

DESIGN AND IMPLEMENTATION OF BOOTH MULTIPLIER IN COMPARISON WITH OTHER MULTIPLIERS

Shanmuga Priya.K¹, Ruth Anita Shirley.D²,Prabu Venkateswaran.S³

¹*PG students / ECE, SNS College of Technology, Coimbatore, (India)*

²*PG student / VLSI Design, SNS College of Technology, Coimbatore, (India)*

³*Assistant Professor, Dept. of ECE, SNS College of Technology, Coimbatore, (India)*

ABSTRACT

The multi-modulus design capable of performing the desired modulo operation for more than one modulus in Residue Number System. The Residue Number System and has been used for efficient carry free operation. It explores the efficient use of hardware resources by the use of Booth algorithm. This algorithm helps to reduce the partial products to half. Radix-4 and Radix-8 booth encoding algorithm has been employed. The Booth multiplier of both signed and unsigned numbers. The use of booth encoding optimizes area overhead and also increases the performance of multiplication process. This module has been implemented using Xilinx. The module has been programmed using Verilog.

Keywords: *Booth Multiplier, RNS, Radix.*

I INTRODUCTION

Residue Number Systems (RNS) allow the distribution of large dynamic range computations over small modular rings, which allows the speed up of computations. This feature is well known, and already used in both DSP and cryptography. Most of implementations use RNS bases of three elements to reduce the complexity of conversions, but if can increase the number of RNS modular computational channels, then we are able to compute over smaller rings and thus further increase the speed of computation. Residue Number System relay on Chinese Remainder Theorem. We consider a n-tuple of co-prime numbers (m_1, m_2, \dots, m_n) . We note $M = \prod_{i=1}^n m_i$, If we consider the n-tuple (x_1, x_2, \dots, x_n) of integer such that $x_i < m_i$. Then there exists an unique X which verifies:

$$0 \leq X < M$$

and

$$x_i = X \bmod m_i = (\bmod X) \text{ base } m_i \quad \text{pour } 1 \leq i \leq n$$

The n-tuple (m_1, m_2, \dots, m_n) of co-primes is generally called RNS basis.

The main interest of the Residue Number Systems is to distribute integer operations on evaluations with the residues values. Thus an operation with large integers is made on the residues which are small numbers and where

computations can be executed independently for each modulo allowing a complete parallelization of the calculus. The multiplication operation is present in many parts of a digital system or digital computer, most notably in signal processing, graphics and scientific computation.

With the recent advances in technology, many researchers have worked on the design of increasingly more efficient multipliers. The common multiplication method is add and shift algorithm. Multiplication can be considered as a series of repeated additions. The number to be added is the multiplicand, the number of times that it is added is the multiplier, and the result is the product. Each step of addition generates a partial product. In most computers, the operand usually contains the same number of bits. When the operands are interpreted as integers, the product is generally twice the length of operands in order to preserve the information content. This repeated addition method that is suggested by the arithmetic definition is slow that it is almost always replaced by an algorithm that makes use of positional representation. It is possible to decompose multipliers into two parts.

The first part is dedicated to the generation of partial products, and the second one collects and adds them. The basic multiplication principle is twofold i.e. evaluation of partial products and accumulation of the shifted partial products. It is performed by the successive additions of the columns of the shifted partial product matrix. The ‘multiplier’ is successfully shifted and gates the appropriate bit of the ‘multiplicand’. They are then added to form the product bit for the particular form. Multiplication is therefore a multi operand operation. To extend the multiplication to both signed and unsigned numbers, a convenient number system would be the representation of numbers in two’s complement format. Booth’s algorithms are meant for this.

II. COMPARISON OF MULTIPLIERS

An efficient multiplier should have following characteristics:-

Accuracy:- A good multiplier should give correct result.

Speed:- Multiplier should perform operation at high speed.

Area:- A multiplier should occupies less number of slices and LUTs.

Power:- Multiplier should consume less power.

Multiplication process has three main steps

1. Partial product generation.

2. Partial product reduction.

3. Final addition.

For the multiplication of an n -bit multiplicand with an m bit multiplier, m partial products are generated and product formed is $n + m$ bits long.

Here we discuss about three different types of multipliers which are

1. [Array Multiplier](#)
2. [Wallace Tree Multiplier](#)
3. [Booth Multiplier](#)

2.1 Array Multiplier

Array multiplier is well known due to its regular structure. Multiplier circuit is based on repeated addition and shifting procedure. Each partial product is generated by the multiplication of the multiplicand with one multiplier digit. The partial products are shifted according to their bit sequences and then added. The summation can be performed with normal carry propagation adder. $N-1$ adders are required where N is the no. of multiplier bits.

The Multiplication of two binary number can be obtained with one micro-operation by using a combinational circuit that forms the product bit all at once thus making it a fast way of multiplying two numbers since only delay is the time for the signals to propagate through the gates that forms the multiplication array. In array multiplier, consider two binary numbers A and B, of m and n bits. There are mn summands that are produced in parallel by a set of mn AND gates. $n \times n$ multiplier requires $n(n-2)$ full adders, n half-adders and n^2 AND gates. Also, in array multiplier worst case delay would be $(2n+1) t_d$.

2.1.1 Disadvantage

- It requires larger number of gates because of which area is also increased.
- Delay for this multiplier is larger.

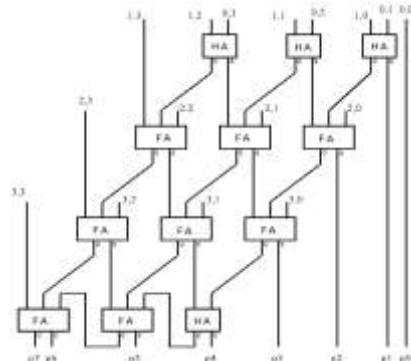


Fig2.1 Array Multiplier

2.2 Wallace Tree Multiplier

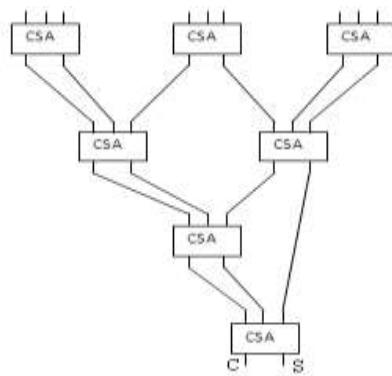


Fig2.2 Wallace Tree Multiplier

A Wallace tree multiplier is an efficient hardware implementation of a digital circuit that multiplies two integers devised by an Australian computer scientist Chris Wallace in 1964. Wallace tree reduces the no. of partial products and use carry select adder for the addition of partial products.

Wallace tree has three steps:-

1. Multiply each bit of multiplier with same bit position of multiplicand. Depending on the position of the multiplier bits generated partial products have different weights.
2. Reduce the number of partial products to two by using layers of full and half adders.
3. After second step we get two rows of sum and carry, add these rows with conventional adders.

Three bit signals are passed to a one bit full adder ("3W") which is called a three input Wallacetree circuit, and the output signal (sum signal) is supplied to the next stage full adder of the same bit, and the carry output signal thereof is passed to the next stage full adder of the same noof bit, and the carry output signal thereof is supplied to the next stage of the full adder located at a one bit higher position. Wallace tree is a tree of carry-save adders arranged as shown in figure 2.2. A carry save adder consists of full adders like the more familiar ripple adders, but the carry output from each bit is brought out to form second result vector rather being than wired to the next most significant bit. The carry vector is 'saved' to be combined with the sum later. In the Wallace tree method, the circuit layout is not easy although the speed of the operation is high since the circuit is quite irregular.

2.3 Booth Multiplier

Booth multiplication algorithm gives a procedure for multiplying binary integers in signed -2's complement representation. Following steps are used for implementing the booth algorithm:-Let X and Y are two binary numbers and having m and n numbers of bits(m and n are equal) respectively.

Step 1-Making booth table:

In booth table we will take four columns one column for multiplier second for previous first LSB of multiplier and other two (U and V) for partial product accumulator (P).

1. From two numbers, choose multiplier (X) and multiplicand (Y).
2. Take 2's complement of multiplicand (Y).
3. Load X value in the table.
4. Load 0 for X-1 value.
5. Load 0 in U and V which will have product of X & Y at the end of the operation.
6. Make n rows for each cycle because we are multiplying m and n bits numbers.

Step2-Booth algorithm:

Booth algorithm requires examination of the multiplier bits, and shifting of the partial product(P). Prior to the shifting, the multiplicand may be added to P, subtracted from the P, or left unchanged according to the following rules:

1. $X_i X_{i-1}$ operation

0 0 Shift only

1 1 Shift only

0 1 Add Y to U and shift

1 0 Minus Y from U and shift

2. Take U & V together and shift arithmetic right shift which preserves the sign bit of 2's complement number. So, positive numbers and negative numbers remain positive and negative respectively.

3. Circularly right shift X because this will prevent us from using two registers for the X value.

Repeat the same steps until n no. of cycles are completed. In the end we get the product of X and Y.

The Booth recording multiplier is one such multiplier; it scans the three bits at a time to reduce the number of partial products. These three bits are: the two bits from the present pair; and a third bit from the high order bit of an adjacent lower order pair.

After examining each triplet of bits, the triplets are converted by Booth logic into a set of five control signals used by the adder cells in the array to control the operations performed by the adder cells. To speed up the multiplication Booth encoding performs several steps of multiplication at once. Booth's algorithm takes advantage of the fact that an adder subtractor is nearly as fast and small as a simple adder. From the basics of Booth Multiplication it can be proved that the addition/subtraction operation can be skipped if the successive bits in the multiplicand are same. If 3 consecutive bits are same then addition/subtraction operation can be skipped. Thus in most of the cases the delays associated with Booth Multiplication are smaller than that with Array Multiplier. However the performance of Booth Multiplier for delay is input data dependent. In the worst case the delay with booth multiplier is on par with Array Multiplier. The method of Booth recording reduces the numbers of adders and hence the delay required to produce the partial sums by examining three bits at a time. The high performance of booth multiplier comes with the drawback of power consumption. The reason is large number of adder cells required that consumes large power

2.3.1 Booth Multiplication Algorithm for radix 2

Booth algorithm gives a procedure for multiplying binary integers in signed -2's complement representation.

I will illustrate the booth algorithm with the following example:

Example, $(2)_{10} * (-4)_{10}$

$(0010)_2 * (1100)_2$

Step 1-Making the Booth table

I. From the two numbers, pick the number with the smallest difference between a series of consecutive numbers, and make it a multiplier.

i.e., 0010 -- From 0 to 0 no change, 0 to 1 one change, 1 to 0 another change, so there are two changes on this one

1100 -- From 1 to 1 no change, 1 to 0 one change, 0 to 0 no change, so there is only one change on this one.

Therefore, multiplication of $2 \times (-4)$, where $(2)_{10}$ i.e $(0010)_2$ is the multiplicand and $(-4)_{10}$ i.e $(1100)_2$ is the multiplier.

II. Let X = 1100 (multiplier)

Let Y = 0010 (multiplicand)

Take the 2's complement of Y and call it $-Y - Y = 1110$

III. Load the X value in the table.

IV. Load 0 for X-1 value it should be the previous first least significant bit of X

V. Load 0 in U and V rows which will have the product of X and Y at the end of operation.

VI. Make four rows for each cycle; this is because we are multiplying four bits numbers.

Step 2-Booth Algorithm

Booth algorithm requires examination of the multiplier bits, and shifting of the partial product. Prior to the shifting, the multiplicand may be added to partial product, subtracted from the partial product, or left unchanged according to the following rules:

- Look at the first least significant bits of the multiplier “X”, and the previous least significant bits of the multiplier “X - 1”.
- Take U & V together and shift arithmetic right shift which preserves the sign bit of 2's complement number. Thus a positive number remains positive, and a negative number remains negative.
- Shift X circular right shift because this will prevent us from using two registers for the X value.

Table 2.1 Radix4 Modified Booth algorithm scheme for odd values of i .

X(i)	X(i-1)	X(i-2)	Y
0	0	0	+0
0	0	1	+y
0	1	0	+y
0	1	1	+2y
1	0	0	-2y
1	0	1	-y
1	1	0	-y
1	1	1	+0

2.3.2 Booth multiplication algorithm for radix 4

One of the solutions of realizing high speed multipliers is to enhance parallelism which helps to decrease the number of subsequent calculation stages. The original version of the Booth algorithm (Radix-2) had two drawbacks. They are:

- (i) The number of add/subtract operations and the number of shift operations becomes variable and becomes inconvenient in designing parallel multipliers.
- (ii) The algorithm becomes inefficient when there are isolated 1's. These problems are overcome by using modified Radix4 Booth algorithm which scan strings of three bits with the algorithm given above:

1) Extend the sign bit 1 position if necessary to ensure that n is even.

2) Append a 0 to the right of the LSB of the multiplier.

3) According to the value of each vector, each Partial Product will be 0, +y, -y, +2y or -2y.

The negative values of y are made by taking the 2's complement and in this paper Carry-look-ahead (CLA) fast adders are used. The multiplication of y is done by shifting y by one bit to the left. Thus, in any case, in designing a n-bit parallel multipliers, only $n/2$ partial products are generated.

III. SIMULATION RESULT AND ANALYSIS

3.1 Simulated Output of Array Multiplier

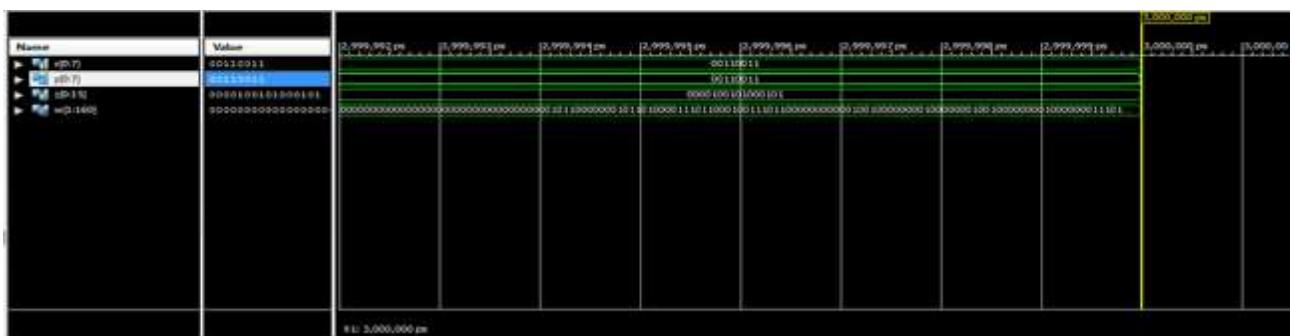


Fig 3.1 Simulated Input Output of Array Multiplier

3.2 Simulated Output of Wallace Tree Multiplier

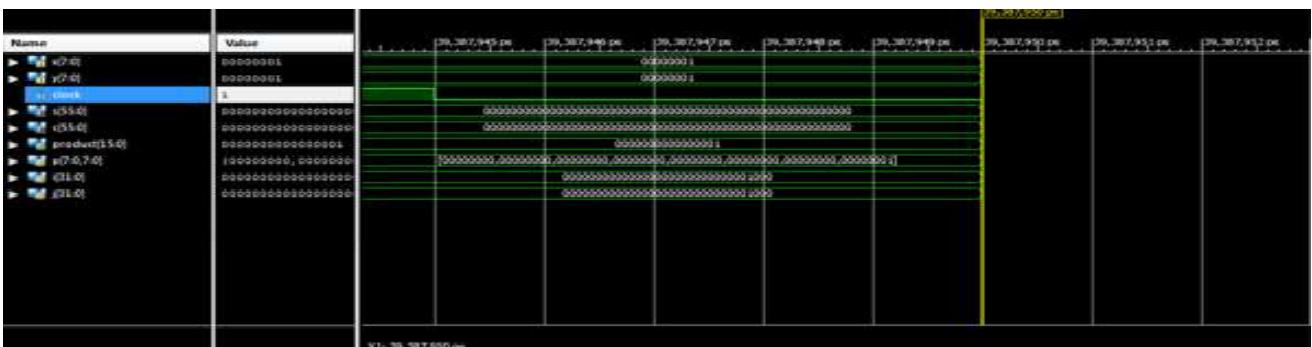


Fig 3.2 Simulated Input Output of Wallace Tree Multiplier

3.3 Schematic Diagram of Booth Encoder

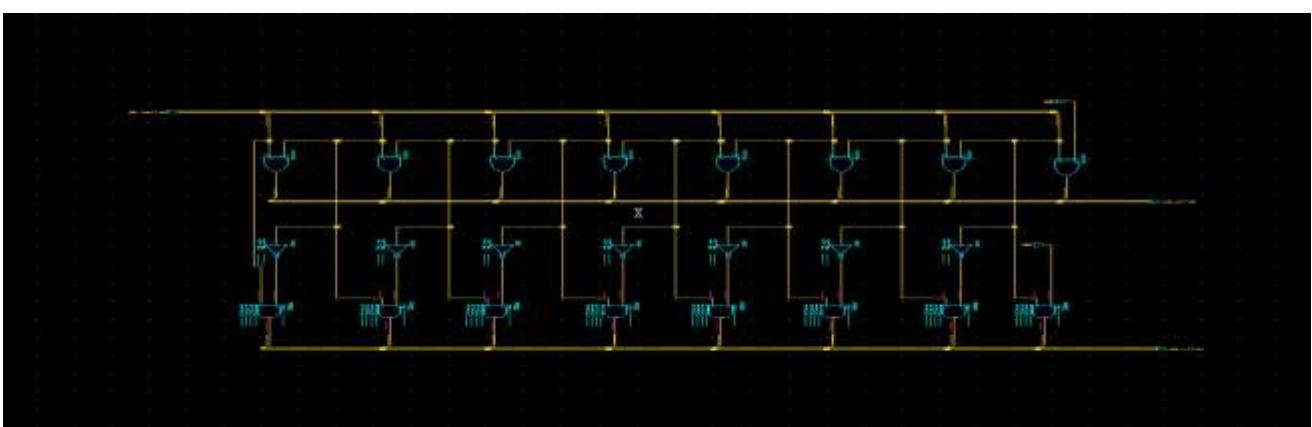


Fig 3.3 Schematic Diagram of Booth Encoder

3.4 Simulated Output of Booth Encoder

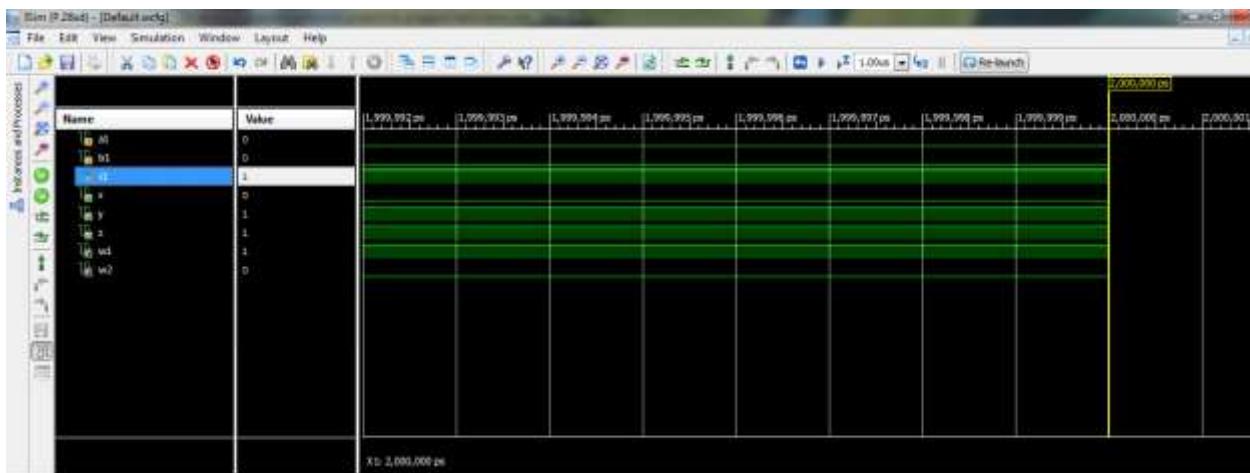


Fig 3.4 Simulated Input Output of Booth Encoder

3.5 Simulated Output of Booth Multiplier

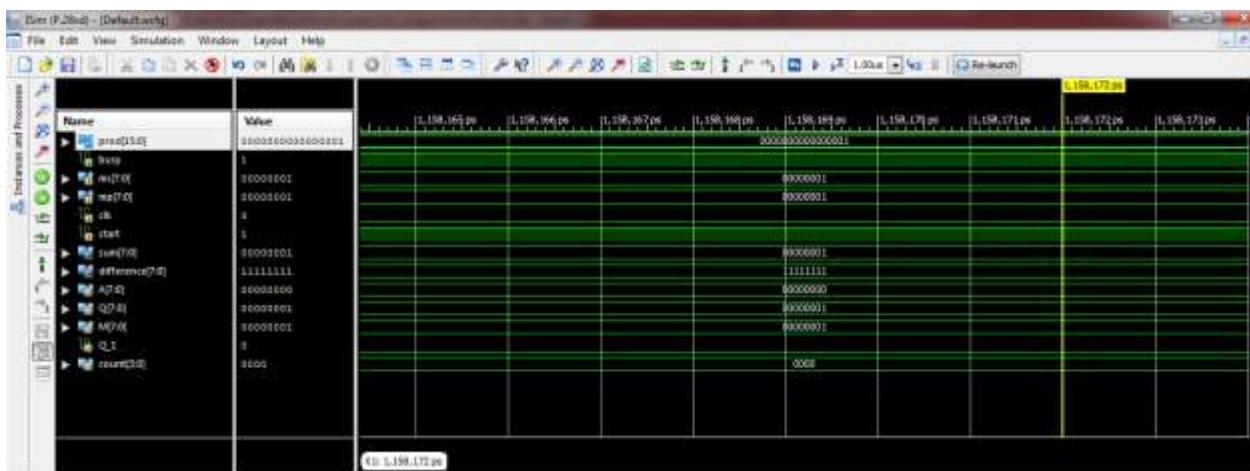


Fig 3.5 Simulated Input Output of Booth Multiplier

IV. CONCLUSION

Different types of 8-bit multiplier have been compared. As a result of comparison in terms of delay, Booth multiplier has been chosen to proceed the multiplication of both signed and unsigned numbers. It also becomes efficient for radix-4 and radix-8 modulo multiplication. It also reduces the number of partial products. Booth encoder saves nearly 40% of area. RNS, an integer system has been chosen since all the positions derive the same weight (base).

V. COMPARISON RESULT BETWEEN MULTIPLIERS**Table 5.1 Comparison of Multipliers**

	ARRAY MULTIPLIER	WALLACE TREE	BOOTH MULTIPLIER
DELAY (ns)	30.999	25.095	5.584
SLICES	72	65	28
LUT'S	126	122	45

REFERENCES

- [1] R. Muralidharan and C. H. Chang, "Area-power efficient modulo 2^n-1 and modulo 2^n+1 multipliers for $\{2^n-1, 2^n, 2^n+1\}$ based RNS," IEEE Trans. Circuits Syst. I, Reg. Papers, vol. 59, no. 10, pp. 2263–2274, Oct. 2012.
- [2] R. Muralidharan and C. H. Chang, "A simple radix-4 Booth encoded modulo 2^n+1 multiplier," in Proc. IEEE Int. Symp. Circuits Syst., Rio de Janeiro, Brazil, May 2011, pp. 1163–1166.
- [3] C. Efstathiou, K. Pekmestzi, and N. Axelos, "On the design of modulo 2^n+1 multipliers," in Proc. 14th Euromicro Conf. Digit. Syst. Design, Oulu, Finland, Aug. 2011, pp. 453–459.
- [4] J. W. Chen and R. H. Yao, "Efficient modulo 2^n+1 multipliers for diminished representation," IET Circuits, Devices, Syst., vol. 4, no. 4, pp. 291–300, Jul. 2010.
- [5] H. T. Vergos, C. Efstathiou, and D. Nikolos, "Diminished-one modulo 2^n+1 adder design," IEEE Trans. Comput., vol. 51, no. 12, pp. 1389–1399, Dec. 2002.
- [6] V. Palioras and T. Stouraitis, "Multifunction architectures for RNS processors," IEEE Trans. Circuits Syst. II, Analog Digit. Signal Process. vol. 46, no. 8, pp. 1041–1054, Aug. 1999.
- [7] G. C. Cardarilli, A. Del Re, A. Nannarelli, and M. Re, "Residue Number System reconfigurable datapath," in Proc. IEEE Int. Symp. Circuits Syst., Scottsdale, AZ, USA, May 2002, vol. 2, pp. 756–759.
- [8] C. Efstathiou, H. T. Vergos, and D. Nikolos, "Modified Booth modulo 2^n-1 multiplier," IEEE Trans. Comput., vol. 53, no. 3, pp. 370–374, Mar. 2004.
- [9] W. K. Jenkins and B. A. Schnaufer, "Fault Tolerant architectures for efficient realization of common DSP kernels," in Proc. 35th Midwest Symp. Circuits Syst., Washington, DC, USA, Aug. 1992, vol. 2, pp. 1320–1323.
- [10] H. T. Vergos and D. Bakalis, "Area-time efficient multi-modulus adders and their applications," Microprocessors Microsyst., vol. 36, no. 5, pp. 409–419, Jul. 2012.
- [11] C. H. Chang, S. Menon, B. Cao, and T. Srikanthan, "A configurable dual-moduli multi-operand modulo adder," in Proc. IEEE Int. Symp. Circuits Syst., Kobe, Japan, May 2005, vol. 2, pp. 1630–1633.
- [12] S. Menon and C. H. Chang, "A reconfigurable multi-modulus modulo multiplier," in Proc. IEEE Asia-Pacific Conf. Circuits Syst., Singapore, Dec. 2006, pp. 1168–1171.
- [13] D. Bakalis and H. T. Vergos, "Area-efficient multi-moduli squarer for RNS," in Proc. 13th Euromicro Conf. Digit. Syst. Design, Lille, France, Sep. 2010, pp. 408–411.

