be created on the host operating system, using hypervisor or it can be directly created on the hardware. For this purpose two types of hypervisor type-1 or bare metal and type-2 or hosted are used.

Type I (Bare Metal): In this type, VMM (Virtual Machine Monitor) is installed as a primary boot system on the hardware. Bare metal hypervisors run directly on the hardware and control the hardware and manage the guest operating system i.e. VMM has full control over all virtual machines. Examples are: Citrix XenServer [18], VMware ESX/ESXi, KVM, and Microsoft Hyper-V hypervisors.

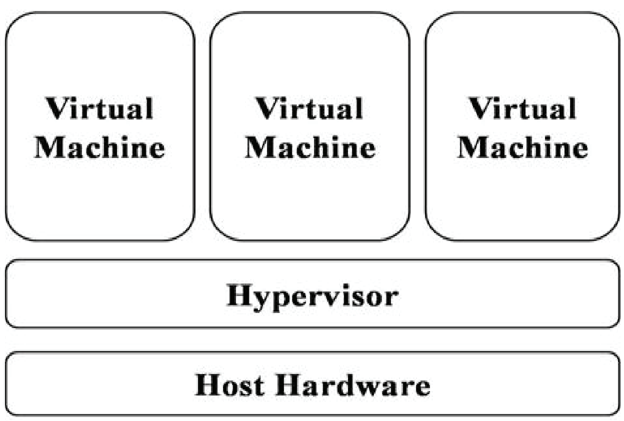

Figure 1.3 Bare-Metal Virtualization

Type II (Hosted): In this type hypervisors run within conventional operating system environment. Hypervisor is installed on the host operating system. Above hypervisor layer guest operating systems or virtual machines are installed. Examples are: VMware Workstation [19] and Virtual Box.

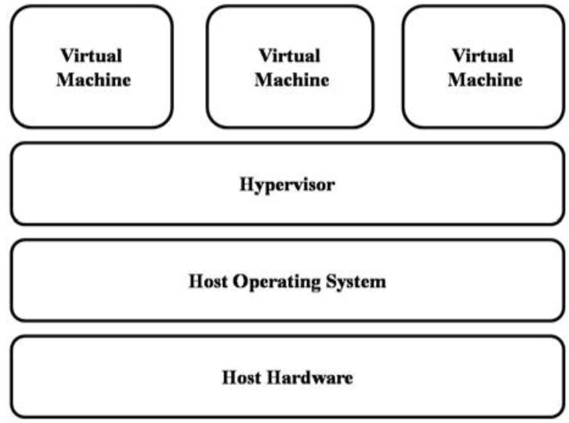

Figure 1.4 Hosted Virtualization

Advantages of virtualization

• ***Efficient use of hardware:*** The typical conventional server runs only one major application (e.g. Exchange) and might be using only 10-15% of its processing capacity. Virtualized hardware works hard and is more cost effective, particularly if it is running many virtual servers.

• ***Better and cheaper backup and disaster recovery***: A virtual computer can be backed up very easily as an "image" - unlike conventional backups, which require complex and often expensive software. The images can be restored onto dissimilar hardware, unlike conventional backups, which often can't. The image can be brought up almost instantly. This provides a working service while the primary computer is restored, and dramatically reduces downtime. It's also very fast and easy to roll back a computer to a previous version, instead of having to fix it in, say, the case of a virus infection.

• ***Better management***: Virtual computers can be centrally and efficiently managed. Central administration and "locked-down" desktop environments dramatically reduces support costs. Software can be installed and updated quickly and automatically across a virtual network. Virtual test machines can be created almost instantly so that testing can be done without any disruption of live machines.

• ***Ability to set up and test new machines:*** This can be done easily and with no disruption to live services.

• ***Less network infrastructure:*** Fewer physical machines mean less physical infrastructure – meaning lower purchase costs and less maintenance.

• ***Lower power and cooling costs***: This is particularly relevant to data centres or organizations with many servers.

• ***Lower co-location costs:*** Fewer physical servers take up less space, slashing collocation costs. This has allowed the hosted application industry (e.g. hosted Exchange, hosted QuickBooks) to fly.

• ***Better security:*** Virtualization can provide centralized and secured computing environments. Desktop virtualization takes data off individual workstations and laptops, removing the risk of data loss through physical theft or loss of desktop machines.

Disadvantages of virtualization

Single point of failure: If a virtualized server fails, the entire organization can be paralyzed. If a company uses virtualized desktops and the central hosting server goes down, users can literally do nothing on their desktops compared with conventional desktops where users can keep functioning even if the network is down, and a single desktop failure doesn't impact anyone else. This is a significant downside and no virtualized system should be put in place without proper contingency planning.

