# DESIGNING OF MPLS AND ENSURING FAST CONVERGENCE AND SECURITY PERFORMANCE THROUGH VPN

**N.Abinaiya[1], S.Rashmi[2], J.Jayageetha[3]**

*[1,2]PG Student/ Communication Systems,[3]Assistant Professor/ Department of ECE,*

*SNS College of Technology, Coimbatore, (India)*

## ABSTRACT

*Need of global networking is increasing day by day and is a primary need. There has been a rapid growth of the routing protocols in the area of communication. A routing protocol is a protocol which is responsible to determine how routers communicate with each other and forward the packets through optimal path to travel from source node to destination node. The performance of each routing protocol is different from each other. In the context of routing protocol, protocol performance, each of them has different architecture, adaptability, route processing delays, convergence capabilities and many more. Among different routing protocols, Multi Protocol Label Switching (MPLS) has been considered for the IPv4 network. When we want to design a Wide Area Network (WAN), Open Shortest path First (OSPF) is a standard protocol which is being widely used. OSPF is classified as an Interior Gateway Protocol (IGP) which provides fast convergence in larger network. It can be ensure that the latency can be reduced and convergence speed can be made still faster when MPLS protocol is used. MPLS is an innovative approach in which forwarding decision is taken based on labels. It also provides a flexible and graceful VPN solution based on the use of LSP tunnels to encapsulate VPN data. Multi-protocol Layer Switching (MPLS) VPNs are best solution for medium and large enterprises that currently deploy site-to-site VPN services. MPLS provides sophisticated traffic engineering capabilities that, coupled with IP QoS, enable multiple classes of service so business critical applications are treated with higher priority than less important applications and "best effort" services. This project is based on simulation for performance analysis of OSPF protocol and MPLS protocol in IPv4 network by the parameters like Latency and Throughput. The simulation tool used is Graphic Network Simulator (GNS-3) and Wireshark*

***Keywords: Adaptability, Convergence, Ipv4, OSPF, VPN.***

## I.INTRODUCTION

MPLS is a scalable, protocol-independent transport. In an MPLS network, data packets are assigned labels. Packet-forwarding decisions are made solely on the contents of this label, without the need to examine the packet itself. This allows one to create end-to-end circuits across any type of transport medium, using any protocol. The primary benefit is to eliminate dependence on a particular OSI model data link layer technology, such as Asynchronous Transfer Mode

(ATM), Frame Relay, Synchronous Optical Networking (SONET) or Ethernet, and eliminate the need for multiple layer-2 networks to satisfy different types of traffic. MPLS belongs to the family of packet-switched networks.

MPLS operates at a layer that is generally considered to lie between traditional definitions of layer 2 (data link layer) and layer 3 (network layer), and thus is often referred to as a "layer 2.5" protocol. It was designed to provide a unified data-carrying service for both circuit-based clients and packet-switching clients which provide a datagram service model. It can be used to carry many different kinds of traffic, including IP packets, as well as native ATM, SONET, and Ethernet frames.

A number of different technologies were previously deployed with essentially identical goals, such as Frame Relay and ATM. Frame Relay and ATM use it to move frames or cells throughout a network. The header of the ATM cell and the Frame Relay frame refer to the virtual circuit that the cell or frame resides on. The similarity between Frame Relay and ATM is that at each hop throughout the network, the “label” value in the header is changed. This is different from the forwarding of IP packets. MPLS technologies have evolved with the strengths and weaknesses of ATM in mind. Many network engineers agree that ATM should be replaced with a protocol that requires less overhead, while providing connection-oriented services for variable-length frames. MPLS is currently replacing some of these technologies in the marketplace. It is highly possible that MPLS will completely replace these technologies in the future, thus aligning these technologies with current and future technology needs.

At the same time, MPLS attempts to preserve the traffic engineering and out-of-band control that made Frame Relay and ATM attractive for deploying large-scale networks. While the traffic management benefits of migrating to MPLS are quite valuable (better reliability, increased performance), there is a significant loss of visibility and access into the MPLS cloud for IT departments.

## II.EXISTING SYSTEM

### 2.1 Introduction

Implementation of high speed networks in internetworking environment very essentials in the present century, at present IPv4 networks provides communication in internet work environment. In IPv4 network, routing is being done at layer 3 network layer based destination network ID. The IPv4 network has disadvantage such as less security, less QoS and Latency. Also routing being done at Layer 3 has the following disadvantages:

- When the number of nodes increased, then the Routing database increases.
- When Routing database increased, processing delay gets increases
- Due to the Processing delay, Latency increases so that the Reliability of the network becomes decreases.

When the WAN has to be designed, at present OSPF is the standard protocol which is being used.

### 2.2 Overview of OSPF Protocol

OSPF is a link-state routing protocol based on open standards and is highly scalable. As such, OSPF can scale 1000s of nodes and therefore routing tables can get very big. To combat this, OSPF networks are divided into multiple areas. It

can support up to FOUR equal cost paths and converges quickly. It uses partial updates with only the changes being flooded to the network. OSPF supports VLSM therefore OSPF is classless. It is good for very large networks i.e. those having a diameter of 15 hops or more. It makes good use of bandwidth; OSPF multicasts link-state updates – these are only sent when a topology change occurs.

OSPF selects routes based on cost (bandwidth). OSPF group's members into 'areas' and breaks the network into small clusters of routers. OSPF limits traffic regionally and can prevent changes in one area affecting another.

OSPF Protocol has the following Characteristics:

- Fast detection of changes in the topology and very fast reestablishment of routes without loops.
- Low overload, use updates that inform about changes on routes.
- Division of traffic by several equivalent routes.
- Routing according type of service.
- Use of multi-send in local area networks.
- Subnet and Super-net mask.
- Authentication

### 2.3 OSPF Packet


**Fig.1: OSPF Packet**

**VERSION field**: Describes which version of the OSPF protocol it is (1 or 2)

**TYPE**: Describes the type of packet. It includes Hello, Database description, LS request, LS update and LS acknowledgement

**PACKET LENGTH:** Packet length including header

**ROUTER ID**: IP of the generated router and IP of the interface over which the message has to be sent

**AREA ID**: Area to which the message belongs

**AUTHENTICATION TYPE**: No authentication, Simple password, Cryptographic authentication

## III. PROPOSED SYSTEM

### 3.1 Introduction

IPv4 network with MPLS protocol is proposed to overcome all the limitation of IPv4 network. This network shares the information through VPN and it provides the corporate domains to access, transfer, receive, data (voice, video, or any form of data) with high efficiency, security, resource management. This VPN provided at layer one and two have efficiency's but lacked in providing uninterrupted transmission and reception of data their higher physical connectivity and reduced knowledge of high layered devices. MPLS plays a Key role in NG Networks by delivering high efficient QoS (Quality of Service) and traffic engineering features. It also proposed that MPLS employed with OSPFv2 protocol (for IPv4 addressing) provides standard Traffic engineering along with BGPv4 protocol provides inter AS high reliable connectivity in an secured L3VPN layered Network. This scheme can achieve reliable explicit routing which deploys maximally-disjoint pre-calculated alternate paths with improved secured packet transmission in networks supported even in heavy traffic environments.

### 3.2 MPLS Overview

Multi-Protocol Label Switching (MPLS) networks are the next-generation of networks designed to allow customers create end-to-end circuits across any type of transport medium using any available WAN technology. Until recent years, customers with the need to connect remote offices in locations across the country were restricted to the limited WAN options service providers offered, usually Frame Relay or T1/E1 dedicated links. The problem with these WAN technologies is that they are usually very expensive and complex to manage, but also not very flexible, making them a headache for both the end customer and service provider. Worst of all, as the distance between the customer's end points increased, so did the monthly bill. MPLS works by tagging the traffic entering the MPLS network. An identifier (label) is used to help distinguish the Label Switched Path (LSP) to be used to route the packet to its correct destination. Once the best LSP is identified by the router, the packet is forwarded to the next-hop router. A different label is used for every hop and the label is selected by the router (or switch) that is performing the forwarding operation.

### 3.3 Operation of MPLS

MPLS works by prefixing packets with an MPLS header, containing one or more labels. Fig.2 shows the label format of MPLS. This is called a label stack. Each label stack entry contains four fields:

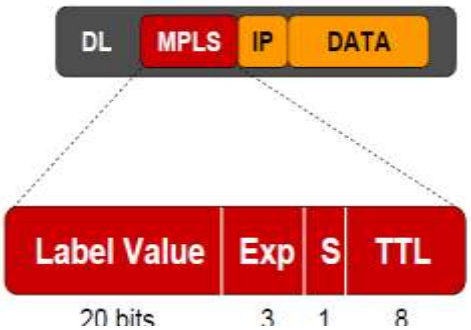



**Fig.2: Generic MPLS Label Format**

- A 20-bit label value. A label with the value of 1 represents the router alert label.
- A 3-bit *Traffic Class* field for QoS (quality of service) priority (experimental) and ECN (Explicit Congestion Notification).
- A 1-bit *bottom of stack* flag. If this is set, it signifies that the current label is the last in the stack.
- An 8-bit TTL (time to live) field.

### 3.4 MPLS Architecture

MPLS is a tunneling technology used in many service provider networks. MPLS works by prefixing packets with an MPLS header having one or more label known as label stack. With the contribution of MPLS-capable routers or switches in central gateway protocols such as Open Shortest Path First (OSPF) or Intermediate System to Intermediate System (IS-IS), the network automatically builds routing tables.

As shown in the fig.3, the MPLS network consists of the following components:

- **Customer Edge**

  It structures the customer message into IP Packets and sends to the entry node of MPLS domain. While receiving the IP Packets from the egress node of the MPLS domain, CE sends packets to Network layer of its own, after removing the IP address.

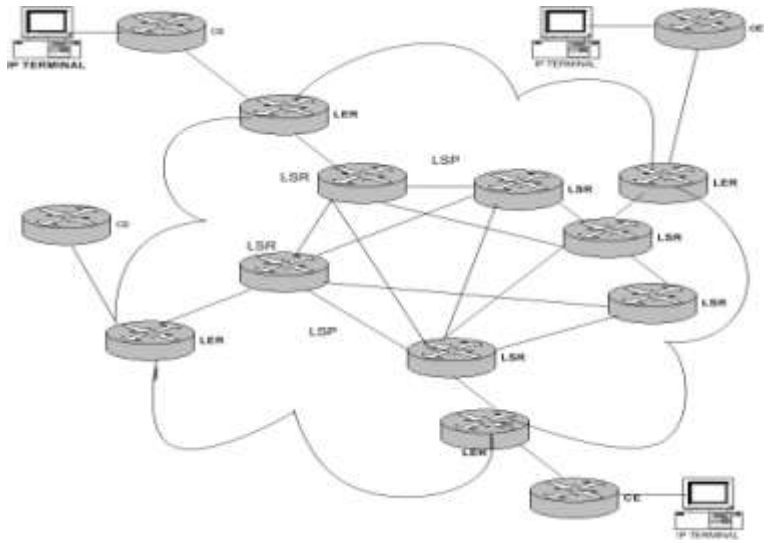



**Fig. 3: Architecture of MPLS**

- **Label Edge Router**

  Label Edge Routers are working as the gateways of MPLS Domain. Ingress LER, it receives the IP Packet from CE, assigns the appropriate Label. After wrapping label, it sends labeled packet towards the next hop through the Label Switched Path, which is assigned for the specific Forward Equivalence Class. Assigning the Label is known

as Label Binding. LER also acts as the egress Router. It receives the labeled IP Packets from the previous transit router, pops up the label (removes the label) and routes the IP packets towards the destined CE. LER receives the multiplexed input from CE, and extends the switched output towards the transit routers.

- **Label Switching Router**

  Label Switched Routers are basically working as transit switches in MPLS cloud. It receives Labeled IP packets through the appropriate LSP.

  It analyses the Label bound over the packet, consults the forwarding information table (LIB) and routes the packet through the appropriately mapped out going LSP. When the LSR is routing the packets from incoming LSP to outgoing LSP, it strips out the Incoming Label and assigns a new label to same packet to ensure the security from the intruders. This process is known as Label Swapping or Label Changing. MPLS Network architecture is as shown in the diagram. Lines, shown between CE and LER carry the IP Packets bi-directionally.

- **Label distribution protocol (LDP)**

  It is one of the primary signaling protocols for distributing labels in MPLS network. It is a set of procedures and messages by which Label Switched routers (LSR) establish Label Switched Path (LSP) through a network by mapping network layer routing information directly to data link layer switched paths. By means of LDP LSR can collect , distribute and release label binding information to other LSRs in the MPLS network thus enabling hop-by-hop delivery of packets in the network along routed paths.

- **Label Switched Paths**

  Within an MPLS domain, a path is set up for a given packet to travel based on an FEC. The LSP is set up prior to data transmission. Lines, shown in the MPLS domain, are the Label Switched Paths that carry labeled IP Packets between the routers. There are two types of Label Switched Path. One is Static LSP and the other is Signaled LSP.

### 3.5 Services Provided By MPLS

- **MPLS VPN**

It is a tunneling technology, which gives the platform to create and implement MPLS based Virtual Private Networks (VPNs). It is developed to enhance the packet forwarding over the high performance backbone networks. MPLS forwards the IP packets to the distinct routers instead of the end devices on the basis of small labels . The MPLS application helps to create a tunnel or Label Switched Path (LSP). The small labels are sent over the path. The ingress (entry point of MPLS network) router over the MPLS network path appends this small label to the arriving packet. Over LSP, the hops swap the labels with the new ones to forward the packet. This process keeps on going until the packet arrives at the egress (exit point of MPLS network) router. The egress router strips-off the label and sends the packet towards its destination. The basic advantage of MPLS technology which we just noticed is that IP header analysis which on the other hand is necessary in traditional IP packet forwarding mechanism does not need here. The IP header is analyzed and a small label is appended to the packet at the entry point of the MPLS network. The ingress router may also analyze some extra information about the entering packet to assign it the best route which results in achieving the Quality of Service (QoS). When we talk about the traffic engineering as compared to traditional IP networks, it becomes

so easier after choosing the explicit routes in MPLS network. So, this makes the MPLS technology more efficient.

The demand of securely sharing confidential data over public networks is growing day by day as the organizations are expanding their networks. The data sharing between offices, sub offices, and end users is an important requirement of large organizations and ensuring data confidentiality and integrity is a major concern. Keeping these requirements in view, the technology which is in use is VPN. The VPNs provides the platform to share data securely across the public network. The main users of VPNs are the service provider administrators, local enterprise network administrators and the end users.

The MPLS based VPNs offers verity of good services as compared to the traditional VPNs. They offer scalability, better flexibility, eases management. They are low cost, and support different QoS models MPLS VPNs use Border Gateway Protocol to distribute routes and MPLS technology to forward packets across the network. BGP/MPLS is point-to-point VPN, which uses the services of both BGP and MPLS. The introduction of MPLS technology into VPN network is made to achieve different services like, easy integration, simplification of virtual network, enhance network security, minimizes the complexity, cost reduction and the most important is QoS. The QoS is the major point of concern when services are required from service providers. Therefore, the MPLS VPN technology helps the service provider to achieve QoS over high performance backbone networks.

- **Traffic Engineering**

Traffic Engineering is the process of routing data traffic in order to balance the traffic load on various links, router and switches in the network. It has the ability to control specific routes across a network to reduce congestion and improves the cost of efficiency of carrying IP Traffic. MPLS is capable of full traffic engineering.

- **Quality Of Service Of Mpls**

QoS stand for Quality of Service is defined as the set of techniques to control bandwidth, delay, and jitter and packet loss in a network. QoS also provides techniques to supervise network traffic. It refers to a number of related features of telephony and computer networks that permits the transportation of traffic with the necessities. At the ingress to the MPLS network, Internet Protocol (IP) precedence information can be copied as Class of Service (CoS) bits or can be mapped to set the appropriate MPLS CoS value in the MPLS label. This is the distinction between IP QoS that is based on IP precedence field in the IP header and MPLS QoS that is based on the CoS bits in the MPLS label. MPLS CoS information is used to provide differentiated services. Hence MPLS CoS enables end-to-end IP QoS across the network.

## IV. VPN

A virtual private network (VPN) is a technology for using the Internet or another intermediate network to connect computers to isolated remote computer networks that would otherwise be inaccessible. A VPN provides varying levels of security so that traffic sent through the VPN connection stays isolated from other computers on the intermediate network, either through the use of a dedicated connection from one "end" of the VPN to the other, or through encryption. VPNs can connect individual users to a remote network or connect multiple networks together.

There are two types of VPN,

1. Remote access VPN
2. Site-to-site VPN

In a site-to-site VPN, hosts do not have VPN client software; they send and receive normal TCP/IP traffic through a VPN gateway. The VPN gateway is responsible for encapsulating and encrypting outbound traffic, sending it through a VPN tunnel over the Internet, to a peer VPN gateway at the target site. Upon receipt, the peer VPN gateway strips the headers, decrypts the content, and relays the packet towards the target host inside its private network.

Nowadays, the network traffic growth rapidly, so the traditional networks like ATM, frame relay, Ethernet are not able to support this situation. So service provider discovers a new technology that solves this problem. The new IP forwarding that can handle this situation is Multi Protocol Label switching (MPLS). This technology can give higher ability such as scale, traffic engineering capability and provides Quality of Services (QOS).

## 4.1 MPLS VPN

MPLS popularity has increased exponentially in the last few years. One of the most compelling drivers for MPLS in service provider networks is its support for Virtual Private Networks (VPNs), in which the provider's customers can connect geographically diverse sites across the provider's network .First thing people confuse is the usage of the words MPLS and VPN. Both are separate terminologies. MPLS is the protocol that runs on top of your routing protocols. And VPN is all about creating a virtual network end to end across the internet. Traditionally VPN were based on IPsec (layer 3) or TLS (layer 2) which were slow and sluggish and merely less on features. MPLS had all these points into consideration as it evolved right inside Cisco labs, where it took birth. The MPLS VPN backbone and the customer sites exchange layer-3 customer routing information and packets are forwarded between multiple customer sites through the MPLS enabled backbone using the MPLS VPN services.

### 4.1.1 Components of MPLS VPN

As shown in the fig. 4, the MPLS VPN has the following five components:

- **Customer network**: It is under customer's administrative domain.
- **Provider network**: It is under Provider's admin control and responsible for providing routing between various customer's sites.
- **CE Routers**: Customer edge routers connecting the Provider MPLS network.
- **PE Routers**: Provider MPLS edge router connecting to single or multiple customer CE routers.
- **P Routers**: Provider MPLS backbone routers that interface with either other Provider backbone or PE routers.

MPLS based VPN accommodates for the overlapping IP address space between multiple customers by isolating each customer's traffic. The CE routers only get the traditional IP traffic and no labeled packets are forwarded to the CE routers. CE routers do not need any MPLS configuration for connecting to the Provider MPLS VPN network. PE Router is the first place where the MPLS VPN implementation starts, the PE router is responsible for isolating customer traffic

if multiple customers are connected to the PE router. This is done in PE router by assigning an independent routing table to each customer, which is as good as assigning a dedicated router to each customer. The rest of the Provider network (P routers), the routing is done using the global routing table where P routers provide label switching between provider edge router and they are unaware of the VPN routes. The entire process is transparent to the customer as the CE routers are not aware of the presence of the P routers and Provider network's internal topology. In the Provider network the P routers are only responsible for the label switching and they do not carry VPN routes and do not participate in the MPLS VPN routing.

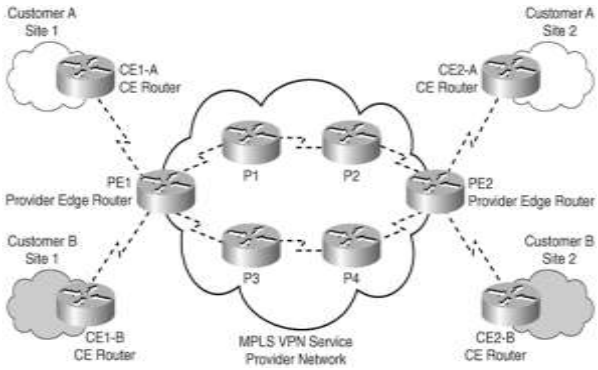



**Fig.4: Architecture of MPLS VPN**

## V. RESULTS

### 5.1 Network Topology

The network topology is created with seven routers and eight clouds as shown in Fig.5. This is considered as a Wide Area Network and it is converged with OSPF and MPLS protocol and the comparisons are made between them. **Graphic Network Simulator** (GNS-3) and **Wireshark** are the simulation tools which are used to make the performance analysis.

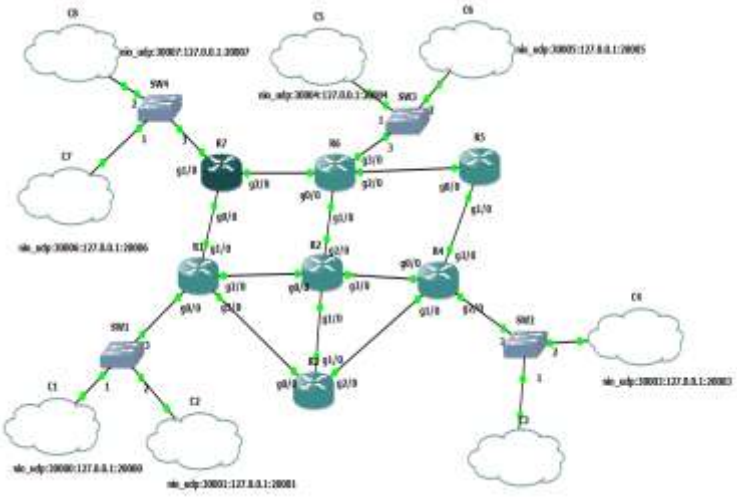


**Fig.5: Network Topology**

### 5.2Latency Analysis

In evaluating the performance of the convergence of OSPF and MPLS, the average transmission latency was measured first. Typically, the average transmission latency is the time taken for a packet to be transmitted across a network connection from sender to receiver.

**TABLE.1: Latency Analysis of OSPF**

| **PACKET SIZE (bits/sec)** | 400 | 600 | 800 | 1000 | 1200 |
|---|---|---|---|---|---|
| **LATENCY (ms)** | 135 | 150 | 155 | 158 | 160 |

**TABLE.2: Latency Analysis of MPLS**

| **PACKET SIZE (bits/sec)** | 400 | 600 | 800 | 1000 | 1200 |
|---|---|---|---|---|---|
| **LATENCY (ms)** | 105 | 120 | 125 | 129 | 132 |

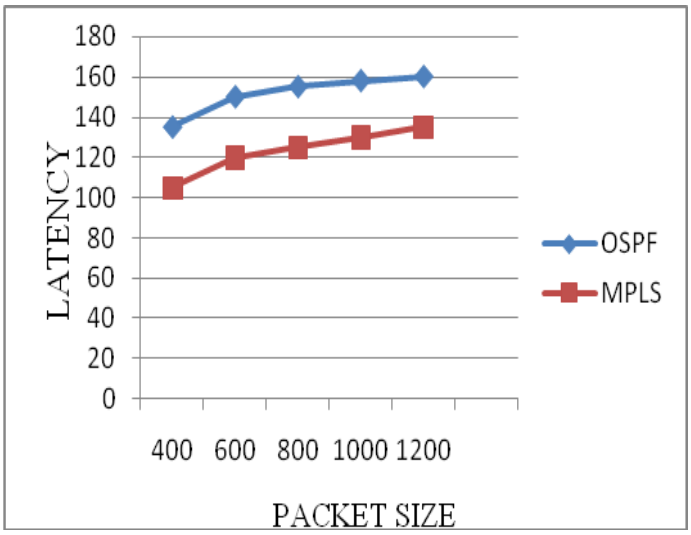



**Fig.6: Comparison of Latency Analysis**

As shown in the figure 6, The MPLS protocol reduces the latency when compared to OSPF protocol.

### 5.3 Analysis of Convergence Time

In evaluating the performance of the convergence time of OSPF and MPLS, the convergence time was measured. The time taken for the packet to take alternative path when any link gets failure is termed as convergence time. By the analysis of convergence time of OSPF and MPLS protocol it has been proved that the MPLS protocol has very less convergence time as compared to OSPF protocol.

## VI.CONCLUSION

This project highlights the need for implementing MPLS technology to overcome some of the limitations involved in pure IP based forwarding. This paper also explains the concept of MPLS protocol in depth by providing the fundamentals of MPLS protocol and operation and working of MPLS network module. So, for this MPLS is an emerging technology and by no means a perfect solution to current IP network problems. It provides much better Traffic Engineering capability than the other networks. MPLS operates in coordination with IP Routing and its main objective is to provide the speed of switching to Layer 3. Introduction of labels provides an effective alternative and evades the need of large routing table lookups and results in fast routing. However, the telling factor of MPLS is its ability to manage and classify the traffic in order to provide better utilization of resources. Hence, this technology is used to effectively resolve integration and traffic engineering issues in carrier networks.

Also by the study of VPN, it can be conclude that MPLS VPN simplifies the network infrastructure by allowing the consolidation of multiple technologies and applications such as voice, video and data. MPLS provides sophisticated traffic engineering capabilities that, coupled with IP QoS, enable multiple classes of service so business critical applications are treated with higher priority than less important applications Via the above-mentioned theories analysis we can see, the MPLS VPN best among all other VPNs and it works best even in case of overlapping address spaces. The proposed system will provides enhanced security, scalability and high availability and will satisfy customer needs in better way.

