"WIRELESS NETWORK: STANDARDS AND ITS APPLICATIONS"

Atul M. Gonsai **Nilesh N. Soni**

Abstract

This paper presents wireless networking scenario with standards & Applications for its implementation. Wireless LAN is needed for the organizations & libraries for unlimited access to their wired LAN. This WLAN set up provides various ways to setup network as the need of libraries and without disturbing the existing network setup of wired network. This paper discusses the wireless network with various standards which is developed by Institute of Electrical and Electronics Engineering (IEEE). These standards explain the need and use of wireless connectivity speed ranging from 11Mbps to 54 Mbps with security and quality of service concept. The paper also discusses WLAN implementation with some example to demonstrate the effective use for newer and current needs like mobility and speed with cost consideration. The paper's focus is WLAN & its Applications for various implementations. The benefited group for this paper is network administrators & management people of any organization and also the librarians.

Keywords : WLAN, wireless standards, Ad hoc wireless network, Infrastructure wireless network.

1. WIRELESS LOCAL AREA NETWORKS

The WLAN market is exploding, with reported yearly growth figures of 300% [1]. WLAN systems are a technology that can provide very high data rate applications and individual links (e.g., in company campus areas, conference centers, airports and in libraries) and represents an attractive way of setting up computers networks in environments where cable installation is expensive or not feasible. LANs and mobile computing, have recalling the attention of equipment manufactures. This shows their high potential and justifies the big attention paid to WLAN by equipment manufacturers. Whereas in the early beginning of WLANs several proprietary products existed, nowadays they are mostly conforming to the Institute of Electrical and Electronics Engineering (IEEE) 802.11b (also known as Wi-Fi) standard [2]. It operates in the unlicensed 2.4-GHz band at 11 Mbps and it is currently extended to reach 54 Mbps [3]. A description of the MAC can be found in [4].

2. WLAN STANDARDS

802.11a

A physical layer standard in the 5 GHz radio band. It specifies eight available radio channels (in some ountries, 12 channels are permitted). The maximum link rate is 54 Mbps per channel; maximum actual user data throughput is approximately half of that, and the throughput is shared by all users of the same radio channel. The data rate decreases as the distance between the user and the radio access point increases.

802.11b

This is a physical layer standard in the 2.4 GHz radio band. It specifies three available radio channels. Maximum link rate is 11 Mbps per channel, but maximum user throughput will be approximately half of this because the throughput is shared by all users of the same radio channel. The data rate decreases as the distance between the user and the radio access point increases [8].

802.11d

This standard is supplementary to the Media Access Control (MAC) layer in 802.11 to promote worldwide use of 802.11 WLANs. It will allow access points to communicate information on the permissible radio channels with acceptable power levels for user devices. The 802.11 standards cannot legally operate in some countries; the purpose of 11d is to add features and restrictions to allow WLANs to operate within the rules of these countries.

802.11e

This standard is supplementary to the MAC layer to provide QOS support for LAN applications. It will apply to 802.11 physical standards a, b, and g. The purpose is to provide classes of service with managed levels of QOS for data, voice, and video applications.

802.11f

This is a “recommended practice” document that aims to achieve radio access point interoperability within a multivendor WLAN network. The standard defines the registration of access points within a network and the interchange of information between access points when a user is handed over from one access point to another.

802.11g

This is a physical layer standard for WLANs in the 2.4 GHz and 5 GHz radio band. It specifies three available radio channels. The maximum link rate is 54 Mbps per channel whereas 11b has 11 Mbps. The 802.11g standard uses orthogonal frequency-division multiplexing (OFDM) modulation but, for backward compatibility with 11b, it also supports complementary code-keying (CCK) modulation and, as an option for faster link rates, allows packet binary convolution coding (PBCC) modulation

802.11h

This standard is supplementary to the MAC layer to comply with European regulations for 5 GHz WLANs. European radio regulations for the 5 GHz band require products to have transmission power control (TPC) and dynamic frequency selection (DFS). TPC limits the transmitted power to the minimum needed to reach the farthest user. DFS selects the radio channel at the access point to minimize interference with other systems, particularly radar.