• ***More powerful hardware needed***: Virtualization uses fewer servers, and uses them better, but because they need to be more powerful, the reduction in total hardware costs may not be as dramatic as expected.

• ***Greater demands on the network***: Network and bandwidth requirements will be greater. If the virtualized server is hosted remotely, adequate and redundant bandwidth is needed, and this can push up running costs.

• ***Complexity:*** Virtualization increases complexity on a computer, making it harder to manage and troubleshoot, particularly if it is not properly set up and documented. Without good automation tools, a virtual server can be almost impossible to manage.

• ***Potential security problems***: Some sources feel that security can be more difficult to manage on a virtualized system. New forms of attack could target the virtualization software itself – though so far this has not happened.

• ***Third-party support issues:*** Some vendors may not be willing or able to support their software if it is running on a virtual server.

• ***Lower tolerance for poor management***: Operators of virtualized systems have to manage and document virtual environments properly. If they do not, they could end up with a messy jumble of virtual machines that can be costly in terms of time and unnecessary licenses.

IV. RESEARCH CHALLENGES IN CLOUD COMPUTING

Cloud computing is emerging technology which is being adapted by big organization as well as by small organizations. Due to complex and hybrid cloud computing architectures, many challenges arise. The research on cloud computing is still at an early stage. Many existing issues have not been fully addressed, while new challenges keep emerging from industry applications. Some of the challenging research issues in cloud computing are given below:

[A] Service Level Agreements (SLA's): It's important for customers to get guarantees from suppliers on service delivery. Cloud customers don't have management over the underlying computing resources, they must make sure the quality, convenience, responsible, and performance of those resources.

[B] Interoperability: The primary goal of ability is to comprehend the seamless fluid knowledge across clouds and between cloud and native applications [20].

[C] Reliability: The cloud servers also experience downtimes and slowdowns as our local server.

[D] Cloud Data Management & Security: There are various security problems such as information loss, phishing cause serious threats to organization's information and software system. Hence, more concerns on security issues, such as availability, confidentiality, data integrity, control, audit etc.

1. **Availability:** The goal of availability for cloud computing systems is to ensure its users can use them at any time, at any place.
2. **Confidentiality:** It keeps user's data secret in the cloud systems.
3. **Data integrity:** In the cloud system Information cannot be not lost or modified by unauthorized users.
4. **Control:** In the cloud system means to regulate the use of the system, including the applications, its infrastructure and the data.
5. **Audit:** It provides to monitor what happened in the cloud system.
6. **Data Encryption:** Data encryption provides security to the data. Encryption should be done before the data is moved to the cloud [21].

[E] Energy Management: The another major issue is energy management. . It has been estimated that the cost of powering and cooling accounts for 53% of the total operational expenditure of data centers [22]. Designing energy-efficient data centers design is big challenge.

[F] Server Consolidation: Server consolidation approach is used to maximize resource utilization while minimizing energy consumption in a cloud computing environment. Live VM migration technology is used to consolidate.

[G] Migration of virtual Machines: Virtual machine migration is a process to move a virtual machine or multiple virtual machines from one physical host to another physical host. It has evolved from process migration techniques [23]

More issues on cloud computing are:

- Multi-tenancy
- Common Cloud Standards
- Platform Management

V. CONCLUSION AND FUTURE WORK

In this paper, we present an overview of cloud computing. We also present its advantages and disadvantages and service and deployment model. We focus on its key technology "virtualization" and its types. Cloud computing is digital era technology which still has many research challenges which we mentioned in our paper. We believe that there are still several areas in cloud computing that require researcher's attention. In future we will have a detail study about cloud computing issues.

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Cloud Computing: Overview and Research Issues

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Abstract:
The computational world has become very large and complex. Cloud is an emerging technology in the world of Information Technology. Cloud computing offers IT capabilities as services. Cloud based services are on demand, scalable, device independent and reliable. Cloud computing is built on the virtualization concept. Virtualization separates hardware from software and has benefits of server consolidation and live migration. In this paper we present an overview of cloud computing and also describe about its key technology "virtualization". We are also presenting research challenges in cloud computing.

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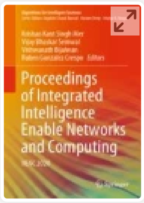

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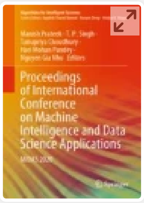

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