## REFERENCES

[1] Er.Jasvinder Sing, Rashed Quayoom Shawl, Rukhsana Thaker, “A Review: Multi Protocol Label Switching,” *International journal of Engineering Research and Applications*, ISSN: 2248-9642, Vol.4, Issue 1 (Version 2), January 2014, pp.66-70

[2] Abid Shah, Mureed Hussain,” *IP Bachbone Security: MPLS VPN Technology*,”International Journal of Fututre Generation Communication and Networking, Vol.6, No.5 (2013), pp.81-96

[3] Dinesh kumar and Gurpreet karur, “MPLS Technology on IP Backbone network,” *International journal of Computer Applications*, Vol.5-No.1, pp.13-16, Aug 2010

[4] Ramakrishnan, V.Wargo, John.s, *“MPLS network security: Gap Analysis,”*ICNS Conference, 2008 IEEE systems, pp.1-7,5-7, May 2008

[5] M.A.Breton, M.Bennani and M.E.Hachimi, *"EfficIent QoS implementation for MPLS VPN,"* International Conference of Advanced Information Networking and Applications, pp.259-263, March 2008.

[6] Botham.P, Liwen He, "*Pure MPLS Technology, Availability, Reliability and Security,"* third international conference, pp.253-259, 4-7, March 2008

[7] Fang.L, Bita.N, Miles.J, *"Interprovider IP-MPLS Services: requirements, implementations and Challenges,"*Communication Magazine, IEEE, Vol.43, no.6, pp.119-128, June 2005

[8] J.H.Lee, Y.H.Kang, *"The Implementation of the Premium Services for MPLS IP VPNs,"* Proceedings of the 7th International Conference on Advanced Communication Technology, pp. 1107-1110, 2005

[9] Daugherty.B, Metz.c, "*MPLS and IP, Part1: MPLS VPNs over IP Tunnels,"* IEEE International Computing, pp.68-72, May-June 2005

[10] L.D.Chou and M.Yuan Hong, "*Design and Implementation of Two Level VPN Service Provisioning Systems over MPLS Networks,"* Proceedings of the 7th IEEE International Symposium on Computer Networks (ISCN'06), (2006), pp.42-48

[11] Y.Nenghai, S.Qiong, G.Yanhui, C.Yuzhong, "A Novel Approach to Improve the Performance of MPLS-VPN," 8th Korea-Russia International Symposium on Science and Technology, KO-RUS,(2004), pp.35-39

[12] M.Ahmad Khan, "Quantiative Analysis of MPLS in VPNs," Proceedings of the IEEE Students Conference, ISCON'02,(2001), pp.56-65

# PERFORMANCE ANALYSIS OF INTERIOR GATEWAY PROTOCOLS

**P.Priyadhivya[1], S.Vanitha[2]**

[1]*Department of Electronics and Communication Engineering, SNSCT, Coimbatore (India)*

[2]*Assistant Professor, Department of Electronics and Communication Engineering, SNSCT, Coimbatore (India)*

**ABSTRACT**

*Routing is usually performed by a dedicated device called a router. Routing is a key feature of the internet because it enables messages to pass from one computer to another and eventually reach the target machine. Each intermediary computer performs routing by passing along the message to the next computer. The most commonly used routing protocols are RIP (Routing Information Protocol), OSPF (Open Shortest Path First) and EIGRP (Enhanced Interior Gateway Routing Protocol). These are the interior gateway routing protocols that have been developed for IP networks and it is used to exchange routing information within autonomous systems. Performance analysis of interior gateway protocols in IPv6 networks is done in terms of Convergence time and Packet loss.*

***Keywords: RIP, OSPF, EIGRP, IGP, Autonomous System, Routing Protocols***

## I. INTRODUCTION

The term IGP (Interior Gateway Protocol) is used to describe any routing protocol operating as a separate routing domain within an AS. IGPs learn about routes to networks that are internal to the AS, hence the name Interior. Within an organization's network there may be one or more routing protocols (IGPs) keeping track of the routes to subnets within the AS. Routers running a single IGP (routing protocol) only share route information with other routers running the same routing protocol. Routers running more than one IGP, like RIP and OSPF, are participants in two separate routing domains. These routers are referred to as border routers, that is, they sit on the border between two IGP routing domains. The IGP is classified into Distance vector routing protocol, Link state routing protocol, Hybrid routing protocol.

### 1.1 Distance Vector Routing

The distance-vector routing is a type of algorithm used by routing protocols to discover routes on an interconnected network. The primary distance-vector routing algorithm is the Bellman-Ford algorithm. Distance-vector routing refers to a method for exchanging route information. A router will advertise a route as a vector of direction and distance. Direction refers to a port that leads to the next router along the path to the destination, and distance is a metric that indicates the number of hops to the destination, although it may also be an arbitrary value that gives one route precedence over another. Internetwork routers exchange this vector information and build route lookup tables from it. Distance vector as the name suggests uses distance between

remote networks to determine the best path to a remote network. The distance vector metric is typically the hop. It's not a measure of distance as such, rather a count of number of routers in between the router and the destination network. The examples of Distance vector routing protocols are RIPv1(version1), RIPv2(version 2), RIPng(Next generation), IGRP(Interior Gateway Routing Protocol).

### 1.2 Link State Routing

Link state protocols are based on Shortest Path First (SPF) algorithm to find the best path to a destination. Shortest Path First (SPF) algorithm is also known as Dijkstra algorithm, since it is conceptualized by Dijkstra. Link state routing always try to maintain full networks topology by updating itself incrementally whenever a change happen in network. In Shortest Path First (SPF) algorithm, whenever a link's state changes, a routing update called a Link-State Advertisement (LSA) is exchanged between routers. When a router receives an LSA routing update, the link-state algorithm is used to recalculate the shortest path to affected destinations. Each router constructs a map of the complete network. The examples of Link state routing are Open Shortest Path First (OSPF), Intermediate system to intermediate system (IS-IS).

### 1.3 Hybrid Routing Protocol

Hybrid routing protocols have both the features of distance vector routing protocols and linked state routing protocols. One example is Enhanced Interior Gateway Routing Protocol (EIGRP).

## II. EXISTING SYSTEM

Internet Protocol version 4 (IPv4) is the delivery mechanism used by the TCP/IP protocols. It is the fourth version in the development of the Internet Protocol (IP) Internet and routes most traffic on the Internet. IPv4 uses 32 bit addressing have maximum of $2^{32}$ combinations of addresses..It is an unreliable and connectionless datagram protocol – a best effort delivery service. The best effort means that IPv4 provides no error or flow control (expect for error detection on the header). IPv4 assumes the unreliability of the underlying layers and does its best to get a transmission through its destination but with no guarantees.

If reliability is important, IPv4 must be paired with a reliable protocol such as TCP. An example of a more commonly understood best effort delivery service is the post office. The post office does its best to deliver the mail but does not always succeed. If an unregistered letter is lost, it is up to the sender or would be recipient to discover the loss and rectify the problem. The post office itself does not keep track of every letter and cannot notify a sender of loss or damage.

IPv4 is a connectionless protocol for a packet switching network that uses the datagram approach. This means that each datagram is handled independently, and each datagram can follow a different route to the destination. This implies that datagram sent by the same source to the same destination could arrive out of order. Also, some could be lost or corrupted during transmission. Again, IPv4 relies in a higher level protocol to take care of all these problems. The limitations of IPv4 networks are;

- IPv4 is unreliable & connectionless datagram protocol.
- It provides no flow control or error control.
- It provides no encryption & authentication.
- It has less address space and provides less security.
- It has more delay and does not provide auto configuration facility.

## III. PROPOSED SYSTEM

There are two basic IP versions: IPv4 and IPv6. Internet Protocol version 6 (IPv6) is a version of the Internet Protocol (IP). It is designed to succeed the Internet Protocol version 4 (IPv4). IPv6 is the new version of Internet Protocol that contains addressing information and some control information enabling packets to be routed in the network. IPv6 is also called next generation IP or IPng. IPv6 uses 128-bit addresses, so it supports $2^{128}$ addresses. The advantages of IPv6 networks are;

- IPv6 gives better QoS.
- It offers better mobility features.
- It provides better end-to-end connectivity.
- IPv6 offers ease of administration.
- It provides encryption & authentication.
- It provides less latency, supports resource allocation & has large address space.

In IPv6 networks RIP, OSPF, EIGRP protocols are enabled and it dynamically updates the routing information that helps to forward the packets from source to destination.

### 3.1 RIP

The Routing Information Protocol (RIP) is one of a family of IP Routing protocols, and is an Interior Gateway Protocol (IGP) designed to distribute routing information within an Autonomous System (AS).RIP is a simple vector routing protocol with many existing implementations in the field. In a vector routing protocol, the routers exchange network reachability information with their nearest neighbors. In other words, the routers communicate to each other the sets of destinations ("address prefixes") that they can reach, and the next hop address to which data should be sent in order to reach those destinations. This contrasts with link-state IGPs; vectoring protocols exchange routes with one another, whereas link state routers exchange topology information, and calculate their own routes locally.A vector routing protocol floods reachability information throughout all routers participating in the protocol, so that every router has a routing table containing the complete set of destinations known to the participating routers.

- **RIP Version 1**

RIP uses classful routing. The periodic routing updates do not carry subnet information, lacking support for variable length subnet masks(VLSM). In other words, all subnets in a network class must have the same size. There is also no support for router authentication.

- **RIP Version 2**

Due to the some deficiencies of the original RIP specification, RIP version 2 (RIPv2) was developed. It includes the ability to carry subnet information, thus supporting Classless Inter-Domain Routing (CIDR). To maintain backward compatibility, the hop count limit of 15 remained. It uses MD5 mechanism for authentication.

- **RIPng**

RIPng (RIP next generation) is an extension of RIPv2 for support of IPv6, the next generation Internet Protocol. While RIPv2 supports RIPv1 updates authentication, RIPng does not. IPv6 routers were at the time supposed to use IPsec for authentication, RIPv2 allows attaching arbitrary tags to routes, RIPng does not. RIPv2 encodes the

next-hop into each route entry. RIPng requires specific encoding of the next hop for a set of route entries. The routing information protocol uses the following timers as part of its operation. They are;

**Update timer**

The update timer controls the time between routing updates. By default the value is 30 seconds.

**Invalid timer**

The invalid timer specifies how long a routing entry can be in the routing table without being updated. It is also called as expiration Timer. By default the value is 180 seconds.

**Hold-down timer**

The Hold Down timer tells the routers to hold down recently affected routes for some period. During this time no update can be done to that routing entry. The default value of this timer is 90 seconds.

**Flush timer**

The flush timer controls how long before a route is completely flushed from the routing table. By default the value is 120 seconds.

Routing Information Protocol has advantages in small networks. It is easy to understand, configure and is supported by almost all routers. Since its limited to 15 hops, any router beyond that distance is considered as infinity, and hence unreachable. RIP has very slow network convergence in large networks. If implemented in a large network, RIP can create a traffic bottleneck by multicasting all the routing tables every 30 seconds, which is bandwidth intensive. The routing updates take up significant bandwidth leaving behind very limited resources.RIP doesn't support multiple paths on the same route and is likely to have more routing loops resulting in a loss of transferred data. RIP uses fixed hop count metrics to compare available routes, which cannot be used when routes are selected based on real-time data. This results in an increased delay in delivering packets and overloads network operations due to repeated processes. In IPv6 networks RIPng protocol is used and by modifying the update time, performance of the network is increased.

## 3.2 OSPF

The OSPF (Open Shortest Path First) protocol is one of a family of IP Routing protocols, and is an Interior Gateway Protocol (IGP) for the Internet, used to distribute IP routing information throughout a single Autonomous System (AS) in an IP network. The OSPF protocol is a link-state routing protocol, which means that the routers exchange topology information with their nearest neighbors. The topology information is flooded throughout the AS, so that every router within the AS has a complete picture of the topology of the AS. This picture is then used to calculate end-to-end paths through the AS, normally using a variant of the Dijkstra algorithm. OSPF supports a variable network subnet mask so that a network can be subdivided.

OSPF defines the following categories of Routers.

- **Internal router(IR)**

An Internal Router is a router that has only OSPF neighbor relationships with routers in the same area.

- **Area border router(ABR)**

Routing devices that belong to more than one area and connect one or more OSPF areas to the backbone area are called area border routers (ABRs). At least one interface is within the backbone while another interface is in another area. ABRs also maintain a separate topological database for each area to which they are connected.

- **Backbone router(BR)**

Backbone Routers are part of the OSPF backbone. This includes all area border routers and also routers connecting different areas.

- **Autonomous system boundary router(ASBR)**

Routing devices that exchange routing information with routing devices in non-OSPF networks are called AS boundary routers. They advertise externally learned routes throughout the OSPF AS. Depending on the location of the AS boundary router in the network, it can be an ABR, a backbone router, or an internal router (with the exception of stub areas). Routing devices within the area where the AS boundary router resides know the path to that AS boundary router. Any routing device outside the area only knows the path to the nearest ABR that is in the same area where the AS boundary router resides.

In addition to the four router types, OSPF uses the terms designated router (DR) and backup designated router (BDR), which are attributes of a router interface.

- **Designated router and Backup designated router**

A Designated Router (DR) is the router interface elected among all routers on a network segment, and Backup designated (BDR) is a backup for the Designated Router. Designated Routers are used for reducing network traffic by providing a source for routing updates. The Designated Router maintains a complete topology table of the network and sends the updates to the other routers via multicast. All routers in an area will form a slave/master relationship with the Designated Router.

OSPF uses the following timers;

- **Hello interval**

Routing devices send hello packets at a fixed interval on all interfaces, including virtual links, to establish and maintain neighbor relationships. The hello interval specifies the length of time, in seconds, before the routing device sends a hello packet out of an interface. This interval must be the same on all routing devices on a shared network. By default, the routing device sends hello packets every 10 seconds (broadcast and point-to-point networks) and 30 seconds (nonbroadcast multiple access (NBMA) networks).

- **Poll interval**

Routing devices send hello packets for a longer interval on nonbroadcast networks to minimize the bandwidth required on slow WAN links. The poll interval specifies the length of time, in seconds, before the routing device sends hello packets out of the interface before establishing adjacency with a neighbor. By default, the routing device sends hello packets every 120 seconds until active neighbors are detected. Once the routing device detects an active neighbor, the hello packet interval changes from the time specified in the poll interval to the time specified in the hello interval.

- **LSA retransmission interval**

When a routing device sends LSAs to its neighbors, the routing device expects to receive an acknowledgment packet from each neighbor within a certain amount of time. The LSA retransmission interval specifies the length of time, in seconds, that the routing device waits to receive an LSA packet before retransmitting the LSA to an interface's neighbors. By default, the routing device waits 5 seconds for an acknowledgment before retransmitting the LSA.

- **Dead interval**

If a routing device does not receive a hello packet from a neighbor within a fixed amount of time, the routing device modifies its topology database to indicate that the neighbor is nonoperational. The dead interval specifies the length of time, in seconds, that the routing device waits before declaring that a neighboring routing device is unavailable. This is an interval during which the routing device receives no hello packets from the neighbor. This interval must be the same on all routing devices on a shared network. By default, this interval is four times the default hello interval, which is 40 seconds (broadcast and point-to-point networks) and 120 seconds (NBMA networks).

- **Transit delay**

Before a link-state update packet is propagated out of an interface, the routing device must increase the age of the packet. The transit delay sets the estimated time required to transmit a link-state update on the interface. By default, the transit delay is 1 second.

OSPF routing protocol has a complete knowledge of network topology allowing routers to calculate routes based on incoming requests. Additionally, OSPF has no limitations in hop count, it converges faster than RIP, and has better load balancing. A downside with OSPF is that it doesn't scale when there are more routers added to the network. This is because it maintains multiple copies of routing information. An OSPF network with intermittent links can increase traffic every time a router sends information. This lack of scalability in OSPF makes it unsuitable for routing across the Internet.OSPFv2 is used in IPv4 networks. In IPv6 networks OSPFv3 protocol is used and by modifying the hello interval, performance is further increased.

### 3.3 EIGRP

Enhanced Interior Gateway Routing Protocol (EIGRP) is considered as a Hybrid Routing Protocol because EIGRP has characteristics of both Distance Vector and Link State Routing Protocols. It is designed to give all the flexibility of routing protocols such as OSPF but with much faster convergence. EIGRP shares routing table information that is not available in the neighboring routers, thereby reducing unwanted traffic transmitted through routers. It uses Diffusing Update Algorithm (DUAL), which reduces the time taken for network convergence and improves operational efficiency. EIGRP is used on a router to share routes with other routers within the same autonomous system. Unlike RIP, EIGRP only sends incremental updates, reducing the workload on the router and the amount of data that needs to be transmitted. EIGRP calculates its metrics by using bandwidth, delay, reliability and load.

## IV. RESULTS

### 4.1 Network Topology

The network topology is created with six routers and four clouds using Graphical Network Simulator (GNS 3) software. This is considered as a Wide Area Network and it is converged with RIP or OSPF protocols and the comparisons are made between them.

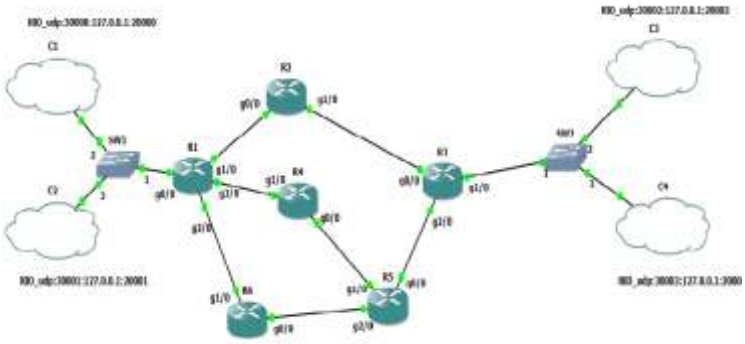


**Fig. 1 IPv6 Network Topology**

### 4.2 Convergence Time Analysis

The time taken for a packet to take alternative path when any link gets failure is termed as convergence time. The convergence time is measured in Wireshark software. While evaluating the performance of the convergence time of modified RIP and modified OSPF, modified OSPF has faster convergence than modified RIP Protocol.

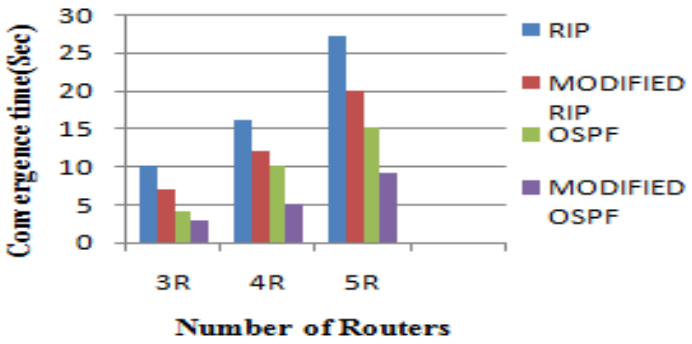



**Fig. 2 Convergence Time**

### 4.3 Packet Loss Analysis

Packet loss occurs when one or more packets of data travelling across a computer network fail to reach their destination. Packet loss is measured in VPCS (Virtual PC Simulator). While evaluating the performance of modified RIP and modified OSPF, modified OSPF has less packet loss.


**Fig. 3 Packet Loss**

## V. CONCLUSION AND FUTURE WORK

This project explains the need for implementing IPv6 technology to overcome some of the limitations involved in IPv4 technology. This paper also explains about different interior gateway protocols. From the simulation results compared to RIP, OSPF has faster convergence and less packet loss and it is suited well for wide area networks. The future work involves modifying the parameters of EIGRP protocol and analyzing the performance in IPv6 networks.

## REFERENCES

[1] Vishal Sharma, Rajneesh Narula and Sameer Khullar "Performance Analysis of IEEE 802.3 using IGRP and EIGRP Routing Protocols" International Journal of Computer Applications(0975-8887) Volume 44-No13, April 2012.

[2] R.Rastogi, Y.Breitbart and M.Garofalakis, "Optimal configuration of ospf aggregates", IEEE/ACM transaction on networking , vol 11, April 2003.

[3] Cisco systems (2012), Enhanced Interior Gateway Routing Protocol (EIGRP) wide metrics, retrieved 14 March 2014.

[4] Ittiphon Krinpayorm and Suwat Pattaramalai, "Link recovery Comparison between OSPF & EIGRP", International Conference on Information and Computer Networks (ICICN 2012) IPCSIT Vol. 27 (2012) IACSIT Press, Singapore.

[5] Ioan Fitigau, Gavril Toderean, " Network performance Evaluation of RIP, OSPF & EIGRP Routing protocols", IEEE, 2013.

[6] Pankaj Rakheja, Prabhjot kaur, Performance Analysis of RIP, OSPF, IGRP and EIGRP Routing Protocols in a Network, International Journal of Computer Application, 2012.

[7] Dejan Spasov , Marjan Gushev, "On the Convergence of Distance Routing Protocols", ICT 2012.

[8] Poprzen, Nemanja, "Scaling and Convergence speed of EIGRPv4 and OSPFv2 dynamic routing protocols in hub and spoke network" IEEE 2009.

[9] Savage, Slice " Enhanced Interior Gateway Routing Protocol" Internet Engineering Task Force, 2013.

[10] Chandra Wijaya "Performance Analysis of Dynamic Routing Protocol EIGRP and OSPF in IPv4 and IPv6 Network", First International Conference on Informatics and Computational Intelligence, 2011.

# IMPLEMENTATION OF ENTERPRISE IPV6 NETWORK WITH AUTO ADDRESSING & SECURITY CONFIGURATION

**S.Rashmi[1], J.Jayageetha[2], N.Abinaiya[3]**

[1]*Department of Electronics and Communication Engineering, SNSCT, Coimbatore (India)*

[2]*Assistant Professor, Department of Electronics and Communication Engineering, SNSCT, Coimbatore (India)*

[3]*Department of Electronics and Communication Engineering, SNSCT, Coimbatore (India)*

**ABSTRACT**

The current Internet protocol, version 4, known as IPv4, poses several problems such as impending exhaustion of its address space, configuration and complexities due to rapid growth of the Internet and emerging new technologies. As a result, IETF developed the next generation IP, called IPv6, to not only eliminate the shortcomings of IPV4 but also deliver new features and services.IPv6 has established itself as the most mature network protocol for the future Internet, over the last decade. The Internet Protocol IPv6 defines mechanisms to autoconfigure interfaces of nodes in wired networks in a distributed manner. This paper describes the applicability of IPv6 Stateless Address Autoconfiguration, overview of security configuration in IPv6 networks and IPv6 Neighbor Discovery Protocol (NDP) to large networks is investigated.

Keywords: NDP, Autoconfiguration, DHCP, TCP, DNS

## I. INTRODUCTION

The current Internet Protocol, version 4, known as IPv4, has been developed to support the Internet's rapid growth during the 80s. IPv4 has been shown to be robust, easily implemented and interoperable. It uses a 32-bit address space, in which can accommodate about 4 billion unique addresses. Today, however, that amount is insufficient, even more if we consider emerging new technologies such as 3G/4G wireless devices and other wireless appliances. The Internet has grown much bigger than was anticipated before. Due to this, there are several problems such as impending exhaustion of the IPv4 address space, configuration and complexities and poor security at the IP level that must be considered.

Aware of the limitations of the current Internet infrastructure, Internet Engineering Task Force (IETF) began developing a new IP protocol in the early 90s to replace IPv4. The next generation Internet Protocol, first called as IPng and then as IPv6, will use a 128-bit address space. It would support unique addresses well beyond the trillions. It will not only eliminate the shortcomings of IPv4, but also deliver new features and services. The development of IPv6 has been on how to do the transition away from IPv4, and towards IPv6. The work on transition strategies, tools, and mechanisms has been part of the basic IPv6 design effort from the beginning of its development.

The network layer is the first layer in OSI which is software based. The network layer or third layer of the OSI model deals with finding, routing and switching for end to end communications, that are not directly connected to each other using a one physical link e.g. an Ethernet cable. The security features is not in built with IPv4, ISP uses ACL, fire wall or check point which enables the security in IPv4 network. The Internet Protocol is the most dominant protocol on the Internet today and usually runs on upper layer protocols such as the Transmission Control Protocol (TCP) and the User Datagram Protocol (UDP).

Over the last decade, IPv6 has established itself as the most mature network protocol for the future Internet. Based on a model of an IPv4 network we design and implement the ipv6 network and it supports auto configuration to the host, security is inbuilt with protocol. This paper describes the automatic IPv6 address configuration in larger networks. IPv6 has been deployed in larger networks because of advantages compared to IPv4.

## II. EXISTING SYSTEM

Network plays a vital role that helps to share information and resources and implement centralized management system. To enable the network features, all organizations and ISPs have design and implemented IPv4 network to share their voice/data/video applications. IP is internet protocol and works on third layer of OSI model and forward packet from one node to another. IPv4 enables encapsulation and add more information that helps for efficient transmission of data. IPv4 address is 32 bit address and have maximum of 2^32 combination address.

### 2.1 IPv4

IPv4 address configured in devices either manually or automatically (DHCP). Used sub netting, VLSM and super netting concepts to increase the Network performance. IP enables encapsulation and add information for error control and fragmentation that support to transport the data error free. Router has memory and stores routing more information due to expansion of network. NAT is used to better utilization of IPv4 address. Used ACL, firewall and check point to ensure the security for data in IPV4 network. IPv4 network supports mobility but generates O/H information. IPv4 network supports dynamic routing by enabling Protocol such as RIP, OSPF, and IS-IS.