802.11i

It will apply to 802.11 physical standards a, b, and g. It provides an alternative to Wired Equivalent Privacy (WEP) with new encryption methods and authentication procedures. IEEE 802.1X forms a key part of 802.11i

3. WIRELESS NETWORK CONFIGURATIONS

There are two kinds of wireless networks:

1. An ad-hoc or peer-to-peer wireless network consists of a number of computers each equipped with a wireless networking interface card. Each computer can communicate directly with all of the other wireless enabled computers. They can share files and printers this way, but may not be able

to access wired LAN resources, unless one of the computers acts as a bridge to the wired LAN using special software. This is called “bridging”. [5] Each computer with a wireless interface can communicate directly with all of the others.

Figure 1: Ad-Hoc or Peer-to Peer Networking.

2. A wireless network can also use an access point, or base station. In this type of network the access point acts like a hub, providing connectivity for the wireless computers. It can connect (or “bridge”) the wireless LAN to a wired LAN, allowing wireless computer access to LAN resources, such as file servers or existing Internet Connectivity.

There are two types of access points:

a. Dedicated hardware access points (HAP) such as Lucent’s Wave LAN, Apple’s Airport Base Station or Web Gear’s Aviator PRO. The Figure 2 shows Hardware access points offer comprehensive support of most wireless features.

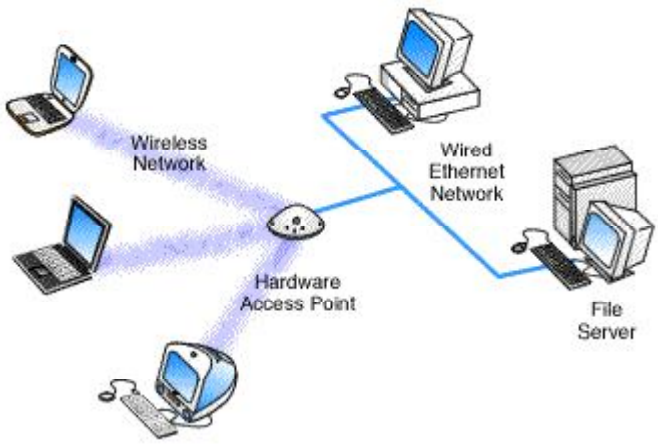

Figure 2: Hardware Access Point. Wireless connected computers using a Hardware Access Point.

b. Software Access Points which run on a computer equipped with a wireless network interface card as used in an ad-hoc or peer-to-peer wireless network which is shown in *Figure 3.* The Vicomsoft Internet Gateway suites are software routers that can be used as a basic Software Access Point, and include features not commonly found in hardware solutions, such as Direct PPPoE support and extensive configuration flexibility, but may not offer the full range of wireless features defined in the 802.11 standard. With appropriate networking software support, users on the wireless LAN can share files and printers located on the wired LAN and vice versa. [6]

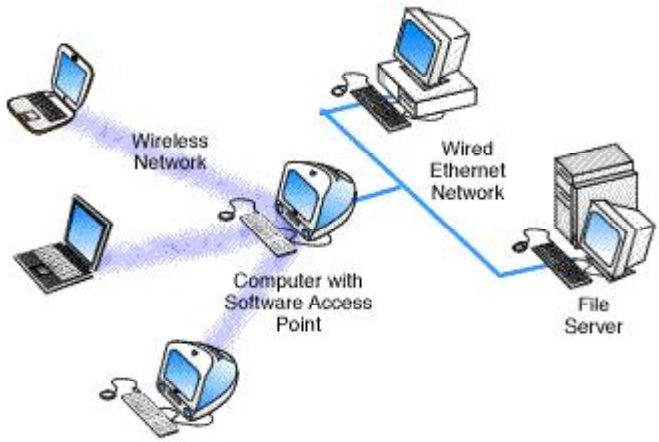

Figure 3: Software Access Point. Wireless connected computers using a Software Access Point.

4 APPLICATIONS OF WIRELESS LANS

When computers were first built, only large universities and corporations could afford them. Today we may find 3 or 4 personal computers in our neighbour's house. Wireless LANs have taken a similar path, first used by large enterprises, and now available to us all at affordable prices. As a technology, wirelesses LANs have enjoyed a very fast adoption rate due to the many advantages they offer to a variety of situations. In this section, we will discuss some of the most common and appropriate uses of wireless LANs.