A SURVEY OF SIMULATION TOOLS FOR PERVASIVE APPLICATIONS

R. Vivadha¹, J. Uma Maheswari ²,

^{1, 2}Assistant Professor, Department Of CSE, Rajiv Gandhi College of Engg & Tech., (India)

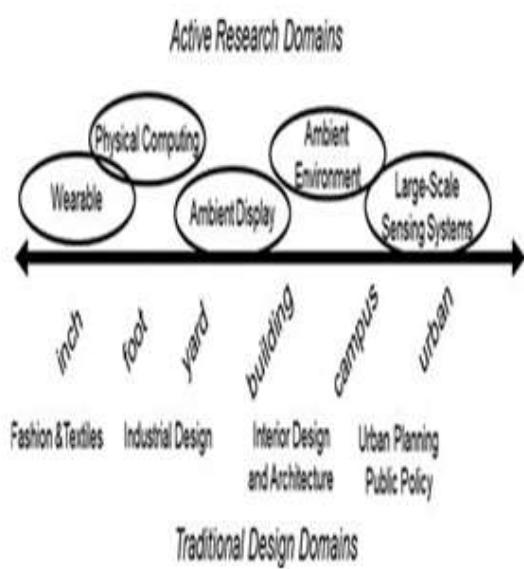
ABSTRACT

Pervasive computing needs a poise of computing, design, and business constraints to be considered all through the design process. Realizing this creation involves a level of design in mixture of different fields that is not present in current pervasive design tools. Besides the progress of the key technologies for pervasive computing, the design of application itself has materialized as a remarkable research area. In spite of much growth, developing a pervasive computing application ruins a challenge because of in need of conceptual frameworks and supporting tools. In this paper, a survey has been conducted with different tools that support the integration of analysis and the design process which helps to identify design considerations. The investigation is done as of which tool involve both designers and engineers to take part in the design process. Evaluation is also performed for each tool with the conventional metrics of pervasive design tools. These evaluations afford imminent to key metrics and allow tool designers to recognize the requirements of their intentional spectators.

Keywords: *Pervasive System, Context-Reorganization, Citycompiler, Diasuite, Sketchify.*

I. INTRODUCTION

Pervasive Computing also known as ambient, physical, embedded, environmental or ubiquitous computing was first introduced by technology prophet Mark Weiser in the year 1991. He visualized a world of entirely coupled devices with economical wireless networks where information is available everywhere. A world in which computers and information technologies become invisible, and impossible to differentiate from everyday life: ‘anytime, anywhere and always on’ concept has been came into use. Today, a family is encircled by hundreds of ‘invisible’ devices in the machines around them. Likewise, in a pervasive computing environment, computers and information processing turn out to be normal, and pierce into every object in our day by day lives. Until lately the ‘ubiquity’ was rarely heard, but nowadays, it has promptly come to mean just about anything having to do with global connectivity. Consequently, information technology perspectives are no longer appreciated so much for the immersiveness they propose as for how tangential they emerge to be, and in this way dropping information overload. In 2004, McCullough renowned that architecture has obtained a digital layer, which occupies the design of organizations, services and communications and it looks as if that both architecture and interaction design mutually can help to compile the required structure for a improved assimilation.^[5] The same as Edwards et al. depicted, the focus should be more on the ‘value for end-users’ than on the ‘core technical workability’. This target conveys new challenges to the design and evaluation of pervasive applications

**Fig-1 Pervasive Computing****Fig 2: Taxonomy of Pervasive Computing Domains**

As a design needs to determine both the technical and users' prompt features to maintain the acceptable user skills, the developers have to build the overall scenarios, so as to recognize the day by day practices of their users. Conversely, the day by day conditions are constantly varying, owing to the diverse perspective of use and the settings for communication, which causes the challenging prophecy in producing a set-up. For example it is extremely tricky to envisage how users will respond when designing an interactive service. Presently, the technical features for constructing pervasive applications are noticeable, due to the existing sensing, data processing and context-recognizing technologies. However for researchers, there is still in need for the criteria to design and estimate the features of the application itself. The purpose of features in a design today mainly depends upon the designers' practices and perceptions or on the particular styles supported by the particular infrastructure systems. It can also be evaluated that a good quality design of pervasive applications can quickly fix on to which elements should be limited within a given application and assess how well those features will put in value for users to tackle their requirements. It aids the designers in speeding up an iterative development process and in accepting the full intricacy of applications by setting the exact reasons in each design phase. In such cases, constructing a prototype is a core means, which permits the designers to reveal, assess or test a developing design with the negligible effort.^[8]

To appropriately implement pervasive systems, the designers must design them to tackle human desires and concerns. Design needs a considerate and harmonizing of appropriate constraints to find a suitable solution. Adding up to this, the vast scale of pervasive computing means this design will occur across multiple domains together with fashion, industrial design, architecture, urban planning.^[7]

Today, numerous tools for pervasive applications are present to satisfy the miscellaneous necessities devolved into the entire design process: from sketching the idea early with a low-fidelity prototype to deploying a high fidelity prototype and testing it in a practical environment. Compared to those more established application domains in pervasive computing, e.g. the middleware for prevailing over the heterogeneity via uniform interfaces, design tools are still at an early stage.^[8]

II. KEY REQUIREMENTS FOR PERVASIVE COMPUTING APPLICATIONS

Moreover to involve proficiency on underlying technologies, mounting a pervasive computing application also entails domain-specific architectural knowledge to gather information pertinent for the application, develop it, and execute actions. Some of the key requirements for developing pervasive computing applications are reviewed below: [3]

2.1 Abstracting Over Heterogeneity

Pervasive computing applications interrelate with entities whose heterogeneity has a tendency to penetrate in the application code, messing it with low-level details. [3] This condition need to raise the level of abstraction at which entities are raised, to factor entity variations out of the application code, and to protect it from distributed systems dependencies and communication protocol details.

2.2 Architecturing an Application

Theoretically, pervasive computing applications gather context information, process it, and carry out actions. Software development methodologies such as model driven engineering are also useful to design pervasive computing applications. [3] A prominent example is PervML which relies on the general-purpose modeling notations of UML to produce particular programming support. However, such approaches do not afford a conceptual framework to direct the design.

2.3 Leveraging Area-Specific Knowledge

Since the pervasive computing domain comprises an increasing number of areas, information about each area wants to be shared and made reusable to make easy the growth of applications. Reusability is required at two levels. [3] First, it is looked-for the entity level because applications in a given area frequently share the same classes of entities. Second, reusability is looked-for the application level to facilitate the developer to act in response to new requirements by using obtainable context computations.

2.4 Covering the Application Development Life-Cycle

Existing general-purpose design frameworks are standard and do not wholly sustain the development life-cycle of pervasive computing applications. To cover this life-cycle, a design framework explicit to the pervasive computing domain is required. This domain-specific design framework would get better yield and assist progress. [3] To make this design framework effectual, the conformance between the requirement and the implementation must be definite. After the application is implemented, tools should aid for all characteristic of its consumption. Maintenance and evolution are important matter for any software system. They are even more significant in the pervasive computing domain where new entities may be organized or detached at any time and where users may have varying needs. These maintenance and evolution phases should be supported by pervasive tools.

2.5 Simulation of the Environment

The use of a pervasive computing application involves abundant equipments to be obtained, tested, configured, and installed. In addition, some scenarios are hard to test because of the situations involved. [3] To overcome this

operation barrier, tools should be made available to the developer to test pervasive computing applications in a computer-generated environment.

III. PROPERTIES OF PervasivE TOOLS

An overview is made by categorizing the pervasive design tools by its properties which are discussed below: ^[7]

3.1 Multiple Representations

A key obscurity in design is the language or representation used to articulate a design. ^[3] Often interactive products are produced using a textual programming language, which is well-known to the engineers, but unknown to the designers. Having multiple, and probably concurrent, representations of a design defeats this problems by letting all members of a design team to take part in the design of an application and have a view that is appropriate for them.

3.2 User Defined Events

Pervasive applications depend greatly on sensor data collected from the physical world. These physical events can be as easy as the state of a switch, or they can be more difficult events such as the classification of an activity. ^[7] Apart from the event in difficulty, blending sensor data into significant information is a tricky task. For easy events, thresholds can be set on sensor data, but more difficult events must be examined with a machine learning algorithms. Several tools have developed methods to assist in fusing events from complex sensor data.

3.3 Knowledge Support

Including sensing and computing brings in a new material into the design process that is unknown to non-computing authority. ^[7] Dow et al. prompts this category by conversing how specialized designers necessitate information about current and imminent technologies to notify their design. Furthermore, when performing collaborative design, all parties must recognize how the basic technology behaves.

3.3 Testing and Device Support

Depending on the size of a pervasive system it may not be probable to have all devices or services there during design. ^[7] As well, the system will have to be tested using real or generated actions.

3.4 Integration with Current Practice

At last, tools are examined that challenge to integrate current design practice into the design of pervasive applications. ^[7] This guideline articulates to the heart of design and tries to use existing design practices to produce interactive computing elements. This approach continues designers within the normal dominion of design, permitting comfort and quick iteration.

IV. SURVEY OF DESIGN TOOLS

In this section we present a survey of design tools for pervasive computing. ^[7] In Section III we summarized the properties by which to evaluate the design tools.

4.1 Diasuite

DiaSuite is a tool suite which covers the development life cycle of a pervasive computing system. This tool suite consists of a domain-specific design language, a compiler for the language that generates a Java programming framework, an editor to identify simulation scenarios, and a 2D-renderer to imitate pervasive computing applications. This tool uses a software design approach to make the development process. DiaSuite presents a language, DiaSpec, devoted to architecturing pervasive computing systems.^[1] DiaSpec lets an area authority to define categorization by asserting the necessary entities of the system. DiaSpec also offers to declare the architecture of the system in the form of context and controller components. A simulation editor and 2D-renderer are also part of DiaSuite to imitate the resulting pervasive computing application.

4.2 Sketchify

Sketchify is a tool for sketching user interfaces. It gives designers the liberty to operate interactive materials by uniting elements of traditional freehand sketching with functional extension and end-user programming tools, such as spreadsheets and scripting.^[6] This tool has a number of features potentially helpful for sketching of interactive systems, as well as support for looking at complex technologies in an easy way, multiplicity and reuse of existing environments. Some of the benefits of using Sketchify tools are investigate the possibilities and limitations of technologies, mixture of components, extensibility and domain independence, reuse of existing environments, diversity of development styles and avoiding proprietary lock-in, promoting more efficient collaboration between designers and engineers.

4.3 Modkit

Modkit is a tool that makes it possible for learners and knowledgeable programmers /designers to fetch tangibles to life by contributing graphical command blocks stimulated by the Scratch programming environment. Modkit as a means for designing systems that entails sensing, actuation, programming, embedded design, and crafting. Participants will look for Modkit programming by using Crimp Cards easy-to-assemble kits of hardware components.^[3] It has as a feature found and manufactured materials into interactive projects by combining them in unpredicted ways. It interprets opinion from different types of sensors into light, motion, or sound. It expands Modkit activities for future designers from all backgrounds. It expands Modkit to improved support certain applications or user groups.

4.4 Inspirational Bits

Inspirational bits as a way to turn out to be more well-known with the design material in HCI, the digital material. The inspirational bits are described as rapid and filthy but fully working systems in both hardware and software constructed with the aim of revealing one or several of the dynamic properties of a digital material. It can also be used as one of the preliminary steps in a design process, making them alike to a technology-driven design process.^[10] These inspirational bits should be rapid to build. Whereas building the first bit in a material may take longer time, nearly all of the digital materials are very flexible and from our experience the second and third bit will take much fewer times to build. By this, we also believe the overall amount of time it takes to build interactive systems in fact will be shorter, in that we will keep away from fighting our material and instead functioning with it functioning out the design concept.

4.5 City Com Piler

CityCompiler is an integrated environment for the iteration-based development of spatial interactive systems.^[9] It envisages interactive systems in a virtual 3D space by combining the Processing source code and the 3D model of the real space, designed with Google SketchUp. Hybrid prototyping would be useful not only for organizing a system into the real world but also for designing a system with a new concept.

Tool name	Multiple Representations			User defined events		Knowledge support	Testing and device support	Integration with current practice	
	Visual and textual representations	States and code	Tangible	Demonstration	Infrastructure/API		Emulation and simulation	Sketching interaction	Field observations and storyboard
Diasuite	✓	✓	✓	✓	✓		✓		
Sketchify	✓	✓	✓					✓	✓
Modkit	✓	✓	✓						
Inspirational bits						✓			
CityCom piler	✓	✓		✓	✓				✓
d.note	✓	✓	✓	✓	✓		✓		
I*CATch	✓	✓	✓						
ESPranto SDK	✓	✓	✓		✓				
Xtel				✓	✓				
Makeit				✓	✓		✓		

Table 1: Comparison of Different Simulation Tools

4.6 d.note

d.note is a revision tool for user interfaces articulated as control flow diagrams. d.note initiates a command set for altering and interpreting both look and performance of user interfaces; it also describes execution semantics so proposed changes can be tested instantly. With d.note, users can set up alternatives for manifestation and application logic.^[2] d.note signifies the alternatives by duplicating the original state and visually summarizing both original and alternative. d.note was implemented as an extension to d.tools.

4.7 i*CATch

i*CATch wearable computing framework, was developed particularly for children and beginners to the field.^[6] The i*CATch framework is based upon a bus-based architecture, and is further scalable than the existing

alternatives. It comprises of a set of plug-and-play components, a construction platform with a homogeneous interface, and an easy-to-use hybrid text-graphical integrated development environment. The i*CATch construction kit was intended for the two reasons of sustaining creativity and make possible standardization in wearable computing.

4.8 ESPranto SDK

The ESPranto SDK is a part of the Edutainment Sensor Platform (ESP) which supports the growth of sensor/actuator based applications, most particularly in the domains of educational toys, games and lighting.^[11] ESPranto SDK is a toolkit that provides beginner programmers to build up simple applications, non-technical domain experts to build up professional content, and technical experts to extend complex building blocks for the other users to include in their applications. The SDK supports the end user's progression from trainee to expert programmer. The preclusion of runtime errors is a patent benefit of the SDK. To trim down development time and costs, the SDK must allow all users to develop applications with no or slight help from a software engineer. The SDK must permit users to switch effortlessly to a higher level of programming, i.e. without having to adjust their attitude. The SDK must be adaptable, in that it is not essential to produce a new tool for each hardware grouping.

4.9 XTel

XTel encompasses three tools: Moxa, Talktic and Entity Collaborator. The 'moxa' Micro Control Unit (MCU) board connects to sensors and actuators and is competent of short-distance wireless communications; the 'Talktic' programming/runtime environment for the MCU board that holds a JavaScript parser, compiler, VM and library; and the 'Entity Collaborator' P2P network library that is capable of managing continuous information such as video and audio in addition to the discrete information from sensors.^[12] The utilization of these tools allows both developers and designers to rapidly and effortlessly generate ubiquitous contents. 'XTel' is a progress support environment that facilitates the proficient making of these ubiquitous contents. The main drawback is that the consumers who are not familiar with programming cannot use it, because it is not easy to build up visual expression such as Processing.

4.10 MAKEIT

The MAKEIT framework an acronym for 'Mobile Applications Kit Embedding Interaction Times' is used to make functional, hi-fi prototypes for mobile devices following sophisticated interaction techniques. It simply produce and modify applications while at the same time provides support in keeping proposed end user interaction times low.^[9] An integrated development environment is used for hi-fi prototyping of mobile phone applications for producing a code framework for the ultimate implementation. A primary model based on state graphs confirms parts of the application logic and perceives faults in the navigational structure and propose alternatives. An integrated model is estimated for task completion times early on the design without calling for organizing a prototype on the actual target hardware platform.

V. RELATED WORK

The design of tools for pervasive computing mainly focuses on the ability and forms. Another consideration for the design of tools is based on how these tools are active in the design process life cycle. The design process life cycle is structured, linear cyclic and iterative. The key property of design tool is its flexibility. This paper mainly focuses on the properties needed for a tool that have various perspectives such as multiple representations, knowledge support etc., Tools that are used for designing must have the attribute of knowledge support so that the user can understand sensing technologies without implementation. The tools must allow for the expression of different ideas and also must support for different domains.

ESPranto SDK attempts to introduce beginners to program. However, domain specific tools such as iCATCH deals with wearable's and location based applications. When using multiple representations, the issues are the amount of linkage or coupling between the two representations. Tools such as DiaSuite, Sketchify, ESPranto SDK, Modkit supports visual and textual representations, state and code, Tangibles. These tools provides graphical user interface and make the user to generate the code efficiently. DiaSuite and Modkit are used as simulating tools. Simulation allows for a richer design experience that can test features such as user interaction and network performance estimation.

VI. CHALLENGES

6.1 Design Representation

While one of the attributes in the multiple representation of a single design, the issues in the determination of which representation is to use. The two parts in the multiple representations are visual and textual representation. Comparing these two representations, textual programming provides explicit control and conditional events which are more difficult to describe in a visual language where as visual representation is easier for beginner programmers and can more easily express continuous behaviors.

6.2 Simulation Environment:

A simulator for pervasive environment needs to serve three roles in the design process. They are as follows: (1) simulating the input space of an application, including the explicit (e.g., mouse or keyboard events) and implicit input (e.g., location sensed input when user moves); (2) simulating the logical control flow that jumps between sensors, servers, handhelds (such as PDA) and any other kinds of networking appliances; and (3) simulating the output space of an application, which means to visualize the environment effects caused by the application behaviors.

6.3 Understanding Context Awareness

Designers who are already familiar with the language can now build context-aware applications. However, the drawback is that the delivered context is not the desired information or is not suited for a particular application. In such case, the context recognition algorithms will need to be re-evaluated, which may cause major difficulty. Recent work has been conducted to provide end-users intelligibility in context aware systems (Lim and Dey, 2010) such that they can realize why certain actions were and were not taken. A similar intelligibility approach

is required to allow design teams to understand the behavior of recognition algorithms, and allow the parameters of the algorithm to be exposed and modified.

VII. CONCLUSION

In this paper, we have done a survey of the current studies in designing and evaluating pervasive applications. We have listed some of the key requirements to design a pervasive computing application and also some properties of pervasive tools. We have also summarized the need for design of pervasive computing systems and performed a survey of some tools.

REFERENCE

- [1] Benjamin Bertrana, Julien Bruneaua, Damien Cassoua, Nicolas Loriantb, Emilie Ballanda, Charles Consela, “DiaSuite: a Tool Suite To Develop Sense/Compute/Control Applications”, May 2012.
- [2] Björn Hartmann, Sean Follmer, Antonio Ricciardi, Timothy Cardenas, Scott R. Klemmer, “d.note: Revising User Interfaces Through Change Tracking, Annotations, and Alternatives”, ACM Transactions, April 2010.
- [3] Damien Cassou, Julien Bruneau, Charles Consel, Emilie Balland, “Towards A Tool-based Development Methodology for Pervasive Computing Applications”, March 2012.
- [4] Edward Baafi, Amon Millner, “A Toolkit for Tinkering with Tangibles & Connecting Communities”, ACM Transactions, Jan 2011.
- [5] A. Fatah gen. Schieck, A. Penn, V. Kostakos, E. O'Neilll, T. Kindberg, D. Stanton Fraser, T. Jones, “Design Tools for Pervasive Computing in Urban Environments”, *DDSS 2006*.
- [6] Grace Ngai, Stephen C.F. Chan, Vincent T.Y. Ng, Joey C.Y. Cheung, Sam S.S. Choy, Winnie W.Y. Lau and Jason T.P. Tse, “i*CATch: A Scalable, Plug-n-Play Wearable Computing Framework for Novices and Children”, ACM Transactions, April 2010.
- [7] Jason B. Forsyth, Thomas L. Martin, “Tools for interdisciplinary design of pervasive computing”, International Journal of Pervasive Computing and Communications, Vol. 8 Iss: 2 pp. 112 – 132.
- [8] Lei Tang, Zhiwen Yu, Xingshe Zhou, Hanbo Wang, Christian Becker, “Supporting rapid design and evaluation of pervasive applications: challenges and solutions”, Springer 2011.
- [9] Paul Holleis and Albrecht Schmidt, “MAKEIT: Integrate User Interaction Times in the Design Process of Mobile Applications”, Springer 2008, LNCS 5013, pp. 56–74.
- [10] Petra Sundström, Alex S. Taylor, Katja Grufberg, Niklas Wirström, Jordi Solsona Belenguer, Marcus Lundén, “Inspirational Bits Towards a Shared Understanding of the Digital Material”, ACM Transactions, May 2011.
- [11] Robert van Herk and Janneke Verhaegh, Willem Fontijn, “ESPranto SDK: an Adaptive Programming Environment for Tangible Applications”, ACM Transactions, April 2009.
- [12] Satoru Tokuhisa, Takaaki Ishizawa, Yoshimasa Niwa, Kenji Kasuya, Atsuro Ueki, Sho Hashimoto, Kazuhiko Koriyama and Masa Inakage, “xtel: A Development Environment to Support Rapid Prototyping of “Ubiquitous Content””, 2009.
- [13] Yasuto Nakanishi, Koji Sekiguchi, Takuro Ohmori, Soh kitahara, and Daisuke Akatsuka, “Hybrid prototyping by using virtual and miniature simulation for designing spatial interactive information systems”, 2011.
- [14] Zeljko Obrenovic and Jean-Bernard Martens, “Sketching Interactive Systems with Sketchify”, ACM Transactions on Computer-Human Interaction, Vol. 18, No. 1, Article 4, Publication date: April 2011.

A STUDY PAPER BASED ON COMPENSATION OF VOLTAGE DISTORTION AND MINIMIZATION OF HARMONIC USING UPQC

Vinod Kumar¹, Dr. Ravindra Pratap Singh²

¹*Ph.D Research Scholar, Department of Electrical Engineering, JJT University, Rajasthan, (India)*

²*Research Guide, Department of Electrical Engineering, J.B. Knowledge Park, Haryana, (India)*

ABSTRACT

This paper presents the comprehensive reviews for compensation of voltage distortion and minimization of harmonics in the power supply which is caused by the non-linear characteristic based loads. This paper present a broad overview on different possible topology of UPQC for single-phase and three-phase networks and recent development in the fields. It is observed that many researchers have used different names for the UPQC based on the application and topology. Hence keeping in view of the above concern, research has been carried out to compensation of voltage distortion and minimization of harmonics. The authors strongly believe that the literature survey will be very much useful to the researchers for finding out the relevant references in the field of power quality problems mitigated by UPQC.

Keywords: *Distribution Static Compensation (D-STATCOM), Harmonic Compensation, Hybrid Filters, Unified Power Quality Conditioner (UPQC), Voltage Distortion Compensation*

I. INTRODUCTION

Power quality issue are of great concern in transmission and distribution system nowadays due to the sensitive nature of load. In power system poor power quality due to different factors, such as voltage sag, voltage swell, poor power factor, and unaccepted level of harmonics in voltage and current waveforms. In distribution system at the load end are facing poor power quality. The reason behind this is the increase of electronics devices which are used by the residences as well as industry. For working properly these devices need high quality energy. The harmonics presence in the system results in several effects such as increased heating losses in motors, transformers and lines. In this scenario, provide quality power to the consumers is difficult for power utility companies. To compensate these identify power quality problems efforts are going on in the name of passive filters, active filters and hybrid filters. Passive filters has the limitations such as, fixed compensation, resonance with the source impedance of filter parameters have forced the use of active and hybrid filters. For enhancing the quality of the power supply and reliability a new technology custom power devices are emerged. Custom power devices include DVR, STATECOM and UCPC/UPQC. The UPQC Unified Power Quality Conditioner is one of the custom power device, which can compensate both voltage and current related problems. The UPQC is one of the APF family members where series and shunt functionalities are integrated together to achieve the control of voltage and current related problems. The shunt APF is usually connected across the loads to

compensate for all current related problems, whereas the series APF is connected in a series with the line through series transformer to compensate all voltage related problems.