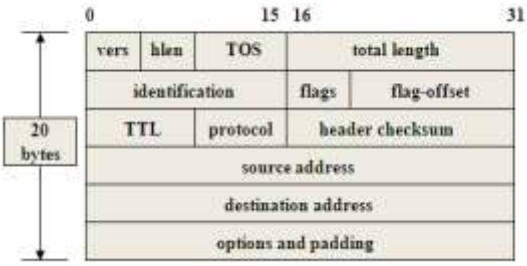



**Fig. 1.IPv4 Header Format**

### 2.2 Limitations

#### 2.2.1 Scarcity of IPv4 Addresses

The IPv4 addressing system uses 32-bit address space. This 32-bit address space is further classified to usable

A, B, and C classes. 32-bit address space allows for 4,294,967,296 IPv4 addresses, but the previous and current IPv4 address allocation practices limit the number of available public IPv4 address. Because scarcity of IPv4 addresses, many organizations implemented NAT (Network Address Translation) to map multiple private addresses to a single public IP address. By using NAT (Network Address Translation) we can map many internal private IPV4 addresses to a public IPv4 address, which helped in conserving IPv4 addresses. But NAT (Network Address Translation) also have many limitations. NAT (Network Address Translation) do not support network layer security standards and it do not support the mapping of all upper layer protocols. NAT can also create network problems when two organizations which use same private IPv4 address ranges communicate. More servers, workstations and devices which are connected to the internet also demand the need for more addresses and the current statistics prove that public IPv4 address space will be depleted soon. The scarcity of IPv4 address is a major limitation of IPv4 addressing system.

### 2.2.2 Security Related Issues

RFC 791 (IPv4) was published in 1981 and the current network security threats were not anticipated that time. Internet Protocol Security (IPSec) is a protocol suit which enables network security by protecting the data being sent from being viewed or modified. Internet Protocol Security (IPSec) provides security for IPv4 packets, but Internet Protocol Security (IPSec) is not built-in and optional. Many IPSec implementations are proprietary.

### 2.2.3 Quality of Service (QOS)

Quality of Service (QoS) is available in IPv4 and it relies on the 8 bits of the IPv4 Type of Service (TOS) field and the identification of the payload. IPv4 Type of Service (TOS) field has limited functionality and payload identification (uses a TCP or UDP port) is not possible when the IPv4 packet payload is encrypted.

## III. PROPOSED SYSTEM

### 3.1 IPv6

IPv6 was developed by the Internet Engineering Task Force (IETF) to deal with this long anticipated IPv4 address exhaustion, and is described in Internet standard document RFC 2460, published in December 1998. It simplifies aspects of address assignment (stateless address auto configuration), network renumbering and router announcements when changing Internet connectivity providers. The IPv6 subnet size has been standardized by fixing the size of the host identifier portion of an address to 64 bits to facilitate an automatic mechanism for forming the host identifier from link layer media addressing information (MAC address). Network security is also integrated into the design of the IPv6 architecture, and the IPv6 specification mandates support for IPsec as a fundamental interoperability requirement.

The present IP uses a Datagram service to transfer packets of data between point to point using routers. The IPv4 packet header structure contains 20 bytes of data, such that it contains within the header, all possible options thereby forcing intermediate routers to check whether these options exist and if they do, process them before forwarding them. In the IPv4 packet header, these options have a certain maximum permitted size.

When compared to IPv4, IPv6 has a much simpler packet header structure, which is essentially designed to minimize the time and efforts that go in to header processing. This has been achieved by moving the optional fields as well as the nonessential fields to the extension headers that are placed only after the IPv6 header.

Consequently, the IPv6 headers are processed more efficiently at the intermediate routers without having to parse through headers or recompute network-layer checksums or even fragment and reassemble packets. This efficiency allows for reduced processing overhead for routers, making hardware less complex and allowing for packets to be processed much faster. Another feature of the IPv6 header structure is that the extension header allows for more flexible protocol inclusions than what IPv4 does. In contrast, IPv6 extension headers have no such restriction on the maximum size. They can be expanded to accommodate whatever extension data is thought necessary for efficient IPv6 communication. In fact, a typical IPv6 packet contains no extension header and only if intermediate routers or the destination require some special handling, will the host sending the packets add one or more extension headers depending on the requirement. This new extension header makes IPv6 fully equipped to support any future need or capabilities.


**Fig. 2.Header Format of IPv6**

## IV. ADDRESS AUTOCONFIGURATION OVERVIEW

In the following, an overview of address autoconfiguration schemes is provided.

### 4.1 DHCP

The Dynamic Host Configuration Protocol (DHCP) has been deployed widely to alleviate administrative requirements for the installation and initial configuration of network devices. Generally speaking, DHCP is used by clients to obtain necessary information like their IP addresses, Domain Name System (DNS) server addresses, domain names, subnet prefixes, and default routers.

On large networks that consist of multiple links, a single DHCP server may service the entire network when aided by DHCP relay agents located on the interconnecting routers. Such agents relay messages between DHCP clients and DHCP servers located on different subnets. Depending on implementation, the DHCP server may have three methods of allocating IP-addresses:

- Dynamic allocation: A network administrator reserves a range of IP addresses for DHCP, and each client computer on the LAN is configured to request an IP address from the DHCP server during network initialization. The request-and-grant process uses a lease concept with a controllable time period, allowing the DHCP server to reclaim (and then reallocate) IP addresses that are not renewed.
- Automatic allocation: The DHCP server permanently assigns an IP address to a requesting client from the range defined by the administrator. This is like dynamic allocation, but the DHCP server keeps a table of past IP address assignments, so that it can preferentially assign to a client the same IP address that the client previously had.
- Static allocation: The DHCP server allocates an IP address based on a preconfigured mapping to each client's MAC address. This feature is variously called static DHCP assignment by DD-WRT, fixed-address by the dhcp documentation, address reservation by Netgear, DHCP reservation or static DHCP by Cisco

and Linksys, and IP address reservation or MAC/IP address binding by various other router manufacturers.

- DHCP is used for Internet Protocol version 4 (IPv4), as well as IPv6. While both versions serve the same purpose, the details of the protocol for IPv4 and IPv6 are sufficiently different that they may be considered separate protocols. For IPv6 operation, devices may alternatively use stateless address autoconfiguration. IPv4 hosts may also use link-local addressing to achieve operation restricted to the local network link.

### 4.2 Stateless Autoconfiguration

Stateless Auto Configuration is a boon for the Network Administrators since it has automated the IP address configuration of individual network devices. Earlier, configuration of the IP addresses was a manual process requiring support of a DHCP server. However, IPv6 allows the network devices to automatically acquire IP addresses and also has provision for renumbering/reallocation of the IP addresses en masse. With a rapid increase in the number of network devices connected to the Internet, this feature was long overdue. It simplifies the process of IP address allocation by doing away with the need of DHCP servers and also allows a more streamlined assignment of network addresses thereby facilitating unique identification of network devices over the Internet.

The auto configuration and renumbering features of Internet Protocol version 6 are defined in RFC 2462. The word "stateless" is derived from the fact that this method doesn't require the host to be aware of its present state so as to be assigned an IP address by the DHCP server. The stateless auto configuration process comprises of the following steps undertaken by a network device:

- **Link-Local Address Generation**: The device is assigned a link-local address. It comprises of '1111111010' as the first ten bits followed by 54 zeroes and a 64 bit interface identifier.
- **Link-Local Address Uniqueness Test:** In this step, the networked device ensures that the link-local address generated by it is not already used by any other device i.e. the address is tested for its uniqueness.
- **Link-Local Address Assignment:** Once the uniqueness test is cleared, the IP interface is assigned the link local address. The address becomes usable on the local network but not over the Internet.
- **Router Contact**: The networked device makes contact with a local router to determine its next course of action in the auto configuration process.
- **Router Direction**: The node receives specific directions from the router on its next course of action in the auto configuration process.
- **Global Address Configuration**: The host configures itself with its globally unique Internet address. The address comprises of a network prefix provided by the router together with the device identifier.

### 4.3 Neighbour Discovery Protocol (NDP)

The IPv6 Stateless Address Autoconfiguration (SAA) protocol provides a useful way to assign IP addresses to nodes in a network with no configuration servers. It is based on the Neighbor Discovery Protocol (NDP) which is specified for links that support a native form of multicast or broadcast.The Neighbor Discovery Protocol or NDP in the IPv6 is an improvement over the Internet Control Message Protocol (ICMP). It is essentially a messaging protocol that facilitates the discovery of neighboring devices over a network. The NDP uses two kinds of addresses: unicast addresses and multicast addresses.

The protocol defines five different ICMPv6 packet types to perform functions for IPv6 similar to the Address Resolution Protocol (ARP) and Internet Control Message Protocol (ICMP) Router Discovery and Router Redirect protocols for IPv4. There are five different ND messages:

- Router Solicitation (ICMPv6 type 133)
- Router Advertisement (ICMPv6 type 134)
- Neighbor Solicitation (ICMPv6 type 135)
- Neighbor Advertisement (ICMPv6 type 136)
- Redirect (ICMPv6 type 137)

### 4.3.1 Router Solicitation

The Router Solicitation message is sent by IPv6 hosts to discover the presence of IPv6 routers on the link. A host sends a multicast Router Solicitation message to prompt IPv6 routers to respond immediately, rather than waiting for an unsolicited Router Advertisement message.

### 4.3.2 Router Advertisement

IPv6 routers send unsolicited Router Advertisement messages pseudo periodically that is, the interval between unsolicited advertisements is randomized to reduce synchronization issues when there are multiple advertising routers on a link and solicited Router Advertisement messages in response to the receipt of a Router Solicitation message. The Router Advertisement message contains the information required by hosts to determine the link prefixes, the link MTU, specific routes, whether or not to use address autoconfiguration, and the duration for which addresses created through address autoconfiguration are valid and preferred.

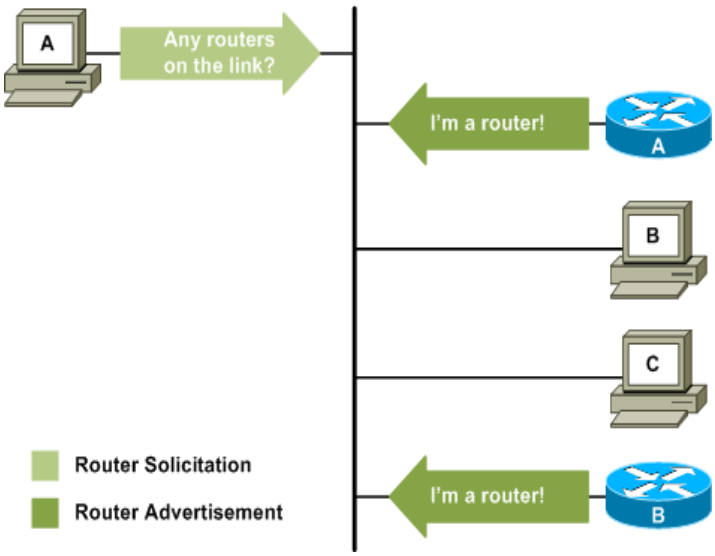



**Fig. 3 Router Advertisement and Solicitation**

### 4.3.3 Neighbour Solicitation

IPv6 nodes send the Neighbor Solicitation message to discover the link layer address of an on link IPv6 node or to confirm a previously determined link layer address. It typically includes the link layer address of the sender.

Typical Neighbor Solicitation messages are multicast for address resolution and unicast when the reach ability of a neighboring node is being verified.

### 4.3.4 Neighbour Advertisement

An IPv6 node sends the Neighbor Advertisement message in response to a Neighbor Solicitation message. An IPv6 node also sends unsolicited Neighbor Advertisements to inform neighboring nodes of changes in linklayer addresses or the node's role. The Neighbor Advertisement contains information required by nodes to determine the type of Neighbor Advertisement message, the sender's role on the network, and typically the linklayer address of the sender.

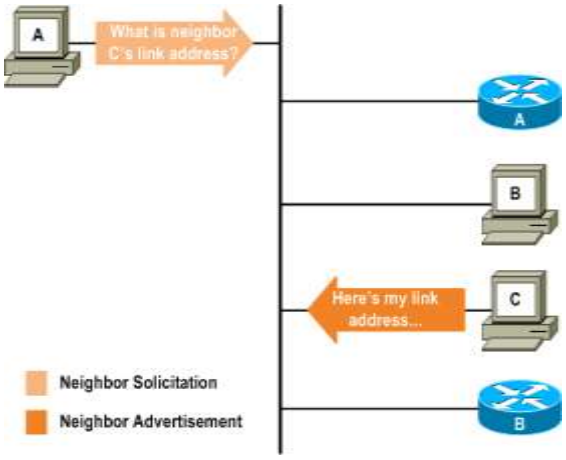



**Fig. 4 Neighbour Advertisement and Solicitation**

### 4.3.5 Redirect

The Redirect message is sent by an IPv6 router to inform an originating host of a better first hop address for a specific destination. Redirect messages are sent only by routers for unicast traffic, are unicast only to originating hosts, and are processed only by hosts.

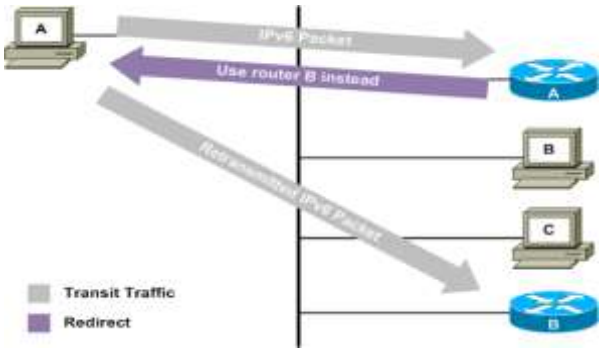



**Fig. 5 Router Redirection**

### 4.4 Advantages of Stateless Autoconfiguration

- Doesn't require support of a DHCP server - Stateless Auto Configuration does away with the need of a DHCP server to allocate IP addresses to the individual nodes connected to the LAN.
- Allows hot plugging of network devices - The network devices can be 'hot-plugged' to the Internet. Since the devices can configure their own IP addresses, there is no need for manual configuration of the network

devices. The devices can be simply connected to the network and they automatically configure themselves to be used over an IPv6 network.

- Suitable for applications requiring secure connection without additional intermediaries in the form of a proxy or a DHCP server - Some of the modern day applications such as teleconferencing require a fast and secure connection sans any intermediary nodes that tend to slow down the communication process. Stateless Auto Configuration helps meet such requirements by removing the intermediary proxy or DHCP servers and thereby facilitating the communication process for such applications requiring high-speed data transfers.
- Cost effective - By facilitating the networking potential of individual nodes and doing away with the requirement of proxy or DHCP servers, Stateless Auto Configuration offers cost effective means to connect the various network devices to theInternet.
- Suitable for wireless networks - Stateless auto configuration is most suited to the wireless environment where the physical network resources are spatially scattered within a geographical area. By allowing direct hot plugging to the network, it reduces an additional link in the wireless network.

### 4.5 Applications of Stateless AutoConfiguration

The Stateless Auto Configuration feature was long awaited to facilitate effortless networking of various devices to the Internet. The feature assumes even greater significance for use over the wireless networks. It allows the various devices to access the network from anywhere within a 'hotspot'. Stateless Auto Configuration finds diverse applications in networking electronic devices such as televisions, washing machines, refrigerators, microwaves etc. to the Internet. The ease of network connectivity through 'hot plugging' of such devices will usher in a new era of convergence where majority of the electronic devices will be connected to the Internet.

## V. SECURITY OF IPV6

This section provides a high-level overview of IPsec. More specific information can be found in the specific IPsec. IPsec is one of the core security technologies for IPv4 and IPv6 and, when combined with other security mechanisms, can create a security infrastructure from which agencies can provide a common set of ubiquitous security services across the enterprise. IPsec is considered a mandatory part of IPv6, but optional for IPv4. IPsec utilizes cryptographically-based mechanisms to implement the following security services at the IP layer and for all protocols carried over IP:

- Access control
- Authentication
- Confidentiality (data traffic flow)
- Integrity

IPsec provides flexibility in the types of security services that are provided through the use of multiple protocols, including the Authentication Header (AH), the Encapsulating Security Payload (ESP) and cryptographic key management procedures and protocols. The IPsec architecture was developed to allow for the deployment of compliant implementations that provide not only the security services, but also the management interfaces needed to meet the security and operational requirements of the user community.

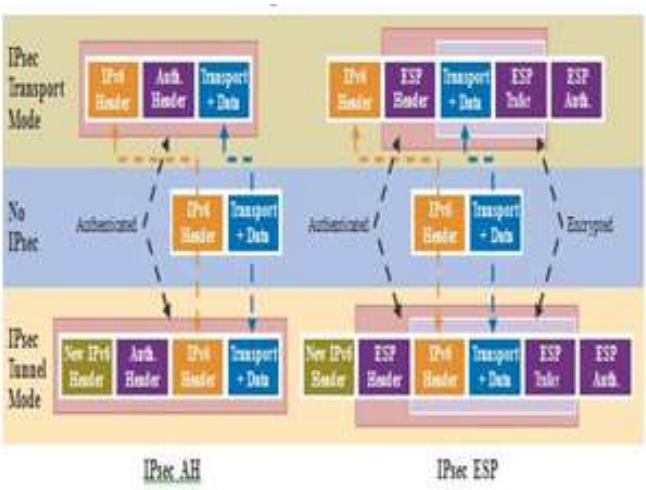



**Fig 6 IP Security (IPsec)**

## VI. CONCLUSION

Compared to IPv4, IPv6 offers a number of technologies that make security more flexible to deploy and more efficient at catching malicious behavior, paving the way for more secure deployments. This paper highlights the need for IPv6 to overcome some of the limitations involved in IPv4 Protocol. This paper also explains the concept of stateless autoconfiguration protocol in depth by providing the fundamentals and operation of NDP protocol. Through this paper it is concluded that the data transmission rate and efficiency is toward the higher side. Thus there is no doubt that this IPV6 has the full feature what our present situation demand .Thus we have done routing dynamically using dynamic protocol OSPF and link -local addresses are assigned automatically to the hosts. The security is ensured in this network by the use of encryption standards.

## REFERENCES

[1] E. Davies and J. Mohacsi , "Recommendations for Filtering ICMPv6 Messages in Firewalls," RFC 4890 (Informational), IETF, May 2007.

[2] T. Narten, E. Nordmark, W. Simpson, and H. Soliman, "Neighbor Discovery for IP version 6 (IPv6)," RFC 4861 (Draft Standard), IETF, Sept. 2007.

[3] S. Guha, K. Biswas, B. Ford, S. Sivakumar, and P. Srisuresh, "NAT Behavioral Requirements for TCP," RFC 5382 (Best Curren Practice), IETF, Oct. 2008.

[4] T. Narten, R. Draves, and S. Krishnan, "Privacy Extensions for Stateless Address Autoconfiguration in IPv6," RFC 4941 (Draft Standard), IETF, Sept. 2007.

[5] J.Abley,P.Savola, and G. Neville-Neil, "Deprecation of Type 0 Routing Headers In IPv6," RFC 5095(Proposed Standard),Internet Engineering Task Force, Dec.2007.

[6] J. Bound, "IPv6 Enterprise Network Scenarios," RFC 4057(Informational), IETF,June 2005.

[7] C. Jelger and T. Noel, "Algorithms for prefix continuity in ipv6 ad hoc networks, adhoc and sensor wireless networks," *OCP Science*, vol. 2, no.2, May 2006.

[8] Thorenoor S.G, "Dynamic Routing Protocol Implementation Decision between EIGRP, OSPF and RIP based on Technology Background Using OPNET Modeler",IEEE Conference on Computer and Network Technology (ICCNT), 2010.

# PROBABILITY BASED OPTIMAL ENERGY CONSUMPTION IN WSN FOR DIFFERENT STRUCTURES

**[1]Ram Krishna Sharma, [2]Kamlesh Kumar Mishra**

*[1]Department of Electronics & Communication Engineering, UIT, Allahabad (India)*

*[2]Assistant Professor, Department of Electronics & Communication Engineering, UIT, Allahabad (India)*

## ABSTRACT

*Scheduled Rendezvous schemes have a disadvantage that some nodes can be active while data are not present. On-demand schemes have advantage that nodes will be active only for data is present and nodes want to communicate to each other necessarily. The power management approach using LEACH is applied which is specifically on-demand MAC protocol with low duty cycle. Assuming LEACH uses Direct Transmission protocol and assuming identical expected distance for all cluster Heads from the sink and for all leaf nodes from their cluster heads, Decentralized MAC using sleep-awake protocol is applied to reduce the energy consumption and then we analyze and calculate probability based energy consumption per node averagely. The analysis is presented for small hexagonal networks. We also analyze average Energy consumption and network life time for different shapes of WSN geographical infrastructure.*

***Keywords: Squared Structure, LEACH, Reduced Energy Consumption***

## I INTRODUCTION

Wireless sensor network consisted of a large number of sensor nodes connected through a wireless medium is a self-organization (Ad-hoc) distributed network system. [3] Wireless sensor network has broad application prospects in military surveillance, environmental monitoring, seismic and weather forecasting, disaster relief, underground, deep water and outer space exploration and other areas. The radio should be switched off as soon as there is no more data to send/receive, and should be resumed as soon as a new data packet becomes ready. In this way nodes alternate between active and sleep periods depending on network activity. This behavior is usually referred to as duty cycling. [7] On-demand protocols take the efficient approach to power management. The basic idea is that a node should wakeup only when another node wants to communicate with it. The main problem associated with on-demand schemes is how to inform the sleeping node that some other node is willing to communicate with it. [1, 2]

## II RELATED WORKS

LEACH incorporates randomized rotation of the high-energy cluster head position among the sensors to avoid draining the battery of any one sensor in the network. In this way, the energy load of being a cluster head is evenly distributed among the nodes. The operation of LEACH is divided into *rounds* [2, 3 and 7] and each period consists of a set-up phase and a steady-state phase. During the setup phase, nodes communicate with short messages and are organized into clusters with some nodes selected as cluster heads. After the set-up phase, each cluster head sets up TDMA schedules for all leaf nodes in its cluster. Leaf nodes send any data to the cluster heads according to the TDMA schedule. [4]

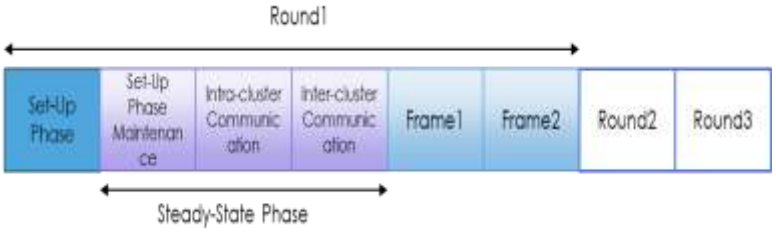



**Fig. 1: Description of a round as well protocols.**

Each round consists of setup phase (formation of new cluster heads), steady-state phase (an intra-cluster communication phase and an inter cluster communication phase) and frame transmission which is data to be sent. [4, 8] A number of schemes to prolong the lifetime of sensor networks have been proposed in different literatures. However, appropriate cluster head selection mechanisms are required to reduce the energy consumption and enhance the lifetime of the network. Each node computes the quotient of its own energy level and the aggregate energy remaining in the network. With this value each node decides if it becomes cluster head for this round or not. Nodes with higher power are more likely to become cluster heads than nodes with lower power. The problem with this scheme is that each node has to estimate the remaining energy in the network which requires additional communication with the sink node and other nodes. [5] The optimal number of cluster-head selection for optimal probability of being cluster head to prolong the lifetime of WSNs based on LEACH architecture is calculated for a squared structure of a wireless sensor network. [2] In this paper, we propose an optimal cluster head selection algorithm to prolong the lifetime of WSNs based on the LEACH architecture for hexagonal field of a wireless sensor network.

## III PROTOCOL DESCRIPTION AND ANALYSIS

There are certain problems while using a normal LEACH. [8]Two of them are,

**3.1** Since cluster heads spend more energy than leaf nodes, it is quite important to reselect cluster heads periodically.

**3.2** The TDMA mechanism which is used by LEACH for intra-cluster communication does not scale when the number of nodes increases.

This paper addresses these two problems by applying a sleep-awake up based, decentralized MAC protocol to LEACH. We also analyze LEACH's cluster head selection algorithm to find the optimal probability.

## IV ASSUMPTIONS FOR SELECTION OF CLUSTER-HEADS

There are two categories of nodes: First is Cluster Head nodes and the next is Non-cluster Head nodes or Leaf Nodes. In a cluster, there is a cluster head and remaining are Non-cluster Head nodes. There are some assumptions for the selection of a cluster head in a cluster: [1, 7]

**4.1.** All the non-cluster head nodes have data to send in a cluster. It means intra-communication phase is such a long so that every non-cluster head node can have data to send.

**4.2.** Inter-communication phase is such a long so that every cluster head can have data to send.

**4.3.** Sink is assumed to be stationary and reachable to all the nodes in the network. Similarly cluster heads are reachable to the non-cluster head nodes in a cluster.

**4.4.** The cluster heads perform data aggregation and compression before transmitting to the sink.

## V CALCULATION OF ENERGY CONSUMPTION

We consider a network area $3\sqrt{3}D_H^2/2$ meters for hexagonal network with N sensor nodes randomly distributed with uniform distribution. The distance of the cluster heads to the sink is denoted by $d_{inter}$ and the distance between the non-cluster head nodes in a cluster and their cluster head is denoted by $d_{intra}$. Let probability that data is available at a node in a cluster is $p_a$. $b_{data}$, $b_{inter}$ and $b_{intra}$ are the message bits for transmission, payload for inter-communication and payload for intra-communication simultaneously.