4.1 Access Role

Wireless LANs are deployed in an access layer role, meaning that they are used as an entry point into a wired network. In the past, access has been defined as dial-up, ADSL, cable, cellular, Ethernet, Token Ring, Frame Relay, ATM, etc. Wireless is simply another method for users to access the network. Wireless LANs are Data-Link layer networks like all of the access methods just listed. Due to a lack of speed and resiliency, wireless networks are not typically implemented in Distribution or Core roles in networks. Of course, in small networks, there may be no differentiation between the Core, Distribution, or Access layers of the network. The Core layer of a network should be very fast and very stable, able to handle a tremendous amount of traffic with little difficulty and experience no down time. The Distribution layer of a network should be fast, flexible, and reliable. Wireless LANs do not typically meet these requirements for an enterprise solution. Figure 4 illustrates mobile clients gaining access to a wired network through a connection device (access point).

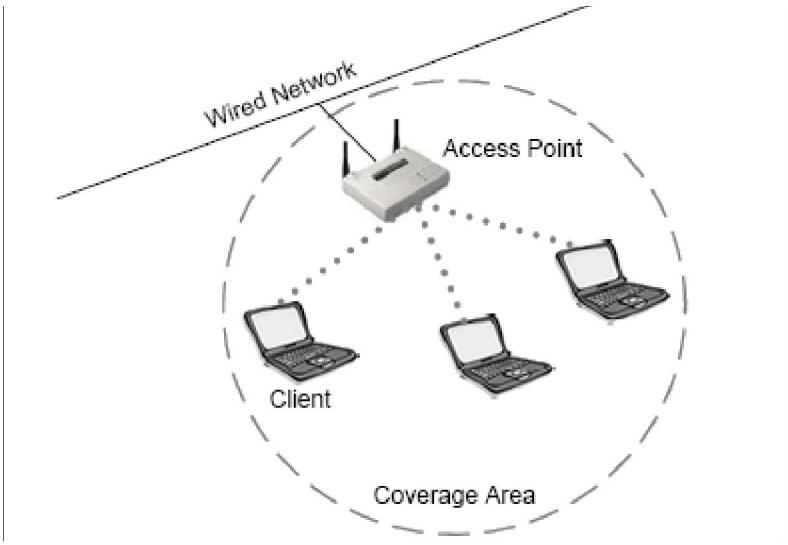

Figure 4 Access role of a wireless LAN

Wireless LANs offer a specific solution to a difficult problem: mobility. Without a doubt, wireless LANs solve a host of problems for corporations and home users alike, but all of these problems point to the need for freedom from data cabling. Cellular solutions have been available for quite some time, offering users the ability to roam while staying connected, at slow speeds and very high prices. Wireless LANs offer the same flexibility without the disadvantages. Wireless LANs are fast, inexpensive, and they can be located almost anywhere. When considering wireless LANs for use in network, keep in mind that using them for their intended purpose will provide the best results. Administrators implementing wireless LANs in a Core or Distribution role should understand exactly what performance to expect before implementing them in this fashion to avoid having to remove them later. The only distribution role in a network that is definitely appropriate for wireless LANs is that of building-to-building bridging. In this scenario, wireless *could* be considered as playing a distribution role; however, it will always depend on how the wireless bridging segments are used in the network.

4.2 Network Extension

Wireless networks can serve as an extension to a wired network. There may be cases where extending the network would require installing additional cabling that is cost prohibitive. You may discover that hiring cable installers and electricians to build out a new section of office space for the network is going to cost tens of thousands of Rupees. Or in the case of a large warehouse, the distances may be too great to use Category 5 (Cat5) cable for the Ethernet network. Fiber might have to be installed, requiring an even greater investment of time and resources. Installing fiber might involve upgrades to existing edge switches. Wireless LANs can be easily implemented to provide seamless connectivity to remote areas within a building, as illustrated by the floor plan image in Figure 5. Because little wiring is necessary to install a wireless LAN, the costs of hiring installers and purchasing Ethernet cable might be completely eliminated.