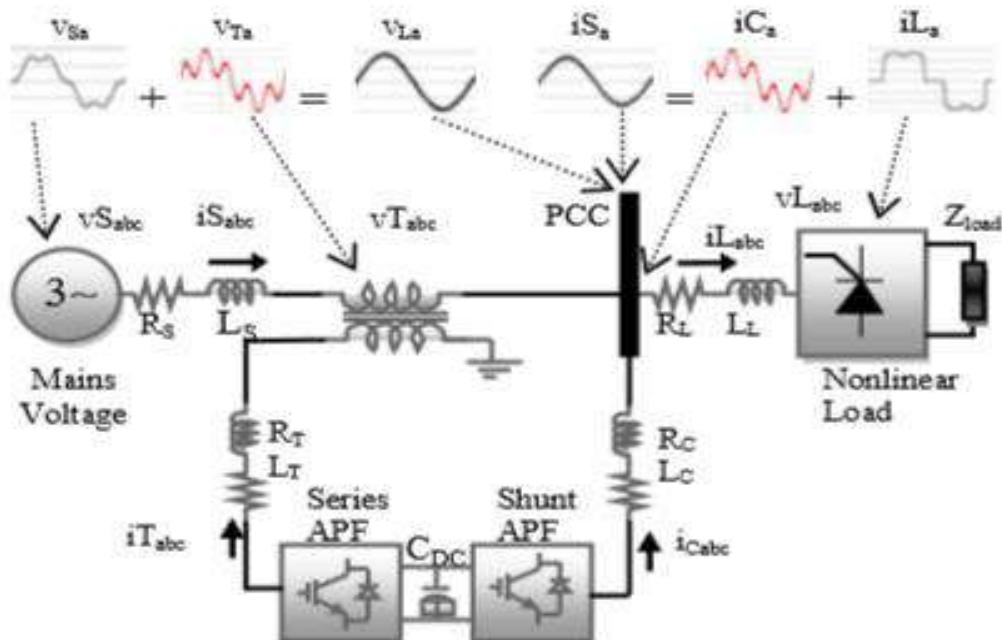


Fig. 1 Unified Power Flow Controller Configuration

II. LITERATURE REVIEWS

In **2009** Khadkikar Stated that due to numerous advantages offered by power electronics based equipments are a Major key component of today's modern power processing, at the transmission as well as the distribution level. Some devices, equipments, nonlinear load including saturated transformers, arc furnaces and semiconductor switches draw non-sinusoidal currents from the utility. Therefore a typical power distribution system has to deal with harmonics and reactive power support.

In **1998** Fujtha Stated that for low impedance path for current harmonics we used passive filters, so that they not flow in the supply and flow in the filter. These filters are applicable only to particular harmonics, for triple-N harmonics isolating transformer is useful and passive filters only for their designed harmonic frequency. The harmonics current is less predictable in some installations.

In **1999** Singh Stated that Improving the power factor and eliminating harmonic distortion we used power factor correction techniques that include both passive and active filters. To reduce phase shift and harmonics uses inductors, transformers, capacitors and other passive component in passive approach. The passive approach is heavier and less compact than the active approach, which is finding greater favour due to new technical developments in circuitry, superior performance and reduced components costs. Power factor correction techniques must be applied to each load or power supply in the system.

In **2000** Joao Afonso stated that for controlling current harmonics in supply networks at low to medium voltage distribution level or for reactive power and/or voltage control at high level, active Power Filters have become a solution,

In **2004** Das stated that, Frequency domain approaches are suitable for both single and three-phase systems. The Frequency domain algorithms are sine multiplication techniques, conventional Fourier and fast Fourier Transform (FFT) algorithms and modified Fourier series techniques.

In **2004** Chen stated that, APF's controls methods in the time domain are based on instantaneous derivation of compensating commands in the form of either voltage or current signals from distorted and harmonic polluted voltage or current signal.

In **2002** Ghosh stated that for Power (<100 KVA), medium Power (100KVA- 10MVA), and High Power (>10 MVA) application, APFs are used. In Single phase and three Phase systems APFs can be applied for low power applications. For Single Phase systems, APFs generally mitigate the current harmonics. For three- Phase systems, APFs generally provide acceptable solutions for unbalanced load current and mitigate the current harmonics. For medium and high power applications, the main aim is to eliminate or reduce the current harmonics.

In **2003** Karimi stated that reactive power compensation using active filters at the high voltage distribution level is not generally regarded as viable because of economic consideration. For high power applications, the harmonic pollution in high power ranges is not such a major problem as in lower power systems. Active filters applications in high power systems are the installation of parallel combination of several active filters because the control and co-ordination requirements of these filters are complicated.

In **2005** Jindal stated that for some applications the combinations of several types of filter can achieve greater benefits. The examined combinations are combination of both parallel and series active filters, combination of series active and parallel passive filters, combination of parallel active and passive filters and active filter in series with parallel filters. Seven-level APF configuration is also examined in this paper.

In **1995** Gunther stated that in medium and large capacity applications multilevel three-leg center-split VSIs are more preferable due to lower initial cost and fewer switching devices that need to be controlled. The multilevel series stacked converter topology, which allows standard three phase inverters to be connected with their DC busses in series.

In **2009** Jayanthi stated that the APF power circuit generally consists of DC energy storage unit, DC/AC converter and passive filter. Two main purposes serves by the DC capacitor (1) it maintains a DC voltage with a small ripple in steady state and (2) it serves as an energy storage elements to supply the real power difference between load and supply during the transient period.

In **2007** Kolhatkar stated that UPQC has the main advantage that it does not require any energy storage. UPQC can be designed to mitigate any sag above a certain magnitude , independent of its duration. This could result in a device that is able to compete with the uninterruptible power supply (UPS) typically used for the protection of low power and low voltage equipment. Separately configured DSTATECOM is less flexible than UPQC

In **1998** Aredes stated that universal active power line conditioner, universal active filter and universal power quality conditioning system are the different names of UPQC. It is a combination of a shunt (Active Power Filter) and a series compensator (Dynamic Voltage Restorer) connected together via a common DC link capacitor, which facilitates the sharing of the active power.

In **2012** Khadkikar stated that different topologies of UPQC are multilevel topology, single phase UPQC with two half-bridge converters, single phase UPQC with three legs, H bridge topology and UPQC is connected between two independent feeders to regulate the bus voltage of one of the feeders while regulating the voltage

across a sensitive load in the other. For simultaneous compensation of voltage and current in adjacent feeders a new configuration used named multi converter unified power quality conditioner.

In **2002** Basu stated that Series converter of UPQC is most of time in standby mode and conduction losses will account for the bulk of converter losses during the operation. In this mode, the series injection transformer works like a secondary shorted current transformer using bypass switches delivering utility power directly to the load. UPQC without injection transformer has been designed.

In **2011** Khadkikar stated that UPQC is a Custom Power device and consists of combined series active power filter that compensates voltage harmonics, voltage unbalance, voltage flicker, voltage sag/swell and shunt active power filter that compensates current harmonics, current unbalance and reactive current.

In **2004** Ghose stated that the generated reference signal is used to produce gate switching signals of the inverter. The main modulation techniques used in DVR are space vector PWM modulation, dead beat control, PWM control and hysteresis control. The hysteresis control has the advantages of quick controllability, easy implementation and variable switching frequency capability. PWM method is widely used for gate signal generation in custom power application.

In **2008** Khadkikar stated that the shunt APF is usually connected across the loads to compensate for all current related problems such as the reactive power compensation, power factor improvement, current harmonic compensation and load unbalance compensation, whereas the series active power filter is connected in a series with a line through series transformer. It acts as controlled voltage supply and can compensate all voltage related problems, such as voltage harmonics, voltage sag, voltage swell, flicker etc.

In **2010** Zhilli stated that this converter has both regenerated energy generation and active power filtering capabilities. An inductance for output filtering of VSI is used to eliminate the harmonic at different frequencies. The different combinations of L & C filters to attenuate the switching ripple currents.

In **2014** Rojin R.K stated that the compensation performance of shunt and series active filter depends on the turning on and turning off of semiconductor switches used in shunt and series active filter. To generate the gate pulses for VSI switches the hysteresis current controller scheme is used. The fuzzy logic controller eliminates the drawback of PI controller. This system can compensate for voltage sag/swell, harmonics in voltage and current waveforms and reactive power, for making the load voltage balanced and sinusoidal.

In **2010** Metin Kesler stated that the UPQC system mainly compensate reactive power, voltage and current harmonics in the load under non-ideal mains voltage and unbalanced load current conditions. In the condition of unbalanced and nonlinear load current or unbalanced and distorted mains voltage conditions the APF control algorithms eliminates the impact of distortion and unbalance of load current on the power line, making the power factor unity. The series APF isolates the load voltages and source voltage and the shunt APF provides three phase balanced and rated currents for the loads.

In **2008** Fatih Mekri stated that the UPQC has the ability to compensate sag, unbalanced voltages and current or voltage harmonics. The function of PAPF is to compensate current harmonics, to maintain the dc link voltage at

constant level and provide the variable required by the load. The function of SAPF is to mitigate the mains voltage perturbations. The current and voltage bands can be easily implemented with fuzzy logic to maintain the modulation frequency nearly constant for each control.

In **2011** Ahmet Take stated that control techniques play a vital role in the overall performance of the power conditioner. The rapid detection of the disturbance signal with high accuracy, fast processing of the reference signal, and high dynamic response of the controller are the prime requirements for desired compensation. A fuzzy logic controller has the rapid and effective compensation capability. The computational method is simpler than other control algorithms of reference extraction.

In **2008** Hind Djeghloud stated that the UPQC topology made up of a hybrid active power filter combination based on a common DC voltage for series and parallel APF. For both series and parallel APFs, we utilized the carrier based pulse width modulation PWM. The series APF controller forces load voltage to be sinusoidal, whereas parallel APF counter harmonic content from supply current.

In **2011** A. Mokhtatour stated that the UPQC has the capability of power flow control as well as power quality compensation. The controlling of UPQC was done by proper compositions of dqo and Fourier transform theories in sag, swell, interruption, unbalance and harmonic condition. In control of parallel active filter, active first order component of load current was determined as reference current for the reactive power compensation as well as current harmonics. In the reactive power compensation conditions, a PI controller was used for the control of load voltage phase in equal by source voltage source.

In **2010** Claudio A. Molina stated that under nonlinear and asymmetrical loads an UPQC with a Four-Leg Full-Bridge inverter (FLFB) used as a shunt active filter is used for improving the power quality. For the generation of the reference currents for the (FLFB) the instantaneous power theory in the dqz reference frame is used. The circulation of the active current in the PCC (point common coupling) side results in an optimal active power flow between the source and the load, but when the load has current harmonics it can produce distortion in the source current that can be undesirable.

In **2004** V. Khadkikar stated that in future, utility service provides will enforce more strict power factor and harmonic standards. One of the solutions towards this end is to employ a control technique based on unit vector templates generation has been proposed for UPQC. With the help of these techniques we can compensate input voltage harmonics and the current harmonics caused by the non-linear load.

III. CONCLUSION

A comprehensive review on the UPQC for compensation of voltage distortion and minimization of harmonics in the power supply at distribution level has been studied. UPQC in this context could be useful to compensate both voltage and current related problems simultaneously. Up to date development in the area of research and different aspects of UPQC have been briefly addressed. With the help of literature survey clearly identify particular application, utilization, configuration, and characteristic of the UPQC. It is desirable that the review on UPQC will serve as a useful reference guide to the researchers working in the area of power quality enhancement utilizing APFs. The control scheme of UPQC has the advantage of flexibility of selection of the power quality indices for which reference may be computed. The result of this study may be useful for selective compensation of different power quality problems and their combinations.

REFERENCES

- [1] Afonso J, Aredes M, Watanabe E, Martins J, ‘*Shunt Active Filter for Power Quality Improvement*’ *International Conference UIE 2000, Portugal, 1-4 Nov. 2000*, pp. 683-691.
- [2] Aredes M, Heumann K, and Walandble E H, ‘*An universal active power line conditioner.*’ *IEEE Trans. Power Del.*, vol. 13, no. 2, pp. 545-551, Apr. 1998.
- [3] Basu M., Das S.P., Dubey G.K., “*Experimental investigation of performance of a single phase UPQC for voltage sensitive and non-linear loads*”, *Proceedings, Power Electronics and Derive Systems*, vol. 1, Oct. 2001
- [4] Chen Y, Zha X, Wang J, Liu H, Sun J, and Tang H, ‘*Unified power quality conditioner (UPQC): The theory, modeling and application,*’ in *Proc. Int. Conf. Power Syst. Technol.*, 2000.
- [5] Chenand Y, Philippe L, “*Advanced control methods for the 3-phase unified power quality conditioner,*” in *Proc. Power Electron. Spec. Conf.*, Jun. 20-25, 2004, pp. 4263-4267
- [6] Das C, ‘*Passive filters- potentialities and limitations,*’ *IEEE Trans. Ind. Applicat.*, vol. 40, pp. 232-241, Feb. 2004.
- [7] Djeghloud H, Benalla H, and Bentounsi A, ‘*Supply current and load voltage distortions suppression using the unified power quality conditioner,*’ in *Proc. Syst., Signals Device*, Jul. 20-22, 2008
- [8] Forghani M and Afsharnia S, ‘*Online wavelet transform-based control strategy for UPQC control system,*’ *IEEE Trans. Power Del.*, vol. 22, no. 1, pp. 481-491, Jan. 2007
- [9] Fujita H and Akagi H, ‘*The unified power quality conditioner: the integration of series and shunt-active filters,*’ *IEEE Trans. Power Electron.*, vol. 13, no. 2, pp. 315-322, Mar. 1998.
- [10] Ghose A and Ledwich G, *Power Quality Enhancement Using Custom Power Devices*. Boston, MA: Kluwer, 2002.
- [11] Ghose A, Jindal A K and Joshi A, “*A unified power quality conditioner for voltage regulation of critical load bus,*” in *Procc. Power Eng.Soc. Gen. Meet.*, Jan, 6-10, 2004, pp. 471-476.
- [12] Gunther E W and Mehta H, ‘*A survey of distribution system power quality*’, *IEEE Trans. On Power Delivery*, vol. 10, No.1, pp. 322-329, Jan. 1995.
- [13] Han B, Bae B, Kim H, and Baek S, ”*Combined operation of unified power quality conditioner with distributed generation,*” *IEEE Trans. Power Del.*, vol. 21, no. 1 pp. 330-338, Jan. 2006.
- [14] Jindal A K, Ghose A, and Joshi A, “*The protection of sensitive loads from inters harmonic currents using shunt series active filters,*” *Elect. Power Syst. Res.*, vol. 73, pp. 187-196, 2005.
- [15] Karimi H, Karimi-Ghartemani M, Iravani M R, and Bakhshai A R, ‘*An adaptive filter for synchronous extraction on harmonics and distortions,*” *IEEE Trans. Power Del.*, vol. 18, no. 4, pp. 1350-1356, Oct. 2003.

SECURED OBJECT BASED STORAGE (OBS)

TECHNIQUE IN CLOUD COMPUTING

Suresh Kumar RG¹, Dr.K.Seetharaman², Saravanan S³

¹*Research Scholar, Vels University, Pallavaram, Chennai, (India)*

²*Associate Professor, DDE, Annamalai University, Annamalai Nagar, (India)*

³*Assistant Professor, Rajiv Gandhi College of Engineering and Technology, Puducherry, (India)*

ABSTRACT

Cloud services are becoming more and more portent for people's life. More or less people's are requested to submit or post some personal private information to the cloud by the Internet. When data is being processed, transformed and stored by the computer system must cache, copy or archive it. People have no knowledge about these copies and cannot manage them, so these copies may leak their privacy. The privacy can also be leaked via Service Providers negligence, hackers' intrusion or some legal actions. The existing system supported three types of assured delete; expiration time known at on-demand deletion of individual files, file creation and custom keys for classes of data. It ensures that all copies of the data become unreadable after a specific time, without any exact action on the part of a user. It also focuses on protecting deleted data with policy-based file assured deletion. Multiple copies of secret key are stored in various locations which could be hacked by the attackers. The proposed system contains TTL , time gets elapsed thereby printing the content, deleting original file, deleting the key. We create an ASO for every key shares which could be stored easily and retrieved for future purposes .By increasing the length of the key shares we can overcome attacks and overwriting of disks also takes place.

Keywords: -Cloud, TTL, ASO, Attacks.

I. INTRODUCTION

The US National Institute of Standards and Technology (NIST) define cloud computing as "a model for user convenience, on- demand network access contribute the computing resources (e.g. networks, storage, applications, servers, and services) that can be rapidly implemented with minimal management effort or service provider interference" Cloud computing can also be defined as it is a new service, which are the collection of technologies and a means of supporting the use of large scale Internet services for the remote applications with good quality of service (QoS) levels [4]. Cloud computing is has many technologies such as SaaS i.e. "Software as a Service", Paas i.e. "Platform as a Service", IaaS i.e. Infrastructure as a Service". Cloud Computing is a paradigm that focuses on sharing data and computations over a scalable network of nodes. Examples of such nodes include end user computers, data centers, and Cloud Services. We term such a network of nodes as a Cloud. Cloud service delivery is divided among three archetypal models and various derivative combinations.

The infrastructure (as a Service), respectively defined.

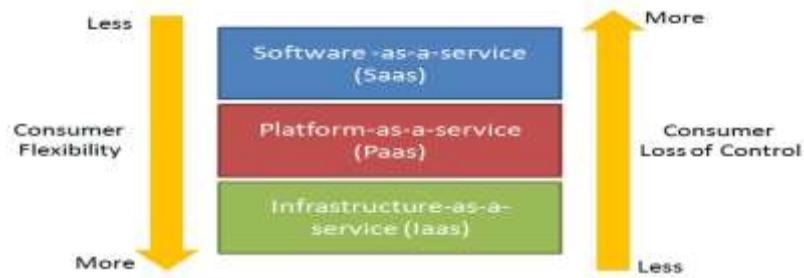


Fig1 -Cloud Service Model

1.1 Cloud Service Models

1.1.2 Cloud Software as a Service (SaaS)

The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a web browser (e.g., web-based email)

1.1.3 Cloud Platform as a Service (PaaS)

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages and tools supported by the provider(e.g., configurations)

1.1.4 Cloud Infrastructure as a Service (IaaS)

The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications.(e.g., host fire walls) [4]

1.2 Cloud Deployment Models

Regardless of the service model utilized (SaaS, PaaS, or IaaS) there are four deployment models for cloud services, with derivative variations that address specific requirements are depicted [4]

1.2.1 Public Cloud

The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.

1.2.2 Private Cloud

The cloud infrastructure is operated solely for a single organization. It may be managed by the organization or a third party, and may exist on-premises or off premises.

1.2.3 Community Cloud

The cloud infrastructure is shared by concerns (e.g., mission, security several organizations and supports a specific community requirements, policy, or compliance considerations). It may be managed by the organizations or a third party and may present on-premises or off-premises.

1.2.4 Hybrid Cloud

The cloud infrastructure is a composition of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability.

II. CLOUD SECURITY

Cloud computing and web services run on a network structure so they are open to network type attacks. One of these attacks is the distributed denial of service attacks. If a user could hijack a server then the hacker could stop the web services from functioning and demand a ransom to put the services back online. To stop these attacks the use of syn cookies and limiting users connected to a server all help stop a DDOS attack. Another such attack is the man in the middle attack. If the secure sockets layer (SSL) is incorrectly configured then client and server authentication may not behave as expected therefore leading to man in the middle attacks. It is clear that the security issue has played the most important role in hindering Cloud computing. Without doubt, putting your data, running your software at someone else's hard disk using someone else's CPU appears daunting to many. Well-known security issues such as data loss, phishing, and botnet (running remotely on a collection of machines) pose serious threats to organization's data and software. Moreover, the multi-tenancy model and the pooled computing resources in cloud computing has introduced new security challenges that require novel techniques to tackle with. [5]

2.1 Service Provider Security Issues

The public cloud computing surroundings offered by the cloud supplier and make sure that a cloud computing resolution satisfies organizational security and privacy needs. The cloud supplier to provision the safety controls necessary to safeguard the these organization's controls information and applications, information and additionally the proof provided regarding the effectiveness of migrating organizational functions into the cloud.

2.1.1 Identity and Access Management (IAM)

(IAM) features are Authorization, Authentication, and Auditing (AAA) of users accessing cloud services. In any organization "trust boundary "is mostly static and is monitored and controlled for applications which are deployed within the organization's perimeter. In a private data center, it managed the trust boundary encompasses the network, systems, and applications. And it is secured via network security controls including intrusion prevention systems (IPSSs), intrusion detection systems (IDSs), virtual private networks (VPNs), and multifactor authentication.

2.1.2 Privacy

Privacy is the one of the Security issue in cloud computing. Personal information regulations vary across the world and number of restrictions placed by number of countries whether it stored outside of the country. For a cloud service provider, in every jurisdiction a single level of service that is acceptable. Based on contractual commitments data can store within specific countries for privacy regulations, but this is difficult to verify. In case of Private and confidential customer's data rising for the consequences and potential costs of mistakes for companies that handle. But professionals develop the security services and the cloud service privacy practices.

An effective assessment strategy must cover data protection, compliance, privacy, identity management, secure operations, and other related security and legal Issues.

2.1.3 Securing Data in Transmission

Encryption techniques are used for data in transmission to provide the protection for data only goes where the customer wants it to go by using authentication and integrity and is not modified in transmission. SSL/TLS protocols are used here. In Cloud environment most of the data is not encrypted in the processing time, but to process data, for any application that data must be unencrypted. In a fully homomorphism encryption scheme advance in cryptography, which allows data to be processed without being decrypted. To provide the confidentiality and integrity of data-in-transmission to and from cloud provider by using access controls like authorization, authentication, auditing for using resources, and ensure the availability of the Internet-facing resources at cloud provider.

2.1.4 User Identity

In Organizations, only authorized users across their enterprise and access to the data and tools that they require, when they require them, and all unauthorized users are blocked for access. In Cloud environments support a large enterprise and various communities of users, so these controls are more critical. Clouds begin a new level of privileged users working for the cloud provider is administrators. And an important requirement is privileged user monitoring, including logging activities. This monitoring should include background checking and physical monitoring.

2.1.5 Audit and Compliance

An organization implements the Audit and compliance to the internal and external processes that may follow the requirements Classification with which it must stand and the requirements are customer contracts, laws and regulations, driven by business objectives, internal corporate policies and check or monitor all such policies, procedures, and processes are without fail. In traditional out sourcing relationships plays an important role for audit and compliance. In Cloud dynamic nature, increase the importance of these functions in platform as-a service (PaaS), infrastructure-as-a-service (IaaS), and software-as-a-service (SaaS) environments. [2]

2.2 Infrastructure Security Issues

Cloud suppliers provide security-related services to a good vary of client types; the security equipped to the foremost demanding clients is additionally created on the market to those with the smallest amount stringent necessities. Whereas Infrastructure Security Solutions and product are often simply deployed, they need to a part of an entire and secure design to be effective. [1]

2.2.1 Securing Data-Storage

In Cloud computing environment data protection as the most important security issue. In this issue, it concerns include the way in which data is accessed and stored, audit requirements, compliance notification requirements , issues involving the cost of data breaches, and damage to brand value. In the cloud storage infrastructure, regulated and sensitive data needs to be properly segregated. In the service provider's datacenter, protecting data privacy and managing compliance are critical by using encrypting and managing encryption keys of data in transfer to the cloud. At the cloud provider, the best practice for securing data at rest is cryptographic encryption

and shipping self encrypting is used by hard drive manufacturers. Self-encrypting provides automated encryption with performance or minimal cost impact. Software encryption is less secure and slower because the encryption key can be copied off the machine without detection.

2.2.2 Network and Server

Server-Side Protection: Virtual servers and applications, very like their non-virtual counterparts, have to be compelled to be secured in IaaS clouds, each physically and logically. Example, virtual firewalls are often used to isolate teams of virtual machines from different hosted teams, like production systems from development systems or development systems from different cloud-resident systems. Rigorously managing virtual machine pictures is additionally vital to avoid accidentally deploying pictures underneath development or containing vulnerabilities. Preventing holes or leaks between the composed infrastructures could be a major concern with hybrid clouds, as a result of will increase in complexity and diffusion of responsibilities. The supply of the hybrid cloud, computed because the product of the supply levels for the part clouds, also can be a concern; if the % availability of anyone part drops, the availability suffers proportionately. In cloud environment, purchasers want to form certain that every one tenant domains are properly isolated that no probability exists for data or transactions to leak from one tenant domain into successive.

2.3 End User Security Issues

End Users need to access resources within the cloud and may bear in mind of access agreements like acceptable use or conflict of interest. The client organization have some mechanism to find vulnerable code or protocols at entry points like servers, firewalls, or mobile devices and upload patches on the native systems as soon as they are found.[1]

2.3.1 Security-as-a-service

In Cloud environment the security provided by customers using cloud services and the cloud service providers (CSPs).Security-as-a-service is a security provided as cloud services and it can provide in two methods: In first method anyone can changing their delivery methods to include cloud services comprises established information security vendors. The second method Cloud Service Providers are providing security only as a cloud service with information security companies.