We assume that the radio dissipates $E_{elec}$ J/bit to run the transmitter or receiver circuit and $E_{amp}$ J/m$^2$-bit for the transmitter amplifier to achieve an acceptable signal to noise ratio. Then Energy consumption due to transmission of b bit data and reception of b bit data are respectively given below.

$$\left.\begin{aligned} E_{Tx}(b,d) &= bE_{elec} + bE_{amp}d^2 \\ E_{Rx}(b) &= bE_{elec} \end{aligned}\right\} \quad (1)$$

Hence, energy consumption by a leaf node

$$E_{NCH} = p_a\left[E_{Tx}(b_{data}, d_{intra}) + E_{Rx}\left(\frac{T_{intra}}{T} - b_{data}\right)\right] + (1-p_a)\left[E_{Rx}\left(\frac{T_{intra}}{T}\right)\right] \quad (2)$$

Where T= transmission and reception time, $T_{inter}$ = the time devoted for inter cluster communications and $T_{intra}$ = the time devoted for intra cluster communications. Where $T <<< T_{inter}$ and $T <<< T_{intra}$.

Similarly energy consumption by a Cluster Head node can be given as

$$E_{CH} = p_{ha}\left[E_{Tx}(b_{data}, d_{inter}) + E_{Rx}\left(\frac{T_{inter}}{T} - b_{data}\right)\right] + (1-p_{ha})\left[E_{Rx}\left(\frac{T_{inter}}{T}\right)\right] + \left[E_{Rx}\left(\frac{T_{intra}}{T}\right)\right] \quad (3)$$

So the average energy consumption of N nodes can be calculated as

$$E_{avg} = \frac{E_{Total}}{TotalNodes} = \frac{NpE_{CH} + N(1-p)E_{NCH}}{N}$$

$$E_{avg} = pE_{CH} + (1-p)E_{NCH} \qquad (4)$$

Assuming $T_{inter}$ and $T_{intra}$ are equal, using $b_{inter}$ and $b_{intra}$ using relation between $T_{inter}$ and $b_{inter}$ as well as $T_{intra}$ and $b_{intra}$ and calculating $p_{ha}$ using $p_a$ , the average energy can be calculated from equations (1), (2), (3) and (4) as

$$E_{avg} = b_{data}E_{amp}\left[(1-p)p_a\, d^2_{intra} + p\left(1-(1-p_a)^k\right)d^2_{inter}\right] + E_{elec}\left(pb_{inter} + b_{intra}\right) \qquad (5)$$

And k (cluster size) can be calculated as $k = 1/p$

Now $d_{inter}$ and $d_{intra}$ can be calculated by using Voronoi Tessellation. Hence assuming $d_{inter}$ as expected distance between cluster heads and sink node and $d_{intra}$ as expected distance between cluster head and non-cluster head nodes, using Voronoi Tessellation,

$$d^2_{intra} = \frac{D_H^2}{Np} \quad and \quad d^2_{inter} = \frac{D_H^2}{3} \qquad (6)$$

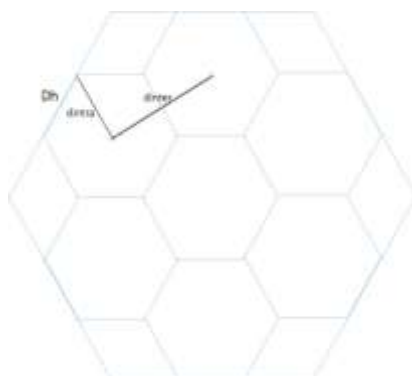



**Fig. 2: Calculation of $d_{intra}$ and $d_{inter}$ in hexagon**

From equations (5) and (6)

$$E_{avg} = b_{data}E_{amp}D_H^2\left[\frac{(1-p)p_a}{Np} + \frac{p\left(1-(1-p_a)^{\frac{1}{p}}\right)}{3}\right] + E_{elec}\left(pb_{inter} + b_{intra}\right) \qquad (7)$$

For minimum energy consumption, derivative of $E_{avg}$ with respect to p,

$$\frac{dE_{avg}}{dp} = 0$$

And assuming all the nodes have data to be sent, we get an optimal value of probability for being a cluster head

$$p = p_{opt1} = \sqrt{\frac{3E_{amp}b_{data}D_H^2}{N\left(E_{amp}b_{data}D_H^2 + 3E_{elec}b_{inter}\right)}} \quad (8)$$

Hence,

$$E_{avg,\min} = b_{data}E_{amp}D_H^2\left[\frac{Np_{opt1}^2 - 3p_{opt1} + 3}{3Np_{opt1}}\right] + E_{elec}\left(p_{opt1}b_{inter} + b_{intra}\right) \quad (9)$$

## VI VERIFICATION OF RESULT

Let, $E_{amp}$ =100x10$^{-12}$ J/m$^2$-bits, $E_{elec}$ =50x10$^{-9}$ J/bits, N=1000 nodes, $b_{data}$ =3000 bits/sec, $b_{inter}$ =3000bits D=100 meter for square region and $D_H$ is the dimension of hexagon of area $D^2$ =10000 m$^2$. Hence we get, $p_{opt1}$ = 0.045 Hence energy consumption at $p_{opt}$ and at different values of $p$ is shown below in table. The analysis shows that when we use Hexagon arrangement of a cluster in hexagonal area same as the area of square then energy consumption per node is very less for same number of nodes. The analysis is done by using MATLAB. This analysis also shows the result that increment in energy consumption is very less after the optimal probability for being a cluster head. This analysis can also be verified by the Tables (1 and 2) and figures (3 and 4) shown.

**TABLE 1. Average Energy Consumption v/s Probability (N=1000)**

| S.N. | $p$ | **Eavg** ($10^{-4}$ J) | |
|---|---|---|---|
| | | **For Square** | **For Hexagon** |
| **1.** | 0.005 | 3.597 | 3.825 |
| **2.** | 0.010 | 2.705 | 2.697 |
| **3.** | $p_{opt}$ **= 0.020** | **2.173(min)** | 2.173 |
| **4.** | 0.030 | 2.468 | 2.034 |
| **5.** | 0.040 | 2.600 | 1.991 |
| **6.** | $p_{opt1}$ **=0.045** | 2.680 | **1.752(min)** |
| **7.** | 0.100 | 3.740 | 2.139 |
| **8.** | 0.200 | 5.840 | 2.616 |

**TABLE 2. Average Energy Consumption v/s Number of Nodes**

| S.N. | N | **Square Region** | | **Hexagon Region** | |
|---|---|---|---|---|---|
| | | **Popt** | **Eavg (in J)** | **Popt1** | **Eavg (in J)** |
| **1.** | 200 | 0.047 | 2.873x10$^{-4}$ | 0.097 | 2.253x10$^{-4}$ |
| **2.** | 300 | 0.039 | 2.626x10$^{-4}$ | 0.079 | 2.120x10$^{-4}$ |
| **3.** | 500 | 0.030 | 2.376x10$^{-4}$ | 0.062 | 1.985x10$^{-4}$ |

| | | | | | |
|---|---|---|---|---|---|
| **4.** | 600 | 0.027 | $2.301 \times 10^{-4}$ | 0.056 | $1.944 \times 10^{-4}$ |
| **5.** | 1000 | 0.021 | $2.122 \times 10^{-4}$ | 0.043 | $1.846 \times 10^{-4}$ |

It is clear from the above two tables that the energy consumption per node is reduced by using the hexagonal structure in wireless sensor network. The tables also show that the average energy consumption reduces as number of nodes in a certain area (node density) increases.

Analysis also shows that average energy consumption per node is lesser for hexagonal network. The plot (using MATLAB 2011b) verifies the result in Figure 3. Average energy consumption per node per node decreases as number of nodes increases. The plot verifies the result in Figure 4.

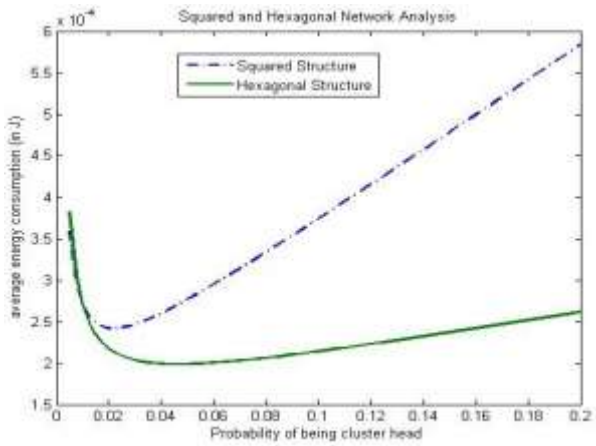



**Fig. 3: Variation in Probability**

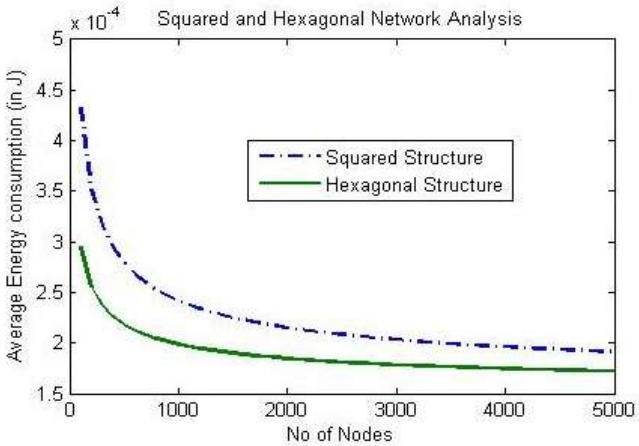



**Fig. 4: Variation in Number of Nodes**

## VII CONCLUSION AND FUTURE SCOPE

The analysis shows that the average energy consumption in different wireless sensor networks of same area having equal number of sensor nodes can be different for different structures. The new structure (Hexagonal) used in this analysis has provided a reduced average energy consumption over the previous structure (Squared). This analysis has its future scope that other structures of wireless sensor networks can be analyzed against the average energy consumption of the network for reduction in energy consumption.

## VIII ACKNOWLEDGEMENT

On the submission of my paper, I would like to extend my gratitude & sincere thanks to Mr. Kamlesh Kumar Mishra (Assistant Professor, Department of Electronics and Communication Engineering, UIT, Allahabad) for his constant motivation and support during the course of our work during last one year. I would like to thank to our Coordinator in M. Tech., Mr. Ranjeet Kumar Pathak (Assistant Professor, Department of Electronics and Communication Engineering, UIT, Allahabad) for his valuable and appropriate suggestions. I would also like to thank to our Head of Department Mr.

Dipanjan De (Assistant Professor, Department of Electronics and Communication Engineering, UIT, Allahabad), for encouraging me at the time when I did get demoralized.

## REFERENCES

[1] Wang Jianguo, Wang Zhongsheng, Shi Fei, Song Guohua, "Research on Routing Algorithm for Wireless Sensor Network Based on Energy Balance", American Journal of Engineering and Technology Research Vol. 11, No.9, 2011.

[2] Xiaoyan Cui, "Research and Improvement of LEACH Protocol in Wireless Sensor Networks", IEEE 2007 International Symposium on Microwave, Antenna, Propagation, and EMC Technologies For Wireless Communications

[3] Wendi B. Heinzelman, Anantha P. Chandrakasan, Hari Balakrishnan, "An Application-Specific Protocol Architecture for Wireless Microsensor Networks", IEEE transactions on wireless communication, Vol. 1, No. 4, October 2002

[4] W. Ye, J. Heidemann and D. Estrin, "An Energy efficient MAC Protocol for Wireless Sensor Networks," Proceedings of IEEE INFOCOM, 2001.

[5] Hu Junping, Jin Yuhui, Dou Liang," A Time-based Cluster-Head Selection Algorithm for LEACH", 978-1-4244-2703-1/08/$25.00 ©2008 IEEE

[6] Wendi Rabiner Heinzelman, Anantha Chandrakasan, and Hari Balakrishnan, "Energy-Efficient Communication Protocol for Wireless Microsensor Networks", 2000 IEEE, Hawaii International Conference on System Sciences, January 4-7, 2000, Maui, Hawaii.

[7] Giuseppe Anastasi, Marco Conti, Mario Di Francesco, Andrea Passarella, "Energy Conservation in Wireless Sensor Networks: a Survey", Department of Information Engineering, University of Pisa, Italy, Institute for Informatics and Telematics (IIT), National Research Council (CNR), Italy

[8] I. Akyildiz, W. Su, Y. Sankarasubramaniam and E.Cayirci, "Wireless Sensor Networks: a Survey", Computer Networks, Volume 38, N. 4, March 2002.

# A STUDY ON DIFFERENT APPROACHES OF OUTLIER DETECTION IN DATA MINING

**Mugdha Sharma[1], Ankit Goyal[2]**

[1]*Assistant Professor, MCA, Rukmini Devi Institute of Advanced Studies, (India)*

[2]*PGDM Student, Marketing, FORE School of Management, (India)*

## ABSTRACT

*Data mining is a process of extracting knowledge from large databases. Knowledge is appreciated as ultimate power now a days and considered as very important factor for the success of any organization because it has impacted the role of people working in that organization. Outlier detection is an important task in data mining and it has got many real time applications. The majority of real-time data contains certain unwanted or unrelated values, generally termed as "outliers". The segregation of outlier improves the quality of data, and thereby the accuracy rate is increased. The outlier is either individual or groups that depend upon the data and applications. Outlier occurs due to various reasons such as automatic faults, behavioral changes in the system, human error, irrelevant data and instrument faults. This paper presents an overview of outlier concepts, taxonomy, approaches and review of outlier detection algorithms and techniques.*

***Keywords**: **Cluster-based outlier, Collective outlier, Contextual outlier, Density-based outlier, Depth-based outlier, Distribution-based outlier***

## I INTRODUCTION

Data mining is a process of mining high quality hidden and valuable information from the data. The availability and accessibility of data are increased in the internet. Many organizations grant permission to freely access their data which are available on the internet (e.g. World Bank, USDA, etc.) by downloading for research purpose. Before using this data for research, the outlier and the anomalous must be removed. Suppose the data is small, inspection can then be done manually. When the quality of data is too large, then an automated procedure is needed to perform this task. The main aim of detecting outlier is to improve the quality of data.

The outlier shall be appropriate to the variability of measurement, or it happens to experimental error or may be barred from the dataset. Outliers can occur in any distribution, but they are measurement errors or population has a heavy-tailed distribution.

Outlier is often considered as noise or error, and also that, outlier might carry important information. Identified outlier may be anomalous data that may also otherwise adversely lead to unfair parameter estimations, incorrect results and imprecise model. Outlier Detection (OD) becomes a significant research problem which aims to find objects which are dissimilar, omitted and contradictory in the behavior of existing database. Many machine learning and data mining algorithm will not work well in the presence of outlier. Along with outlier, if the model is trained, then it will not produce accurate results. Removal of outlier may greatly improve the performance of

statistical and data mining algorithms. Detecting and eliminating such outliers in a pre-processing level will be effective for further analyses. Some of the outlier detection applications are: Intrusion Detection System, Credit Card Fraud, Interesting Sensor Measures,Medical Analysis [3], etc. This paper briefly analyses the outlier detection concepts, approaches and review of techniques for various applications.

The paper is structured as follows. Section 2 covers the related work done by various researchers. Then section 3 analyses the problems of outlier detection, Section 4 presents the taxonomy of outlier detection method, Section 5 enumerates the different types of outliers, Section 6 deals with the approaches of outlier detection. After which the Conclusion is provided in section 7.

## II RELATED WORK

This section analyses the existing work of outlier detection by various researchers over different types of data. According to Moore and McCabe (1999) "an outlier is an observation that lies outside the overall pattern of a distribution". Chen *et al.* (2002) are of the view that "Outliers are those data records that do not follow any pattern in an application".

Various outlier detection methods are proposed by great number of researchers. Rohan Baxter et al. [16] presented the comparison of outlier detection & linkage between data mining method and statistical outlier detection methods. They performed various techniques on statistical based dataset and network related dataset and found that Hadi technique performs well for both, large and complex datasets. They also proved that Donoho- Stahel technique will not be able to handle large datasets. Graham Williams et al. [5] proposed a comparative study of Replicator Neural Networks (RNN) for Outlier Detection in Data Mining. They proposed that RNN works well for both large and small datasets and MML works well for scattered outlier. S. D. Pachgade and S. S. Dhande [14] described a hybrid clustering based method which worked better than distance based method. So it helps in better outlier detection due to reduction in size and computational time.

Manish Gupta et al. [11] explained the outlier detection for temporal data. They presented a comprehensive and structured overview with the large temporal dataset. Fabrizio et al. [4] illustrated the detecting and predicting of the outliers based on unsupervised distance based method. Their proposed method based on the notion of outlier detection solving set and subset used to predict any unseen objects being considered as outliers. R. Andrew Weekley et al. [1] proposed an algorithm which can identify optimal clusters with both delay space and time domain. Similarly, Bo Liu et al. [2] also worked on improving the tradeoff between detection rate and false rate.

This paper presents a study on application of outlier detection and its various approaches.

## III PROBLEMS IN OUTLIER DETECTION

Outlier detection will identify the patterns of data which is deviating from the normal behavior. It is not very easy to define normal behavior or normal region. The difficulties are enlisted below:

1) Enclose with possible normal behavior in the region,

2) The rough boundary between normal and outlier behaviour is the same, time outlier observation is also very close with behavior of normal and vice-versa,

3) The outlier observations must be made as a normal observation, when outlier results from malicious actions,

4) A different notion of outlier is used in different application domain that leads to applying techniques which are developed for each domain,

5) Easy to use the labeled data for validation or training of models used by outlier detection techniques, and

6) Detecting outlier and noise is difficult and it is also hard to differentiate between noise and outlier.

Owing to exceeding challenges, the outlier detection problem is not very easy to solve. Even the existing outlier detection techniques will solve the specific problem formulation, which will take into account the various factors such as the nature of the data, type of outlier belongs, data labels and output of outlier detection [9].

## IV TAXONOMY OF OUTLIER DETECTION METHOD

The Outlier Detection Method is classified into various methods which are charted in the following fig. 1.

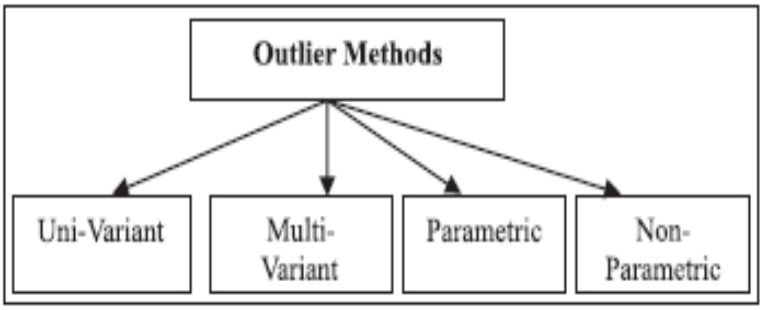



**Figure 1: Taxonomy of outlier methods.**

**Uni-Variant Method** means looking for single variables or parameter.

**Multi-Variant Method** will look for more than one parameter or one variable [6].

**Parametric (Statistical) Method** assumes a known primary distribution of the observations or is based on statistical evaluation of unknown distribution parameters. This method results in outlier, when the observation deviates from the model assumptions. This method will not suit high-dimensional datasets and arbitrary dataset, and need prior knowledge of underlying data distribution [19].

**Non-Parametric Method** works well with a lot of data which are used for modeling high dimensional data and does not know whether it belongs to underlying data distribution.

## V TYPES OF OUTLIERS

Outlier is classified into three categories which are given below:

1. Point Outlier,
2. Contextual Outlier, and
3. Collective Outlier.

**Point Outlier:** Any individual data instance can be referred as anomalous with respect to the rest of the data, and then the individual instance will be considered as a point outlier. Example: fig. 2 demonstrates point outlier in a form of simple 2-dimensional data. The data has 2 normal regions. $N1$ and $N2$, as most of the observations of the data lie in these two regions. Points which are away from normal regions, i.e., $o1$, $o2$ and $o3$ are considered as point outlier.

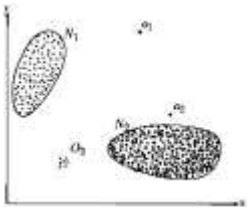


**Figure 2: Example of point outlier.**

**Contextual Outlier:** When the data instance is anomalous for a specific context, then it is known as contextual outlier (also known as conditional outlier). The notion of context is based on the structure of the dataset and those must be specified as part of the problem statement. All data instances are defined by two sets of attributes:

**Contextual Attributes:** Helps to determine the context for each instance. For example, in time-series data, the attribute of time is contextual where it will decide the location of instance for the entire series.

**Behavioral Attributes:** It defines the non-textual uniqueness of an instance. For example, in spatial data, average is a behavioral attribute which describes the average rainfall of the entire world from any location.

Generally, the anomalous behavior of contextual outlier is determined by using the values of behavioral attributes within a specific context. A data instance may be a contextual outlier in a given context, but the identical data instance, according to behavioral attribute, can be considered as normal in a different context. This key helps to identify contextual and behavioral attributes for contextual outlier detection. Time-series and spatial data alone can work well in contextual outlier. For example, a six feet tall adult may be a normal person, but according to kids, it will be considered as abnormal.

**Collective Outlier:** In a data set, if the collection instance is detected as anomalous, it is known as collective outlier. Each and every data present in the collective outlier might not be anomalous by itself, but their incidence together is considered as a collection of outlier. For example, in a school, a particular standard, say 5th, students are sitting in their class. Among them, half of the students belong to the 6th standard. These 6th standard students are called outliers. Collective outlier can be explored in spatial data, graph data and sequence data. The crucial point to be noted is that the point outlier can occur in any data set, but collective outlier can occur only when the data instances are having relationship between them.

In addition to the above outliers, there are cluster outlier (occur in small, low variance), radial outlier (occur in a plane out from the major axis) and scattered outlier (occur randomly scattered). The proportion of outliers is known as contamination levels. In statistical literature, the proportion of the outlier can be considered upon 40%, while the data mining literature study says the contamination level can be at least an order of magnitude less than 4%. Detecting and eliminating the outlier is a preprocessing step in data cleaning.

## VI APPROACHES FOR OUTLIER DETECTION

There are different approaches available to handle outlier detection. Researchers use these approaches for different applications and for different problems. One after another, the various approaches are analyzed below:

**Distribution-basedMethod:** This method is based on statistical techniques.When data deviate from the model, the standard distribution model will flag as outlier. The functioning of high dimensional data is complex. Before applying arbitrary dataset, prior knowledge is required, or else it becomes more expensive to determine which

model is best for the dataset. This method depends on data distribution which helps to fit the data, the parameter of the distribution (known or not) and the number and expected outliers (Upper or lower).

Two main problems of this method are:

1) Unsuitable for multidimensional data set, and

2) Depends only on distribution base for fitting the data.

Some of the algorithms are Index-based, Nested Loop based, Linearization, ORCA, RBRP and Grid Based.

**Depth-based Method:** This method works with computational geometry and computes different layers of *K–d u*-shaped hulls. Based on depth, data objects are organized as hull layers in data space according to peeling depth, and outliers are found out from the data objects with shallow depth value. This method overcomes the problem of distribution method where it will be able to work with multidimensional data objects and avoids the problem of distribution for fitting the data.

**Clustering Method:** This method is a base method for detecting outlier. It helps to detect potential outlier from the dataset. According to clustering algorithm, data which are not located in the clusters, and those data which are away from cluster, are considered as outliers. Clustering algorithm should satisfy three important constraints:

• Determine clusters with arbitrary shape,

• Efficiency is good on large database, and

• Determine the input parameters.

Some of the clustering algorithms are developed in the context of Knowledge Discovery Database (KDD) which will help to detect outlier from data. The main objective of clustering algorithm is to detect outlier. According to clustering, the exception is known as "noise", which is bearable or else ignored when the result is produced.

**Distance-based (DB) Method:** This method was originally proposed by Knorr and Ang [10]. Again, this method was enhanced by Ramaswamy *et al.* [13,22]. It is a non-parametric method which identifies outlier, based on distance between points and nearest neighbor in the dataset. The outlier is detected as "An object *O* in a dataset *T* is a *(p, D)* considered outlier only, if at least a fraction *p* of the objects in *T* lies at a distance greater that *D* from *O*". The parameter *p* is threshold value, one of the constraints of normal data points. In mining, distance based outlier is index based algorithm, nested loop algorithm and cell based algorithm. Pruning and batch processing are used to improve the efficiency of outlier detection [4].

**Deviation Based Method:** This method does not use any distance-based or a statistical test to identify exceptional objects in the dataset. It identifies outliers by examining the main characteristics of objects as a group. Outliers are points which will not fit with the characteristics of the dataset.

**Density-based Method:** It was proposed by Breunig *et al.* [16]. It estimates the density distribution of the input space and then discovers outliers as those lying in regions with low density. This approach is very sensitive to parameters for defining neighborhood. It needs the concept of local outlier. Index based, two-way approach and the micro cluster based analysis algorithms are used for density based.

**Novel Deviation Method:** Dangtong Yu *et al.* proposed this method. This method works for Signal Processing to solve problems in data mining. Hence a researcher can combine both clustering and outlier in a combined form. According to wavelet form, FindOut (or outlier) helps to remove the clusters from the original dataset and then recognize outlier. Find- Out can able to detect outlier even from large data sets.