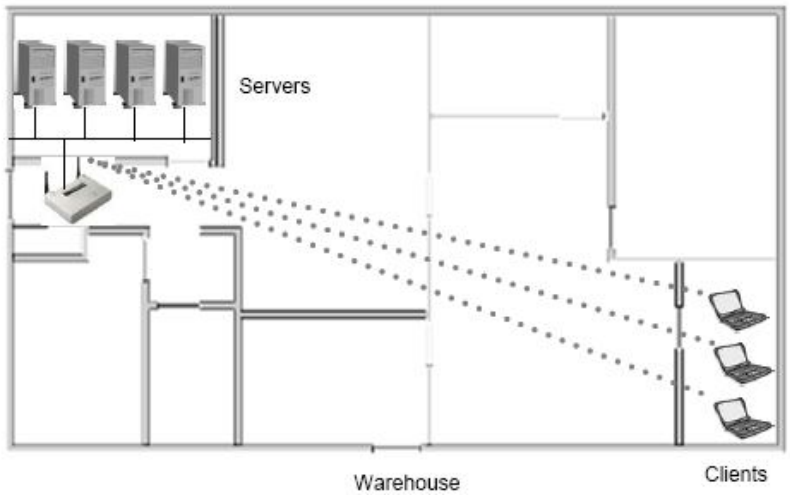

Figure 5 Network Extensions

4.3 Building-to-Building Connectivity

In a campus environment or an environment with as few as two adjacent buildings, there may be a need to have the network users in each of the different buildings have direct access to the same computer network. In the past, this type of access and connectivity would be accomplished by running cables underground from one building to another or by renting expensive leased-lines from a local telephone company. Using wireless LAN technology, equipment can be installed easily and quickly to allow two or more buildings to be part of the same network without the expense of leased lines or the need to dig up the ground between buildings. With the proper wireless antennas, any number of buildings can be linked together on the same network. Certainly there are limitations to using wireless LAN technology, as there are in any data-connectivity solution, but the flexibility, speed, and cost-savings that wireless LANs introduce to the network administrator make them indispensable. There are two different types of building-to-building connectivity. The first is called point-to-point (PTP), and the second is called point-to-multipoint (PTMP). Point-to-point links are wireless connections between only two buildings, as illustrated in Figure 6.. PTP connections almost always use semi-directional or highly-directional antennas at each end of the link.

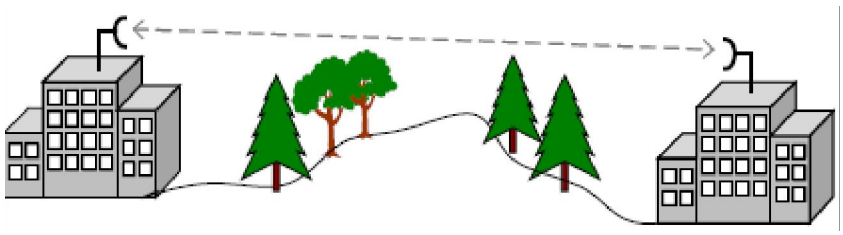

Figure 6 Building-to-building connectivity

Point-to-multipoint links are wireless connections between three or more buildings, typically implemented in a hub-n-spoke fashion, where one building is the central focus point of the network. This central building would have the core network, Internet connectivity, and the server farm. Point-to-multipoint links between buildings typically use omni-directional antennas in the central “hub” building and semi-directional antennas on each of the outlying “spoke” buildings. There are many ways to implement these two basic types of connectivity.

4.4 Last Mile Data Delivery

Wireless Internet Service Providers (WISPs) are now taking advantage of recent advancements in wireless technology to offer last mile data delivery service to their customers. “Last mile” refers to the communication infrastructure wired or wireless that exists between the central office of the telecommunications company or Cable Company and the end user. Currently the BSNL and cable companies own their last mile infrastructure, but with the broadening interest in wireless technology, WISPs are now creating their own wireless last mile delivery service, as illustrated in Figure 7.