Fig- 2 Various Point of View of Cloud Security

2.3.2 Browser Security

In a Cloud environment, remote servers are used for computation. The client nodes are used for input/output operations only, and for authorization and authentication of information to the Cloud. A standard Web browser is platform in-dependent client software useful for all users throughout the world. This can be categorized into different types: Software as- a-Service (SaaS), Web applications, or Web 2.0. TLS is used for data encryption and host authentication. [7]

2.4 Authentication

In the cloud environment, the primary basis for access control is user authentication and access control are more important than ever since the cloud and all of its data are accessible to all over the Internet. Trusted Platform Module (TPM) is a widely available and stronger authentication than username and passwords. Trusted Computing Groups (TCG's) is IF-MAP standard about authorized users and other security issue in real-time communication between the cloud provider and the customer. Other such risks which are marked as high risk in cloud security are

2.4.1 Loss of Governance

In using cloud infrastructures, the client necessarily cedes control to the Cloud Provider (CP) on a number of issues which may affect security. At the same time, SLAs may not offer a commitment to provide such services on the part of the cloud provider, thus leaving a gap in security defenses. [8]

2.4.2 Lock-In

There is currently little on offer in the way of tools, procedures or standard data formats or services interfaces that could guarantee data, application and service portability. This can make it difficult for the customer to migrate from one provider to another or migrate data and services back to an in-house IT environment. This introduces a dependency on a particular CP for service provision, especially if data portability, as the most fundamental aspect, is not enabled.

2.4.3 Data Protection

Cloud computing poses several data protection risks for cloud customers and providers. In some cases, it may be difficult for the cloud customer (in its role as data controller) to effectively check the data handling practices of the cloud provider and thus to be sure that the data is handled in a lawful way. This problem is exacerbated in cases of multiple transfers of data, e.g. between federated clouds. On the other hand, some cloud providers do provide information on their data handling practices. Some also offer certification summaries on their data processing and data security activities and the data controls they have in place, e.g.,SAS70 certification. Data flowing from the Internet is filled with mal ware and packets intended to lure users into unknowing participation in criminal activities. [7]

III. LIMITATIONS OF CLOUD COMPUTING

3.1 Data losses / leakage

Cloud computing efforts to control the security of the data is not very better; accordingly API access control and key generation, storage and management deficiencies may result in data leakage, and also may lack the important data destruction policy. Leakage, and causes lack the vital- data destruction policy. [2]

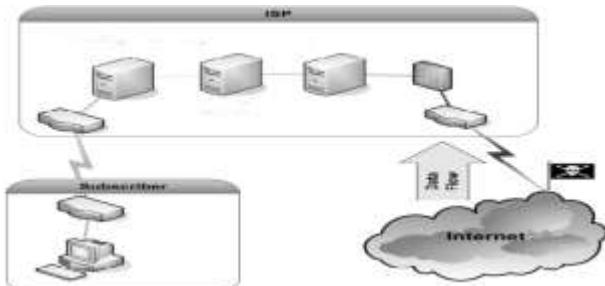


Figure-3 Security aspect of Cloud

3.2 Difficult To Assess the Reliability of Suppliers

Cloud computing service provider of background checks on staff strength may be related to corporate efforts which is then actually used to control data access which is different from many suppliers in this circumstances, but not enough, companies need to Evaluation of suppliers and propose to prove that how to filter the program staff.

3.3 Authentication Mechanisms Are Not So Strong

In cloud, huge data, applications and resources are collected and cloud computing is very weak authentication mechanism, then the attacker can easily obtain the client user account and log in the virtual machine. [6]

IV. CONCLUSION

In this paper, we explored the security issues at various levels of cloud computing service architecture. Security of customer information is a major requirement for any services offered by any cloud computing. We investigated ongoing security issues in Software-as-a-service (SaaS), Platform as a service (PaaS) and Infrastructure as a service (IaaS). Cloud computing systems challenge is assessing and managing risk. In the system lifecycle, risks that are identified should be rigorously balanced against the protection and privacy controls out there and therefore the expected edges from their utilization. However, one must be very careful to understand the security risks and challenges posed in utilizing these technologies. Cloud computing is no exception. In this paper key security considerations and challenges which are currently faced in the Cloud computing are highlighted.

REFERENCES

- [1] "Security Architecture of Cloud Computing", V.KRISHNA REDDY 1, Dr. L.S.S.REDDY, International Journal of Engineering Science and Technology (IJEST), Vol. 3 No. 9 September 2011.
- [2] 'The Effective and Efficient Security Services for Cloud Computing ",Sambhaji Sarode, Deepali Giri, Khushbu
- [3] Chopde, International journal of Computer Applications (0975 - 8887) Volume 34- No.9, November 2011
- [4] "Cloud Computing Security" Danish Jamil Hassan Zaki, International Journal of Engineering Science and Technology (IJEST), Vol. 3 No. 4 April 2011

YMCA, New Delhi (India), 1 Feb 2015

www.conferenceworld.in

- [5] Peter Mell, and Tim Grance, "Draft NIST Working Definition of Cloud Computing," 2009
- [6] <http://csrc.nist.gov/groups/SNS/cloud-computing>
- [7] "Cloud Computing Security Issues and Challenges", Kuyoro S. O.Ibikunle F., Awodele O.
- [8] Catteddu D. 2010 Cloud Computing. [Online] Available from: <http://w.enisa.europa.eu/act/rm/files/deliverables>
- [9] /cloud-computing risk- assessment [Accessed 26th April 2010]
- [10] <http://www.maintec.comblog/find-your-way-to-securecloud-part-2>

REDUCING POWER DISSIPATION IN NETWORK-ON-CHIP

J.Sowmya¹, B.Sivasankari², P.Poongodi³

^{1,2}*Department of ECE, SNS College of Technology, Coimbatore, (India).*

³*Department of ECE, VSB Engineering College, Coimbatore, (India).*

ABSTRACT

As technology get smaller, the power dissipated by the links of a network-on-chip (NoC) starts to compete with the power dissipated by the other elements of the communication subsystem, namely, the routers and the network interfaces (NIs). The proposed encoding technique whose goal is to reduce the power dissipated by point-to-point inter-router links of a NoC. The proposed schemes are general and transparent with respect to the underlying NoC fabric it does not require any modification of the routers and link architecture. Experiments carried out on both synthetic and real traffic scenarios show the effectiveness of the proposed schemes. The main advantage is to reduce power dissipation and energy consumption without any significant performance degradation and with less area overhead in the NI.

Keywords—Coupling Switching Activity, Data Encoding, Interconnection On Chip, Low Power, Network-On-Chip (Noc), Power Analysis.

I INTRODUCTION

As the number of IPs used to implement the functionalities demanded by the current systems-on-a-chip (SoCs) increases, the role played by the on-chip interconnection system becomes more and more important. The International Technology Roadmap for Semiconductors depicts the on-chip communication issues as the limiting factor, for performance and power consumption in current and next generation SoCs. Network-on-Chip (NoC) is generally viewed as the ultimate solution for the design of modular and scalable communication architectures. Nowadays, the on-chip communication issues are as relevant as, and in some cases more relevant than, the computation related issues. In fact, the communication subsystem increasingly impacts the traditional design objectives, including cost, performance, power dissipation, energy consumption, reliability, etc.

A NoC-based communication infrastructure promises flexibility in network topology, the support of advanced routing algorithms, flow-control and switching techniques, and the possibility of guarantying quality-of-service requirements. The basic elements which forms a NoC based interconnect are network interfaces (NIs), routers, and links. As technology shrinks, the power dissipated by the links is as relevant as (or more relevant

than) that dissipated by routers and NI on power dissipated by network links. Links dissipate power due to the switching activity (both self and coupling) induced by subsequent data patterns traversing the link. Focus on data encoding schemes as a viable way to reduce power dissipated by the network links.

These advantages over bus-based architectures comes at the cost of increase in complexity which pushes the communication system to become one of the main elements of a SoC which strongly impact the cost, power, and performance figures of the overall system. For instance, in the Intel's 80-tiles TeraFLOPS processor over 30% of the chip area is dedicated to the communication system and the communication power accounts for about 28% of the total. In the Ethereal NoC the largest percentage of power dissipation (54%) is due to the NoC clock, followed by the NoC links (18%). It has been shown that on-chip interconnects account for a significant fraction (up to 50%) of the total on-chip energy consumption.

II FEATURES

To meet the growing computation-intensive applications and the needs of low-power, high-performance systems, the number of computing resources in single-chip has enormously increased, because current VLSI technology can support such an extensive integration of transistors. By adding many computing resources such as CPU, DSP, specific IPs, etc to build a system in System-on-Chip, its interconnection between each other becomes another challenging issue. In most System-on-Chip applications, a shared bus interconnection which needs an arbitration logic to serialize several bus access requests, is adopted to communicate with each integrated processing unit because of its low-cost and simple control characteristics.

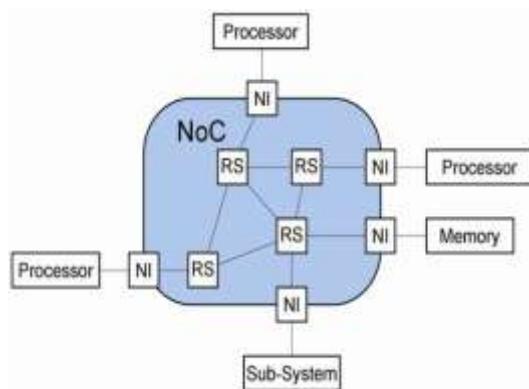


Fig.1 Basic Structure of Network-On-Chips

III OVERVIEW OF THE PROPOSAL

In the proposed scheme, an encoder and a decoder block are added to the NI. The basic idea of the proposed approach is encoding the flits. It has been done before they are injected into the network with the goal of minimizing

the self-switching activity and the coupling switching activity in the links traverse by the flits. The encoder encodes the outgoing flits of the packet such that the power dissipated by the inter-router point-to-point link is minimized, except for the header flit. In fact, self-switching activity and coupling switching activity are responsible for link power dissipation. This end-to-end encoding technique takes advantage of the pipeline nature of the wormhole switching technique. Since the same sequence of flits passes through all the links of the routing path, the encoding decision taken at the NI may provide the same power saving for all the links.

IV PROPOSED ENCODING SCHEME

In this section present the proposed encoding technique whose goal is to reduce the power dissipated by point-to-point inter-router links of a NoC. Before start to discuss the proposed technique, briefly analyze the different contributions which determine the power dissipated by a link.

Table 1. How Transition Mutate if Data is Inverted

Time	Normal	Inverted
t-1	Type I 00 00 11 11	Type I 00 00 11 11
	t 01 10 01 10	10 01 10 01
t-1	Type II 01 10	Type II 01 10
	t 10 01	01 10
t-1	Type III 00 01	Type III 00 11
	t 11 00	00 11
t-1	Type IV 00 11 01 10	Type IV 00 11 01 10
	00 11 01 10	11 00 10 01
	T ₄ * T ₄ **	T ₃ T ₂

For each partition, the first line represents the values at time t-1, whereas the second line the values at time t. For instance, looking at the first partition which reports Type I transitions, the first column 00 → 01 indicates that, on time slot t, lines I and i+ 1 of a link were 0 and 0, respectively, and in the next time slot t they switch to 0 and 1, respectively.

As can be observed from Table 1, Type I transitions still remain Type I transitions if the flit is inverted. Type II and Type III transitions will mutate in Type IV transitions if the flit is inverted. Type IV transitions mutate either in

Type II or Type III transitions. In particular, transitions indicated as T^*_4 in the table mutate in Type III transitions whereas those indicated with T^{**}_4 mutate in Type II transitions. Similarly, it is simple to find that $T'_{0 \rightarrow 1} = T_{0 \rightarrow 0}$.

4.1 Scheme I-Encoder

In scheme I, we focus on reducing the numbers of Type I transitions (by converting them to Types III and IV transitions) and Type II transitions (by converting them to Type I transition). The scheme compares the current data with the previous one to decide whether odd inversion or no inversion of the current data can lead to the link power reduction.

4.1.1 Power Model

The dynamic power consumed by the interconnectors and drivers is given by:

$$P = [T_{0 \rightarrow 1} (C_s + C_l) + T_c C_c] V_{dd}^2 F_{ck} \quad (1)$$

Where, V_{dd} is the supply voltage, F_{ck} is the clock frequency, C_s is the self-capacitance (which includes the parallel-plate capacitance and the fringe capacitance), C_l is the load capacitance and C_c is the coupling capacitance. $T_{0 \rightarrow 1}$ and T_c are the average number of effective transitions per cycle for C_s and C_c respectively. They are computed as follows. $T_{0 \rightarrow 1}$ counts the number of $0 \rightarrow 1$ transitions in the bus in two consecutive transmissions. T_c counts the correlated switching between physically adjacent lines. Precisely, it can enumerate four types of coupling transitions as follows. A Type I transition occurs when one of the lines switches while the other stays unchanged. In a Type II transition one line switches from low to high and the other from high to low. A Type III transition occurs when both lines switch simultaneously. Finally, in a Type IV transition both lines do not switch. The effective switched capacitance varies from type to type.

Thus, the coupling transition activity T_c is a weighted sum of the different type of coupling transition contributions.

$$T_c = k_1 T_1 + k_2 T_2 + k_3 T_3 + k_4 T_4 \quad (2)$$

Where the T_i , $i = 1, 2, 3, 4$, are the average number of transition type i and k_i are weights. Assume $k_1 = 1$, $k_2 = 2$ and $k_3 = k_4 = 0$. That is, k_1 is assumed as reference for other types of transition. The effective capacitance in Type II transition is usually twice that of a Type I transition. In Type III transition, as both signal switch simultaneously, C_c is not charged (here assume that there are no misalignment between the two transitions). Finally, in Type IV transition there is no dynamic charge distribution over C_c . Based on this, Equation (1) can be expressed as follows:

$$P = [T_{0 \rightarrow 1} (C_s + C_l) + (T_1 + 2T_2) C_c] V_{dd}^2 F_{ck} \quad (3)$$

The proposed encoded technique primary goal is to minimize T_1 and T_2 , and to minimize $T_{0 \rightarrow 1}$ as secondary goal. Looking at equation (1) and (2) have following expression

$$P \propto T_{0 \rightarrow 1} C_s + (k_1 T_1 + k_2 T_2 + k_3 T_3 + k_4 T_4) C_c \quad (4)$$

If the data (from now on, the flit) is inverted, the link power consumption will be

$$P' \propto T'_{0 \rightarrow 1} C_s + (k_1 T'_1 + k_2 T'_2 + k_3 T'_3 + k_4 T'_4) C_c \quad (5)$$

Thus, equation (5) can be expressed in function of T_1, T_2, T_3, T'_4 and T''_4 as

$$P' \propto T_{0 \rightarrow 0} C_s + [k_1 T_1 + k_2 T''_4 + k_3 T'_4 + k_4 (T_2 T_3)] C_c. \quad (6)$$

It is convenient to invert the flit before transmission if $P > P'$. Taking equation (4) $k_1 = 1, k_2 = 2, k_3 = k_4 = 0$ and $C_c/C_s = 4$, we obtain the following invert condition:

$$T_{0 \rightarrow 1} + 8T_2 > T_{0 \rightarrow 0} + 8T''_4 \quad (7)$$

In conclusion, the proposed encoding scheme simply inverts the flit before its transmission if and only if the invert condition equation (7) is satisfied. In the next subsection, we assess the hardware implications of implementing this encoding scheme into the network interface in a NoC based system. Looking again at the invert condition equation (7) and considering a link width less than or equal to 8 bit, if T_2 is greater than T''_4 then the invert condition is satisfied. Use this algorithm as the base for the implementation of the encoding logic.

The proposed encoding architecture, which is based on the odd invert condition defined is shown in Fig.2. Consider a link width of w bits. If no encoding is used, the body flits are grouped in w bits by the NI and are transmitted via the link.

In our approach, one bit of the link is used for the inversion bit, which indicates if the flit traversing the link has been inverted or not. More specifically, the NI packs the body flits in $w - 1$ bits [Fig.2]. The encoding logic E , which is integrated into the NI, is responsible for deciding if the inversion should take place and performing the inversion if needed.

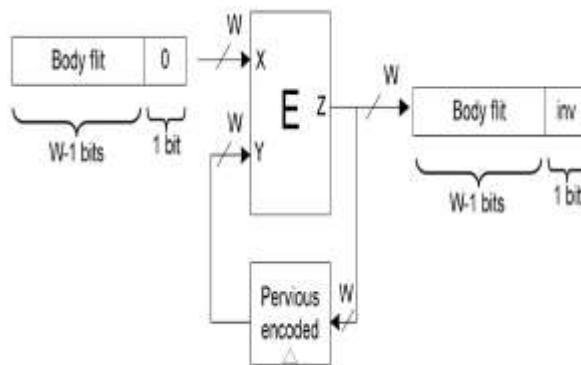


Fig.2 Encoder Architecture Scheme I

The generic block diagram shown in Fig.2 is the same for all three encoding schemes proposed and only the block E is different for the schemes. To make the decision, the previously encoded flit is compared with the current flit being transmitted. This latter, whose w bits are the concatenation of $w - 1$ payload bits and a "0" bit, represents the first

input of the encoder, while the previous encoded flit represents the second input of the encoder [Fig.3]. The $w - 1$ bits of the incoming (previous encoded) body flit are indicated by X_i (Y_i), $i = 0, 1, \dots, w - 2$.

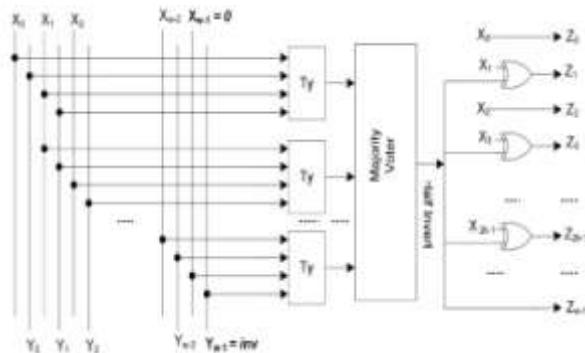


Fig.3 Internal View of the Encoder Block

The w^{th} bit of the previously encoded body flit is indicated by inv which shows if it was inverted ($\text{inv} = 1$) or left as it was ($\text{inv} = 0$). In the encoding logic, each T_y block takes the two adjacent bits of the input flits (e.g., $X_1X_2Y_1Y_2$, $X_2X_3Y_2Y_3$, $X_3X_4Y_3Y_4$, etc.) and sets its output to “1” if any of the transition types of T_y is detected.

V RESULTS AND DISCUSSION

Fig.4 shows the area, delay, and power overhead due to the encoding/decoding logic. The decoder is the same for all the techniques. It simply inverts the input data if the inv bit is asserted. Since its complexity is negligible as compared with that of the encoders, omit it from this analysis. Assume 12-bit link and for each encoder type E consider three different versions named E4, E8 and E12.

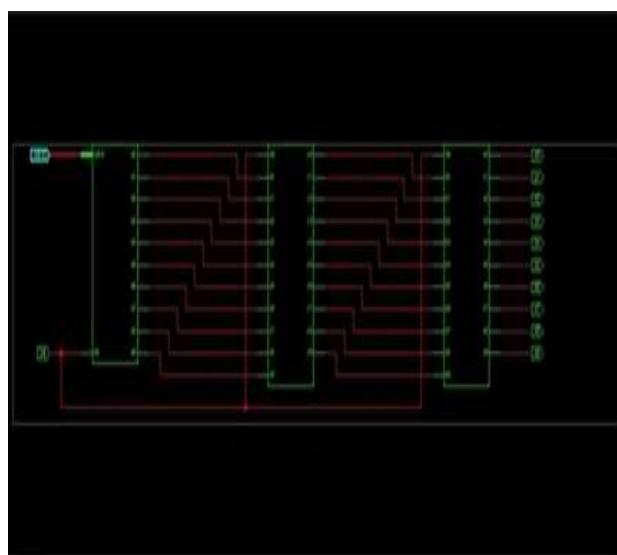


Fig.4 RTL View of Proposing System

Fig.5 shows the output waveform of Scheme-I Encoder .In this 10 bit X0 – X9 is given as input. This input is given to Ty block in which D latch and XOR operation is performed. The output of Ty is given as input to majority voter. In this majority voter majority number of bit is determined (may be ‘0’ or ‘1’). Finally XOR operation is performed and the output obtained is denoted as Z0 – Z9.



Fig.5 Output Waveform of Scheme-I Encoder

VI CONCLUSION AND FUTURE WORK

In this project a new data encoding technique which allows reducing the power dissipated by the links of a NoC and contributed by both the self-switching activity and the coupling switching activity. The proposed data encoding technique (SCS) exploits the wormhole switching and operates end-to-end. when data encoding is used as compared to the case in which no data encoding is used. Of course, the analysis takes into consideration the overhead both in area and power and the delay due to the insertion of the encoding and decoding logic into the network interface. compared SCS against the bus-invert coding (BI) and the coupling driven bus invert coding (CDBI) as they have the highest potential for power saving while still represent a feasible implementation for on-chip communication found that SCS outperforms BI and CDBI both in terms of power dissipation and energy consumption. Precisely, for a set of representative data stream, obtained up to 26% power reduction and up to 9% energy reduction

REFERENCES

- [1] W. Wolf, A. Jerraya, and G. Martin, “Multiprocessor system-on-chip MPSoC technology,” IEEE Trans. Comput.-Aided Design Integr. Circuits Syst., vol. 27, no. 10, pp. 1701–1713, Oct. 2008.
- [2] L. Benini and G. De Micheli, “Networks on chips: A new SoC paradigm,” Computer, vol. 35, no. 1, pp. 70–78, Jan. 2002.

- [3] C. P. Fan and C. H. Fang, "Efficient RC low-power bus encoding methods for crosstalk reduction," *Integr. VLSI J.*, vol. 44, no. 1, pp. 75–86, Jan. 2011.
- [4] S. R. Vangal, J. Howard, G. C. Roberts and S. Y. Borkar, "TeraFLOPS processor in 65-nm CMOS," *IEEE J. Solid-State Circuits*, vol. 43, no. 1, pp. 29–41, Jan. 2008.
- [5] S. Murali, C. Seiculescu, L. Benini, and G. De Micheli, "Synthesis of networks on chips for 3D systems on chips," Jan. 2009, pp. 242–247.
- [6] C. Seiculescu, S. Murali, L. Benini, and G. De Micheli, "A tool for networks on chip topology synthesis for 3-D systems on chips," in Proc. IEEE vol. 29, no. 12, pp. 1987–2000, Dec. 2010.
- [7] M. R. Stan and W. P. Burleson, "Bus-invert coding for low-power I/O," *IEEE Trans.(VLSI) Syst.*, vol. 3, no. 1, pp. 49–58, Mar. 1995.
- [8] S. Ramprasad, N. R. Shanbhag, and I. N. Hajj, "A coding framework for low-power address and data busses," *IEEE Trans. Very Large Scale Integr. (VLSI) Syst.*, Jun. 1999.

DOES BRAND PERSONALITY HAVE AN INFLUENCE ON CUSTOMER ENGAGEMENT USING FACEBOOK?

S. Sharma¹, E. Nagpal²

^{1,2} University Business School, Panjab University, (India)

ABSTRACT

Marketers have long been debating over the significant role played by Brand Personality in engaging customers, especially since the advent of Web 2.0. Brands have distinguishing human like characteristics which form their personality that in turn helps connect with the customer. However, not many studies have been found on the subject, particularly in India. The aim of this study was to investigate the relationship between Brand Personality and Customer Engagement in the Restaurant Industry using the Social Media platform of Facebook. The research was also extended to study the impact of Non-Personality attributes on Customer Engagement. An empirical analysis was conducted after collecting data from 100 respondents from the tricity- Chandigarh, Panchkula, Mohali. The findings suggested that both Personality and Non-Personality attributes have a significant impact on Customer Engagement. However, the Non-Personality Attributes were found to have a stronger impact as compared to Brand Personality. In the end, the paper discusses key managerial implications of the study conducted.

Keywords: Brand Personality, Customer Engagement, Social Media, Restaurant Industry

I INTRODUCTION

In traditional marketing, brands used to communicate with customers by conventional advertising ways such as a print ad or a corporate website. With the dawn of the era of Web 2.0, this has radically changed to a two-way interaction between the customers and the brands and amongst customers themselves. This is a double edged sword for brands, if positive word travels through happy customers, it can make the brand a hero, on the other hand, if negative feedback is given by one disgruntled customer, it can reach out to millions overnight and completely ruin the brand. The emergence of new media provides businesses with an opportunity to start a two-way digital conversation with the audiences and makes it almost effortless for an individual customer to talk back and also talk to each other [1]. “Engage or die” is the new marketing catchphrase, which emerged as a result of the rise of social media in the past few years [2]. New Media like Facebook, Twitter, YouTube, MySpace, etc comprise Web2.0 that assists the two-way interaction. Thus, a dire need of understanding the various opportunities presented by this new media was felt amongst academicians and practitioners.