The above approaches are used to detect outlier, and process of techniques varies for each approach. Each approach has a number of techniques [2, 8]. Some techniques will work only for specific data, and also, some techniques will detect outlier for any kind of data. The size of the dataset also differs for each algorithm, i.e., there is some restriction on handling the size of the dataset. Each approach has its own merits and demerits. But all the above approaches help to detect outlier effectively.

## VII CONCLUSION AND FUTURE SCOPE

One of the main works in data mining is to find out outliers. This paper concludes that most of the outlier detection research focuses on algorithm which requires background knowledge of outlier detection and also which varies from one domain to another domain. The efficiency of outlier detection heavily depends on the distribution of data and type of data. For example, the novel detection method will work only for signal processing. Likewise, there is a limitation in handling the data and size of data set. Detecting outlier is very important, because, it includes lot of important information which leads to further research in a different domain. It was observed that individual methods are not efficient for detecting outlier in particular data. In such a situation it is better to combine different approaches for outlier detection. This survey provides a brief analysis about outlier detection concepts, problems in outlier detection, types of outliers, approaches and related works of outlier detection.

## REFERENCES

[1] R. Andrew Weekley, Robert K. Goodrich and Larry b. Cornman (2009), “An Algorithm for Classification and Outlier Detection of Time-Series Data”, Journal of Atmospheric and Oceanic Technology Vol. 27, pp. 94–107.

[2] Bo Liu, Yanshan Xiao, Philip S. Yu, Zhifeng Hao and Longbing Cao (2013), “An Efficient Approach for Outlier Detection with Imperfect Data Labels”, IEEE Transactions on Knowledge and Data Engineering, pp. 1–14.

[3] Edwin M. Knorr, Raymond T. Ng and Vladimir Tucakov (2000), “Distance-based outliers: Algorithms and applications”, The VLDB Journal, Vol. 8, pp. 237–253.

[4] Fabrizio Angiulli, Stefano Basta and Clara Pizzuti (2006), “Distance-Based Detection and Prediction of Outliers”, IEEE Transactions on Knowledge and Data Engineering, Vol. 18, No. 2, pp. 145–160.

[5] Graham Williams, Rohan Baxter, Hongxing He, Simon Hawkins and Lifang Gu (2002), “A Comparative Study of RNN for Outlier Detection in Data Mining”, 2nd IEEE International Conference on Data Mining (ICDM02), ISSN 0-7695-1754-4, pp. 709–712.

[6] G. S. David, Sam Jayakumar and Bejoy John Thomas (2013), “A New Procedure of Clustering Based on Multivariate Outlier Detection”, Journal of Data Science, pp. 69–84.

[7] Hodge, V.J. and Austin, J. (2004), “A survey of outlier detection methodologies”, Artificial Intelligence Review, pp. 85-126,

[8] Hui Xiong, Gaurav Pandey, Michael Steinbach and Vipin Kumar (2006), "Enhancing Data Analysis with Noise Removal", IEEE Transactions on Knowledge and Data Engineering, Vol. 18, No. 3, pp. 304–319.

[9] Karanjit Singh and Dr. Shuchita Upadhyaya (2012), "Outlier Detection: Applications and Techniques", IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 1, No. 3, ISSN (Online): 1694-0814, pp. 307–323.

[10] Markus M. Breunig, Hans-Peter Kriegel, Raymond T. Ng and J¨org Sander (2000), "LOF: Identifying density based Local outliers", ACM Conference Proceedings, pp. 93–104.

[11] Manish Gupta, Jing Gao, Charu C. Aggarwal and Jiawei Han (2013), "Outlier Detection for Temporal Data: A Survey", IEEE Transactions on Knowledge and Data Engineering, Vol. 25, No. 1, pp. 1–20.

[12] Mark Last and Abraham Kandel, "Automated Detection of Outliers in Real-World Data", Ben-Gurion University of the Negev, pp. 1–10.

[13] M. O. Mansu and Mohd. Noor M.d. Sap (2005), "Outlier Detection Technique in Data Mining: A Research Perspective", Proceedings of the Postgraduate Annual Research Seminar, pp. 23–31.

[14] Ms. S. D. Pachgade and Ms. S. S. Dhande (2012), "Outlier Detection over Data Set Using Cluster-Based and Distance-Based Approach", International Journal of Advanced Research in Computer Science and Software Engineering, ISSN.2277 128X, Vol. 2, No. 6, pp. 12–16.

[15] Prakash Chandore and Prashant Chatur (2013), "Outlier Detection Techniques over Streaming data in data mining: A Research Perspectives", International Journal of Recent Technology and Engineering, ISSN.2277-3878, Vol. 2, No. 1, pp. 157–162.

[16] Rohan Baxter, Hongxing He, Graham Williams, Simon Hawkins and Lifang Gu, "An Empirical Comparison of Outlier Detection Methods", Mathematical and Information Sciences (CSIRO).

[17] R. B. Robinson, Chris D. Cox and K. Odom (2005), "Identifying Outliers in Correlated Water Quality Data", Journal of Environmental Engineering, pp. 651–657.

[18] Silvia Cateni, Valentina Colla and Marco Vannucci (2008), "Outlier Detection Methods for Industrial Applications", Advances in Robotics, Austria, ISBN: 78-953-7619-16-9, pp. 265–282.

[19] Spiros Papadimitriou, Hiroyuki Kitagawa, Phillip B. Gibbons and Christos Faloutsos (2002), "LOCI: Fast Outlier Detection Using the Local Correlation Integral," Intel Research Laboratory Technical Report No. RP-TR-02-09.

[20] Yuh-Jye Lee, Yi-Ren Yeh and Yu-Chiang Frank Wang (2013), "Anomaly Detection via Online Oversampling Principal Component Analysis", IEEE Transactions on Knowledge and Data Engineering, Vol. 25, No. 7, pp. 1460–1470.

[21] Zhiguo Li, Robert J. Baseman, Yada Zhu, Fateh A. Tipu, Noam Slonim and Lavi Shpigelman (2014), "A Unified Framework for Outlier Detection in Trace Data Analysis", IEEE Transactions on Semiconductor Manufacturing, Vol. 27, No. 1, pp. 95–103.

[22] Zuriana Abu Bakar, Rosmayati Mohemad, Akbar Ahmad, Mustafa Mat Deris (2006), "A Comparative Study for Outlier Detection Techniques in Data Mining", IEEE, pp. 1–6.

# STRUCTURAL, MORPHOLOGICAL AND MAGNETIC PROPERTIES OF $COGA_XFE_{2-X}O_4$ NANO-CRYSTALLINE

**Gayathri.S [1], Kalainathan.S [2]**

[1]*School of Advance Science, Center for Crystal Growth, VIT University, Vellore - 14, TamilNadu, (India.)*

[2] *Senior Professor, School of Advance Science, Center for Crystal Growth, VIT University, Vellore - 14, TamilNadu, (India.)*

## ABSTRACT

*Nanocrystalline Gallium substituted cobalt ferrite materials have been synthesized by coprecipitation route. The structural, morphological and magnetic properties of* $CoGa_xFe_{2-x}O_4$ *(0.0 ≤ x≤ 0.8) were determined by XRD, SEM, EDX spectroscopy and VSM. SEM images reveal that the sample surface exhibits well defined crystalline nanoparticles of spherical shapes with small agglomeration. Energy dispersive x- ray (EDAX) analysis confirms the presence of Co, Fe, Ga and oxygen in the prepared nanoparticles. From the HR-TEM, the average particle size is found to be 21 nm that is similar to that of the particle size obtained from the XRD data. The saturation magnetization (Ms), coercivity (Hc) and remanent magnetization (Mr) increase with Ga content and the phase transformation from Para to ferromagnetic takes place with increase of Gallium*.

***Keywords: Coprecipitation method, Magnetic material, Nanoparticles, SEM, TEM analysis.***

## 1. INTRODUCTION

Ferrites general structure $[A^{2+}]_{tet}$ $[B^{3+}]_{octa}$ $O_4$ are well known for their electrical, magnetic and catalytic properties [1,2]. In a spinel structured compound $AB_2O_4$(A site = divalent cations and B site = trivalent Fe ions) one unit cell contains 32 oxygen atoms that are in direct contact to one another forming a closed-pack face-centered cubic structure with 8 tetrahedral (A) and 16 octahedral (B) occupied sites[3,4]. $CoFe_2O_4$ has an inverse spinel structure with $Co^{2+}$ ions in the (B) sites and $Fe^{3+}$ ions equally distributed between tetrahedral (A) and octahedral (B) sites. Therefore, by substituting various metal cations change in properties can be observed in these nanoferrites [5, 6].

The literature survey reveals that bulk growth of $CoGa_xFe_{2-x}O_4$ has been carried out by ceramic method; Ranvah et al[7] studied the effect of Ga substitution on the temperature dependence of magnetization, magnetic

anisotropy, and coercive field of gallium-substituted cobalt ferrite. S.H.Song et al [8] investigated the magnetic and magnetoelastic properties of Ga substituted Cobalt ferrite found that the Curie temperature $T_c$ and hysteresis properties vary with Ga content which indicates that exchange and anisotropy energy changed as a result of Ga substitution in Fe. S.J.Lee et al [9] observed the magneto – optic spectra particularly polar Kerr rotations in Ga substituted cobalt ferrite where the Kerr rotation can be controlled by adjusting the Ga content in cobalt ferrite. In the present study, Ga substituted Co ferrites nanoparticles have been investigated. $Ga^{3+}$ is known to prefer the tetrahedral sites[10], therefore, the properties and the results are expected to be different from Al, Mn, Cr, Ni, Zn, Zr substituted cobalt ferrites.

## II EXPERIMENTAL SYNTHESIS

Nanoparticles of Ga doped Cobalt ferrite with the stoichiometry ratio $CoGa_xFe_{2-x}O_4$ ($0.0 \leq x \leq 0.8$) samples were prepared by co-precipitation method. The starting materials used were Cobaltous chloride ($CoCl_2.6H_2O$), Ferric chloride anhydrous ($FeCl_3$), Gallium (III) chloride ($Gacl_3$) of 99.999% purity and Sodium hydroxide (NaOH), all from Alfa Aesar and Analytical Grade. Polyethylene glycol – 400(PEG -400) is used as a surfactant. The salts were dissolved in double distilled water separately according to their mole ratio.0.1M of cobalt and 1.8M of iron was dissolved and mixed together. Then 0.2M of gallium was added to this mixture. All the processes were carried out with continues stirring. Sodium hydroxide solution of 0.3M is added drop by drop to the above mixture till the pH of the solution reaches between 10 - 12. Finally, few drops of PEG -400 were added to the solution. The aqueous solution was heated at 80°C with continuous stirring for 1hr.The heated solution was brought to room temperature and washed thoroughly with 2D –water until the precipitate is free from sodium and chloride ions. The precipitate was dried in the oven at 100°C for overnight to remove water contents. The dried sample was fluffy mass in appearance and grinded for 1hr using a motor and pestle to get a homogeneous mixture and the resulting powder was sintered for 5 hrs at 500°C. The sintered samples were grinded using Ball milling for 2hrs and proceeded for further characterization.

## III RESULTS AND DISCUSSION

### 3.1. Structural

The XRD pattern for each sample was recorded (Fig: 1) and confirms the incorporation of $Ga^{3+}$ ions into the cubic spinel structure. The phase analysis was done with JCPDS card number 22- 1086. According to the Debye – Scherrer formula, the crystalline size $D_{hkl}$ [11] for the samples was calculated and the average crystalline size was found to be in the range of 16-24 nm.

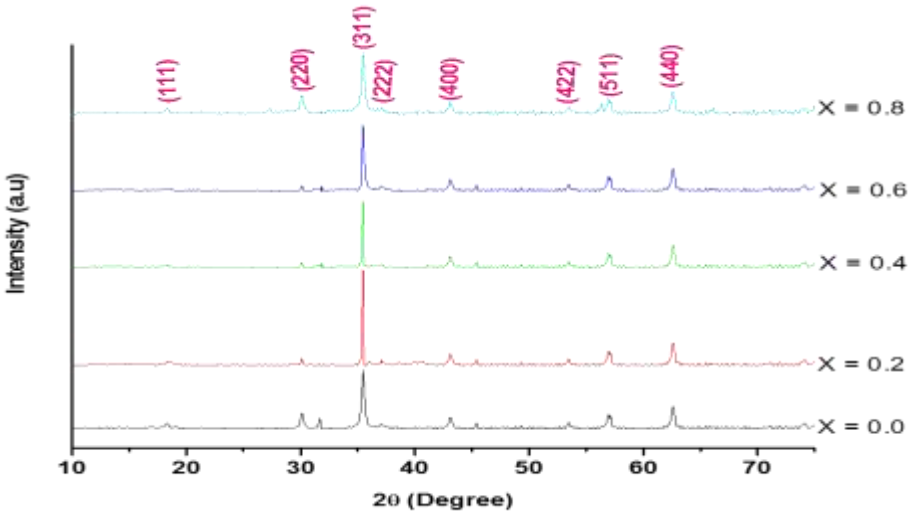



**Fig: 1 XRD pattern of $CoGa_xFe_{2-x}O_4$ (x = 0.0, 0.2, 0.4, 0.6 and 0.8) annealed at 500°C**

The SEM images and EDX spectra are shown in Fig.2 .SEM images indicate that the samples consist of spherical shaped nanoparticles which are dense, distributed regularly on the surface with the existence of soft agglomeration. The EDX spectrum confirms the presence of all elemental composition in the sample.

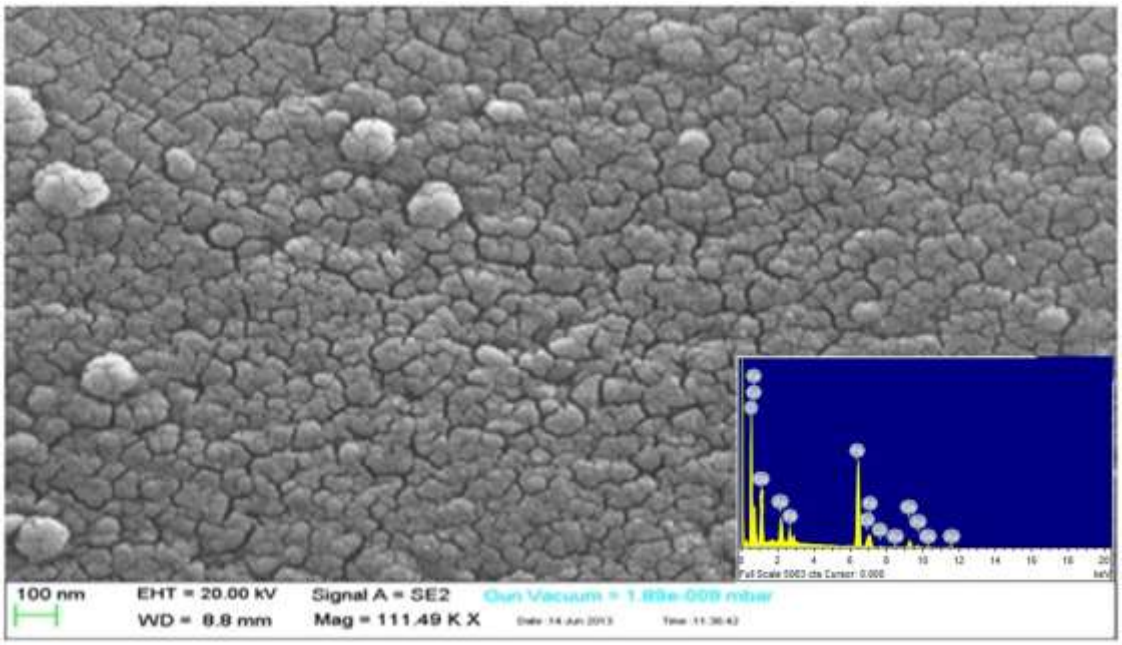



**Fig: 2 SEM with EDX Spectrum of $CoGa_{0.6}Fe_{1.4}O_4$**

The morphology of the particle formed was examined using high- resolution transmission electron microscope for the collected samples. HR-TEM images of the $CoGa_xFe_{2-x}O_4$ (x =0.6) are shown in Fig 3. It can be seen that

the entire powder sample is composed of small nanoparticles with a spherical shape. The average particle size is found to be 21 nm that is similar to that of the particle size obtained from the XRD data.

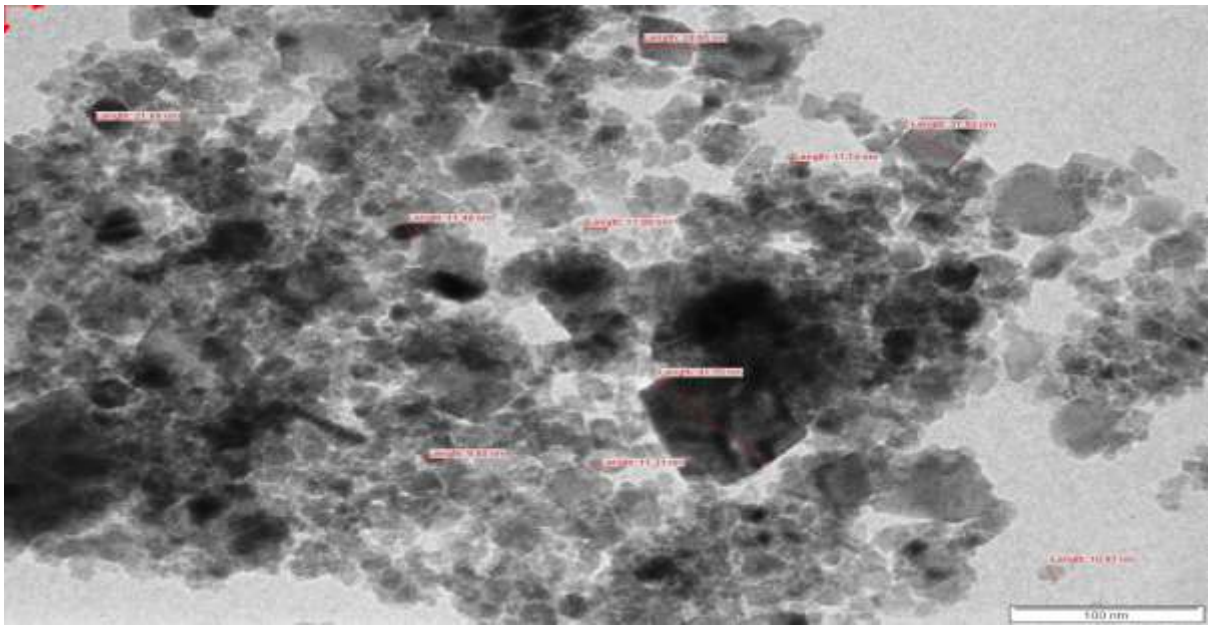


**Fig: 3 TEM image of $CoGa_{0.6}Fe_{1.4}O_4$**

### 3.2 Magnetic studies

The room temperature hysteresis loops for $CoGa_xFe_{2-x}O_4$ samples (x = 0.2, 0.4, 0.6 and 0.8) which were annealed at 500°C are shown in Fig: 4. In spinel ferrites, the magnetic order is due to a superexchange interaction between the metal ion in the A and B sublattices. The substitution of nonmagnetic ion Gallium, which has a preferentially A site occupancy results in the reduction of the exchange interaction between A and B sites. Hence, by varying the Ga content, it is possible to vary magnetic properties of the nanoparticles. The saturation magnetization (Ms), remanent magnetization (Mr) and coercivity (Hc) values are listed in TABLE: 1 for the given samples. It can be seen that both saturation magnetization (Ms) and remanent magnetization (Mr) increase with an increase in Ga content. The saturation magnetization (Ms) increases with increase of crystallite size. Alignment of number of atomic spins along with the applied magnetic field increases with the increase of magnetic domain, which leads to enhancement of the saturation magnetisation with the crystallite size [5].The coercivity (Hc) value, also increases with an increase in gallium content. Pure Cobalt ferrite is ferromagnetic which changes to paramagnetic with the addition of Gallium content at x =0.0, and an increases in Ga content the material is changing back to ferromagnetic at x = 0.8.Phase transition takes place with the addition of Gallium to pure Cobalt ferrite. Hence, we observe that the Ms, Mr and Hc values obtained for the $CoGa_xFe_{2-x}O_4$ nanoparticles are less than that of the values obtained by S.H.Song et al [8] in bulk growth.

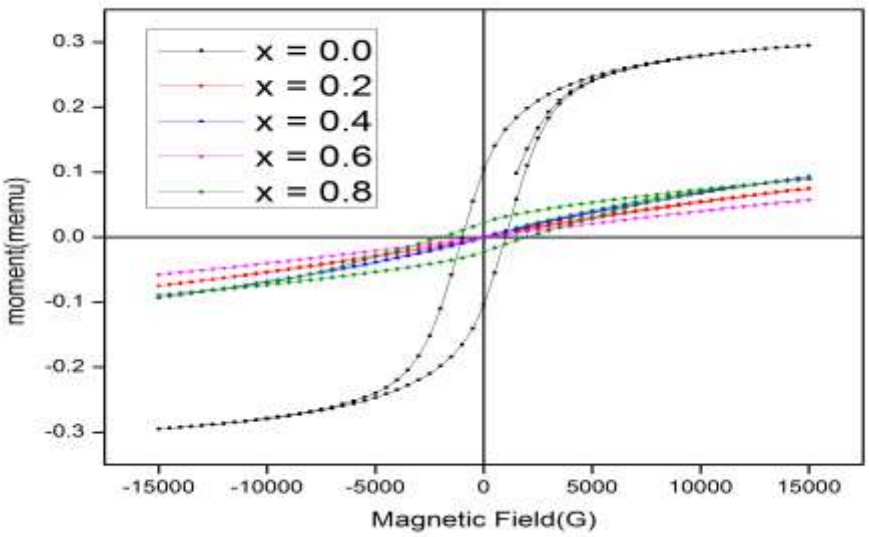



**Fig: 4 Hysteresis loop of $CoGa_xFe_{2-x}O_4$ annealed at 500°C**

| Compound $CoFe_{2-x}Ga_xO_4$ | Saturation Magnetization Ms(emu/g) | Retentivity Mr (emu/g) | Coercivity Hc ( K Oe) |
|---|---|---|---|
| X = 0.0 | 2.67 | 0.0116 | 131.09 |
| X = 0.2 | 1.057 | 0.0208 | 219.76 |
| X = 0.4 | 1.684 | 0.0216 | 511.03 |
| X = 0.6 | 1.692 | 0.1992 | 1534.9 |
| X = 0.8 | 1.988 | 0.5009 | 1986.9 |

**Table.1: The saturation magnetization (Ms), remanent magnetization (Mr) and coercivity (Hc) values of $CoGa_xFe_{2-x}O_4$ annealed at 500°C.**

## IV CONCLUSION

The nanoparticles of $CoGa_xFe_{2-x}O_4$ were synthesized by coprecipitation method. The size of the nanoparticles is in the range of 16-24 nm which are in good agreement with the values obtained by XRD, SEM and TEM indicating that there are no agglomerations. The EDX spectrum confirms the presence of all elemental

composition in the sample. No impurity phase is found in the spectra. The saturation magnetization (Ms), remanent magnetization (Mr) and coercivity (Hc) increase with an increase in Ga content. The saturation magnetization (Ms) increases due to increase in the crystallite size with the annealing temperature.

**Acknowledgment**

I gratefully acknowledge the support from VIT University, Vellore, Tamil Nadu, India.

## REFERENCES

[1] C.C.H. Lo, A.P. Ring, J.E. Snyder, D.C. Jiles, Improvement of magneto mechanical properties of cobalt ferrite by magnetic annealing, *IEEE Trans. Magn. 41 (2005) 3676–3678.*

[2] Y. Koseoglu, M. Bay, M. Tan, A. Baykal, H. Sozeri, R. Topkaya, N.Akdogan, Magnetic and dielectric properties of $Mn_{0.2}Ni_{0.8}Fe_2O_4$ nanoparticles synthesized by PEG-assisted hydrothermal method, *J. Nanopart. Res. 13 (2011) 2235–2244.*

[3] Lawrence Kumar, Manoranjan Kar, Influence of $Al^{3+}$ ion concentration on the crystal structure and magnetic anisotropy of Nanocrystalline spinel cobalt ferrite, *Journal of Magnetism and Magnetic Materials 323 (2011) 2042–2048.*

[4] M. Mozaffari , S.Manouchehri, M.H.Yousefi, J.Amighian, The effect of solution temperature on crystallite size and magnetic properties of Zn substituted Co ferrite nanoparticles, *Journal of Magnetism and Magnetic Materials 322 (2010) 383–388.*

[5] V.G Patil, S.E. Shirsath, S.D. More, S.J. Shukla, K.M. Jadhav, Effect of zinc substitution on structural and elastic properties of cobalt ferrite, *J.Alloys Compd. 488 (2009) 199–203.*

[6] S.B. Waje, M. Hashim, W.D.W. Yousoff, Z. Abbas, Sintering temperature dependence of room temperature magnetic and dielectric properties of $Co_{0.5}Zn_{0.5}Fe_2O_4$ prepared using mechanically alloyed nanoparticles, *J Magn. Magn. Mater. 322 (2010) 686–691.*

[7] N. Ranvah, Y. Melikhov, D. C. Jiles, J. E. Snyder, A. J. Moses et al. Temperature dependence of magnetic anisotropy of Ga-substituted cobalt ferrite, *J. Appl. Phys. 103, 07E506 (2008).*

[8] S.H.Song, C.C.H.Lo and S.J.Lee, S.T.Aldin, J.E.Snyder and D.C.Jiles, Magnetic and magnetoelastic properties of Ga- substituted cobalt ferrite, *J. Appl. Phys.101,09C517,2007*.