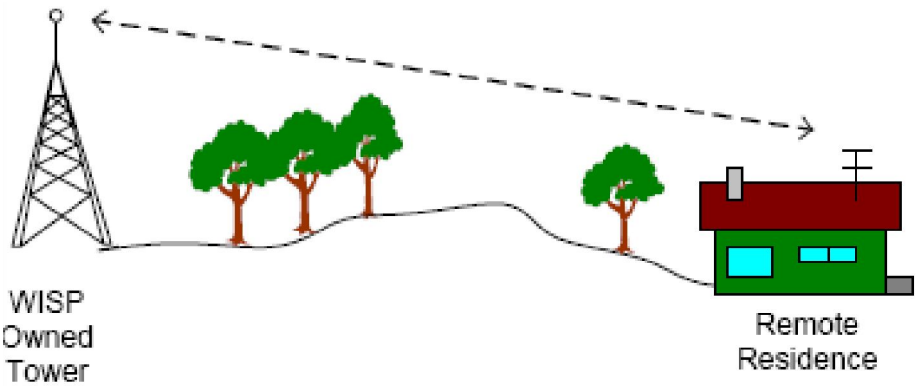

Figure 7 Last Mile Service

4.5 Mobility

As an access layer solution, wireless LANs cannot replace wired LANs in terms of data rates (100BT at 100Mbps versus IEEE 802.11a at 54Mbps). What wireless LANs do offer is an increase in mobility (as can be seen in Figure 8) as the trade off for speed and quality of service.

For example, a parcel delivery company uses wireless technology to update parcel tracking data immediately upon the arrival of the delivery vehicle. As the driver parks at the dock, the driver’s computer has already logged onto the network and transferred the day’s delivery data to the central network.

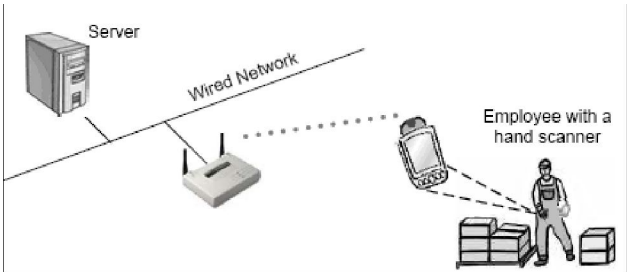

Figure 8 Mobility

In warehousing facilities, wireless networks are used to track the storage locations and disposition of products. This data is then synchronized in the central computer for the purchasing and shipping departments. Handheld wireless scanners are becoming commonplace in organizations with employees that move around within their facility processing orders and inventory. In each of these cases, wireless networks have created the ability to transfer data without requiring the time and manpower to input the data manually at a wired terminal. Wireless connectivity has also eliminated the need for such user devices to be connected using wires that would otherwise get in the way of the users. Some of the newest wireless technology allows users to *roam,* or move physically from one area of wireless coverage to another without losing connectivity, just as a mobile telephone customer is able to roam between cellular coverage areas. In larger organizations, where wireless coverage spans large areas, roaming capability has significantly increased the productivity of these organizations, simply because users remain connected to the network away from their main workstations.

4.6 Small Office-Home Office

As an IT professional, one may have more than one computer at the home. And if you do, these computers are most likely networked together so you can share files, a printer, or a broadband connection. This type of configuration is also utilized by many businesses that have only a few employees. These businesses have the need for the sharing of information between users and a single Internet connection for efficiency and greater productivity. For these applications – small office-home office, or SOHO – a wireless LAN is a very simple and effective solution. Figure 9 illustrates a typical SOHO wireless LAN solution. Wireless SOHO devices are especially beneficial when office workers want to share a single Internet connection. The alternative of course is running wires throughout the office to interconnect all of the workstations. Many small offices are not outfitted with pre-installed Ethernet ports, and only a very small number of houses are wired for Ethernet networks. Trying to retrofit these places with Cat5 cabling usually results in creating unsightly holes in the walls and ceilings. With a wireless LAN, users can be interconnected easily and neatly.

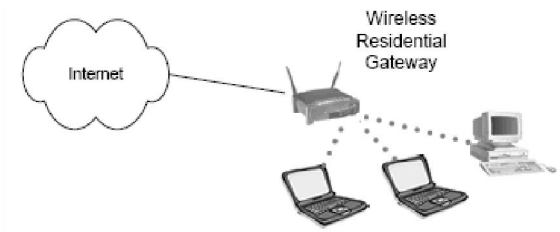

Figure 9 SOHO Wireless LAN

4.7 Mobile Offices

Mobile offices or classrooms allow users to pack up their computer equipment quickly and move to another location. Due to overcrowded classrooms, many schools now use mobile classrooms. These classrooms usually consist of large, movable trailers that are used while more permanent structures are built. In order to extend the computer network to these temporary buildings, aerial or underground cabling would have to be installed at great expense. Wireless LAN connections from the main school building to the mobile classrooms allow for flexible configurations at a fraction of the cost of alternative cabling. A simplistic example of connecting mobile classrooms using wireless LAN connectivity is illustrated in Figure 10. Temporary office spaces also benefit from being networked with wireless LANs. As companies grow, they often find themselves with a shortage of office space, and need to move some workers to a nearby location, such as an adjacent office or an office on another floor of the same building. Installing Cat5 or fiber cabling for these short periods of time is not cost-effective, and usually the owners of the building do not allow for the installed cables to be removed. With a wireless network, the network components can be packed up and moved to the next location quickly and easily.