The Restaurant Industry in India is chiefly driven by the young population aged 15-44 years. It has grown at a CAGR of 6.6% from FY'2008 to FY'2013 [3]. Many international chains like KFC, McDonald's, Dominos, Pizza Hut have dominated the organized restaurant market in the country for a long time now. Restaurant Social Media Index (RSMI) was created and developed by DigitalCoCo, an agency that builds restaurant brands through social media, apps, and other digital initiatives aimed at creating a trusted source for return on investment for social media in restaurant and hospitality [4]. On analyzing the social footprints of restaurants, the engagement of customers is calculated and consumer behaviour is predicted. According to this Index, top 250 restaurants brands were enlisted in Quarter 2 of 2014. It consisted of brands that are rocking their overall social footprint via excellent engagement levels with their customers through social media. Starbucks, Subway, McDonald's were amongst the top performers.

Branding is an imperative measure to succeed in today's world of business. It does not just mean giving a brand name or indicating that such a product or service has been stamped with the mark of an organization, but expands to being a strategy which organizes the market driven by an idea. Marketing academicians and practitioners attempt to differentiate their brands from others and to make their brands desirable for consumers based on functional (e.g. price, quality and warranty) and emotional approaches (e.g. brand personality perceptions) [5]. Brand Personality is used as one of such tools to convey consumers' emotional responses to a brand. It also helps in distinguishing it from others beyond attractive functional characteristics. With the explosion of brands in different industries of the Indian market, brands of distinguishing features are available based on our choice, taste and culture. From the car we drive to the food we take, we demand varying attributes in every brand. These personalities that the brands hold make them appear in a different way in different situations. A successful brand is the one which creates a long term bonding with the consumers by evoking a sense of interest with its personality. Competition is increasing swiftly; changes do challenge the status quo and branding needs to be regularly adapted to stay efficient and effective [6]. The companies should diligently work towards sustaining the bonding created by the brand's personality and image with the customers as the long term vision of a company is not just to generate a single sale contract but to be on the top of the customer's recall list. The concept of brand personality plays an important role in the successful management of brands. A company establishes better relationships with its customers by using personality directed brand management. Hence, it becomes crucial to examine the significance of brand personality in customer engagement and eventually in the decision making of the marketers as an essential variable for branding success.

II REVIEW OF LITERATURE

2.1 Brand Personality

The American Marketing Association (AMA) defines brand as "a name, term, sign, symbol, or design, or a combination of them, intended to identify the goods and services of one seller or group of sellers and to differentiate them from those of competitors". According to De Chernatony and MacDonald [7], a brand goes beyond physical constituents and what it stands for, it has some additional attributes which although maybe intangible but are still important to consumers consideration. "The set of human characteristics associated with a

brand, which makes it unique, compared to other brands” [8]. “A brand’s personality embodies all of the qualities it has to offer over and above its primary characteristics and its functional purpose” [9]. The notions that brands have personality and that the relationship between consumers and brand personality is very significant for success are regarded as the most important concepts in the fields of marketing and advertising [10]. There are various scales used to measure Brand Personality like Aaker’s five dimensions sincerity, excitement, competence, sophistication and ruggedness [11] based on the “Big Five” human personality dimensions, [12], [13] 12 item scale to operationalize personality dimensions etc. Companies Nowadays direct all the marketing activities at making consumers believe and recognize a brand personality, and reinforcing the relationship between the brand and the consumer [14]. Thus, we can say that brand personality is something which helps the consumers in relating to a particular brand. Besides all the functional benefits derived from the product, the brand personality adds value to the brand in a way that improves its overall image. It is a way a brand would speak or behave. A strong and positive personality of a brand can thus, help in enhancing the image of the brand in the eyes of the customers and make them more loyal towards a specific brand. All these features make brand personality a very useful tool for the marketers in today’s competitive world of business.

2.2 Customer Engagement

Bowden [15] presents customer engagement as a sequential psychological process that customers move through to become loyal towards a brand. This process is suggested to model the mechanisms by which loyalty may be developed and maintained for two different types of customers – new and existing. The final goal is an intense, active relationship between the brand and the customer, part of which is engagement with the brand expressed as customer eagerness to talk about the brand, learn about it, and exhibit its use [16]. The concept of engagement is multidimensional and comprises the expressions of emotional, behavioural and cognitive engagement specific to this particular context [17]. Cheung et al. [18] have initiated a study exploring customer engagement in online social platforms. They have defined it as “the level of a customer’s physical, cognitive, and emotional presence in connections with a particular online social platform”. Thus, Customer Engagement is a two-way interaction between customers with one another and with a brand. The initiative for engagement can either be taken by the consumer or by the company via an online or an offline media. Online Customer Engagement is different from offline Customer Engagement. It helps in customer awareness, customer acquisition, customer satisfaction, brand loyalty and electronic word-of-mouth. Kevin Ertell [19] elaborated on the concept of ‘Customer Engagement Cycle’ in 2010. He said that this cycle comprised of Customer Awareness, Customer Acquisition, Customer Satisfaction, Customer Conversion, Customer Retention and finally, Customer Referral. All these components combine to form the complete Customer Engagement Cycle. Each of these components, when aimed at individually, result in successfully engaging the customer. The Economist Intelligence Unit [20] establishes the importance of customer engagement in the following statement. “Companies are now realizing that engagement is also a more strategic way of looking at customer and stakeholder relationships. In this emerging approach, engagement refers to the creation of a deeper, more meaningful connection between the company and the customer, and one that endures over time. Engagement is also seen as a way to create customer interaction and participation.”

III RESEARCH OBJECTIVE

To provide valuable insight into the relationship between Brand Personality and Customer Engagement in the Restaurant Industry using the Social Media platform of Facebook and offer a foundation for future research on the aforementioned subject. This study empirically tests the association and impact between the three variables, viz-a-viz Brand Personality, Non-Personality Attributes and Customer Engagement. Consequently, it throws light on whether Brand Personality or Non-Personality Attributes or both affect customers' engagement on social media.

IV RESEARCH METHODOLOGY

The research is **descriptive** in nature. It aims at investigating the relationship and impact of brand personality and non-personality attributes on customer engagement with restaurant brands on social media.

4.1 Hypotheses

H1: There is a significant relationship of Brand Personality with Customer Brand Engagement through Facebook Fan Page.

H2: There is a significant impact of Brand Personality on Customer Brand Engagement through Facebook Fan Page.

H3: There is a significant relationship of Non-Personality Brand Attributes with Customer Brand Engagement through Facebook Fan Page.

H4: There is a significant impact of Non-Personality Brand Attributes on Customer Brand Engagement through Facebook Fan Page.

4.2 Sample Design And Sample Size

A total of 100 respondents were contacted for carrying out the research out of which those that were completely filled and usable were 86. **Purposive sampling** was used for collecting primary data in order to arrive at the findings of the research. The duration of data collection spanned over about 40 days during September- October 2014. To collect data, prospective customers were approached at various restaurant outlets in and around the tricity: Chandigarh, Panchkula, Mohali.

4.3 Research Instrument

A self-administered questionnaire was developed for the purpose of collecting primary data to arrive at empirically tested results. The questionnaire contained four sections as under:

- i. Demographics
- ii. Brand Personality

- iii. Non Personality Attributes
- iv. Customer Engagement

The questionnaire contained 35 items to record responses in order to study the relationship and impact of brand personality and non personality attributes on customer engagement. Therefore, brand personality and non personality attributes are the independent variables, whereas, customer engagement is the dependent variable in this research.

4.4 Research Tools

SPSS 22 Software is used to conduct analysis on the data collected. Statistical tools: Correlation and Regression Analysis are used to analyze data and derive useful findings so as to arrive at conclusions which will have practical managerial implications.

4.5 Analysis of Data

H1: There is a significant relationship of Brand Personality with Customer Brand Engagement through Facebook Fan Page.

Variables	N	Sig. (2-tailed)	Pearson Correlation (r)
Brand Personality	86	.000	.601
Customer Engagement	86		

From the table above, we can see that there is a positive correlation between Brand Personality and Customer Engagement with $r=0.601$. Hence, H1 is accepted.

H3: There is a significant relationship of Non-Personality Brand Attributes with Customer Brand Engagement through Facebook Fan Page.

Variables	N	Sig. (2-tailed)	Pearson Correlation (r)
Non Personality Attributes	86	.000	.694
Customer Engagement	86		

From the table above, we can see that there is a positive correlation between Non Personality Attributes and Customer Engagement with $r=0.694$. Hence, H3 is accepted.

H2: There is a significant impact of Brand Personality on Customer Brand Engagement through Facebook Fan Page.

H4: There is a significant impact of Non-Personality Brand Attributes on Customer Brand Engagement through Facebook Fan Page.

Regressio	Variables	R	R Square	Adjusted R	F	Sig.
1	Brand Personality and	.601	.362	.354	47.602	.000
1	Non Personality	.694	.482	.476	78.214	.000

The results of the regression analysis show that both, Brand Personality and Non Personality Attributes have a significant impact on Customer Engagement. However, the impact of Non Personality Attributes is more as compared to the Brand's Personality. The values of adjusted R^2 have come out to be 0.354 and 0.476 respectively. Thus we can say that 35.4% change in Customer Engagement can be explained by the Brand's Personality whereas, 47.6% change Customer Engagement can be explained by the Non Personality Attributes of the brand.

V CONCLUSION

The study conducted was aimed at exploring the relationship between Brand Personality and Customer Engagement in the Restaurant Industry using Facebook Fan Page. An effort was made to make the research more comprehensive by studying the impact of Non-Personality Attributes also. The results of the empirical analysis indicate that in fact, Non Personality Attributes impact Customer Engagement more than the Brand's Personality. However, both were found to have a positive impact on Customer Engagement. This explains the importance of creating a brand image in order to engage customers aggressively on social media, which in turn will help bring in more and more customers to the restaurants due to the connect they feel with the brand. As almost every restaurant seeks to provide similar quality standards, the marketers need to focus on the brand image to make the restaurant unique and attractive. Consumers seem to prefer brands with distinctive personalities, with which they can identify themselves.

VI MANAGERIAL IMPLICATIONS

The results of the study substantially prove that both Brand Personality and Non Personality Attributes affect Customer Engagement. They help in giving insights on how restaurateurs can take advantage of social media in order to establish, develop and maintain customer relationship by. The results contribute to the existing literature and make valuable suggestions for future research. For Marketing Managers, the results carry specific significance as they help in differentiating the personality profile of each brand. The findings can be used to promote brands according to their Brand Personality by relating it to the target audience.

Social media is growing exponentially in India, and young people are connecting with it on a very regular basis. This is proving to be a great platform for a two-way communication between the brand and the customers. Thus, the opportunities presented by this new media in terms of engaging the socially present and aware customer are

tremendous. However, the highly dynamic nature of the industry makes further research into the subject very recommendable to identify new customer engagement patterns.

REFERENCES

- [1] Deighton, J., & Kornfeld, L, Interactivity's unanticipated consequences for marketers and marketing, *Journal of Interactive Marketing*, 23(1), 4-10, 2009.
- [2] Nelson-Field, K., & Taylor, J., Facebook fans: A fan for life? *Admap*, 25-27, 2012.
- [3] India Restaurant Market Outlook to 2018 Report, Ken Research Private Limited, 2013.
- [4] RSMI, <http://rsmindex.com/about-us/>.
- [5] Keller, Kevin Lane, "Conceptualizing, Measuring, and Managing Customer-Based Brand Equity," *Journal of Marketing*, 57, 1-22, 1993.
- [6] Randall, G., *Branding – A Practical Guide to Planning, Organising and Strategy*. London, UK: Kogan Page Limited, 1997.
- [7] De Chernatony, L. and McDonald, M. *Creating Powerful Brands in Consumer, Service and Industrial Markets*, 3rd ed, Oxford, Butterworth-Heinemann, 2003.
- [8] Aaker David A., *Building Strong Brands*, New York: Free Press, 1996.
- [9] Patterson, Maurice, "Re-Appraising the Concept of Brand Image," *Journal of Brand Management*, 6 (6), 409-26, 1999.
- [10] Freling, Traci H. and Lukas P. Forbes, "An Empirical Analysis of the Brand Personality Effect," *Journal Of Product & Brand Management*, 14, 404-413, 2005.
- [11] Aaker, Jennifer L., "Dimension Of Brand Personality," *Journal of Marketing Research*, 34, 347-356, 1997.
- [12] Briggs, Steven, "Assessing the Five-Factor Model of Personality Description," *Journal of Personality*, 60 (2), 253-93, 1992.
- [13] Geuens, M, Weijters, B., & De Wulf, K. A New Measure of Brand Personality. *International Journal of Research in Marketing*, 26, (2), 97-107, 2009.
- [14] Govers, P.C.M. and Schoormans, J.P.L., "Product personality and its influence on consumer preference", *Journal of Consumer Marketing*, Vol. 22 No. 4, pp. 189-97, 2005.
- [15] Bowden, J. L.-H., The Process of Customer Engagement: a Conceptual Framework, *Journal of Marketing Theory & Practice*, 17(1), 63-74, doi: 10.2753/mtp1069-6679170105, 2009.
- [16] Goldsmith, R.E., Brand Engagement and Brand Loyalty, In Avinash Kapoor & Chinmaya Kulshrestha (Eds.), *Branding and Sustainable Competitive Advantage: Building Virtual Presence* (pp. 121-135), Hershey, PA: IGI Global, 2011.
- [17] Malciute, J., Customer Brand Engagement on Online Social Media Platforms: A conceptual model and empirical analysis, August 2012.
- [18] Cheung, C., Lee, M., & Jin, X., Customer Engagement in an Online Social Platform: A Conceptual Model and Scale Development, ICIS 2011 Proceedings. , Paper 8, 2011.
- [19] Ertell, K., Retail: Shaken Not Stirred, <http://www.retailshakennotstirred.com/retail-shaken-not-stirred/2010/01/the-missing-link-in-the-customer-engagement-cycle.html>), 2010,Retrieved on May 4, 2014.
- [20] Kekic, L., *The Economist Intelligence Unit*, 2007.

PLATINUM (II) AND PALLADIUM (II) DERIVATIVES OF HETEROCYCLIC SULPHONAMIDE IMINES: SYNTHESIS, CHARACTERIZATION AND THEIR BIOLOGICAL ASPECTS

Bhavana Gupta¹, Renu Khedar² and Nighat Fahmi³

^{1,2,3} Department of Chemistry, University of Rajasthan, Jaipur 302004, (India)

ABSTRACT

The present article describes the synthesis and characterization of a new series of Pt (II) and Pd(II) complexes with two $N\cap O$ donor ligands, salicylaldehyde sulphathiazole and salicylaldehyde sulphaguanidine. The 1:2 reactions of metal chlorides ($PtCl_2$ and $PdCl_2$) with monobasic bidentate ligands resulted in the formation of coloured solids. All the synthesized compounds were characterized by melting point determinations, elemental analyses and a combination of IR, and 1H NMR spectroscopic techniques for structural elucidation. Probable square planar structures for the resulting derivatives have been proposed on the basis of above characterization. The ligands, and their complexes, have also been screened in vitro for their antimicrobial activity against a number of pathogenic fungal and bacterial strains. Besides, the DNA cleavage activity of the complexes has also been studied. The studies indicate that the metal chelates are more potent than the respective ligands.

Keyword: Palladium (II) And Platinum (II) Complexes, Elemental Analyses, Antimicrobial Activity and DNA Cleavage Activity.

I INTRODUCTION

Schiff bases and their metal complexes exhibit a number of biological activities such as antibacterial, antiviral, and antitumor, because of their specific structures. Schiff base complexes have found applications as magnetic materials, catalysts and in the biological engineering field [1-2]. Schiff bases obtained by condensation reaction usually act as bi-, tri- or poly-dentate ligands and form stable complexes with transition metals. Schiff bases show their versatile use in the synthesis of various inorganic compounds, in identification and determination of carbonyl compounds, use in the preparation of various dyes and in pharmaceutical industry.

Sulpha drugs are a group of compounds used for eliminating wide range of infections in human and other animal systems. Many chemotherapeutically important sulpha drugs, like sulphadiazine, sulphathiazole possess SO_2NH moiety which exhibit an important toxophoric function[3].

The coordination chemistry, biological effects and toxicology of platinum and palladium complexes, such as their requirements in pharmacological activities, are areas of increasing research interest [4]. It has been well established that certain platinum and palladium complexes are of biological importance due to their anticancer [5], antitumor [6], antiamoebic [7] and catalytic activity [8].

It has been reported that the activity of sulphur-containing ligand increases on complexation [9-11]. In view of the diversified chelating behaviour of sulphonamide imines as well as biological importance of palladium and platinum complexes, it has been considered worthwhile to synthesize, characterize some new palladium(II) and platinum(II) derivatives of sulphonamide imines and to investigate their physico-chemical and structural features as well as the biological activity.

II EXPERIMENTAL

2.1 Analytical Methods and Physical Measurements

The metal salt, PtCl_2 and PtCl_2 was commercial product and was used as received. All the reagents used were of AR grade and the solvents used were dried, distilled and purified by the standard methods. Nitrogen was estimated by the Kjeldahl's method [12] and sulfur was estimated by Messenger's method [13]. Palladium was estimated gravimetrically and chlorine was estimated volumetrically by Volhard's method [14]. The Rast Camphor Method was used to carry out the molecular weight determinations. Infrared spectra of the ligands and their complexes were recorded with help of Nicolet Magna FTIR-550 spectrometer on KBr pellets. ^1H NMR spectra were recorded in DMSO –d6 using TMS as the internal standard.

2.2 Preparation of the Ligands

The ligands, i.e. salicylaldehyde sulphathiazole and salicylaldehyde sulphaguanidine, L^1H and L^2H respectively, used during these investigations were prepared by the condensation of salicylaldehyde with the sulpha drugs. An ethanolic solution of salicylaldehyde (0.1mol) was added slowly to an ethanolic solution containing sulpha drugs (0.1 mol) in 1:1 molar ratio under stirring for 15 min, and then refluxed on a water bath for five-six hours. On cooling overnight in a refrigerator, crystals separated out which were further purified by washing with ethanol and finally recrystallized with acetone. The analytical results came in good consistence with the proposed formulas as in Table 1 (Fig. 1).

2.3 Synthesis of the Metal Complexes

2.3.1 Platinum complexes

The 1:1 water–ethanol solution of PtCl_2 was mixed with an ethanolic solution of the ligands in 1:2 molar ratio. To obtain the $\text{Pt}(\text{L}^n)_2$ (where $n=1\&2$) type of complexes aqueous ammonia was added dropwise to the reaction mixture until it was weakly alkaline (pH ca. 8.0). The reaction mixture was then heated under refluxed for about 1 h. On cooling, the complexes were separated out which were filtered and washed with ethanol and dried in vacuum. On the other hand, $[\text{Pt}(\text{L}^n)_2]\text{Cl}_2$ type of complexes have been synthesized by stirring the above reaction mixture (solution of $\text{PtCl}_2 + \text{L}^n\text{H}$ in 1:2 molar ratio) on a magnetic stirrer for about 2–3 h in the presence of few

drops of concentrated HCl. The resulting product was recovered by filtration, washed with ethanol and dried in vacuum.

2.3.2 Palladium complexes

The methanolic solution of PdCl_2 was mixed with methanolic solution of the ligands in 1:2 molar ratio. Aqueous ammonia was added dropwise to the reaction mixture, until it was weakly alkaline (pH ca. 8.0) and this reaction mixture was then heated under reflux for about 1 h to synthesize $\text{Pd}(\text{L}^n)_2$ type of complexes. To obtain the $[\text{Pd}(\text{L}^n)_2]\text{Cl}_2$ type of complexes the methanolic solution of PdCl_2 and L^nH in 1:2 molar ratio was stirred on a magnetic stirrer for 2–3 h in presence of few drops of concentrated HCl. The resulting products were recovered by filtration, washed with methanol and dried in vacuum.

III BIOLOGICAL STUDIES

3.1 Anti-microbial studies

3.1.1 In- vitro Antifungal Activity

The newly prepared complexes were also screened for their antifungal activity against *Altenaria alternata*, *Aspergillus niger*, *Fusarium oxysporum* and *Macrophomina phaseolina* in DMSO by agar diffusion method. Agar media was prepared by dissolving peptone (10 g), D-glucose (40g) and agar (20 g) in distilled water (1000 mL) and adjusting pH to 5.7. Normal saline water was used to make suspension spore of fungal strain lawning. A loopful of particular fungal strain was transferred to 3 mL saline to get suspension of corresponding species. Twenty millilitres of agar media were poured into each petri dish. Excess of suspension was decanted and plates were dried by placing in an incubator at 37°C for 1 h using an agar punch, wells were made and each well was labelled. A control was also prepared in triplicate and maintained at 37°C for 96 h. The fungal activity of each compound was compared with *Bavistin* as standard drug. The medium with DMSO as solvent was used as a negative control whereas media with *Bavistin* (standard antifungal) were used as positive control. The experiments were performed in triplicates. The cultures were incubated for 96 h at 35°C and the growth was monitored and the percentage of inhibition was calculated by equation:

$$\% \text{ inhibition} = 100(\text{C}-\text{T})/\text{C}$$

Where, C and T are the diameters of the fungal colony in the control and the test plates, respectively.

3.1.2 In- vitro Antibacterial Activity

The newly prepared compounds were screened for their antibacterial activity against *Staphylococcus aureus*, *Klebsiella aerogenous*, *Escherichia. coli* and *Pseudomonas cepacicola* by paper disc plate method. Each compound was dissolved in DMSO and solutions of the concentrations (500 and 1000 ppm) were prepared separately. Paper discs of Whatman filter paper (No. 42) of uniform diameter (5 mm) were cut and sterilized in an autoclave. The paper discs soaked in the desired concentration of the complex solutions were placed aseptically in the petri dishes containing nutrient agar media (agar 20 g + beef extract 3 g + peptone 5 g) seeded with bacteria strains separately. The petri dishes were incubated at 37°C and the inhibition zones were recorded after 24 h of incubation. The antibacterial activity of common standard antibiotic *Tetracyclin* was also recorded

using the same procedure as above at the same concentrations and solvent. The medium with DMSO as solvent was used as a negative control whereas media with *Tetracyclin* (standard antibiotics) were used as positive control. The experiments were performed in triplicates.

3.2 DNA cleavage activity

3.2.1. Preparation of culture media

Nutrient broth (peptone, 10; yeast extract, 5; NaCl, 10 in g/L) was used for culturing of *E. coli*. The 50-mL medium was prepared and autoclaved for 15 min at 121 °C under 15 lb pressures. The autoclaved media was inoculated with the seed culture and *E. coli* was incubated for 24 h.

3.2.2. Isolation of DNA

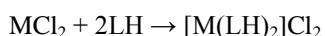
The fresh bacterial culture (1.5 mL) was centrifuged to obtain the pellet, which was then dissolved in 0.5 mL of lysis buffer (100 mM Tris pH 8.0, 50 mM EDTA, 10 % SDS). To this 0.5 mL of saturated phenol was added and incubated at 55 °C for 10 min. Then, it was centrifuged at 10,000 rpm for 10 min and equal volume of chloroform:isoamyl alcohol (24:1) and 1/20 volume of 3M sodium acetate (pH 4.8) was added to this supernatant and centrifuged at 10,000 rpm for 10 min. To this supernatant three volumes of chilled absolute alcohol was added. The precipitated DNA was separated by centrifugation. The pellet was dried and dissolved in TE buffer (10 mM Tris pH 8.0, 1 mM EDTA) and stored in cold conditions.

3.2.3 DNA cleavage analysis

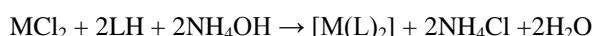
Agarose gel electrophoresis cleavage products were analyzed by the agarose gel electrophoresis method. Test samples (1 mg/mL) were prepared in DMF. The samples (25 µg) were added to the isolated DNA of *E. coli*. The samples were incubated for 2 h at 37 °C and then 20 µl of DNA sample (mixed with bromophenol blue dye at 1:1 ratio) was loaded carefully into the electrophoresis chamber wells along with standard DNA marker containing TAE buffer (4.84 g Tris base, pH 8.0, 0.5 M EDTA/l) and finally loaded on agarose gel and passed the constant 50 V of electricity for around 30 min. The gel was removed and stained with 10.0 g/mL ethidium bromide for 10 – 15 min, and the bands were observed under a UV transilluminator and photographed to determine the extent of DNA cleavage, and the results were compared with standard DNA marker.

IV RESULTS AND DISCUSSION

The metal chloride interacts with the ligands in 1:2 molar ratios in the presence of few drops of concentrated HCl to form $[M(LH)_2]Cl_2$ type of complexes as follows:



However, complexes of the type $[(Pd(L)_2)]$ were obtained when reactions were carried out in the presence of aqueous NH_4OH . The reactions may be written as:



where M= Pd(II) and Pt(II) and LH is the ligand molecule.

The reactions proceed easily and all the complexes are coloured solids. All the complexes are soluble in DMSO, DMF and $CHCl_3$ and insoluble in common organic solvents.