[9] S.J.Lee, S.H.Song, S.H.Song, S.T.Aldin, D.C.Jiles Magneto – optic properties of $CoGa_xFe_{2-x}O_4$, *J. Appl. Phys.101,09C502,2007.*

[10] M.H.Mahmoud, H.H.Hamdeh, J.C.Ho, A.M.Abdalla, A.I.Abdel-Mageed, Mossbauer studies on $MnGa_xFe_{2-x}O_4$,*Solid.State.Commun,120, 451-453 (2001).*

[11] Cullity B D 1956 *Elements of X-Ray Diffraction* (New York:Addison-Wesley) chap 7 p 139

# A NOVEL GENETIC ALGORITHM FOR SELECTIVE HARMONIC ELIMINATION IN CASCADE SWITCHED-DIODE MLC

**A.Shruthi**

*PG Scholar, Raja College of Engineering and Technology, Madurai, Tamilnadu, (India),*

**ABSTRACT**

*The multilevel inverters are robust and flexible in grid connected operations. This topology intelligently eliminates lower order harmonics such as 1, 3, 5, 7, 11 up to 19 by solving non-linear transcendental Fourier series equation. The conventional methods like Newton Raphson have problem of iterative and the initial guess are needed to solve non-linear equations. However the Genetic Algorithm eliminates the pre matured convergence as well as initial guesses. The new topology cascade switched diode MLC reduces the no of switches used in MI. Cascade switched-diode multilevel converter can produce many levels with minimum number of power electronic switches, gate driver circuits, power diodes, and dc voltage sources.*

***Key Words: Cascade, Harmonic Optimization, Multilevel Converter (MLC), Genetic Algorithm (GA).***

## 1. INTRODUCTION

Multilevel inverters have drawn tremendous interest in high-power applications such as laminators, mills, conveyors, pumps, fans, blowers. Multilevel converters have been used for several applications such as static reactive power compensation, adjustable- speed drives, renewable energy sources. Multilevel converters can produce a large number of output voltage levels, which results in high voltage capability, better electromagnetic compatibility and high power quality. The principal function of multilevel converter is to synthesize a desired ac voltage from several separate dc sources. An attempt has been made in early for multilevel converter with reduced number of power electronic components in comparison with conventional cascade converter. This converter needs a large number of bidirectional switches. In addition, the magnitude of blocked voltage by bidirectional switches is high. In another new topology for cascade multilevel converter has been introduced, which reduces the number of bidirectional switches, power diodes, and dc voltage source in comparison with proposed topology. This topology consists of several sub multilevel converters and full-bridge converters. But, this topology requires a large number of bidirectional switches and gate driver circuit's .In this paper asymmetric, cascade switched-diode multilevel

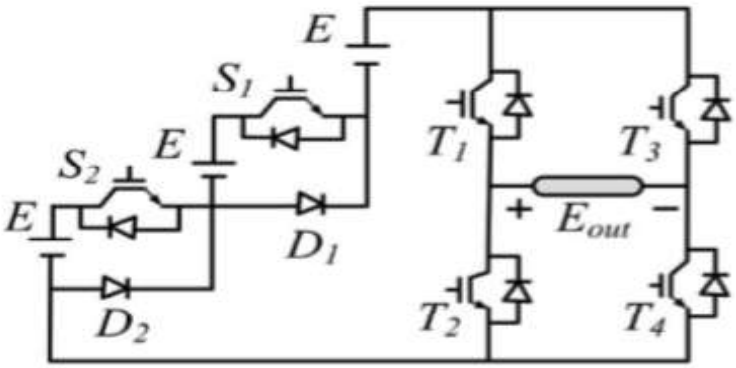
converter is used, which have more advantages in comparison with previous presented topologies. Many levels of voltage are produced with least number of components. The number of required power electronic switches against required voltage levels is a very important factor in designing of multilevel converter, because switches define the reliability, circuit size, cost, installation area, and control complexity. However increasing level produces harmonics. Switching strategies are applied to any inverters to control fundamental component and amount of produced harmonics. Mathematical methods are not suitable for high level inverters. Selective harmonic elimination pulse width modulation is the most famous switching strategy. The aim of this method is the eliminating low order harmonics, if it is possible, or at least to minimize them. The nature of these equations is nonlinear. Some iterative methods such as the Newton Raphson have been used to solve the equations .Iterative methods depend mainly on the initial guess and divergence problems are likely to occur. They have initial guesses and time of convergence is high. They are not used for high level inverters. They can only find one set of solutions. The GA is simple and applicable to problems with any number of levels, without the extensive derivation of analytical expressions, for both eliminating and minimizing harmonics. This algorithm is chosen for the optimization goals.

## II CONSTRUCTIONAL FEATURE

Asymmetrical multilevel converter provides an increased number of output voltage levels for the same number of power electronic devices than its symmetric counterpart. To provide a large number of levels with less number of components, cascade switched-diode multilevel converters is used.. The output voltage of the proposed cascade switched- diode multilevel converter is given by

$$E_{out} = Eo1 + Eo2 + \cdots + Eon.$$

The proposed asymmetric cascade topology for a seven level inverter.



The value of dc sources suggested as

**E1 =E**

**E j =2 ^( j−1) E For j=2 ,3 ,4,...,Z.**

For this method, the number of levels and maximum output voltage are given respectively

**N level =2 (Z+1) −1**

**$E_o$ max =(2Z −1)E**

where Z represents the number of dc sources. In the proposed asymmetric topology, the number of IGBTs is obtained by

**$N_{IGBT}$ = Z +4**

## III CIRCUIT OPERATION

When the switch S is turned off, the current flows from the diode D and load voltage will be E. But, when the switch S is turned on, the diode is reverse biased and current flows from the voltage source E and load voltage will be (2E). By the use of this method, the load voltage is controlled. This method is the basic for this cascade multilevel converter.In this topology, the values of dc sources are unequal and voltages 50V, 50V, 10 V has been used in each cascade bridge.The output of 240v is obtained.In this topology, three dc sources and six IGBTs has been used. For the same number of levels, the symmetric CHB topology needs three dc sources and 12 IGBTs, which the number of IGBTs is higher than that of recommended symmetric structure.

It is obvious that increasing the number of level leads to the multilevel converter producing only near-sinusoidal output voltage waveform and, as a result, harmonic distortion. Therefore calculation of the optimal switching angles for the elimination of selected harmonics and reducing the total harmonic distortion must be done.

## IV GENETIC ALGORITHM

This algorithm is usually used to reach a near global optimum solution. In each iteration of the GA a new set of strings, which are called chromosomes, with improved fitness is produced using genetic operators. A selection operator, a crossover operator which acts on a population of strings to perform the required reproduction and recombination, and a mutation operator which randomly alters character values, usually with a very low probability.They are generally solved by equating fourier equations to zero and then by obtaining switching angles.

Fourier series expansion for waveform is:

$$\mathbf{V\ (wt)} = \sum_{n=1}^{\infty} V_n \sin(wt)$$

where, $V_n$ is the amplitude of the harmonics. The angles are limited to between zero and 90◦ ($0 \leq \theta \leq 90$). Because of an odd quarter-wave symmetric characteristic, the harmonics with an even order become zero. Subsequently, $V_n$ becomes:

$$V_n = \begin{cases} 4V_{dc}\sum_{i=1}^{s}\cos(n\theta_i) & n: odd \\ 0 & n: even \end{cases}$$

For elimination of $5^{th}$ ,$7^{th}$ harmonics, these three equations should be solved

$$M = [\cos(\theta_1) + \cos(\theta_2) + .. + \cos(\theta_4)]/4$$

$$0 = [\cos(5\theta_1) + \cos(5\theta_2) + \ldots + \cos(5\theta_4)]$$

$$0 = [\cos(7\theta_1) + \cos(7\theta_2) + .. + \cos(7\theta_4)]$$

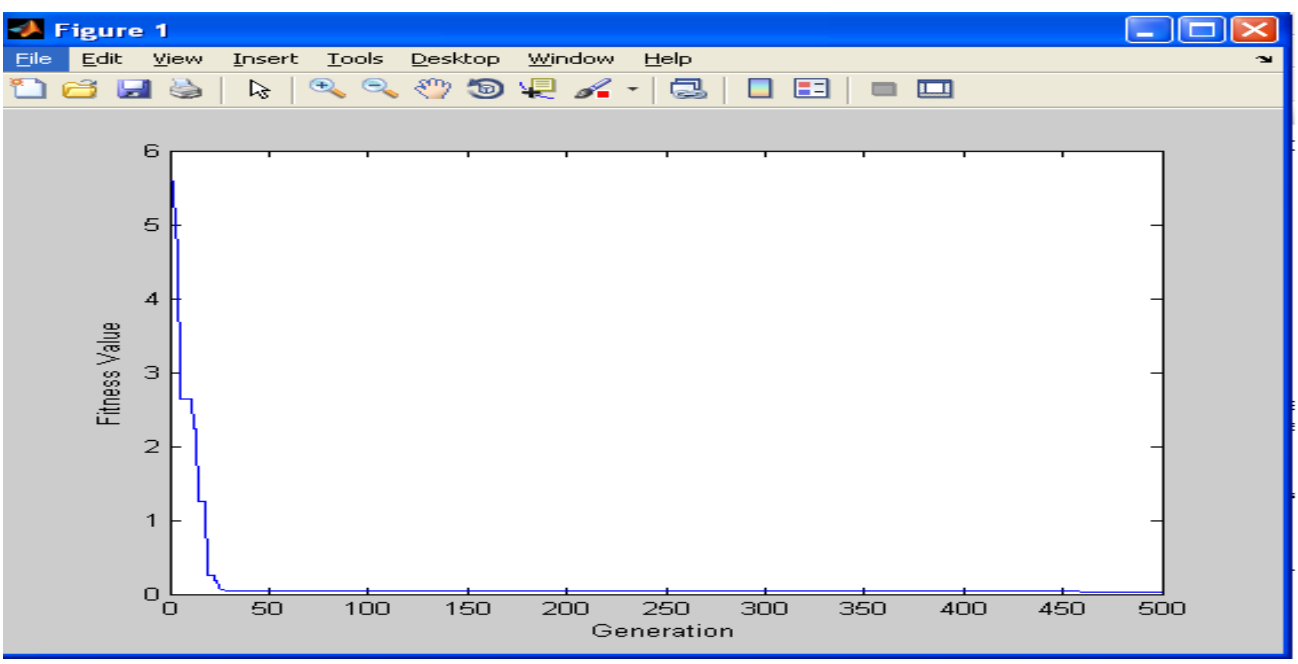
The modulation index is given by

$$M \triangleq V1 \Big/ \frac{4V_{dc}S}{\pi}$$

The value of M is between 0 and 1 to cover different values of $V_1$. It is necessary to determine switching angles, namely θ1, θ2, θ3 such that the equation sets are satisfied.

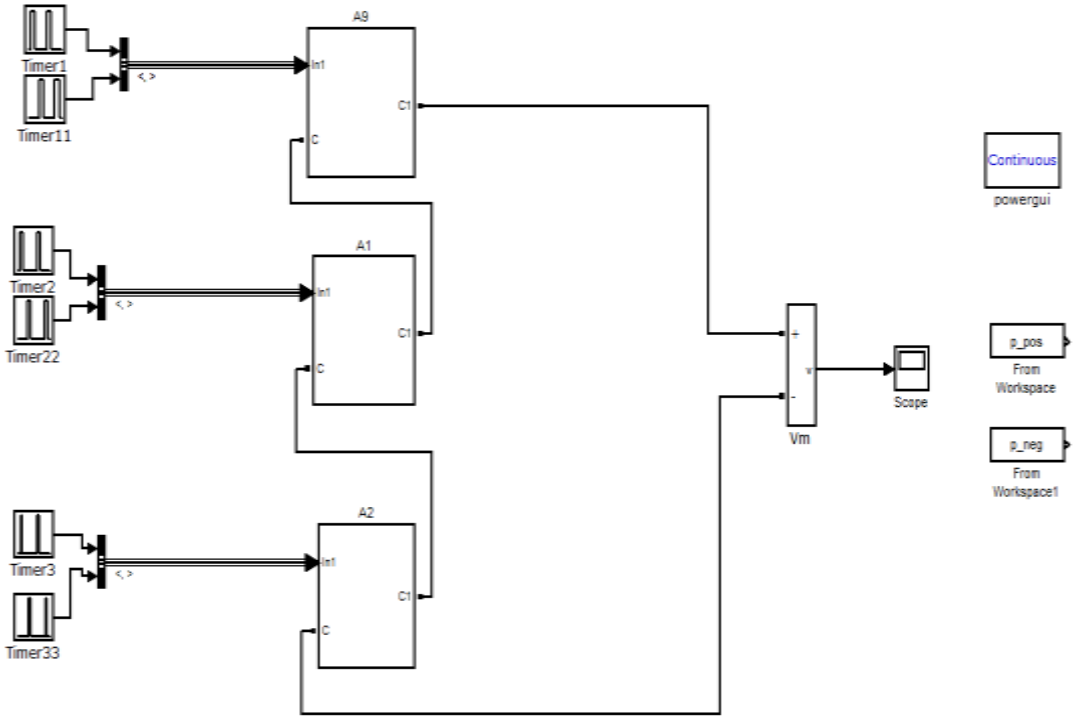
The output of genetic algorithm is switching angles corresponding to level and modulation index. The coding can be done for n levels. The output of GA is given to multilevel inverter as input.

The output graph for GA representing genereation against fitness value

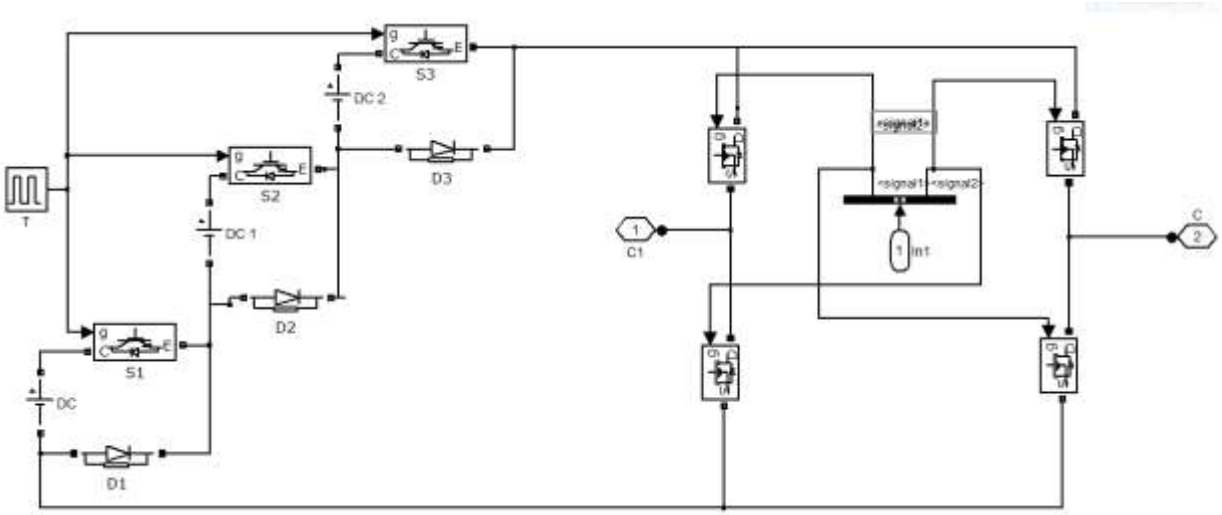


## V PROPOSED MODEL

The simulation model for proposed seven level system is

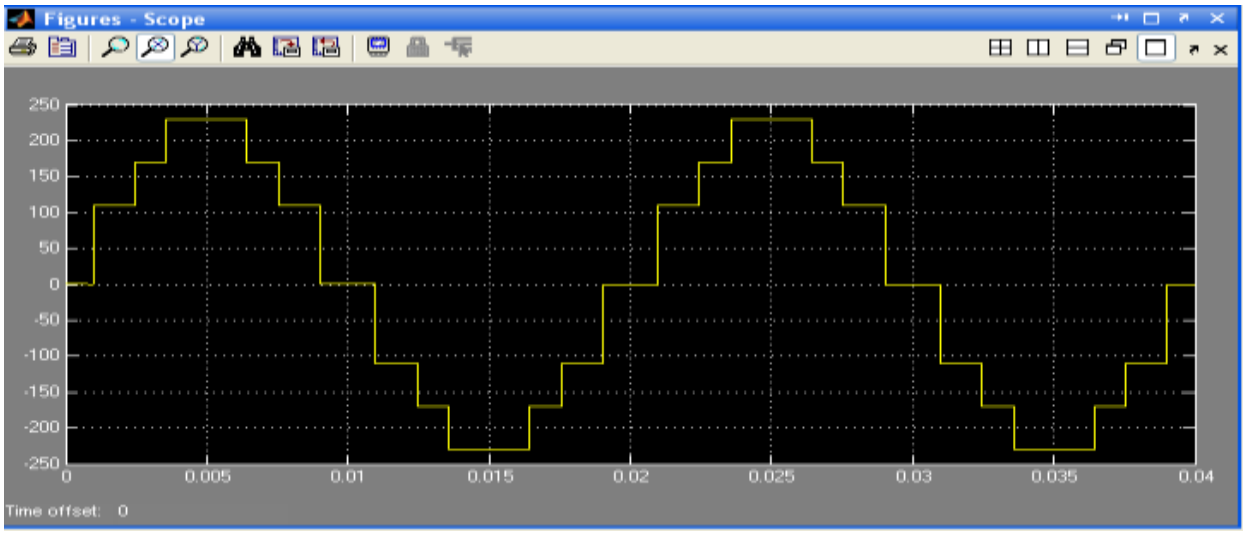



The subsystem for single cascade switched diode bridge is

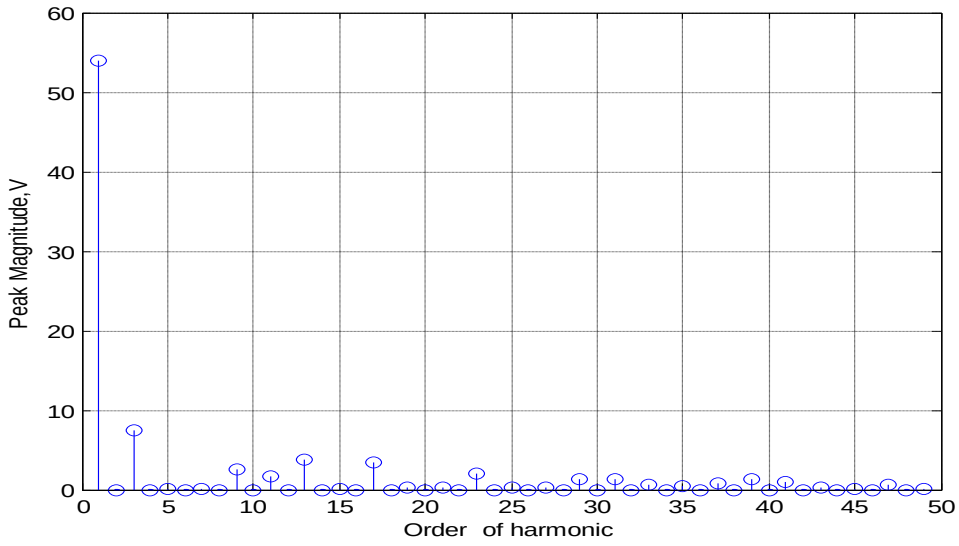



## VI STIMULATION RESULTS

The simulation output for cascade seven level inverter is given below




The lower order harmonics are eliminated using genetic algorithm. Reduced harmonic output graph can be obtained. The harmonic order corresponding to peak order graph is given below




## VII CONCLUSION

The cascade structure extends the design flexibility and the possibilities to optimize the converter for different objectives such as minimization of number of IGBT's, gate driver circuits, dc voltage sources, standing voltage on switches and power diodes. Less number of components leads to the reduction of size, simple control strategy and high

efficiency. Harmonics caused by increasing levels are optimized using genetic algorithm by eliminating lower order harmonics. GA is better for optimizing THD in multilevel converters.

## REFERENCES

1. Novel Topologies for Symmetric, Asymmetric, and Cascade Switched-Diode Multilevel Converter With Minimum Number of Power Electronic Components.Rasoul Shalchi Alishah, Daryoosh Nazarpour, Seyed Hossein Hosseini, Member, IEEE, and Mehran Sabahi, Member, IEEE
2. R. Stala, "A natural DC-link voltage balancing of diode-clamped inverters in parallel systems," IEEE Trans. Ind. Electron., vol. 60, no. 11, pp. 5008– 5018, Nov. 2013.
3. M. D. Manjrekar, P. K. Steimer, and T. A. Lipo, "Hybrid multilevel power conversion system: A competitive solution for high-power applications," IEEE Trans. Ind. Appl., vol. 36, no. 3, pp. 834–841, May/Jun. 2000
4. L. M. Tolbert and F. Z. Peng, "Multilevel converters as a utility interface for renewable energy system," in Proc. IEEE Power Eng. Soc. Summer Meet., 2000, pp. 1271–1274.
5. J.Rodriguez, J.-S. Lai, and F. Z. Peng, "Multilevel inverters: a survey of topologies, controls, and applications," IEEE Trans. Ind. Electron., Vol. 49,No. 4, pp. 724-738, Aug. 2002.
6. D. G. Holmes and T. A. Lipo, Pulse width modulation for power converters principles and practice, NJ: Wiley-IEEE Press, Oct. 2003.
7. W. Fei, X. Du, and B. Wu, "A generalized half-wave symmetry SHE- PWM formulation for multilevel voltage inverters," IEEE Trans. Ind. Electron., Vol. 57, No. 9, pp. 3030-3038, Sep. 2009.
8. Elimination of Low Order Harmonics in Multilevel Inverters Using Genetic Algorithm Reza Salehi∗, Naeem Farokhnia†, Mehrdad Abedi∗, and Seyed Hamid Fathi∗Dept. of Electrical Eng., Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran

# FUZZY ONTOLOGY BASED SEMANTIC VIDEO CONTENT EXTRACTION

**Balamurugan N[1], Dr. S. Chitrakala[2]**

[1] *Department of Computer Science and Engineering, CEG, Chennai (India)*

[2]*Associate Professor, Department of Computer Science and Engineering, CEG, Chennai (India)*

**ABSTRACT**

*Now-a-days In the Video Applications increases the need of the semantic content extraction from the videos. To satisfy the user's needs by the raw video data's and low-level features alone are not sufficient. Hence more understanding at the Semantic level is needed. But the manual techniques are subjective and costly in terms of times and the user querying capabilities. It is also important to handle the uncertainty which occurs because of the video semantic content. This Paper presents a framework for semantic content extraction from the videos. Semantic content extraction system allows extracting objects, spatial relation between the objects, events, temporal relation between the events. Here the Spatial, temporal relations are in Event Definition are defined by using a new Ontology based Video Semantic Content Modelling (VISCOM Model). The given ontology model provides a domain independent rule construction that provides the user to develop ontology for a given domain. We can also use additional rules to be able to define complex situations effectively. Here satisfactory recall and precision rates for object, event and concept extraction are obtained.*

***Keywords:*** *Ontology, Semantic Content Extraction Uncertainty, VISCOM.*

## I. INTRODUCTION

In Recent years video content extraction and modelling became important because of the increasing amount of the video. Basically video content categorized into three levels. The first level consists of a raw video information with some basic video attributes such as format, length, frame rate, title etc. the second level consists of low level feature such as colour, shape, motion etc. the third level consists of high level concepts that contain semantic information such as object, events etc. The first two levels are easily extracted by semantic content extraction system. But they hardly provide semantic information of the videos. Moreover users the ultimate goal is to estimate video content by querying and retrieval of the video data in an efficient manner. Therefore physical properties of the video and low level features alone are not satisfied the user needs. In many video database applications requires deeper understanding of the information at higher level of semantic content. However it is much more difficult process to extract semantic information of the videos directly from raw video content. Therefore different semantic representations [1] such as the events, objects, temporal relations are used to extract the semantic information about the videos.

Many research works uses manual semantic content extraction method which is subjective and more complex [2] that reduce the querying efficiency. But automatic or semi-automatic methods are also not providing effective performance. In the process at [3] event extraction is depends on the object tracking robustness where simple events alone predicted. In [4] expressed heuristic method where event definitions are made by predefined objects and by their temporal relations. That could not handle multiple actor events.

The Meta ontology provides a rule construction standard that allows constructing ontology for a domain. It is more complex to model the semantic content of the videos than the low level features. To achieve semantic content modelling by video semantic content model (VISCOM) provides relations between the events, and the objects. In [5] provided hierarchical model which deals with content based video retrieval. It can do by event queries, spatial and temporal relations. The main goal of the system is to attain prototype of visual database management system. But the system is difficult to handle uncertainty of the video data. In [6] proposed multi agent event by varying sub events. First, event structure should learning from training videos. Next, novel videos as clustering the sub-events using normalized cuts are the problems of event detection. There are other event representation proposed in the literature such as event representation language and Bayesian network based event representation and video ontologies. In video database system [7] has semantic query functions and spatio-temporal relations. The rule based system used to handle the complex representation problems. BilVideo that is Video Database Management system [8] [20] provided support with all low level video property and high level semantic content. It is domain independent and can be supported any kind of the application video data. Rule based system used for handle spatio-temporal relation. But it does not handle the uncertainty of thevideo information. Content based video retrieval system should handle the uncertainty of the video data for provide proper answer to user. Therefore it is necessary to develop a system which handles the uncertainty of the video information.