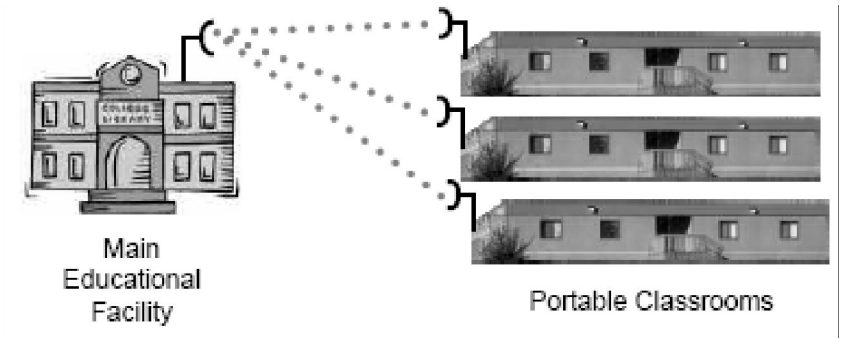

Figure 10 A school with mobile classrooms

Wireless LANs are well suited to these types of environments. Hospitals and other healthcare facilities benefit greatly from wireless LANs. Some valuable uses of wireless LANs within these facilities include doctors using wireless PDAs to connect to the networks and mobile diagnostic carts that nurses can move from room to room to connect to the patient and the network. Wireless networks allow doctors and nurses to perform their jobs more efficiently using these new devices and associated software. Industrial facilities, such as warehouses and manufacturing facilities, utilize wireless networks in various ways. A good example of an industrial wireless LAN application is shipping companies whose trucks pull into the dock and automatically connect to the wireless network. This type of networking allows the shipping company to become automated and more efficient in handling the uploading of data onto the central servers. [7]

5. CONCLUSION

The purpose of this paper has been to describe and discuss the wireless technology in accessing information in the hope that libraries and librarians will benefit from using this technology. This paper will help us in understanding the capabilities of WLAN. The evolution of wireless technology has perceived as a powerful tool for getting fast information which will become universal in the near future. The goals of libraries are to provide information to their users. But the way users receive that information is changing. By integrating more effective delivery tools with current university infrastructure, libraries can help to

attract more students and faculty to access information from inside or outside the library, 24 X 7 days a week. WLAN and its applications provide this extension possible to make “Library without Walls”.

6. REFERENCES

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About Authors

Dr. Atul Gonsai has completed his Graduation in Bachelor of Business Administration (BBA) and Master degree in Master of Computer Applications (MCA) then recently in completed his Ph.D work in Computer Networking. He is working as Assistant Professor in Department of Computer Science Saurashtra University Rajkot after completing his MCA from the same Institute in April 2000. He has written 19 research paper and 1 paper submitted for conference for acceptance. His research interest encompasses performance tuning of computer networks, wireless networks, High performance networking etc. He has taken part in 10 national and 7 international conferences and seminars. He is DCNI D – link Certified Network Integrator from D-link India Goa. He has published one book and is also writing one book on Computer Networking, which is not yet published. He is maintaining and handling MCA computer Labs and Saurashtra University Library Networking. He is life Member of ISTE New Delhi.

Email : atulgosai@yahoo.com

Mr. Nilesh N Soni has completed his Graduation in Bachelor of Commerce and also Library & Information Sc. with Master degree in 1992. He is working as I/c University Librarian, Saurashtra University Library Rajkot. He has written 8-research paper and 1 paper submitted for international conference for acceptance. His research interest encompasses computerization of Library, Digitization of Library Collection, networks, wireless networks etc. he has already computerized Nirma and Saurashtra university library. He has taken part in 6 national and international conference and seminars. He is life member of ISTE – New Delhi, ILA- New Delhi, Gandhralaya Sewa Sangh- Gujarat. He is engaged in the project to create a database of Rajkot Library Networking**.**

Email : sulnilesh@yahoo.co.uk