4.1 Spectroscopic Characterization

4.1.1. IR Spectra

The significant IR bands of the ligands and platinum (II) and palladium(II) complexes were observed that are useful for the establishment of the mode of the coordination of the ligands to the metal ion. Several significant changes with respect to the ligands bands on complexation suggest coordination through the azomethine nitrogen and oxygen of the salicylaldehyde. A comparison of the IR spectra of the complexes and the ligands L¹H and L²H show that the stretching vibration bands of ν(-OH) of the ligands at 3255cm⁻¹ is absent in the spectra of the substitution complex. This disappearance of -OH signals confirms the deprotonation of salicylaldehyde -OH group and its involvement in coordination. The ν(C=N) bands in complexes appear at 1600-1598 cm⁻¹; significantly lower than the free ligands values indicating coordination by the azomethine nitrogen atoms of the Schiff bases. However, no ν(M-Cl) bands in the region 295-345cm⁻¹ is observed in the spectra of [M (LH)₂]Cl₂ type of complexes, suggesting the chloride is ionic in these complexes. Non-ligand bands at 415–428, 352–360, 442-448 and 410-415 cm⁻¹ have been assigned to ν(Pt-N₂) ν(Pd-N), ν(Pt-O) and ν(Pd-O) respectively. The overall IR spectral evidence suggests that both ligands are bidentate, coordinating through oxygen and azomethine-nitrogen forming a six-membered chelate ring.

4.1.2. ¹H NMR Spectra

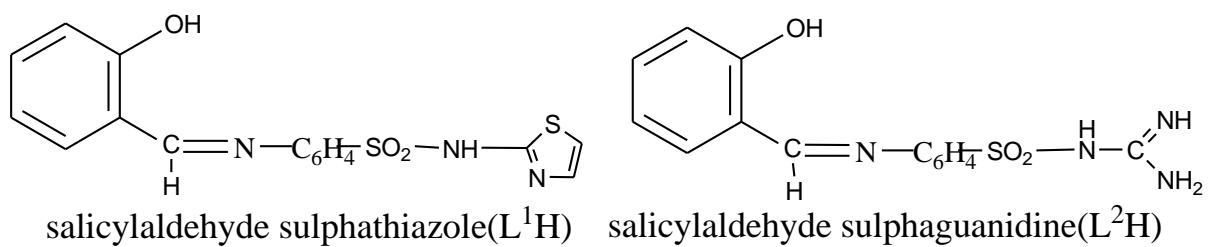
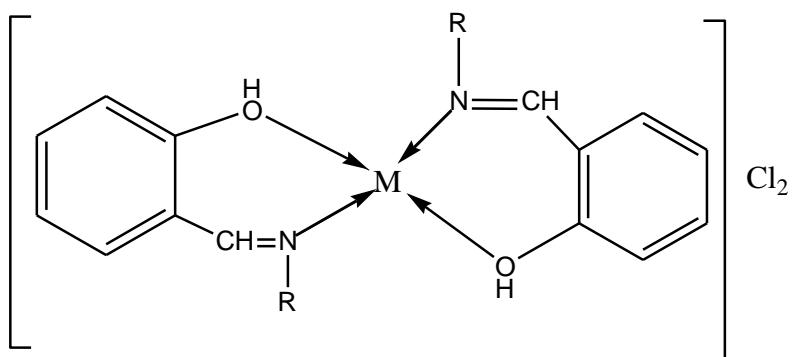
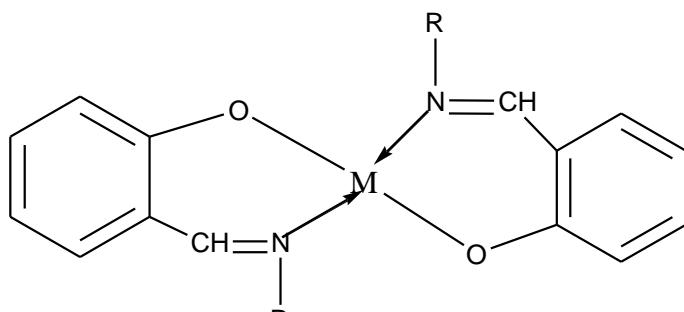
4.1.2.1. ¹H NMR spectra of the ligands

The ¹H NMR spectral data of the ligands were recorded in DMSO-d6 taking TMS as an internal standard. The free ligands exhibit OH proton resonance signals at δ12.10-12.20 ppm. The free ligands show a complex multiplet at δ6.50–8.85 for the aromatic protons. A singlet at δ10.15ppm due to the -NH proton appear in the spectra of the ligands.

4.1.2.2. ¹H NMR spectra of the complexes

The ¹H NMR spectra of the complexes further support the bonding pattern as discussed above. The free ligands exhibit OH proton resonance signals at δ12.10-12.20 ppm, which completely disappear in the spectra of metal complexes. This indicates the deprotonation of OH group as a result of bonding through phenolic oxygen to the metal atom in the substitution complex. Further, in the spectra of the complexes, a downfield shift in the position of the aromatic protons also indicates the coordination of the azomethine nitrogen to the metal atom. The signal due to -NH remains unaltered in the complexes indicating that the -NH group is not taking part in the complexation.

On the basis of above discussion the following structures as shown in the Fig. 1 and 2 have been proposed for the ligands and the metal complexes.

**Fig.1 Structure of the Ligands****Addition Complex****Substitution Complex**

Where, M = Pt and Pd and R = $-\text{C}_6\text{H}_4\text{SO}_2-\text{N}-\text{C}_2\text{H}_4\text{S}$ and $-\text{C}_6\text{H}_4\text{SO}_2-\text{N}-\text{C}(\text{NH}_2)=\text{NH}$

Fig.2 Structure of the synthesized Complexes

4.2 Biological studies

4.2.1 In vitro antifungal and antibacterial studies

All the compounds tested against the fungi, *Alternaria alternata*, *Aspergillus niger*, *Fusarium oxysporum*, and *Macrophomina phaseolina* and the bacteria *Staphylococcus aureus*, *Klebsiella aerogenous*, *Escherichia Coli*, and *Pseudomonas cepacicola* and were found to be active. The results have been summarized in Tables 2 and 3. The biological activity of metal complexes exhibited markedly much promising results than the ligands against all the test bacterial/fungal strains. It was evident that overall potency of the ligands was enhanced on

coordination with metal ions. It has been suggested that the ligands with nitrogen and oxygen/sulfur donor systems inhibit enzyme activity, since the enzymes which require these groups for their activity appear to be especially more susceptible to deactivation by metal ions on coordination. Moreover, coordination reduces the polarity of the metal ion mainly because of the partial sharing of its positive charge with the donor groups [15] within the chelate ring system formed during coordination. This process, in turn, increases the lipophilic nature of the central metal atom, which favours its permeation more efficiently through the lipid layer of micro-organism [16], thus destroying them more aggressively.

DNA cleavage activity

The representative ligands and their complexes are studied for their DNA cleavage activity by the agarose gel electrophoresis method against DNA of *E. coli* in the presence of H₂O₂. From the gel picture it is clear that Lanes 1, 2, 3, 4, 5, 6, 7& 8 have shown cleavage activity, which was confirmed by observing the tail in the DNA band. The tail was missing in L3 & L4 indicating the non-cleavage activity. This shows that the Schiff base alone does not show any apparent cleavage, whereas its complexes do show. The results indicated the important role of metal in these isolated DNA cleavage reactions. The cleavage efficiency of the complexes compared with that of the control is due to their efficient DNA-binding ability. The metal complexes were able to convert super coiled DNA into open circular DNA. The general oxidative mechanisms proposed account for DNA cleavage by hydroxyl radicals via abstraction of a hydrogen atom from sugar units and predict the release of specific residues arising from transformed sugars, depending on the position from which the hydrogen atom is removed. The cleavage is inhibited by the free radical scavengers implying that hydroxyl radical or peroxy derivatives mediate the cleavage reaction.

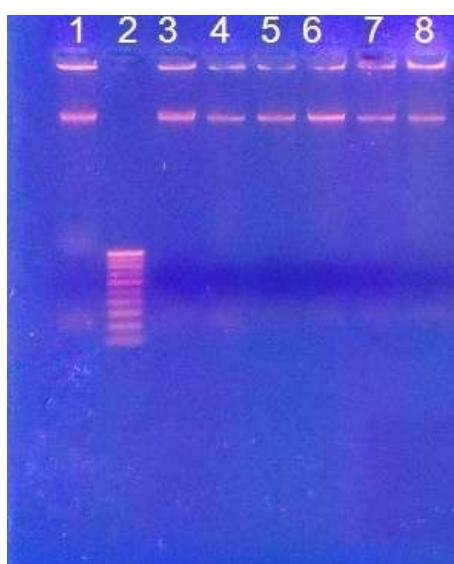


Fig.4 DNA cleavage gel diagram of ligands and synthesized compounds. , Lane 1 : (C *E. Coli*), Lane 2: (standard molecular weight marker), Lane 3&4: (*E. Coli* DNA cleavage of L¹H & L²H), Lanes 5 – 8, (*E. coli* DNA treated with the complexes): [Pt(L¹H)₂]Cl₂ [Pt(L²H)₂]Cl₂ [Pd(L¹H)₂]Cl₂ & [Pd(L²H)₂]Cl₂, respectively.

V CONCLUSIONS

We have synthesized biologically relevant ligands and their Pt(II) and Pd(II) complexes. Thus, on the basis of the above spectral features, as well as the analytical data, square planar geometries shown in Fig. 3 have been suggested for the both the Pt(II) and Pd(II) complexes. The antimicrobial results indicated that the complexes showed promising antibacterial and antifungal activities. Both the ligand and their respective metal complexes were found to be sensitive against all the fungal and bacterial strains and the metal complexes are more potent antimicrobial agents than the free ligand. The results indicated that the palladium and platinum complexes exhibited almost similar antimicrobial activity. Furthermore, DNA cleavage studies revealed that metal complexes cleave DNA more efficiently in comparison to the ligands.

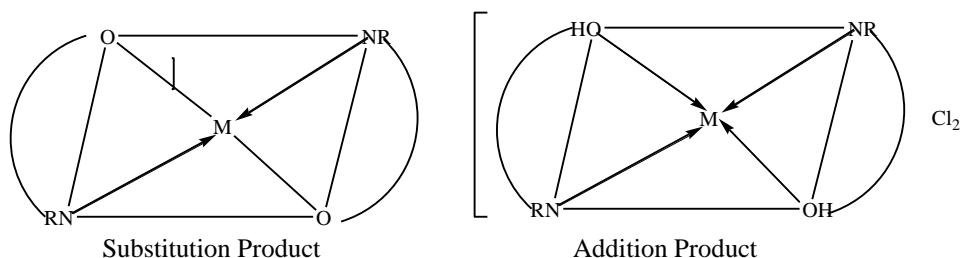


Fig.3

REFERENCES

- [1] H-Y.Zhang, J.Lei, Y-Y.Chen, Q-A.Wu, Y-S.Zhang, L-H.Gao, Synthesis and Reactivity in Inorganic and Metal-OrganicChemistry, 31,2001 973.
- [2] E.Abele, Activation of silicon bonds by fluoride ion in the organic synthesis in the new millenium: A Review. Main Group Metal Chemistry, 28,2005, 45.
- [3] H. Singh, V. K. Srivastava, S.N. Shukla, M. K. Srivastava, M. K. Upadhyay, Indian Journal of Chemistry, 33A, 1994, 350.
- [4] M. Navarro, A. Betancourt, C. Hernández, E. Marchan, Braz. Chem. Soc. 19, 2008,1355.
- [5] C.F. Caires, Antonio, Anti-Cancer Agents, 7,2007, 484.
- [6] G. Garcia-Friaza, A. Fernandez-Botello, J.M. Perez, M.J. Prieto, V. Moreno, J. Inorg. Biochem.100, 2006 1368.
- [7] N. Bharti, Shailendra, S. Sharma, F. Naqvi, A. Azam, Bioorg. Med. Chem. 11,2003,2923.
- [8] W. Nazihah, W. Ibrahim, M. Shamsuddin, B.M. Yamin, Malaysian J. Anal. Sci. 11,2007, 98.
- [9] M. Jain, R.V. Singh, International Journal for Chemical Science,1(1),2003,17.
- [10] M. Jain, S. Gaur, S. C. Diwedi, S.C. Joshi, A.Bansal, R.V.Singh, Phosphorus, Sulfur, and Silicon,179, 2004,1517.
- [11] M. Jain, S.Gaur, V.P. Singh, R.V. Singh, Applied OrganometallicChemistry. 18(2),2004, 73.
- [12] J.T. Makode, A.S. Aswar. Indian J. Chem., **43A**, 2004,2120.
- [13] A.I. Vogel. ‘’A Textbook of Organic Quantitative Analysis’’, 5th Ed., (PEL, London) 2004, 243.

- [14] A.I. Vogal "A Text Book of Quantitative Inorganic Analysis", (Longmans Green ELBS, London), 1962.
- [15] B.N. Meyer, N.R. Ferrigni, J.E. Putnam, L.B. Jacobsen, D.E. Nichols, J.L. Mc Laughlin, *Planta Med.* 45, 1982, 31–34.
- [16] Z.H. Chohan, *Synth. React. Inorg. Met-Org. Chem.* 34, 2004, 833–846.

Table 2: Fungicidal screening data of the ligands and their respective metal complexes.
(Average percentage inhibition after 96 hours; conc. in mg/well (w/v)

Compound	<i>Alternaria alternata</i>			<i>Aspergillus niger</i>			<i>Fusarium oxysporum</i>			<i>Macrophomina phaseolina</i>		
	0.5	1.0	2.0	0.5	1.0	2.0	0.5	1.0	2.0	0.5	1.0	2.0
L ¹ H	36	38	40	30	33	34	28	30	35	27	31	34
[Pt(L ¹ H) ₂]Cl ₂	45	48	50	38	39	41	30	33	39	29	33	38
[Pt(L ¹) ₂]	47	52	53	41	40	42	33	36	40	31	33	40
[Pd(L ¹ H) ₂]Cl ₂	42	45	48	33	36	40	27	30	35	26	30	36
[Pd(L ¹) ₂]	44	48	50	35	36	42	30	33	35	28	33	39
L ² H	35	37	40	27	30	31	25	29	35	22	25	33
[Pt(L ² H) ₂]Cl ₂	41	45	48	33	34	38	28	30	35	26	35	37
[Pt(L ²) ₂]	43	45	51	35	39	40	31	35	39	30	36	41
[Pd(L ² H) ₂]Cl ₂	39	41	42	29	31	33	25	27	31	22	26	33
[Pd(L ²) ₂]	42	43	45	30	33	34	25	31	34	29	31	35
Bavistin	85	100	100	84	100	100	84	100	100	82	100	100

Table 3 : Bactericidal screening of the ligands and their respective metal complexes : Inhibition after 24 hours (conc. in mg/well (w/v)

Compound	Diameter of inhibition zone (mm)							
	<i>Staphylococcus aureus</i>		<i>Klebsiella</i>		<i>Escherichia coli</i>		<i>Pseudomonas</i>	
	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
L ₁ H	8	10	5	8	6	8	4	5
[Pt(L ¹ H) ₂]Cl ₂	12	14	8	10	11	10	6	9
[Pt(L ¹) ₂]	12	16	10	11	13	10	8	11
[Pd(L ¹ H) ₂]Cl ₂	9	12	8	9	10	11	6	8
[Pd(L ¹) ₂]	10	13	10	11	7	8	7	10
L ₂ H	7	9	6	7	5	8	4	9
[Pt(L ² H) ₂]Cl ₂	15	16	7	8	9	13	6	7
[Pt(L ²) ₂]	15	18	8	9	10	12	7	9
[Pd(L ² H) ₂]Cl ₂	13	15	4	5	7	9	4	5
[Pd(L ²) ₂]	14	16	4	6	9	11	5	8
Tetracyclin	15	18	6	11	17	18	6	10

Table 1. Analytical data and physical properties of the ligands and their complexes.

Compound	Color	M.P. (°C)	Analysis (%) Found (Calcd.)						Mol.Wt. Found (Calcd.)
			C	H	N	S	Cl	M	
L ¹ H	Crystalline white	120	53.12 (53.33)	3.45 (3.88)	11.42 (11.66)	17.22 (17.77)	-	-	360
[Pt(L ¹ H) ₂]Cl ₂	Light yellow	140-144	38.54 (38.94)	2.45 (2.83)	8.14 (8.51)	12.46 (12.98)	7.06 (7.20)	19.25 (19.78)	986.07
[Pt(L ¹) ₂]	Light yellow	146-149	41.89 (42.05)	2.16 (2.84)	9.09 (9.19)	13.92 (14.01)	-	21.05 (21.36)	913.07
[Pd(L ¹ H) ₂]Cl ₂	Brick red	152-154	42.56 (42.78)	3.05 (3.12)	9.11 (9.36)	14.08 (14.26)	7.56 (7.91)	11.42 (11.85)	897.42
[Pd(L ¹) ₂]	Dark brown	158-160	46.15 (46.57)	3.10 (3.15)	10.01 (10.18)	15.03 (15.32)	-	12.46 (12.90)	824.42

L^2H	Creme	114	52.45 (52.99)	4.02 (4.10)	17.14 (17.66)	9.65 (10.09)	-	-	374
$[Pt(L^2H)_2]Cl_2$	Light Yellow	144-146	37.01 (37.33)	2.45 (2.88)	12.08 (12.44)	7.01 (7.11)	7.49 (7.88)	20.95 (21.6)	900.07
$[Pt(L^2)_2]$	yellow	146-148	40.10 (40.62)	2.45 (2.90)	12.94 (13.54)	7.65 (7.73)	-	23.06 (23.58)	827.07
$[Pd(L^2H)_2]Cl_2$	Brown	162-164	41.02 (41.40)	3.12 (3.20)	13.49 (13.80)	7.45 (7.88)	8.45 (8.75)	12.78 (13.11)	811.42
$[Pd(L^2)_2]$	Dark brown	165-168	45.26 (45.87)	3.11 (3.25)	15.11 (15.16)	8.26 (8.66)	-	14.07 (14.52)	732.42

ATTACKS AT DATA LINK LAYER OF OSI MODEL: AN OVERVIEW

Raminderpal Singh¹, Amanjeet Kaur², Sania Sethi³

¹ Associate Professor, ^{2,3} Assistant Professor,

Department of Computer Applications &Management, SBSSTC, Ferozepur (India)

ABSTRACT

Security is at the forefront of most networks and many companies implement a comprehensive security policy encompassing many of the OSI layers, from application layer all the way down to IP security. OSI Was Built to Allow Different Layers to Work without the Knowledge of Each Other Unfortunately this means if one layer is hacked, communications are compromised without the other layers being aware of the problem Security is only as strong as the weakest link when it comes to networking, layer 2 can be a very weak link

However, one area that is often left untouched is hardening layer 2 and this can open the network to a variety of attacks and compromises. This document has a focus on the security issues surrounding and understanding and preventing Layer 2. With a significant percentage of network attacks originating inside the corporate firewall, exploring this soft underbelly of data networking is critical for any secure network design. Security issues addressed in this session include ARP spoofing, MAC flooding, VLAN hopping, DHCP attacks, and Spanning Tree Protocol concerns. Denial-of-Service (DoS) attacks are also a major concern as they can come from both internal and external sources. The focal point of this paper is to understand how Attacksworks and what techniques can be used to mitigate this type of attacks from security perspective.

I INTRODUCTION

Network security has become a concern with the rapid growth of the internet .There are several ways to provide security in the application ,transport ,or network layer of a network .However ,the network security is only as strong as the weakest section. Since the Data Link Layer security has not been adequately addressed yet, the weakest section may be the Data Link Layer (Layer 2) [1]. Layer 2 enables interoperability and interconnectivity in networks. However, a compromise in Layer 2, which enables internal attacks, may not be detected by the upper layers.In this paper, we focus on the security problems of the Layer 2, when those are ignored, it can increase the vulnerability of the critical infrastructure, including the information systems and the national security systems. Because the Layer 2 attacks are relatively more difficult to accomplish from outside, from the Internet, they are only concentrate on the other layer of OSI 3, they think that the LAN4 and the backbone network provided by the internet

service provider is safe, but it isn't. There are some well-known technics which allows reaching the elements of the LAN network in short time from outside

II UNDERSTANDING OF LAYER 2

Before explaining the vulnerabilities of the Layer 2, need to understand a few words about what is this – for those who are less experienced in this field. The Layer 2 is one part of the OSI – seven-layer hierarchical – model. The ISO (International Organization for Standardization) developed the OSI model, so that they can determine the requirements of mutual cooperation the communication devices – including computers – between each other with individual layers. In fact, the same communication functions are grouped into logical layers. A layer serves the layer above it and is served by the layer below it. Main concern was that the different manufacturer's products (hardware, software) work together at the border of different layer[2]. Find below the list of levels with short explanation: (Figure 1.)

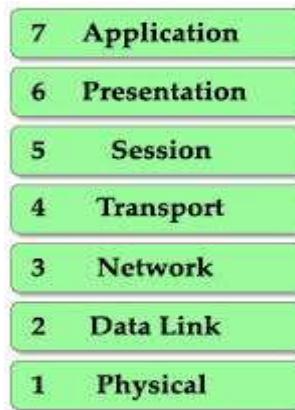


Figure 1.OSI Reference Model

The datalink layer provides the functional and procedural means to transfer data between network entities and to detect and possibly correct errors that may occur in the physical layer. Following are the functions of data link layer:

- Framing
- Physical Addressing
- Flow Control
- Error Control
- Access Control
- Media Access Control (MAC)

III TYPES OF ATTACKS ON LAYER 2

There are three main classes of attacks:

- Spanning Tree Protocol.

- Cisco VLAN9/Trunking Protocols.
- Otherattacks.

3.1 Spanning Tree Protocol

Spanning-Tree Protocol (STP) prevents loops from being formed when switches or bridges are interconnected via multiple paths. Spanning-Tree Protocol implements the 802.1D IEEE algorithm by exchanging BPDU messages with other switches to detect loops, and then removes the loop by shutting down selected bridge interfaces[3]. This algorithm guarantees that there is only one active path between two network devices. Within this framework the bridges negotiate between them, who will be the „root” bridge in the network, determine the least cost paths and disable all other paths. The attack technique of this protocol, the Spanning Tree Protocol manipulation attack, within this framework the attacker sends BPDUs to become „root” bridge (or switch) in the network. Therefore the attacker can influence the flow of data. Requires attacker is dual homed to two different bridges (or switches) or one of the two connections is WLAN access point which is not connected to the same bridge (or switch)[4].

Attacker can eavesdrop all messages of victims; he can inject new ones in MITM position. (Figure 2.)

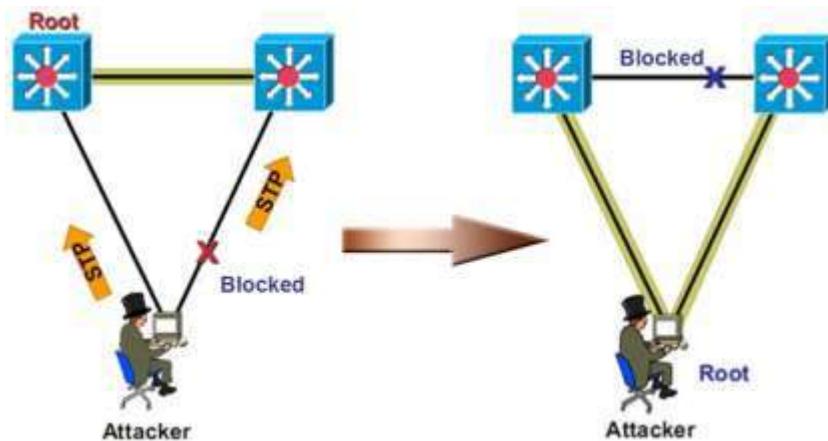


Figure 2. Spanning Tree Protocol manipulation

3.2 Cisco VLAN/Trunking Protocols

VLAN's allow a network manager to logically segment a LAN into different network of departments such as marketing, sales, accounting, and research. There are lots of VLANs overthe backbone switches of Internet connecting different site of company. The attacker has twomethod of VLAN hopping attack in order to be a member of other VLANs:

1. Basic VLAN hopping attack: The switches connected to a trunk15 link, which has access to all VLANs by default. The attacker station can spoof as a switch with DTP signaling, and the station will be a rogue

switch – member of all VLANs and all traffic can be monitored. The „Yersinia” software is very useful for this task. (Figure 3.)