In this paper we propose a framework for the semantic video information into database and retrieval of the video content. The proposed framework initially extracts semantic content in the videos such as the objects, the events, spatial relation between the objects, and temporal relation between the events. The objects are extracted by automatic semantic content extraction framework (ASCEF). The Meta ontology used to propose spatial and temporal relations among the semantic content of the video data. VISCOM model is used as the Meta ontology. It used to form a relation between the objects and the events. The proposed framework is differing from the previous studies in the following aspects: 1.Initially this framework proposes Meta ontology, a rule construction standard which is domain independent to construct domain ontology. Domain ontology enriched by Different class attributes of the objects. 2. The uncertainty existing in the video data or the user query is handled which is ignored by many video database systems. The organization of the paper is as follows. In Section 2, Overview of the framework is described in details. Section 3, discussed the semantic content extraction system in details. In Section 4, shows that Experimental results of the proposed framework. Finally, in Section 5, our conclusions and future Works are discussed.

## II. OVER VIEW OF THE SYSTEM

The proposed framework is illustrated in Fig. 1. The framework consists of two main systems: the semantic content extraction framework system and the storage-retrieval system. The task of the semantic content extraction

framework system is to extract the semantic information of a raw video and send them to the storage-retrieval system. Semantic contents like the objects, the events are extracted automatically or manually. The semantic content extraction process initially determines the objects from the key frames of the videos. Then, the spatial relation among the objects is extracted, finally the events are extracted and then temporal relation among the events is determined. Here VISCOM ontology using to form the spatial, the temporal relations among the Objects, the events class attributes.

## III. SEMANTIC CONTENT EXTRACTION SYSTEM

Main aim of this system is to take a video as input and extract the semantic contents such as the objects, the events from the videos. Initially input video is classified into the shots, the sequences. Then their key frames are extracted automatically. After the key frame extraction, the semantic contents are extracted by [22] automatic semantic content extraction algorithm. For example, a player object can be determined by the automatic extraction process. But identification of that player is done manually during the annotation phase.

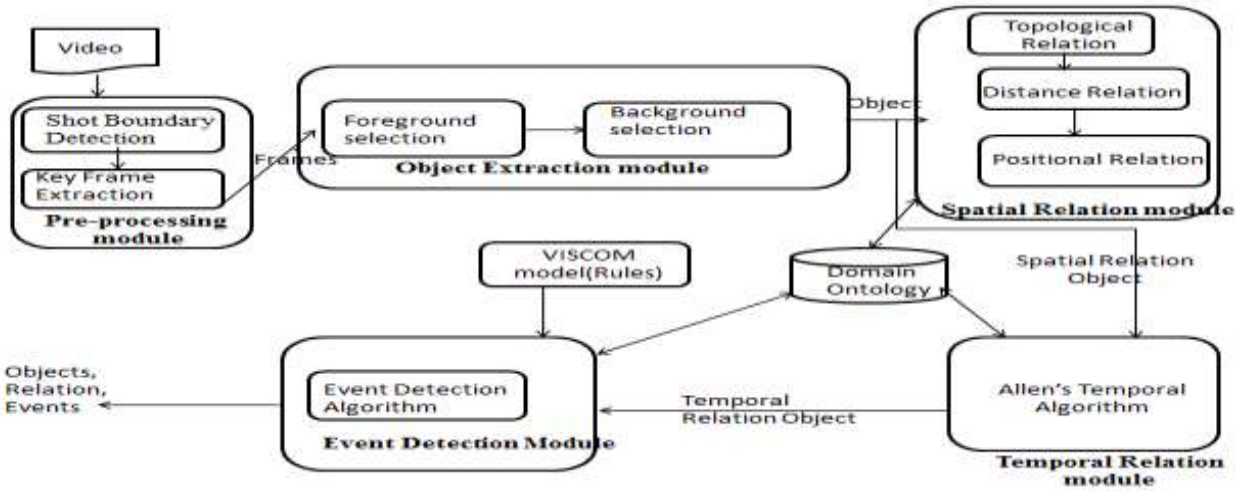



**Fig. 1 System Architecture**

### 3.1. Automatic Semantic Content Extraction Framework

In a video, generally a shot is a sequence of frames. It can have temporal dimension of the video. The key frames of each shot are also obtained during this process. In The proposed framework IBM Mpeg annotation tool [9][21] is used for segment the videos into the shots and key frames extracted from the shots. The main goal of automatic semantic content extraction framework (ASCEF) [23] is to extract all of the semantic content existing in the video instances. Here ASCEF takes Vi, ONTi, and Ri, where Vi is a Video instance, ONTi is the domain ontology for domain Di which Vi belongs to, and Ri is the set of rules for domain Di. The output is named VSCi. OIi = {OIi0 ; . . .OIin }is the set of object instances occurring in Vi, where an object instance is represented as OIij =<frameno;MBR;μ;type>.MBR is the minimum bounding rectangle surrounding the object instance. μ represents the certainty of the extraction, where 0 <μ<1. Type is an individual of a class CIi in ontology ONTi. EIi ={EIi0 . . . EIin} is the set of event instances occurring in Vi, where an event instance is represented as EIij=<startframeno; endframeno;μ; type>.

$$VideoSemanticContent: \begin{cases} \begin{bmatrix} video \Rightarrow \{V_i\}, \\ objects \Rightarrow \{OI_i\}, \\ events \Rightarrow \{EI_i\}, \\ concepts \Rightarrow \{CI_i\} \end{bmatrix} \\ where \\ ind(V_i, Video), \\ ind(OI_i, ObjectInstance), \\ ind(EI_i, EventInstance), \\ ind(CI_i, ConceptInstance). \end{cases} \quad (1)$$

There are two main steps in ASCEF process. A first step is to extract and classify the object instances from representative frames of the shots. Second step is to extract the events by using domain ontology and rule definitions. A set of procedures is extracted such as spatial relation instances between the object instances. Then, the temporal relations are extracted by using the spatial relation. Lastly the events are extracted by using the spatial and temporal relations. Details about these procedures are described in below given sections.

### 3.2. Object Extraction

In this study [10] [11] object extraction and classification done through a semi-automatic genetic algorithm. Mpeg-7 descriptor is used to represent the object which is based on a supervised learning approach.in object extraction process extracting object instances from the key frames and which is stored with their type, frame number, membership value and Minimum Bounding Rectangle (MBR). In the event extraction process these object instances are used by VISCOM Model.

$$ObjectInstance: \begin{cases} \begin{bmatrix} frameNo \Rightarrow [number], \\ minBoundingRectangle \Rightarrow \{MBR_i\}, \\ membership \Rightarrow \{MSV_j\}, \\ objectType \Rightarrow \{O_k\} \end{bmatrix} \\ where \\ ind(O_k, Object), \\ ind(MBR_i, MBR), \\ ind(MSV_j, MemberShip). \end{cases} \quad (2)$$

### 3.3 Spatial Relatio N Extraction

Every object instances are represented with the MBR value. There can be “n‟ object instances (as region) represented with R in a frame F, where F= {R0 . . .Rn}. For every R, the upper left-hand corner point represented with Pul, length and width of R are stored. The area inside Ri is represented with Riα , where the edges of Ri are represented with Riβ . the spatial relation instances contains frame number, the object instances, type of the spatial relation and Membership value of the relation. The Classification module is responsible for computing the similarity between the centroids in the current bag of poses versus the centroids of all the bags present in the current repository.

$$SpatialRelationInstance: \begin{cases} \begin{bmatrix} object \Rightarrow \{O_i\}, \\ subject \Rightarrow \{S_j\}, \\ relationType \Rightarrow \{R_k\}, \\ frameNo \Rightarrow [number], \\ membership \Rightarrow \{MSV_m\} \end{bmatrix} \\ where \\ ind(O_i, ObjectInstance), \\ ind(S_j, ObjectInstance), \\ ind(R_k, SpatialRelation), \\ ind(MSV_m, MemberShip). \end{cases} \quad (3)$$

In the spatial relation extraction we are using the topological relations (inside, partially inside, disjoint and touch), distance relations (far, near), positional relations (right, left, above and below).

#### 3.3.1 Topological Relations

Topological relation is expressed in terms of inside, partially inside, touches and disjoint. The membership values

are calculated by using

$$\mu_{top}(R_i, R_k) = \frac{(R_i^\alpha \cap R_k^\alpha)}{R_k^\alpha} \quad [13] \qquad (4)$$

Where Ri α and Rkα are Regions If μtop(Ri, Rk)=1 then, topological relation is INSIDE. Likewise if μtop(Ri, Rk)≠1 then, topological relation is DISJOINT. Finally if 0<μtop(Ri, Rk)<1 then, topological relation is TOUCH.

### 3.3.2 Distance Relations

Two distance relation types are far and near. The distances between two nearest points are used in the formulas of μ_far and μ_near. When regions have topological relation, membership values are assigned as μ_far(Ri,Rk)= 0 and μ_near(Ri,Rk)= 1. In an objects relations, "near" relation is happened, if the distance between the objects is less than or equal to the longest side of the smaller objects bounding rectangle. Similarly "far" relation is if the distance is greater than or Equal to the longest side of the bigger objects bounding rectangle. The distance relation membership value is calculated according to the membership function.

### 3.3.3 Positional Relations

μpos is calculated as $\mu_{pos}^{above}$, $\mu_{pos}^{below}$, $\mu_{pos}^{left}$, and $\mu_{pos}^{right}$ values of positional type. Centre points are used to calculate membership values. The centre regions [13] [14] [15] is fixed as origin (0,0). The sinus of the angle (ø) between the x coordinate and the line between two centre points of regions is calculated. For the membership value calculation we are using the following formula

$$\mu_C(o_j) = \frac{\sum INC(rng_C(a_i)/o_j(a_i)) * RLV(a_i, C)}{\sum RLV(a_i, C)} \qquad (5)$$

Where, *INC (rngC(ai)/oj(ai))* is the inclusion degree of the attribute *ai*"s value to its range. The calculation of the inclusion degree depends on the semantics of the attribute such as AND, OR, XOR semantics. *RLV (ai,C)* is the relevance of the attribute *ai.* The weighted-average is used to calculate the object membership degree.

### 3.4 Temporal Relatio N Extraction

In this proposed framework temporal relations are used in order to add temporality to the sequence of the spatial changes or event changes. Allen's temporal interval algebra [12] which describes a temporal representation that takes a notion of temporal intervals. Allen Temporal algebra defined a 13 temporal relations that holds interval between X = [x+, x-] and Y = [y+, y-]. In table 1 given column formulas used to extract temporal relation between instances.

### 3.5 Event Extraction

In our proposed framework, the event instances calculating after the automatic extraction process over during event extraction process. Semantic content is extracted a degree between 0 and 1.Event extraction process holds the following instances.

$$EventInstance: \begin{cases} \begin{bmatrix} frameSet \Rightarrow \{FS_i\}, \\ eventType \Rightarrow \{E_k\}, \\ membership \Rightarrow \{MSV_j\}, \\ objectRole \Rightarrow \{OR_m\} \end{bmatrix} \\ where \\ ind(FS_i, FrameSet),\ ind(E_k, Event), \\ ind(MSV_j, MemberShip), \\ ind(OR_m, ObjectRole). \end{cases} \quad (6)$$

**TABLE 1**

Allen's Temporal Interval Relations

| Name | Notation | Definition |
|---|---|---|
| **before** | b($X$,$Y$) | $x^+ < y^-$ |
| **overlaps** | o($X$,$Y$) | $x^- < y^- \wedge y^- < x^+ \wedge x^+ < y^+$ |
| **during** | d($X$,$Y$) | $y^- < x^- \wedge x^+ < y^+$ |
| **meets** | m($X$,$Y$) | $x^+ = y^-$ |
| **starts** | s($X$,$Y$) | $x^- = y^- \wedge x^+ < y^+$ |
| **finishes** | f($X$,$Y$) | $x^+ = y^+ \wedge y^- < x^-$ |
| **equals** | e($X$,$Y$) | $x^- = y^- \wedge x^+ = y^+$ |
| **after** | bi($X$,$Y$) | b($Y$,$X$) |
| **overlapped-by** | oi($X$,$Y$) | o($Y$,$X$) |
| **contains** | di($X$,$Y$) | d($Y$,$X$) |
| **met-by** | mi($X$,$Y$) | m($Y$,$X$) |
| **started-by** | si($X$,$Y$) | s($Y$,$X$) |
| **finished-by** | fi($X$,$Y$) | f($Y$,$X$) |

**Algorithm 1:** Event extraction

Input – Domain Ontology, Object Instances

Output –Event Instances

For all SpatialRelationComponents in Ontology do

Extract SpatialRelationComponents Instances;

Execute SpatialRelation rule Defn;

End for

For all SpatialMovementComponents in Ontology do

Extract SpatialMovementComponent Instances;

End for

For all SpatialComponents in Ontology do

Check if there are SpatialRelationComponents or SpatialMovementComponent instances;

End for

For all TemporalSpatilaComponents in Ontology do

Extract SpatialComponent Instances;

End for

For all ConceptDefinitions in Ontology do

Check if there are SpatialComponents or SpatialRelationComponents, TemporalSpatilaComponents instances;

End for

For all E individual in Ontology do

Check if there are ConceptDefinitions;

End for

For all Event individual Which have TemporalEventCompnents do

Extract Event Instances;

End for

Check All rules Defined Events to Extract Additional Events;

### 3.6 Viscom Ontology

VISCOM is a well-defined Meta ontology which constructing both Domain dependent as well as domain independent model. VISCOM is Video semantic content Model which contains classes and association between the classes. It integrates the objects instances, the events instances with some logical rules. For examples sports video database applications event can constructing by VISCOM ontology. Here initially all possible spatial relations between the objects and the temporal relations between the events are extracted by Automatic semantic content extraction framework. Then that was forming relations among then by using the VISCOM Model. The following algorithm 2 expressed VISCOM ontology constructions.

**Algorithm 2: VISCOM Ontology construction**

Input : VISCOM RULES

Output **:** Domain ontology

For all Events do

if an Event can be Defn with Event Defn then

Define Event in terms of EventDefinitions

End if

if an Event can be Defn with Temporal Relation Between other Event then

Define E in terms of EventTemporalRelations

End if

End for

For all Concepts do

Construct Relation With Concept That Can be Placed in its meaning;

End for

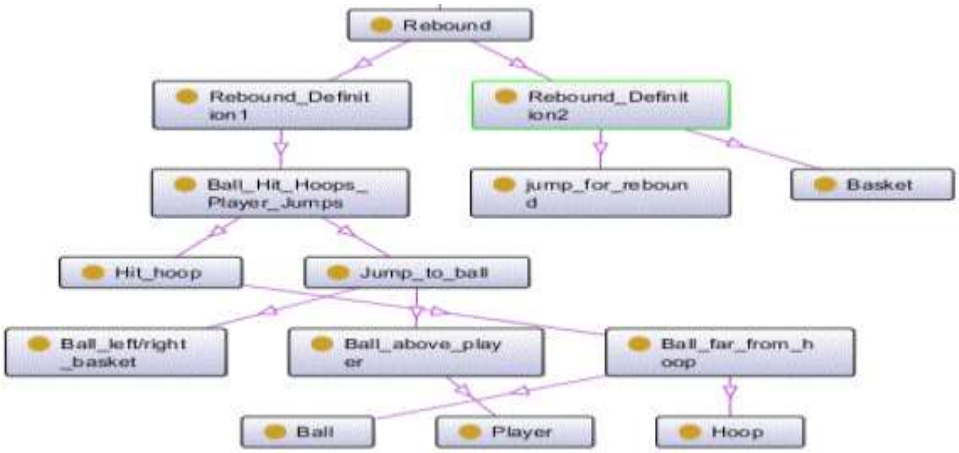



**Fig 3.Rebound Event Ontology Construction**

For example Rebound event, free throw and Jump ball Event in Basket Ball sports video considered in our study. Fig 4 expressed the Rebound Event Ontology Construction.

## IV. EXPERIMENTAL RESULTS

In this paper, the semantic mark-up language and Semantic Web Rule Language (SWRL) [16] is used to make rule definitions as OWL. To capture imprecision, a fuzzy extension of SWRL is used. In this extension, OWL individuals include a specification of the degree that is a truth value between 0 and 1, of confidence with which an individual is an instance of a given class or property. Protege [17] is integrated with libraries which handle ontology deployment issues and management issues as well. But main problem in video processing is to Identifying event in video. This paper presents some measures that are used to evaluate extraction performance. There are many measures used in video classification (Wang, 1980).Reviewing the precision, recall, and F-measure, followed by looked at Zhang (1989). The common metric in evaluating classification systems is how accurate the system is. More specifically, what portion of video data belonging to known classes is correctly assigned to those classes. The data set metric for algorithm evaluation includes precision and recall.

Recall rate is calculated by using the equation 7,

$$\text{Recall} = \frac{\text{Number of relevant event retreived}}{\text{Total number of relevant events}} \tag{7}$$

Precision is calculated by using the equation 8,

$$\text{Precision} = \frac{\text{Number of relevant event retreived}}{\text{Total number of retrieved events}} \tag{8}$$

F-score is calculated by using the equation 9,

$$\text{F-score} = 2.\frac{\text{Precision} \,.\, \text{Recall}}{\text{Precision} + \text{Recall}} \tag{9}$$

Table 2 shows the basketball event Time distribution over the videos consists of eventless basketball videos such as 4, 5 which have little opportunities to be generated from any event.

**TABLE 2 EVENT TIME RELATIONS**

| | Events | | |
|---|---|---|---|
| Video Id | Rebound | Jump Ball | Free Throw |
| 1 | 0.6 | 0.5 | 0.4 |
| 2 | 0.5 | 0.7 | 0.26 |
| 3 | 0.35 | 0.5 | 0.62 |
| 4 | 0.41 | 0.63 | 0.5 |
| 5 | 0.5 | 0.4 | 0.78 |

Multiple event basketball video shares a variety of event at the same time. In figure 5 video 1 is the multiple event basketball video in which it shares rebound, jump ball events. Figure 4 shows the probability distribution of event in the Basketball video of the pre-processed videos. Relation rate is high for the videos in which probability of the

events in the video is high.

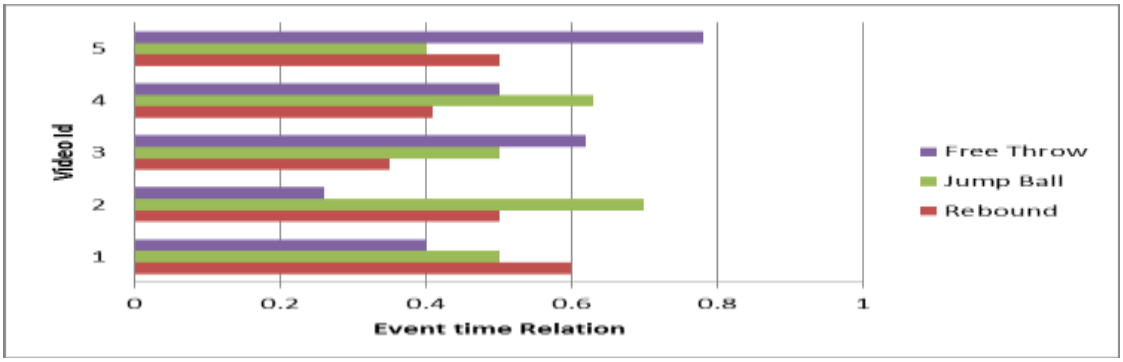



**Fig. 5 Events Time Relation**

Relation rate is low for the videos in which probability of the events in the video is low or zero. Thus predicting event using event relation distribution increases events rate in the video.

**TABLE 3 Comparative results**

| Events | Precision | Recall | F-Score |
|---|---|---|---|
| Rebound | 80% | 76% | 70% |
| Jump Ball | 62% | 55% | 55% |
| Free Throw | 71% | 67% | 61% |

Table 3 shows the comparative results for different models. Results are predicted by Calculating the Precision, recall and F-score values. The figure 6 shows the precision, recall and F-score values for various basketball events such as Rebound, Free throw, Jump Ball.

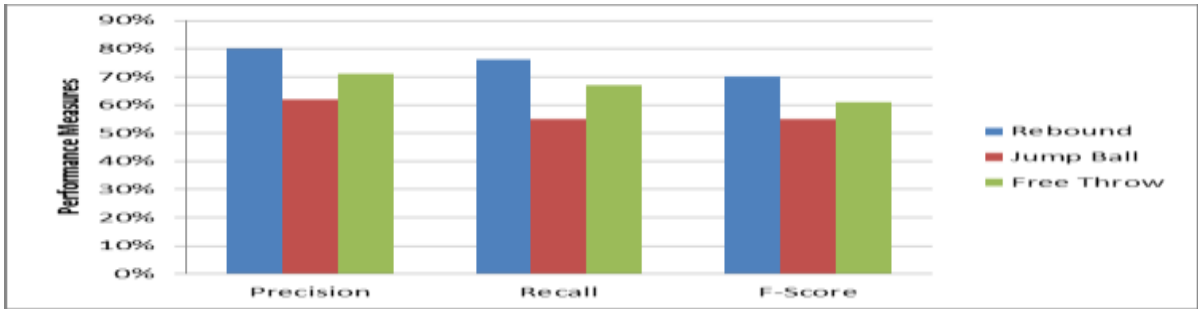



**Fig. 6 Precision, recall, F-score graph**

Thus comparing the values for these three events, the rebound event video has the high precision, recall and f-score values. The values are high as the probability of the retrieved events relevant to the video is high. The performance measure value decreases as the probability of the retrieved relevant events in the video is low.

## V. CONCLUSION AND FUTUREWORK

This paper is to develop a framework for the semantic content extraction system for videos which can be utilized in sport events [18] [19] video applications. Here the novel idea is to utilize domain ontologies and generated with a domain-independent ontology-based semantic content Meta ontology model. And it has also included a set of

special rule definitions. First of all, the ontology-based semantic Meta ontology model for videos (VISCOM) is proposed by which semantic content extraction process is done automatically. The proposed system capturing [24][25] the semantic content that integrates by an automatic Genetic Algorithm-based object extraction method. By adding fuzziness in class, relation, and rule definitions [26] improving semantic content extraction capabilities. The test results clearly shows that the developed systems success. In future, we can improve the model and the extraction capabilities of the framework for spatial relation extraction by considering the motions in the depth dimension.

## REFERENCES

[1] M. Petkovic and W. Jonker, "An Overview of Data Models and Query Languages for Content-Based Video Retrieval," Proc. Int", Conf. Advances in Infrastructure for E-Businessand Education on the Internet, Aug. 2000.

[2] M. Petkovic and W. Jonker, "Content-Based Video Retrieval by Integrating Spatio-Temporal and Stochastic Recognition of Events," Proc. IEEE Int Workshop Detection and Recognition of Events in Video, pp. 75-82, 2001.

[3] L.S. Davis, S. Fejes, D. Harwood, Y. Yacoob, I. Haratoglu, and M.J.Black, "Visual Surveillance of Human Activity," Proc. Third Asian Conf. Computer Vision (ACCV), vol. 2, pp. 267-274, 1998.

[4] G.G. Medioni, I. Cohen, F. Bre´mond, S. Hongeng, and R. Nevatia,"Event Detection and Analysis from Video Streams," IEEE Trans.Pattern Analysis Machine Intelligence, vol. 23, no. 8, pp. 873-889,Aug. 2001.

[5] A. Hakeem and M.Shah,"Multiple agent event detection and representation in videos,"2005

[6] G.G. Medioni, I. Cohen, F. Bremond, S. Hongeng and R. Nevatia "Event Detection and Analysis from Video Streams,"Aug.2001.

[7] T. Sevilmis, M. Bastan, U. Gudukbay, and O . Ulusoy, "Automatic Detection of Salient Objects and Spatial Relations in Videos for a Video Database System," Image Vision Computing, vol. 26, no. 10, pp. 1384-1396, 2008.

[8] M.E. Donderler, E. Saykol, U. Arslan, O. Ulusoy, and U. Gudukbay, "Bilvideo: Design and Implementation of a Video Database Management System," Multimedia Tools Applications, vol. 27, no. 1,pp. 79-104, 2005.

[9] C. Y. Lin, B. L. Tseng and J.R. Smith, "IBM MPEG-7 Annotation Tool Version 1.5.1, 2003, [Online], available: http://www.alphaworks.ibm.com/tech/videoannex.

[10] T. Yilmaz, "Object Extraction from Images/Videos Using a Genetic Algorithm Based Approach," master‟s thesis, Computer Eng. Dept., METU, Turkey, 2008.

[11] Y. Yildirim, T. Yilmaz, and A. Yazici, "Ontology-Supported Object Extraction with a Genetic Algorithms Approach for Object Classification," Proc. Sixth ACM Conf. Image and Video Retrieval pp. 202-209, 2007.

[12] J.F. Allen, "Maintaining Knowledge about Temporal Intervals," Comm. ACM, vol. 26, no. 11, pp. 832-843, 1983.