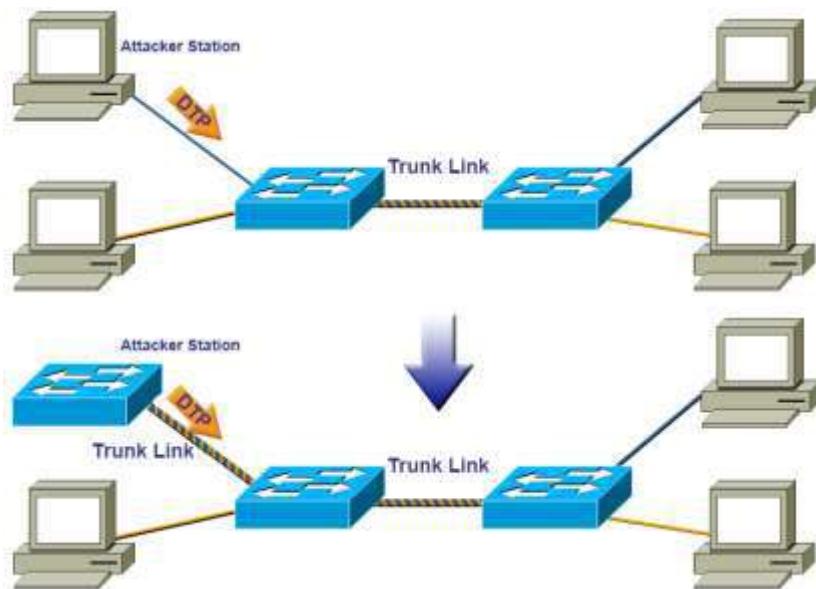


Figure 3. Basic VLAN hopping attack

2. Double tagging VLAN hopping attack: A widely used VLAN networks operate with an additional 802.1q header, or VLAN tag to distinguish the VLANs. VLAN tag changes the information frame. The service-provider infrastructures are doubletagged,with the outer tag containing the customer's access VLAN ID, and the innerVLAN ID being the VLAN of the incoming traffic. When the double-tagged packetenters another trunk port in a service-provider core switch, the outer tag is stripped asthe packet is processed inside the switch. The attacker sends „Double tagging “frame. The first belongs to the own VLAN and the second one belongs to the targetVLAN. The switch performs only one level DE encapsulation (strip off first tag) and the

Attacker can use unidirectional traffic to the Victim. This method works if trunk hasthe same VLAN as the attacker and the trunk operates with 802.1q. (Figure 4.)

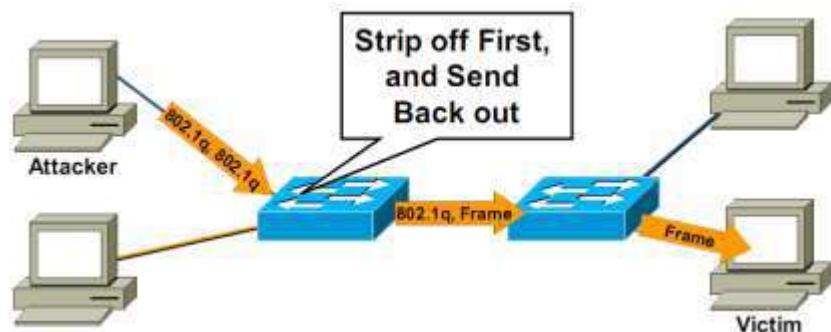


Figure 4. Double tagging VLAN hopping attack

3.3 Other attacks

In this section, only those relevant attack techniques will be explained - in addition to the previous ones - which are widely known and worth considering at the developing of the system-wide security policy and at work out of the basic safety procedures.

3.3.1 Cisco Discovery Protocol (CDP) attack

The Cisco Discovery Protocol (CDP) is a proprietary protocol that all Cisco devices can be configured to use. CDP discovers other Cisco devices that are directly connected, which allows the devices to auto-configure their connection in some cases. CDP messages are not encrypted. Most Cisco routers and switches have CDP enabled in the default configuration. Can be used to learn sensible information about the CDP sender (IP address, Cisco IOS software version, router model, capabilities...).

Besides the information gathering benefit CDP offers an attacker, there was vulnerability in CDP that allowed Cisco devices to run out of memory and potentially crash if you sent it tons of bogus CDP packets.

CDP is unauthenticated: an attacker could craft bogus CDP packets and have them received by the attacker's directly connected Cisco device. (**Figure 5.**) If the attacker can getaccess to the router via Telnet, he can use the CDP information to discover the entire topologyof your network at Layer 2 and 3, and he could launch a very effective attack against your network.[6]

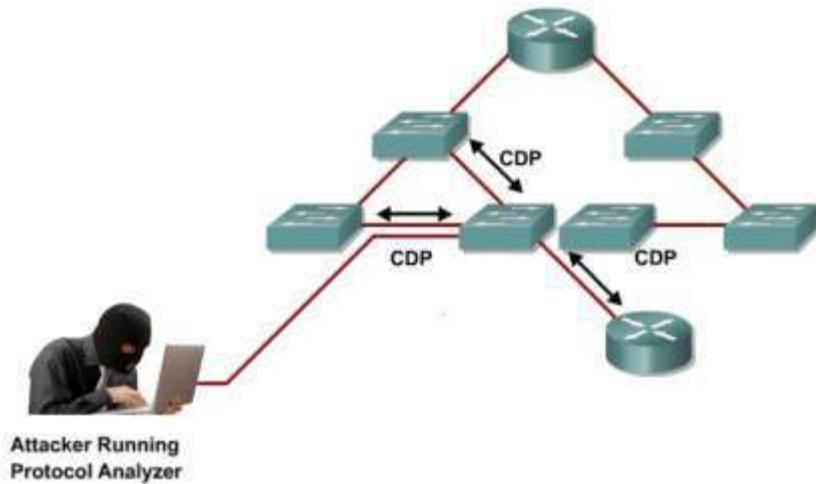


Figure 5. CDP Attack

3.3.2 CAM table overflow attack

The CAM table, which stores information such as MAC addresses available on physical ports. CAM tables (sometimes called MAC address table) have a fixed size (19KB..128KB, it can store about 100..100000 MAC entries).

When frames arrive on physical ports, the source MAC addresses are learned from Layer 2 Packet header and recorded in the CAM table. All entries have a default aging timer which is 300 seconds. If a host does not send frames toward the port, the entries will be removed after 5 minutes.[7]

The switch forwards the frame to the MAC address port designated in the CAM table. If the MAC address does not exist, the switch acts like a hub and forwards the frame out every other port on the switch.

There is a common tool that performs CAM overflow. This tool can generate 155000 MAC entries on a switch per minute. A CAM overflow attack turns a switch into a hub, which enables the attacker to reach every host on the network, to eavesdrop on a communication and perform MITM attacks. This method is applicable to attack the neighbor switches. (Figure 6.)

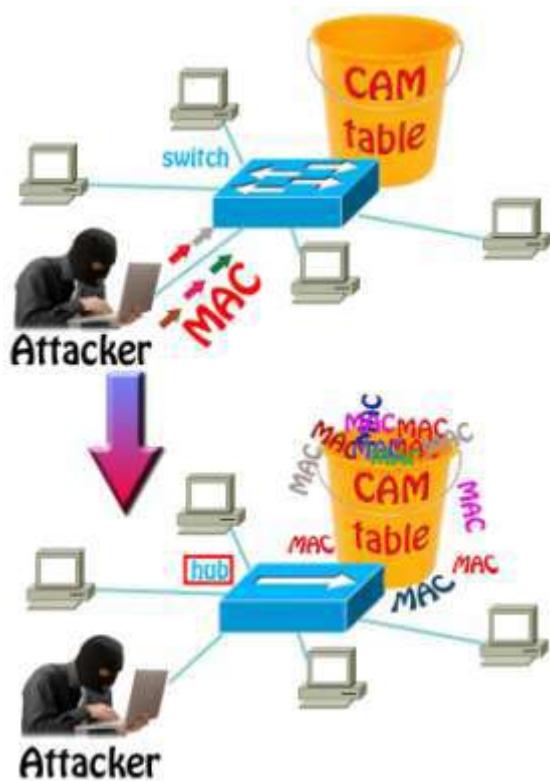


Figure 6. CAM table overflow attack

3.3.3 MAC Spoofing (ARP poisoning)

MAC spoofing attacks are launched by attacker on a Layer 2 network. The attacker can send out a gratuitous ARP (GARP) to the network. GARP is used by hosts (computers) to “announce” their IP address to the local network and avoid duplicate IP addresses on the network. Computers, routers and other network hardware may use cache information gained from gratuitous ARPs. Because ARP has no methods for authenticating ARP replies on a network, ARP replies can come from other system which is expected. In one common attack the attacker says „my PC is the default gateway” so that users send their traffic through the attacker rather than the default gateway. The

attacker then forwards user traffic to the real default gateway so that victims do not notice any change in their network access. [8] An attacker on a fast enough host can capture the traffic and can modify them. Figure 7.

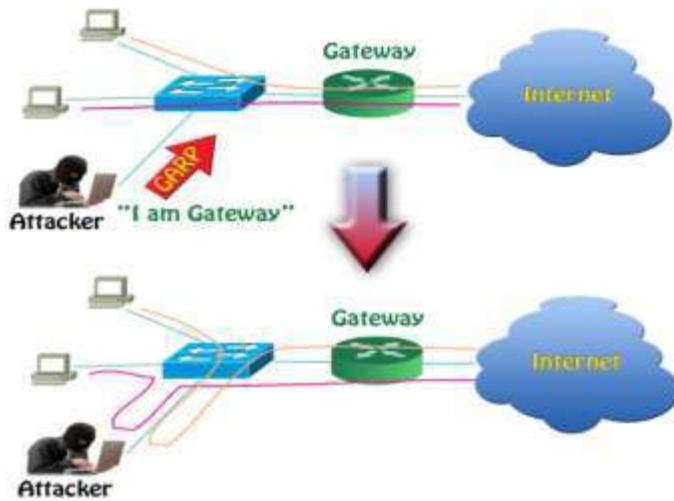


Figure 7. MAC Spoofing

3.3.4 DHCP starvation attack

The DHCP server is used to configure network devices so that they can communicate on computer network. The clients and a server are operating in a client-server model. DHCP client sends a query requesting necessary information (IP address, default gateway²⁵, and so on) to a DHCP server. On receiving a valid request, the server assigns the computer an IP address, and other IP configuration parameters.

This is special kind of attack where attacker sends tons of requests to the DHCP server with a false MAC address. If enough requests flooded onto the network, the attacker can completely exhaust all of the available DHCP addresses. Clients of the victim network are then starved of the DHCP resource.

The network attacker can then set up a Rogue DHCP Server on the network and reply modified IP configurations to the victims. (**Figure 8.**) These parameters ensure the MITM possibilities to the attacker.

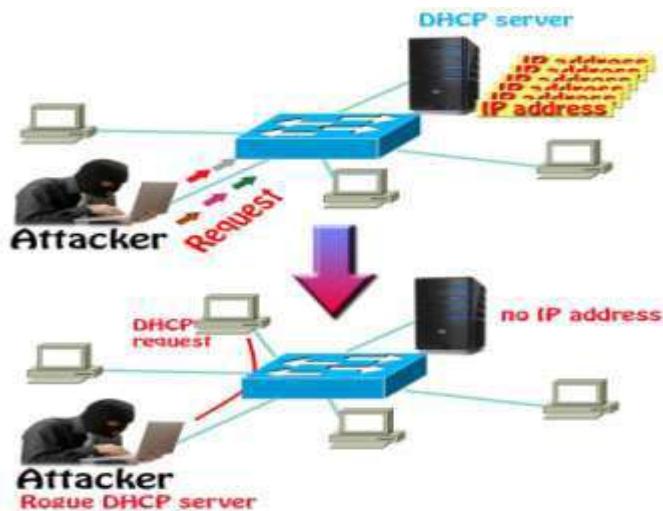


Figure 8 DHCP starvation attack

3.3.5 Wireless 802.11 (Wi-Fi) attacks

Wi-Fi can be less secure than wired (Ethernet) connections because an attacker does not need a physical connection, since only need one antenna and a laptop to compromise one.

In this type of attack, the attacker can execute:

- To insert himself in the MITM position (client's data can be modified),
- To deny the service,
- To capture all traffic.

In order to insert oneself in the middle of the communication, one has two ways:

- Send DE authentication packets to one or more clients which are currently associated with an AP and set up a rogue AP with the same credentials as the original for purposes of allowing the client to connect to it.
- Set up a rogue AP with a big signal (bigger than the original) and same credentials as the original for purposes of allowing the new client to connect to it.

IV CONCLUSIONS

This paper is an overview of the most recognized attack techniques on Layer 2 and draw attention to the vulnerabilities of this level emphasizing that the other layers being aware of the problem. A lot of attention is paid to securing the higher layers of the OSI reference model with network-level devices such as firewalls, intrusion protection systems (IPS), and applications such as antivirus and host-based intrusion protection (HIPS).

The attacker can

- Eavesdrop traffic,
- Manipulate data,
- Deny the information flow, and
- Use combination of the above mentioned.

Apply any of these options pose a serious threat to critical infrastructure, state institutions or governmental systems, even if no attacking intent is used. Certain critical infrastructure is controlled via the Internet which is maintained by wired and mobile telecommunication carriers.

REFERENCES

- [1] GReAT, Kaspersky Lab Expert: The "Red October" Campaign - An Advanced Cyber Espionage Network Targeting Diplomatic and Government Agencies
https://www.securelist.com/en/blog/785/The_Red_October_Campaign_An_Advanced_Cyber_Espionage_Network_Targeting_Diplomatic_and_Government_Agencies
- [2] OSI model, http://en.wikipedia.org/wiki/OSI_model
- [3] Spanning Tree Protocol
http://www.cisco.com/en/US/tech/tk389/tk621/tsd_technology_support_protocol_home.

YMCA, New Delhi (India), 1 Feb 2015

www.conferenceworld.in

- [4] http://seclab.cs.ucdavis.edu/papers/Marro_masters_thesis.pdf
- [5] SANS Institute: Understanding Wireless Attacks and Detection:
http://www.sans.org/reading_room/whitepapers/detection/understanding-wirelessattacks
- [6] http://www.iaeng.org/publication/IMECS2008/IMECS2008_pp1143-1148.pdf
- [7] https://www.cisco.com/web/ME/exposaudi2009/assets/docs/layer2_attacks_and_mitigation_t.pdf
- [8] <http://www.sans.org/reading-room/whitepapers/intrusion/detecting-responding-data-link-layer-attacks-33513>

EXPERIMENTAL INVESTIGATION OF PV PANEL WITH FIN COOLING UNDER NATURAL CONVECTION

J.A.Gotmare¹, D.S.Borkar², P.R.Hatwar³

^{1,2,3} Department of Mechanical Engineering,

Dr.BabasahebAmbedkar College of Engineering & Research, Nagpur, (India)

ABSTRACT

Photovoltaic solar cell generates electricity by receiving solar irradiance in the forms of photons. Photons with wavelengths above the threshold are converted into heat in the PV cells. This waste heat must be dissipated efficiently in order to avoid excessive high temperatures, which have an adverse effect on the electrical performance of the cell. Therefore, in this paper, performance enhancement of PV panels was experimented utilizing passive fin cooling under natural convection. To properly cool the PV panel, different cross sectional fins with perforation was attached at the backside of the panel. Comparative experimental study on PV panels with and without fin cooling was carried out to investigate the effect of operating temperature on the voltage, current & power output developed by the panel. The results showed that due to fin cooling temperature of the PV panel dropped significantly & the power output was improved by 5.5% under natural convection.

Keywords: Aluminium Fins, K-Thermocouple, Passive Cooling, PV Panel, RTD Meter

I INTRODUCTION

The concern for environment due to ever increasing use of fossil fuels & rapid depletion of these resources have led to the development of alternative sources of energy, which are renewable & environment friendly. Solar energy can be a major source of power & can be utilized by using thermal and photovoltaic conversion systems. India, receives solar energy equivalent to more than 5,000 trillion KWh per year, which is far more than its total annual consumption. The daily global radiation is around 5 kWh per sq. m per day with sun shine ranging between 2,300 and 3,200 hours per year in most part of India. Though the energy density is low and the availability is not continuous, it has now become possible to harness this abundantly available energy very reliably for many purposes

by converting it to usable heat or through direct generation of electricity.[1] Photovoltaic cell / Solar cell has a potential to convert the solar energy into electricity.

The solar cell works in several steps:

- Photons in sunlight hit the solar panel and are absorbed by semiconducting materials, such as silicon.
- Electrons are excited from their current molecular/atomic orbital. Once excited an electron can either dissipate the energy as heat and return to its orbital or travel through the cell until it reaches an electrode. Current flows through the material to cancel the potential and this electricity is captured.
- An array of solar cells converts solar energy into a usable amount of direct current (DC) electricity.

The solar energy technology or synonym as photovoltaic and solar thermal technology has many advantages and disadvantages comparing to others energy.

The potential advantages such as:

- It works on noiseless environment; do not produce any unwanted waste such as radioactive materials;
- High performance and reliable system;
- Clean technology – does not produce any toxic waste or radioactive material;
- Highly credible system with life span expectation is between 20 and 30 years;
- Low maintenance system.

The disadvantages:

- Non-uniform cooling – need innovative absorber design;
- Payback – less efficiency, longer payback period;
- Production and installation cost – expensive and high cost;
- Not suitable for integration with present roof system;
- Need larger space for separate systems (hot water and electricity production). [2]

The performance of the PV system is affected by several parameters including temperature. The part of absorbed solar radiation that is not converted into the electricity converts into heat energy and causes a decrease in electrical efficiency. This undesirable effect which leads to an increase in the PV cell's working temperature and consequently causing a drop of conversion efficiency can be partially avoided by a proper method of heat extraction [3].

Many researchers have investigated & proposed different methods to optimize the performance of Photovoltaic panel & to reduce the installation costs. Hosseini et al. [3] experimentally studied the performance of a PV system combined with a cooling system consisting of a thin film of water running on the top surface of the panel & an additional fabricated system to use the hot water produced by the system. The results showed that the power output and electrical efficiency of combined system were higher and lower module temperature and reflection losses compared to conventional PV system. Furushima & Nawata [4] developed a photovoltaic system with cooling device utilizing siphonage & evaluated the performance of photovoltaic panel for the summer condition. The study showed

that the cooling of the PV module increased the electrical power output & the hot water produced could be used for heating purposes. In order to reduce the cell reflection & improve the PV performance Abdolzadeh&Ameri [5] evaluated the performance of the photovoltaic water pumping system by spraying water over the front of the photovoltaic cell & concluded that the PV cell efficiency, subsystem efficiency & total efficiency were increased by 3.26%, 1.40% & 1.35 % respectively at 16 m head due to spraying water over the cell.Teo et al. [6] developed ahybrid photovoltaic / thermal system consisting of a parallel array of ducts with an inlet/outlet manifold designed for uniform airflow distribution attached to the back of the PV panel. The experimental study showed that with an air cooling, the temperature of the panel dropped significantly & solar efficiency increased between 12% to 14%. Bahaidarah et al. [7] experimentally investigated the performance of photovoltaic module by incorporating a heat exchanger (cooling panel) at its rear surface. The water circulated through the heat exchanger absorbed the heat from the panel & the hot water produced could be utilized for the domestic applications. The result showed that with an active cooling, the module temperature dropped significantly to about 20% & the panel efficiency increased by 9%. Gang et al. [8] experimentally studied the performance of a novel heat pipe photovoltaic/thermal system and validated the model output with measured data. The experimental results showed an improvement in the system efficiency with cooling with water circulation. Krauter[9] used a method of reducing the reflection by flowing water over the top surface of the panel. The result showed that cell temperature dropped to 22°C & improved electrical yield 10.3% over the day. Many researchers employed air or water for active cooling of PV to achieve higher electrical efficiency, but additional energy consumption for air or water circulation may reduce the net power output. Therefore, Hongbing Chen et al. [10] conducted an experimental study to compare the performance of photovoltaic panel with & without fin cooling to investigate the effect of PV panel inclination, ambient temperature, and solar radiation & wind velocity on the electrical efficiency & power output. The study showed that the average power output of the PV panel with fin increased by 1.8% - 11.8% than without fin.

The objective of this study is to investigate the possibility of improving the performance of PV panel with fin cooling under natural convection.

II EXPERIMENTAL SETUP

The experimental setup was designed to investigate the effect of fin cooling on the performance of the photovoltaic panel. Figure2.1 shows the experimental setup consists of two 37W PV panel having area of 0.351m^2 . The maximum output voltage and current developed by the panel are 17.7V, 2.09A respectively at irradiance of 1000w/m^2 and ambient temperature of 25°C .For the passive cooling, fins made up of aluminium sheet of 0.8 mm thickness are used & glued evenly to the backside of the panel with thermal grease. Total 9 fins with different cross-sections are attached alternately with a constant spacing of 50 mm to restrict the flow of air in order to improve the heat transfer rate from the PV panel.Perforation has been done on the fins at an equal distance by a 10 mm drill bit. The panels tilt angle are set to 21 deg with respect to the horizontal, which is the local latitude of Nagpur (Latitude 21.1500° N , Longitude 79.0900° E), India, so as to face in the south direction. The temperatures of the panels are

measured by K-thermocouples which can sense the temperature from 0°C - 300°C & the readings will be shown on the RTD meter. Total 4 thermocouples are used to measure the temperatures at different locations. Two thermocouples are installed at the top & two at the backside of both the panels. Also the current & voltage are measured by the Omega type multimeter. The experiment was conducted from 9.00am to 3.00pm for 10 days & recorded the data for every 5 min.



Figure 2.1 Experimental setup (PV panels with & without Fins)

Table: 1Details of fin dimension & no of perforation shown in figure 2.2

Case	Size of fin	No. of perforation	Distance of perforation from bottom
1	600mm×100mm	09	50mm
2	600mm×60mm	09	30mm



Figure 2.2 Backside of the PV panel with Fins

2.1 Mathematical Formulation

Incident solar radiation on the PV panel gives the input power (in W) to the system which is given by

$$P_i = I_s \times A_c$$

The D.C. output power from the PV panel is given by

$$P_o = V \times I$$

Panel efficiency (E_a) is the measure of how efficient the PV panel is in converting sunlight to electricity.

$$E_a = P_o / P_i [11]$$

III RESULT & DISCUSSION

In this experiment, work was conducted to investigate the effect of fin cooling on the PV power output & efficiency for that two separate PV panels with & without fins were developed. Both the panels were placed close to each other to have same solar radiation. Readings were taken on both the panels simultaneously for comparison.

A PV solar cell's electrical power generation depends on its operating temperature. The impact of fin cooling on the cell temperature throughout the day is shown in figure 3.1. The variation of cell temperature for cooling & non-cooling case is presented and respective average cell temperatures were 59.5°C & 62°C . Cooling the PV Panel resulted in the reduction of the cell temperature by 4.2%. This temperature reduction resulted in a noticeable improvement in power output.

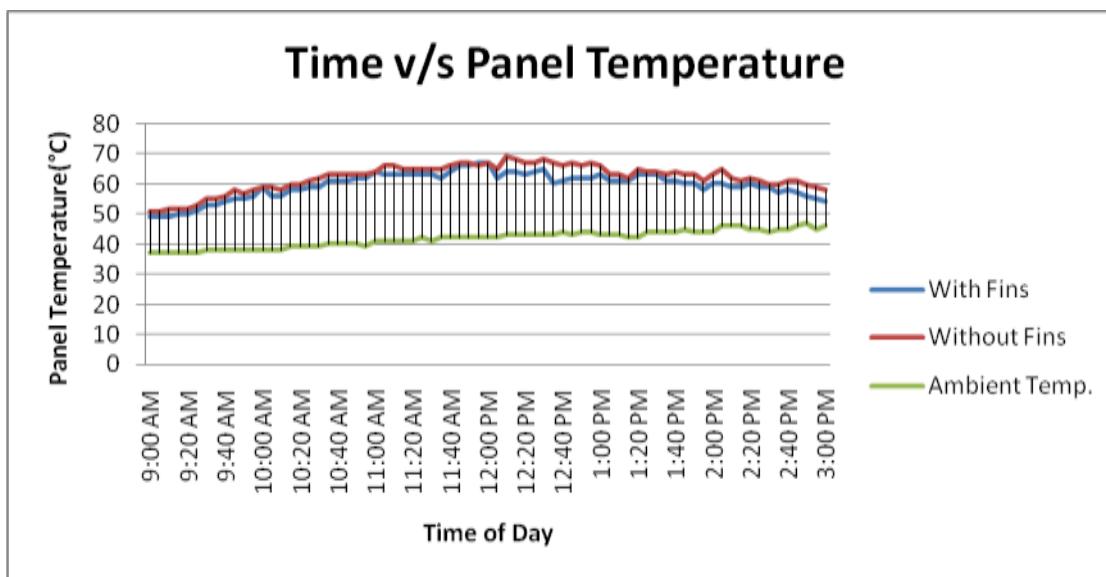


Figure 3.1 Comparison of PV panel temperatures with & without fin cooling

The maximum power output from the panel varies with the intensity of the solar irradiance and the temperature of the cell. It can be seen in the figure 3.2 that the maximum power developed by the module without fins was 53.24W at 11.55am whereas maximum power with fins was 58.5 W. An average increase of 5.5% in the power output of the module was observed in the case of fin cooling.

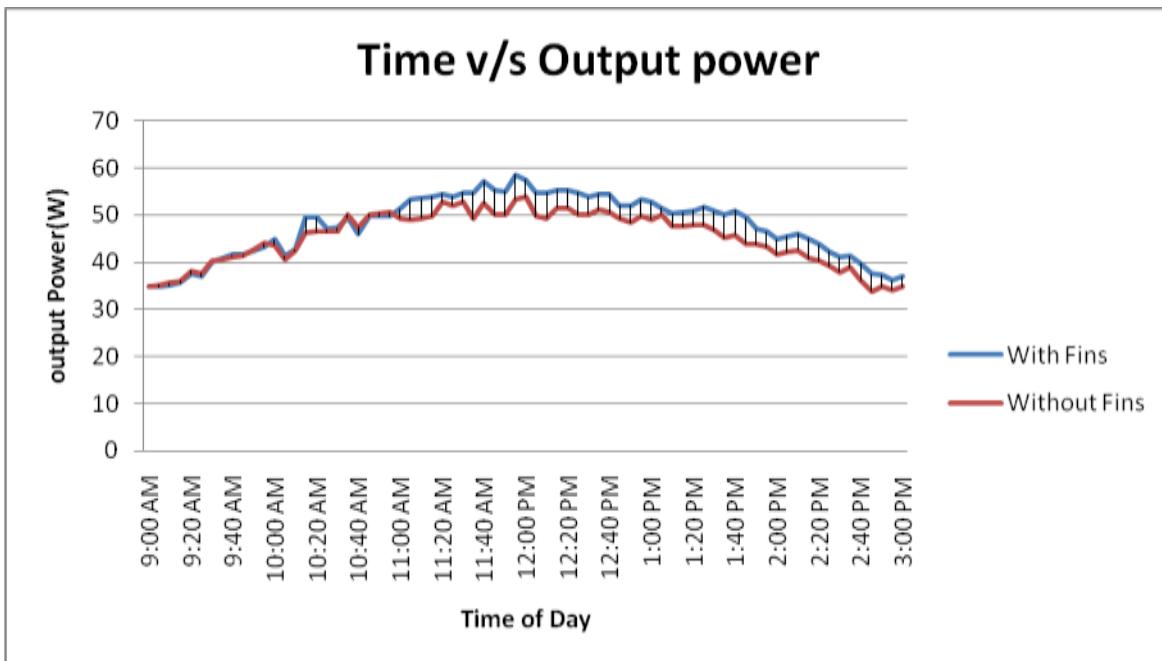


Figure 3.2 Comparison of output power with & without fin cooling

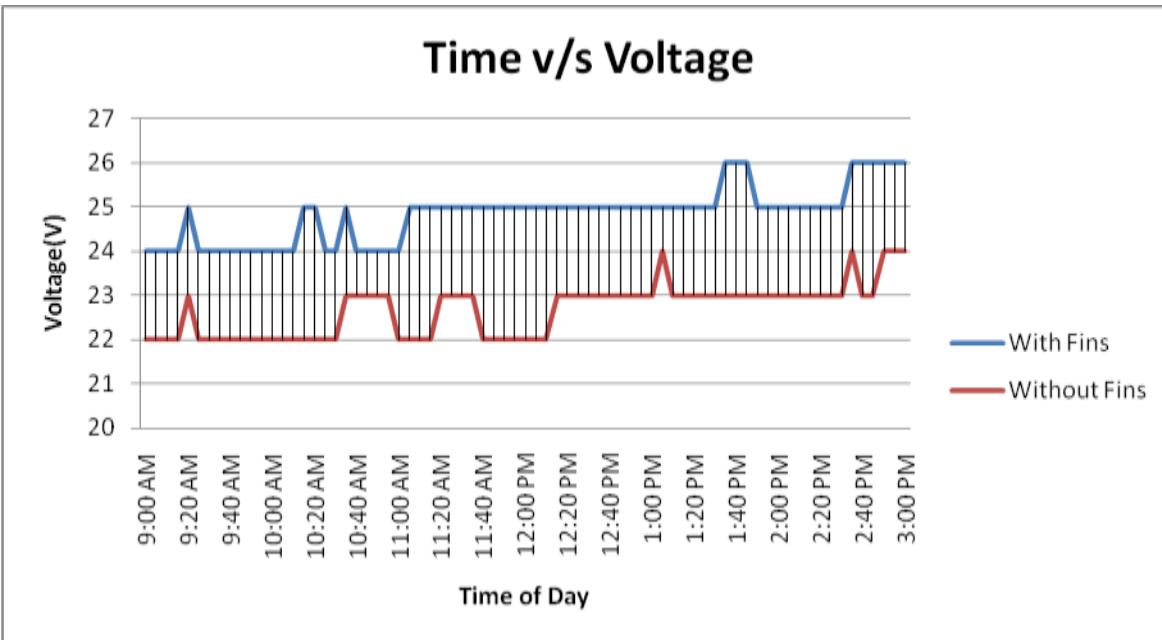


Figure 3.3 Comparison of PV Panel voltages with & without fin cooling

The short circuit current (I_{sc}) increases slightly with increasing temperature & the open circuit voltage (V_{oc}) decreases significantly with increasing temperature. This results in a reduction of electrical power output. Since efficiency and electrical yield decrease with increased operating temperatures, it is preferable to keep cells temperature as low as possible. In the present study, fins are used to cool the PV panel. Cooling of the PV panel with fins affects the variation of voltage & current as shown in the figure 3.3 & 3.4. It is clear from both the figures that due to the use of fins, temperature of panel decreases which slightly drops the current but increases the voltage. This ultimately increases the power output from the PV panel.

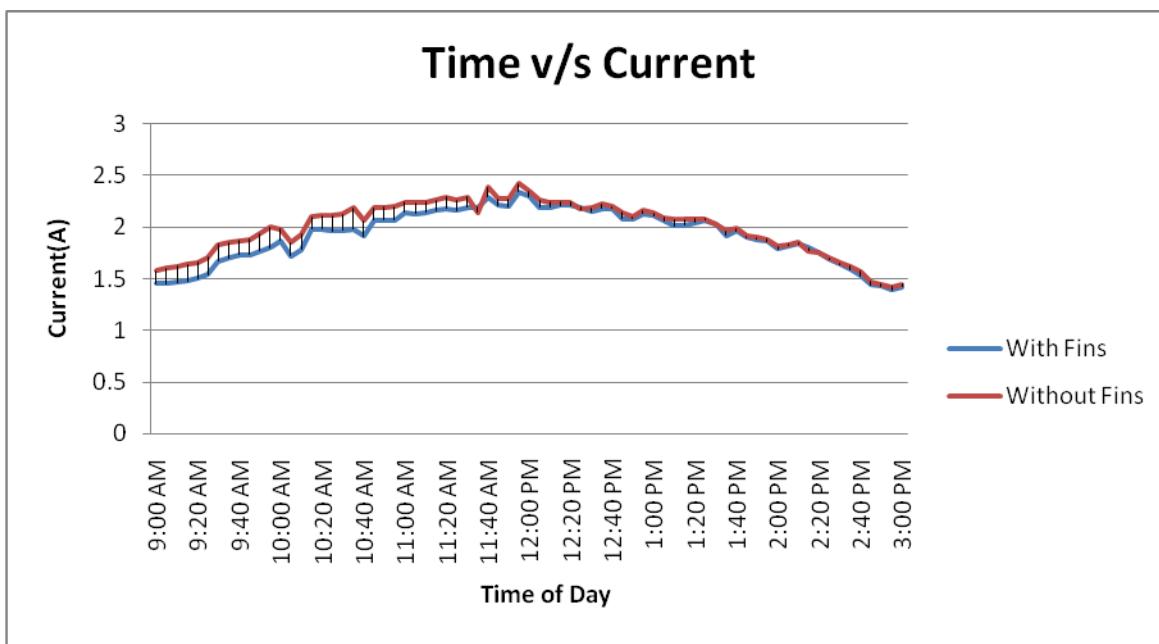


Figure 3.4 Comparison of PV panel current with & without fin cooling

IV CONCLUSION

Solar cells generates more electricity when receive more solar radiation but the efficiency drops when temperature of solar cell increases. Loss of efficiency due to raised temperature of PV panel can be reduced by the heat removal from the back surface of the panel with the help of fins which absorbs the heat generated by the cells during the day. This study examines the performance of the 37W PV panel with the fins. It is shown that with passive cooling technique, the operating temperature of the PV panel dropped significantly to about 4.2% and an increase of 5.5% in power output was observed. This increased power output increases the electrical efficiency of the panel.

NOMENCLATURE

P_i = Input Power in W

I_s = Solar radiation in W/m^2

YMCA, New Delhi (India), 1 Feb 2015

www.conferenceworld.inAc = Effective module cell area in m²

Po = Photovoltaic array output power in W

V = D.C. output voltage in Voltage (V)

I = D.C. output operating current in A

Ea= Panel efficiency

REFERENCES

Books:

[1]B.H.Khan,Non Conventional Energy Resources (Tata McGraw Hill Pulication, 2006), 5-21.

Journals:

[2]Adnan Ibrahim, Mohd Yusof Othman, Mohd Hafidz Ruslan, Sohif Mat, Kamaruzzaman Sopian, Recent advances in flat plate photovoltaic/thermal (PV/T) solar collectors, Renewable and Sustainable Energy Reviews, 15, 2011, 352-365.

[3]R. Hosseini, N. Hosseini, H. Khorasanizadeh, An experimental study of combining a photovoltaic system with a heating system, World Renewable Energy Congress 2011 Sweden, 8-13th may 2011.

[4]K. Furushima, Y. Nawata, Performance evaluation of photovoltaic power generation system equipped with a cooling device utilizing siphonage, Journal Solar Energy Engineering ASME, 128(2), 2006, 146-151.

[5]M. Abdolzadeh, M. Ameri, Improving the effectiveness of a PV water pumping system by spraying water over the front of photovoltaic cells, Renewable Energy, 34, 2009, 91-96.

[6] H.G. Teo, P.S. Lee, M.N.A. Hawlader, An active cooling system for photovoltaic modules, Applied Energy, 90, 2012, 309-315.

[7]H. Bahaidarah, Abdul Subhan, P. Gandhidasan, S. Rehman, Performance evaluation of a PV (photovoltaic) module by back surface water cooling for hot climatic conditions, Energy, 59, 2013, 445-453.

[8]P. Gang, Fu Huide, Z. Huijuan, JiJie, Performance study and parametric analysis of a novel heat pipe PV/T system, Energy, 37(1), 2012, 384-395.

[9]S. Krauter, Increased electrical yield via water flow over the front of photovoltaic panels, Solar Energy Materials & Solar Cells, 82, 2004, 131-137.

[10]Hongbing Chen, Xilin Chen, Sizhuo Li, Hanwan Ding, Comparative study on the performance improvement of photovoltaic panel with passive cooling under natural ventilation, International Journal of Smart Grid and Clean Energy, 3(4), 2014, 374-379.

[11]Shiv Lal, Pawan Kumar, Rajeev Rajora, Performance analysis of photovoltaic based submersible water pump, International Journal of Engineering and Technology, 5(2), 2013, 552-560.

ROLE OF INFRASTRUCTURE AVAILABILITY IN INDUSTRIAL DEVELOPMENT OF RESOURCE RICH STATES OF INDIA WITH RESPECT TO JHARKHAND

Bimal Chandra Roy

Assistant Professor, Department of Architecture, Birla Institute of Technology, Mesra, Ranchi (India)

ABSTRACT

Growth and diversification of industrial activities in any country or region can take place if there is adequate availability of resources along with financial and social infrastructure in the economy. Furthermore, the lack of integration among physical, financial and social development is also very instrumental in unpleasant economic growth. Interestingly, in the Indian states, the situation is more robust. This study tries to find out the state level disparities in terms of various parameters considered for facilitating the industrialisation process for the selected states. Further, using OLS Regression the study finds out the impact of various infrastructures on the industrial development of the selected mineral rich states formulating different models.

Keywords: *Disparity, Economic Growth, Industrial Development, , Infrastructure, Regression, Resource Rich*

I INTRODUCTION

It is widely recognized that industrialization, intended as the shift from agriculture to manufacturing, is key to development: hardly any countries have developed without industrializing. This phenomenon has been so striking to induce some economists to hypothesize that the manufacturing sector is the engine of economic growth, the so-called “engine of growth argument” (Kaldor, 1967; Cornwall, 1977). Infrastructure plays a leading role in industrial development. .The causal study by many researchers has established that in long run infrastructure is the leader and the industrial development is the follower.

In Indian context the main characteristic of development has been the wide regional disparity in development levels. Since India is a vast country, the geographical diversity does create some imbalance in resource base. A country with more than 65 years of planned development should have exploited the available resources of the different regions to stimulate some sort of development in every region. No doubt, the efforts have been made in this direction, but wide regional disparity is still a ground reality in India (Gulati, S.C. ,1977; Ghosh, B. and P. De,1998; Dadibavi, R.V. ,1991).

However, this study focuses on Jharkhand, which is one of the most mineral rich states of India. The study initially reviews the level of industrial development and the availability of the infrastructure facilities of Jharkhand with respect to the other mineral rich states of Maharashtra, Orissa, Tamilnadu and West Bengal. Formulating composite indices for different components of infrastructure, the extent of disparities among the districts is found. Further using the econometric models it is seen as to how far the mineral production, infrastructural availability and the institutional quality for the selected mineral rich states, is influencing their industrial development.

Further investigation reveals that 'Infrastructure' is contributing maximum (out of the components considered - mineral production, infrastructure and institutional quality) as suggested by the highest coefficient values under infrastructure head for all the models. The next contributing component is the institutional quality of the states.

However in all the three models considered, value of mineral production per capita is not found to be contributing significantly if the other infrastructural availability with proper institutional quality is not significant. The paper further tries to find out the contribution/impact (numeral values) of different components of the industrial development models which may find its implication in formulation of the useful policy tools for the urban planners

II IDENTIFICATION OF VARIOUS PARAMETERS CONTRIBUTING TO INDUSTRIAL DEVELOPMENT

Every parameter, on which development index of a region depends, has a correlation amongst each other. The parameter may be positively or negatively correlated i.e. increase in the level of one parameter may increase or decrease the level of other in question, but all the most they have some level of relation.

The correlation obtained from state level data obtained and generated for each state of Jharkhand as well as developed states of Maharashtra, Orissa, Tamilnadu and West Bengal gives vital directions into dependency of one parameter on other, both for Jharkhand as well as developed states. The parameters with which the correlations of level of industrialisation have been derived may be listed below as:

Resource parameters: Mineral Reserves; Per Capita Value of minerals production;

Physical infrastructural parameters: Road length in states per 100 Sq.Km; Railway route length in states per 100 Sq.Km; Electricity availability per 1000 population [total]

Banking Infrastructure parameters: Number of banks; Per capita bank deposits; Per capita bank credits to industry;

Social Infrastructure parameters: Literacy rate; Infant Mortality Rate

Institutional Quality parameters: Case Disposal Ratio per court; C-D Ratio of Banks; Ratio of Surfaced roads to total roads; Number of times President's rule imposed; Number of times CM headed a coalition government

III INTERSTATE DIFFERENCES WITH RESPECT TO VARIOUS PARAMETERS

The parameters for analysing the interstate differences for the considered resource rich states are taken from various development aspects like per capita income which is generally used as a routine economic indicator, percentage of urban population as a demographic parameter, annual average growth rate of the industry sector as an industrial development parameter, road length, railway route length, percent of villages electrified as parameters for physical infrastructure, number of commercial banks and credit deposit ratio as parameters of banking infrastructure and literacy rate and infant mortality rate as parameters of social infrastructure.

Table 1.0: Interstate Differences with respect to various parameters

Infrastructure Measures	Jharkhand	Maharashtra	Odisha	Tamilnadu	West Bengal	India
Per capita income(Rs.)	21734	66729	25708	51117	31673	35993
% of urban population	22.25	42.4	33	43.86	28.03	27.8
Annual average growth rate in industry sector (%)	5.30	9.16	8.04	8.79	5.44	6.87
No. of scheduled commercial banks offices	2118	9053	3196	7253	5796	96059
Road length per 100 Sq.Km	29.99	133.41	166.23	147.89	337.13	115.30
Railway route length per 1000 Sq.Km	24.89	18.20	15.81	31.23	44.36	19.61
% of villages electrified	31.1	88.3	62.6	100	97.3	83.7
Credit deposit (C-D) ratio (%)	33.62	87.08	46.92	116.16	62.87	78.09
Literacy rate (%)	56.21	75.48	64.36	73.86	71.16	65.46
Infant mortality rate (%)	28	17	40	19	26	29
Total major mineral reserves (million tonnes)	82982.98	10799.01	73920.00	33373.92	29956.71	--

Source: Census 2011, Various Data Tables of Planning Commission of India for 2011, GSI & CMPDI 2010

For most of the infrastructure measures shown in Table 1.0, covering the different aspects of socio-economic development, Jharkhand is found to be lagging behind, among the states considered as well as at the national average perspective. A paradox (reflecting a mineral resource conflict) may be noticed that-in the total mineral reserves, Jharkhand is the leading state having maximum value but for all the other developmental parameters considered, Jharkhand is found to be an underperformer among the states considered and it is far below the national average except only one parameter i.e. the railway route length.

IV DATA AND METHODOLOGY

The study is mainly based on the secondary data for the selected mineral rich states of Jharkhand, Maharashtra, Orissa, Tamilnadu and West Bengal, which measures the level of industrialisation and the infrastructural

availability for the period 2001-2011. The data of, value of mineral production are referred from various issues of annual reports of Indian Bureau of Mines (IBM) and infrastructure facilities are referred from the statistical abstract from Directorate of Economics and Statistics of the respective states, Planning Commission annual reports, , whereas demographic statistics of individual states are taken from Statistical Abstract, State Census data , are considered for the analysis.

4.1 Research Method

Common problems with such type of analysis are multicollinearity and dimensionality. Principal component analysis (PCA) is used as a statistical tool to remove these problems. Dimension reduction technique of Factor analysis which uses PCA is applied to those variables/proxies which are highly correlated amongst each other Since the units of measurement of correlated variables are different, the rotated component matrix using PCA is used in order to obtain the corresponding weights. Since a variable should not have an artificially higher weight due to its higher variance, the data are standardized with variance one (1) and mean zero (0) before applying PCA. Principal components having Eigen values greater than one (1) are selected. After standardizing the data, it is multiplied with the weight as suggested by PCA to arrive at the corresponding indices or. The obtained weights are multiplied by the corresponding standardized values of the variables to arrive at the composite indices.

V MODELS

For better understanding the impact of various components like Value of Mineral Production Per Capita [VMPC], Infrastructure which covers mainly the Physical Infrastructure [PI], Banking infrastructure [BI] and Social Infrastructure [SI] parameters along with the various parameters of Institutional Quality [IQ], on the industrial development, the following model is formulated -

$$Y_i = \alpha_i + \beta_i (\text{VMPC})_i + \lambda_i (\text{Infrastructure})_i + \theta_i (\text{IQ})_i + \varepsilon_i$$

Where Y_i represents the level of industrial development of the i^{th} state, VMPC is the value of mineral production per capita, Infrastructure is composite contribution of PI,BI and SI, IQ is the composite contribution of the parameters considered under Institutional Quality. Composite contribution can be assessed by formulating the corresponding composite indices. α is the intercept, β , λ and θ are the corresponding co-efficient of the different parameters of industrial development and ε is the error term.

The level of industrial development may be analysed using- share of industry sector in SGDP, share of manufacturing sector in SGDP and the per capita income of the selected states.

The subsequent models can be rewritten as-

$$Y_{SISi} = \alpha_i + \beta_i (\text{VMPC})_i + \lambda_i (\text{Infrastructure})_i + \theta_i (\text{IQ})_i + \varepsilon_i \quad (\text{I})$$

$$Y_{SMSi} = \alpha_i + \beta_i (\text{VMPC})_i + \lambda_i (\text{Infrastructure})_i + \theta_i (\text{IQ})_i + \varepsilon_i \quad (\text{II})$$

$$Y_{PCLIi} = \alpha_i + \beta_i (\text{VMPC})_i + \lambda_i (\text{Infrastructure})_i + \theta_i (\text{IQ})_i + \varepsilon_i \quad (\text{III})$$

Where Y_{SIS_i} represents the level of industrial development in terms of share of industry sector in SGDP for the i^{th} state, Y_{SMS_i} is the level of industrial development in terms of share of manufacturing sector in SGDP for the i^{th} state, and Y_{PCI_i} is the per capita income for the i^{th} state, of the selected states.

VI RESULTS AND DISCUSSIONS

The results are analysed using the different composite indices formulated, which is used in studying the interstate disparities, as well as the solutions to the different models. The three alternative equations have been solved for all selected states as a group and for parallelly for the individual states. As the result of Model I did not give significant results, in the second section, the study discusses the results of the Model II and Model III only.

6.1 Results of OLS regression between level of industrial development, VMPC, Infrastructure and IQ [For all the states as a group]

Values of Table 2.0 suggest that Model-I is not explaining the variances in the data, but the rest models i.e. Model-II and Model-III are contributing to the level of industrial development of the resource rich states, which are shown by the highly significant values of F-Statistics.

Further investigation reveals that ‘Infrastructure’ is contributing maximum (out of the components considered - mineral production, infrastructure and institutional quality) as suggested by the highest coefficient values under infrastructure head for all the models. The next contributing component is the institutional quality of the states. However in all the three models considered, value of mineral production per capita is not found to be contributing significantly which may be an indication that mineral production without any value addition is not contributing in its maximum extent.

Table 2.0: Regression values for the resource rich states under consideration for Model-I, Model II and Model III [Contribution of different components to industrial development]

	Intercept	VMPC	Infrastructure	IQ
Model I	3.614	0.0104	0.0769	0.0212
AR ²	0.8046			
F-Statistics	1.682			
Model II	4.135	-0.0167	2.461***	0.072**
AR ²	0.594			
F-Statistics	22.502***			
Model III	6.589	-6.535	2.589***	0.340***
AR ²	0.854			
F-Statistics	140.322***			

Abbreviations: VMPC-Value of mineral production per capita, IQ- Institutional Quality.

*** Significant at 1% significance level ** Significant at 5% significance level

Further it would be better if Model-II and Model-III are further analysed at individual state level. The next section takes a look into the interstate differences for the various components contributing to the industrial development, at individual state level.

6.2 Results of OLS regression between level of industrial development, VMPC, Infrastructure and IQ [For individual state]

It is clear from the value of Table 2.0 that only Model-II and Model-III are contributing models, hence for these models, the level of industrial development is analysed, for the individual state under consideration.

Table 3.0: Regression values for the resource rich states under consideration for Model- II and Model-III

States	Model-II				Model-III			
	Intercept	AR ²	t-Stat.	F-Stat.	Intercept	AR ²	t-Stat.	F-Stat.
Jharkhand	-21.06	0.491	0.4573	0.2092	60.94	.6032	6.1436***	37.74***
Maharashtra	37.34	0.753	3.041**	5.166**	-244.29	0.8293	6.6880***	44.72***
Orissa	33.02	0.584	1.701	2.894	-756.6	0.617	3.9388***	15.51***
Tamilnadu	-21.77	0.723	2.317**	10.638***	372.82	0.845	14.923***	32.70***
West Bengal	37.20	0.595	2.89**	8.375**	734.91	0.767	5.533***	30.68***

*** Significant at 1% significance level

** Significant at 5% significance level

Table 3.0 shows that, Model-III which measures the industrial development with respect to per capita income is found to be highly significant for all the states. Model -II, which measures the industrial development with respect to share of manufacturing sector, is significant only for Maharashtra, Tamilnadu and West Bengal. This may be explained as these states are the better performing states in terms of industrial development, while the states of Jharkhand and Orissa, are not contributing, reflecting the low level of industrial development in these states.

Further, the comparative analysis of the states, suggests the lowest value of Adjusted R² in Model-II is 0.491 which corresponds to Jharkhand. Similarly in Model-III, Jharkhand has the lowest Adjusted R² value of 0.6032. The lowest Adjusted R² values suggest that (for both the models), Jharkhand is not performing satisfactorily and is lagging behind amongst the other resource rich states.

VII CONCLUSION

The above study thus leads us to believe that the Industrial Development level of a region is substantially determined by the level of Infrastructure available therein. Different types of infrastructure affect different facets of development and the interactions between them are such that infrastructure is the leader and development is the follower in most cases. Moreover, specific developmental stage of a region is also a crucial factor that determines the nature and magnitude of the association between different components of infrastructure and development level. The outcome of the study seems to highlight the immediate need for infrastructural expansion and development in Jharkhand.

REFERENCES

- [1] Kaldor, N., *Strategic Factors in Economic Development*, Cornell University Press, Ithaca, New York, USA, 1967.
- [2] Cornwall, J., *Modern Capitalism: Its Growth and Transformation*, London, Martin Robertson, 1977.
- [3] Gulati, S.C. , Dimensions of Inter-District Disparities, Indian Journal of Regional Science, 9(2), 1977.
- [4] Ghosh, B. and P. De , *Role of Infrastructure in Regional Development - A Study over the Plan Period*, Economic and Political Weekly, 33(47), 1998.
- [5] Dadibhavi, R.V. , *Disparities in Social Infrastructural Development in India: 1970-71 to 1984-85*, Asian Economic Review, 33(1), 1991.