[13] M.J. Egenhofer and J.R. Herring, "A Mathematical Framework for the Definition of Topological Relationships," Proc. Fourth Int‟l Symp. Spatial Data Handling, pp. 803-813, 1990.

[14] M. Vazirgiannis, "Uncertainty Handling in Spatial Relationships," SAC ‟00: Proc. ACM Symp. Applied Computing, pp. 494-500, 2000.

[15] P.-W. Huang and C.-H. Lee, "Image Database Design Based on 9D-SPA Representation for Spatial Relations," IEEE Trans. Knowledge and Data Eng., vol. 16, no. 12, pp. 1486-1496, Dec. 2004.

[16] I. Horrocks, P.F. Patel-Schneider, H. Boley, S. Tabet, B. Grosof, and M. Dean, "Swrl: A Semantic Web Rule Language," technical report, W3C, http://www.w3.org/Submission/SWRL/, 2004.

[17] "Prote´ge´ Ontology Editor," http://protege.stanford.edu/, 2012.

[18] C. Xu, J. Wang, K. Wan, Y. Li, and L. Duan, "Live Sports Event Detection Based on Broadcast Video and Web-Casting Text," MULTIMEDIA ‟06: Proc. 14th Ann. ACM Int‟l Conf. Multimedia, pp. 221-230, 2006.

[19] Y. Zhang, C. Xu, Y. Rui, J. Wang, and H. Lu, "Semantic Event Extraction from Basketball Games Using Multi-Modal Analysis," Proc. IEEE Int‟l Conf. Multimedia and Expo (ICME ‟07), pp. 2190- 2193, 2007.

[20] J. Fan, W. Aref, A. Elmagarmid, M. Hacid, M. Marzouk, and X. Zhu, "Multiview: Multilevel Video Content Representation and Retrieval," J. Electronic Imaging, vol. 10, no. 4, pp. 895-908, 2001.

[21] R. Nevatia and P. Natarajan, "EDF: A Framework for Semantic Annotation of Video," Proc. 10th IEEE Int‟l Conf. Computer Vision Workshops (ICCVW ‟05), p. 1876, 2005.

[22] A.D. Bagdanov, M. Bertini, A. Del Bimbo, C. Torniai, and G. Serra, "Semantic Annotation and Retrieval of Video Events Using Multimedia Ontologies," Proc. IEEE Int‟l Conf. Semantic Computing (ICSC), Sept. 2007.

[23] R. Nevatia, J. Hobbs, and B. Bolles, "An Ontology for Video Event Representation," Proc. Conf. Computer Vision and Pattern Recognition Workshop, p. 119, 2004.

[24] M. S. Lew, N. Sebe, C. Djeraba, and R. Jain, "Content-based multimedia information retrieval: state of the art and challenges", ACM Transactions on Multimedia Computing, Communications, and Applications, Vol. 2, pp. 1-19, Feb. 2006.

[25] Y. Liu, D. Zhang and G. Lu,W. Ma, "A survey of content-based image retrieval with high-level semantics", Pattern Recognition, Vol. 40, pp. 262 – 282, Jan. 2007.

[26] R. Hjelsvold and R. Midtstraum, "Modelling and querying video data". Proc. of the 20th Int. Conf. on Very Large Data Bases, 1999,pp. 686-694.

## Biographical Notes:

**Mr. Balamurugan N**, Is currently pursuing his Master's degree in Computer Science and Engineering at College of Engineering – Guindy. He has received his Bachelor's degree (B.Tech ) in engineering from Anna University in Information Technology at 2013.

**Dr. S. Chitrakala** is working a associate professor in department of Computer Science of Engineering at College of Engineering – Guindy, Chennai.

# IMPLEMENTATION OF SKILL ACQUISITION PROGRAM (PDP) IN EDUCATIONAL INSTITUTIONS

**Mrs. Sheetal Kasana[1], Mrs. Nidhi Bindal [2]**

[1] *Assistant Professor, Dept. of Management, Dr. K.N. Modi Institute of Engineering and Technology, Modinagar, Ghaziabad, U.P. (India)*

[2] *Assistant Professor, Dept. of Management, Dr. K.N. Modi Institute of Engineering and Technology, Modinagar, Ghaziabad, U.P. (India)*

**ABSTRACT**

*Personality development is becoming a significant aspect in the evolution of a student in higher education. In education sector, there is constantly growing demand from aspirants for a course to groom them for required skills in corporate sector so that they achieve something. The educationists are more focusing on devising scientific ways by taking help of educational technology to fulfill their required need of students. So, personality development program has evolved to fulfill the need of industry. Therefore recently many educational institutions has introduced personality development programme in their curriculum. Most educational institutions have put stronger emphasis on the mode and module of personality development programme rather than the documented outcomes. The mode and module of training are keys because they adds value by helping students reflects on their experience and improve their ability to coherent and reveal resulting competencies during recruitment activities. Institutions have adopted various methods for personality development program like In house training and outsourcing.*

*Through this research paper we have analyzed the impact of different mode on student development. This research has focused on new innovative model for training and program of students. This paper attempted to analyze the relationship between training need, mode and curriculum by focusing on outsource and in house training program.*

***Key Words:*** *Development Of Student, Personality Development Programme, Mode of Training.*

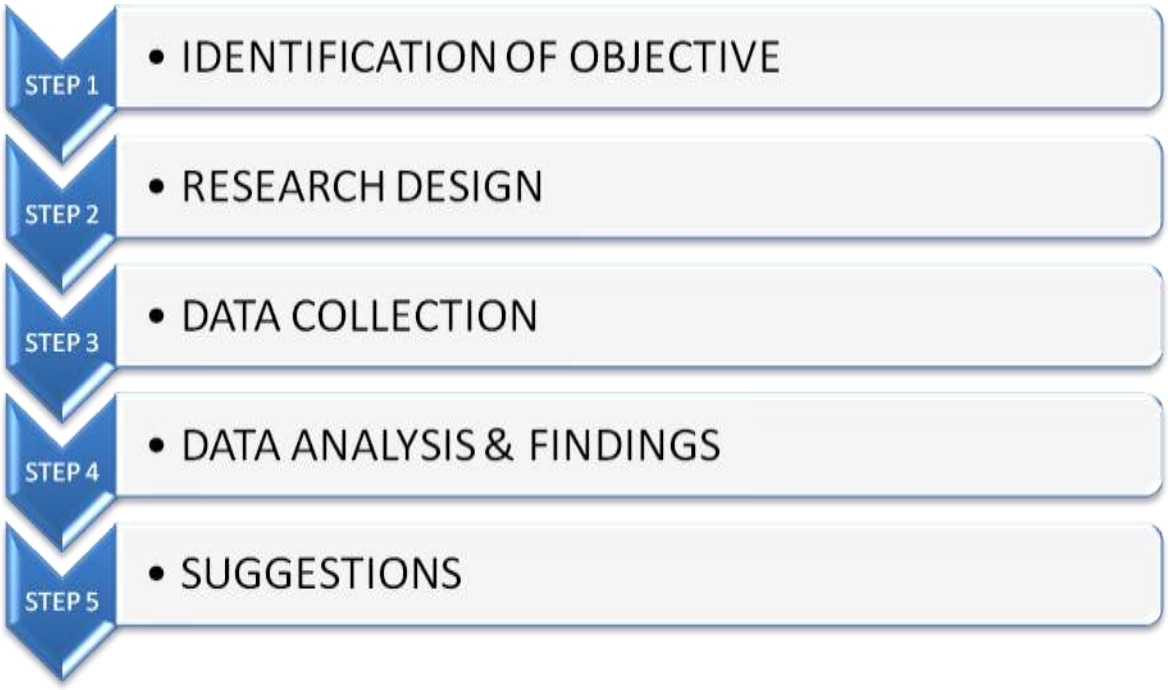
## I. INTRODUCTION

You must have been to parties, get-togethers etc. There are some people the personality trait of being surrounded by lots of people all the time and on the other hand there are people who enjoy sitting alone in the room and enjoying a drink alone? The difference lies mainly because of their differences in ideas, characters and personality traits. Personality is a function of values, emotion, temper and actions. Taking about an individual's personality, it refers to his/her outer shell, personality, approach, state of mind and conduct.

Personality development is becoming a significant aspect in the evolution of a student in higher education. In academic sector, there is constantly growing demand from aspirants for a course that can groom them according to the skills required in the corporate sector. Personality development plays a vital role in developing one's personality externally as well as one's inner self. An individual should have those traits in one's personality which have the capability to attract people towards him. Personality development helps you gain recognition and acceptance from the society as well as people around. Personality development programme helps one differentiate between ones personal and corporate life. Keeping a proper sense of equilibrium between both the lives is essential so that one can lead a peaceful and stress free life.

Personality development helps you develop an extraordinary personality and makes you different from the rest. Personality development also helps in improving one's soft skills. Individuals should have command on the art of expressing their thoughts and feelings in the most desirable way. This makes you confident individual who is respected and appreciated wherever he goes.

## II. METHODOLOGY OF THE STUDY




## III. OBJECTIVE OF THE STUDY

Our objectives behind writing this research paper are as follows

1. To study the impact of various mode of personality development programme in Indian educational institution.
2. To study needs of Indian students and their preferences for mode of training.
3. To develop the innovative model of development of student.

## IV. IMPORTANCE OF PERSONALITY DEVELOPMENT PROGRAM INCONTEXT TO INDIAN STUDENT

India is one of the developing countries having a lot of manpower resources but it is not being properly utilized. The young age group is having adequate qualification and a considerable percentage of youth are grabbing good job opportunity as well. But the average level candidates are having a vision of getting a good job. Employers prefer to hire those persons who are resourceful, ethical and self directed along with good soft skills. Personality Development is a means through which one can bring out one's capabilities and one's strengths making oneself aware of one's inner self and become more confident to face the outside world. An effective personality development programme can help students to face and meet the challenges of the corporate world more efficiently effectively and effectively. At the same time, it makes easier for students to climb up the complex corporate hierarchy more efficiently. Personality development helps in reducing stress and conflicts easily. It also helps one in developing a positive approach towards life. Have you realized that current economic development trends are not sustainable? The key elements that will move our society towards sustainability are public awareness, education and training. Only a quality future human capital can foresee development of its nation to fulfill the needs of the present without compromising the ability of the future generations to meet their own needs. Therefore, inculcation of soft skills in the midst of the students will be two prongs, to develop their understanding, knowledge, skills and values as well as to improve quality human capital.

## V. PERSONALITY TRAITS REQUIRED IN A PROFESSIONAL STUDENT

List of specific skills which needs to be developed and implemented in various institutions for learning are as follows:

- Communication skills.
- Thinking and problem solving skills.
- Team spirit.
- Interpersonal skill - Negotiations, listening skills, social skills, assertive skills, cross-cultural communications.
- Entrepreneur skills.
- Time Management.
- Leadership skills.

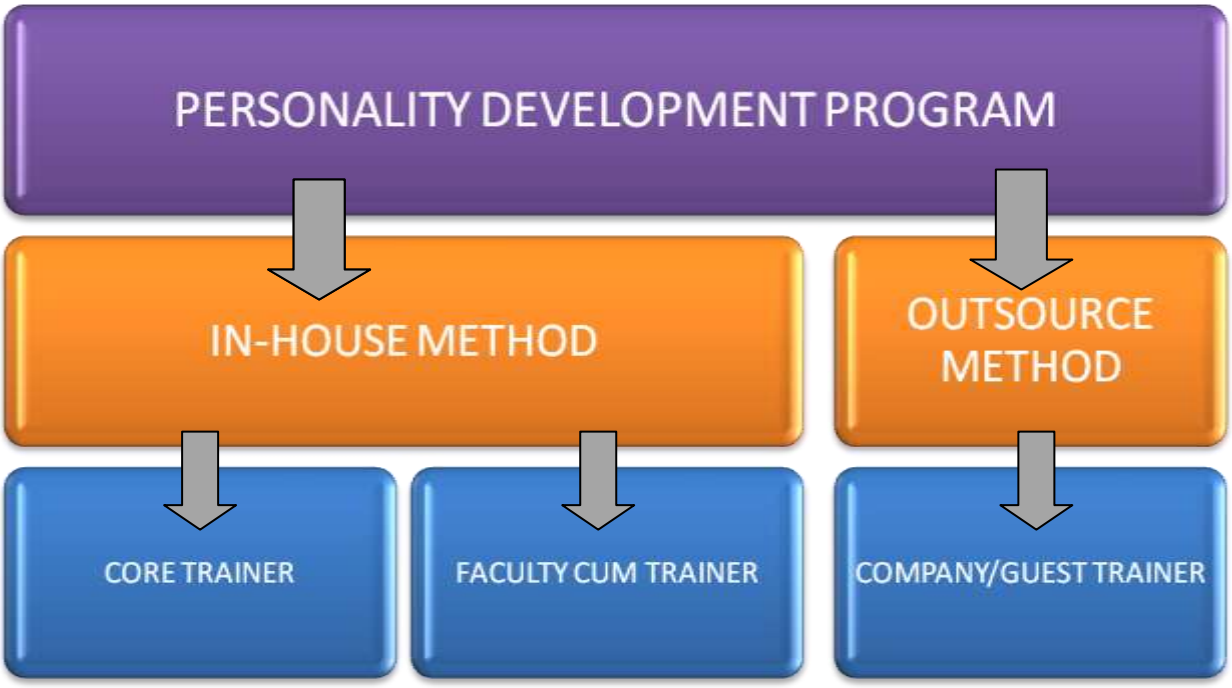
## VI. EDUATIONAL INSTITUTIONS AND PDP

Now a day's educational institutions are playing a pivotal role in developing skills of students. Today lack of competence in soft skill is considered as one of the reasons of poor rate of employability of professional graduates though it is true that soft skill need to be inculcated at a very young age at home but the role of soft skill training in schools and colleges cannot be ignored. So, the development of skill of students has become a necessary condition to place the students in industry. Institutions are providing both technical and soft skill

training. Here, in this research paper we have focused on soft skill development of the students. Personality development means removing all abnormalities from existing current personality of the student. Personality Development is the growth and development of the perception, thinking, nature, attitude, activities, mood and behavior that differentiate among people. It is a tool to shine out one's abilities and powers for making oneself aware of his inner self and to be more confident to face the outer world. Personality means appearance, individualism and distinctiveness of an individual and his/her reflections of emotions, behavior, corporeal characteristics, thinking and soft skills. So, if one feels that there are some personality traits that needs improvement, it can be done with the help of PDP. Despite of such great significance of soft skills many educational institutions are reluctant to include soft skills training in their curriculum. Institutions which have included personality development program in their curriculum are played an important role in personality development of their students. The student's intelligence is of course an important determinant to decide his learning ability. Institutions acts as a means of socializing the student and of nurturing the mental health and personality alteration necessary to facilitate him to take his place in corporate world. Once academic qualifications are accomplished, success doesn't solely depend on the degree or certificate but on the combination of academic and persona both. Regular behavioral problems observed in students and adolescents can be cured if a proper base is developed towards holistic personality development. Therefore, educational institutions have adopted different modes to train the student. They are helping student to become more competent along with the course curriculum. Educational institutions are trying hard to bridge the gap between the education sector development and need of corporate sector through skill acquisition program.

## VII. IMPLEMENTATION OF SKILL ACQUISITION PROGRAM IN EDUCATIONAL INSTITUTIONS

The educational institutions are following basically three modes which are as follows



### 7.1 Outsource Mode

Outsource mode means that institutions have hired companies which are in the field of training or person who is expertise on the basis of course duration and requirement. They usually visit the campus for their lecture for training. They do not reside in the campus premises during working time. Students can meet and interact them in their lecture time only.

By selecting the outsourced training programs student can learn from the skilled trainers. The guidance can be provided much faster when it is imparted by someone who actually has the skill of passing the apt information to the other people.

Training companies charge handsome amount per student as per lecture for training course from the educational institutions. Thus, training programs tend to be more expensive. If institution requires training services once in a while, maintaining a separate training department is unworkable and outsourced training would be the only cost-effective option. According to changing era of education, training for personality development should me on continuous basis. Institution has outsourced training to make the student competitive. The training service providers decide on the format and content of the training program, which in general contain generic examples and case studies. Training companies usually retain copyright of all training materials, which means that institution may not be able to customize the manuals or presentation slides for future internal training needs. These restrictions make institution dependent on third parties for creating a skilled student, which is a key success factor for all organization.

### 7.2 In- House Training

In-house training programs make sense for institutions that hire frequently; student having unique training needs would be poorly served by a general seminar or course. In- house training means that institute hired either core expert persons as a trainer or is utilizing the expert faculty to train the students. For in- house training the following process has to follow:

**Process of in-house training**

1. Identification of training needs

   For devising an effective in-house training program, begin by researching what areas would most benefit from development and whether training is the most effectual way to achieve that development.

2. Development of module of training

   Institutes can design the materials for their in-house training program by picking an online course that seems well-suited to their need, by finding a helpful book or video or by writing the materials their self based on your their experience. Institute can also alter or addition existing materials as needed. When scripting their own training materials, try to break each task into a number of simple steps and organize them in the sequence they are usually performed.

3. Implementation of module

   Once done with designing training program, institute can begin offering the training to their students. When conducting the training sessions, go through the steps in scripted in training materials in a step-by-step fashion.

4. Evaluation of result

   Always have a measurable, clear and definite goal for your training courses. If you set a clear and measurable goal ahead of time, you'll find it much easier to assess whether your training is effective the way it is or whether it needs to be redesigned.

   In – house training can be conducted in two modes

1. Core trainer (learning & development centre)
2. Faculty cum trainer

### 7.2.1 Learning & Development Centre

Core trainer means that institute has recruited the expert people in the field of training to train the students. Many educational institutional have developed their own learning and development department. Many institutes consider it is a part of placement cell. Now institutions are developing this department to meet the criterion of corporate world so that they can develop the students to match their criterion. Now students are also judging the performance of institute in the basis of their placement performance. To meet this expectation institutes have focused to develop their own learning center. For this purpose they are recruiting the professional in the field of training to train their students. They have to focus only to design the module according to need of students and train them so that they will not face any problem to face their interview.

### 7.2.2 Faculty Cum Trainer (In- House Mode)

Faculty cum trainer means faculty who are playing a role of a trainer also. Many institutions have adopted this new technique to utilize their available resources. They are utilizing their faculty as a trainer to train the students for soft skill development. Psychologically trained teachers work with student in such a planned manner so that they adapt and modify their faulty concepts for themselves. Good teachers make all their efforts for the non-intellectual as well as with the intellectual development of student. A teacher can motivate student to develop their ability and aspiration to learn. The primary responsibility, as a teacher, is to ensure that learners are engrossed onto the correct track, in terms of fulfilling their aspirations, abilities and needs.

## VIII. DATA COLLECTION

Using a combination of following, information and data collection in relation to each research question were carried out:

- Survey questionnaires
- Examination of resource material on public websites
- Telephonic interview
- Focus group
- Face to face interview

### 8.1. Research Questions

The purpose of this study was to gain a better understanding of student perception regarding the different modes of training adopted by educational institution in India. The glimpse of research questions that guided the research are given below:

Q1. Which modes of training have good impact? Why?

Q2. Which mode do you feel comfortable to solve your personal challenges to develop your personality?

Q3. Does in- house training encourage students to work regularly for their development?

Q4. The students will be punctual, regular & systematic in studies if there is internal PDP.

Q5. If there is internal PDP, the students can not differentiate the profile of teacher & trainer.

Q6. A scientifically prepared evaluation performa should be provided to teachers.

Q7. Which mode of training is not considered as routine lecture schedule?

Q8. In which mode of training, the training module and material is according to the need of the student?

Q9. In which mode of training, development of the students is highly focused?

Q10. In which mode of training, student- trainer association is higher and will it help to develop the students?

Note- in above questions, we considered the three mode of training as options i.e. outsource trainer, core trainer (in-house) and faculty cum trainer (in- house).

## IX. ANALYSIS

From the above data, we can analyze the following:

- Outsource mode has many benefit to the organization and students. In this mode students consider the training lecture as a separate identity. They do not consider them as routine lecture schedule.
- Inspite of many benefits, outsource mode has disadvantage like association with students. In this mode, trainers have no close association with needs and problems of students. They perform their training schedule in practical and standard way.
- In outsource mode they follow standard material to all institutions. They do not customize according to the need of the student in respective institutions.
- In outsource mode training student do not share their weak areas where improvement has to be done with the trainer.

- Core trainer (in house) have great focus on their job that is to train the students according to need of the corporate world.
- Those institutions have developed their own training department; they have great focus on their module of training and trainer. They have proper follow up and feedback system.
- Core trainer have appointed only for the purpose to train the student so they have core focus to develop the student. They can work according to the need of the students.
- Faculty cum trainer is a cost effective mode to institute also where training is to be provided on regular basis.
- Core trainer can be more specific – generally running a course for a single student allows the training to focus on specific items that are possible in this mode.
- Core trainer mode is customized training and learning to be focused on the students and can discuss real and current examples.
- In core trainer mode institutions have extra administration burden – need to make sure they have suitable training room, equipment, trainer parking, get the students there.
- In context to faculty cum trainer mode, faculties are designing or amending learning resources that are varied and intellectually challenging for students.
- Faculty as a trainer has a wider scope to change the student attitude towards the learning.
- Faculty as trainer has more capability to develop the student because they have close association and understanding the need of the student. Student can share their learning problem with them more easily.
- Instead of many benefits in faculty cum trainer mode, there are some problems also like

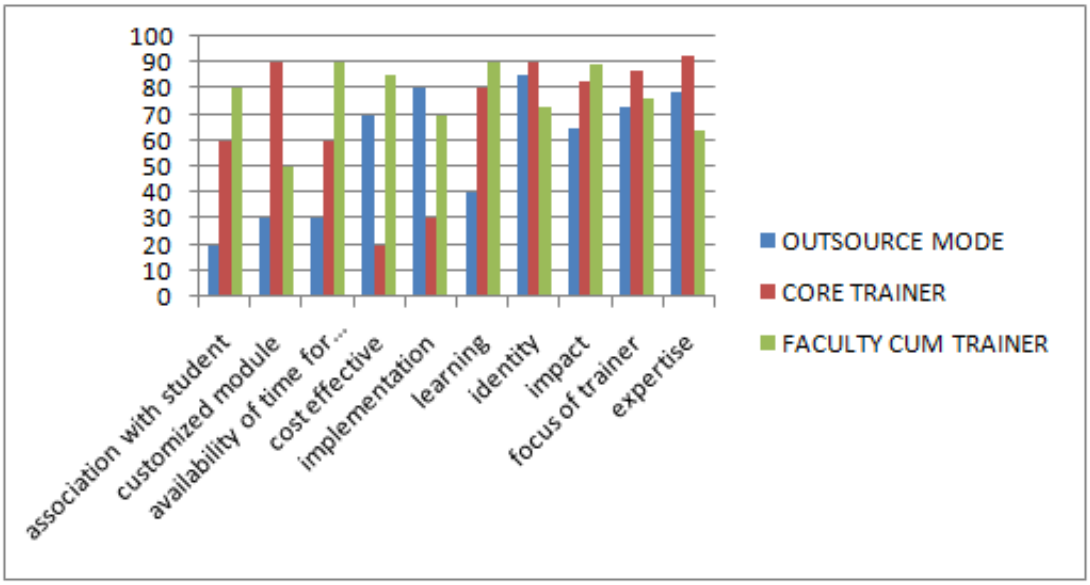
a) Differentiation between course curriculum and training module

b) Main course curriculum pressure

c) Lack of core focus on training

d) Expertise in training is constraint for all faculty ( all faculty cannot be trainer)

We have analyze this research on the parameter like association with student, customized module, availability of time for student, cost, implementation, learning, identity, impact, focus of trainer, expertise.



## X. SUGGESTIONS

- Faculty as a trainer should have experience, determined and dedicated towards the training the student
- For the perfect personality development is to be honest to you. You need to examine yourself and evaluate your existing personality. This will help you realize your weak areas.
- Trainer should keep accurate records of individual development and his progress for future needs. This is often kept in the form of an individual learning plan or self designed format.
- Trainer should adhere to ethics, morale, key legislation, regulatory requirements and codes of practice
- Trainer needs to be aware of the support mechanisms available.
- Trainer needs to be reflective, ordered, controlled and organized which means learning from success as well as mistakes.
- Trainer should bear professional attitude and behavior at all times to inspire student and they should also ensure their own professional development also
- Trainer should develop the module according to need and requirement of students and plan the learning activities based on the need of student.
- Keeping accurate records of training program to contribute to institution's quality improvement and development strategy. This will consist of keeping true records of date of joining the PDP, achievement, weak area, scope of improvement, techniques to improve, progress of student and evaluation of student.

## REFERENCES

[1] http://scholarship-positions.com/blog/importance-of-personality-development/201309/

[2] http://smallbusiness.chron.com/develop-inhouse-training-plan-company-64767.html

[3] BOOK: A Complete Guide to the Level 4 Certificate in Education and Teaching by Lynn Machin, Duncan Hindmarsh, Sandra Murray and Tina Richardson.(p31)

[4] http://en.wikipedia.org/wiki/Personality_development

[5] Book on personality development by shefali monga

[6] Feedback from different institution's trainer of personality development program.

[7] Data collection by students of different education institutions in Delhi/NCR

[8] http://www.personalitydevelopment-leidenuniversity.nl/research-around-the-world

[9] http://www.personalityresearch.org/journals.html

[10] http://www.trainingindustry.com/suppliers.aspx?gclid=CKGM7NLrn8MCFVglvQod3BEAuw