ISSN : 0976-8491 (Online) | ISSN : 2229-4333 (Print)

An Unused Bandwidth Utilization in Wireless Broad Band Networks

[1]Ram Rajesh Maddineni, [2]A.V.Praveen Krishna, [3]Rama Krishna Gavirneni
[1,2,3]Dept. of CSE, KL University, Green Fields, Vaddeswaram, AP, India

Abstract
High-Speed Networks are capable of carrying many types of services for instance voice, data, images, and video. These services have different requirements in terms of bandwidth, cell loss, delay, etc. In order to provide quality of service, each application reserves bandwidth from Base Station (BS). However, it is difficult for the Subscriber Station (SS) to predict the amount of incoming data. To provide quality of service, subscriber station may reserve bandwidth than its demand. so, the allocation of bandwidth to every subscriber stations done by priority. The mechanism is to reserve the bandwidth by dynamic resource reservation mechanism [2], and it has the ability to dynamically reconfigure a network in order to gain benefit from network resources which is concerned with different types of services. The idea of proposed scheme is allocate bandwidth on priority and recycle the unused bandwidth in PMP mode.

Keywords
Reuse of Bandwidth, Throughput, QoS, Dynamic Bandwidth, Bandwidth Allocation

I. Introduction
Broadband wireless access networks have rapidly been growing in these years to support the increasing demands of wireless multimedia services. Mobile Worldwide Interoperability for Microwave Access (WiMAX),The traditional solution to provide high-speed broadband access is to use wired access technologies, such as cable modem, DSL (Digital Subscriber Line), Ethernet, and fiber optic. However, it is too difficult and expensive for carriers to build and maintain wired networks, especially in remote areas. BWA (Broadband Wireless Access) technology is a flexible, efficient, and cost-effective solution to overcome the problems. WiMAX is one of the most popular BWA technologies at present, which aims to offer high speed broadband wireless access for WMANs (Wireless Metropolitan Area Network).WiMAX provides an affordable alternative for wireless broadband access supporting a variety of applications of different types including video conferencing, non-real-time large volume data transfer and web browsing. Each traffic flow requires different treatment from the network in terms of allocated bandwidth, maximum delay, and jitter and packet loss .Traffic differentiation is thus a crucial feature to provide network-level QoS (Quality of Service). The standard leaves Qos support features specified for WiMAX networks .One of the most critical issues is the design of a very efficient scheduling algorithm which coordinates all other QoS-related functional entities. The key components in WiMAX QoS guarantee are the admission control and the bandwidth allocation in BS. WiMAX standard defines sufficient signaling schemes to support admission control and bandwidth allocation, but does not define the algorithms for them. This absence of definition allows more flexibility in the implementation of admission control and bandwidth allocation. In this study, we focus on evaluating scheduling algorithms for the uplink traffic in WiMAX. We evaluate a number of WiMAX uplink scheduling algorithms in a single-hop network, which is referred to as PMP (Point Multi Point) mode of WiMAX.

II. IEEE 802.16e QoS Architecture
The IEEE 802.16e MAC layer provides QoS differentiation for various categories of scheduling services. The WiMAX uplink scheduling framework The scheduling of uplink packet transmissions is centrally controlled in the BS. The IEEE 802.16e standards [3-4] accept a connection-oriented MAC protocol, i.e., each connection is linked with a connection ID. When a check flow generated at the application layer arrives at the MAC layer, the MS initially sends a connection establishment demand to the BS [1]. The admission control mechanism at BS then estimates whether the remaining bandwidth can support the QoS requirements of new connections without violating offered users' QoS. If the connection request is established, the BS replies with a connection response which indicates the connection IDs for each direction of this connection. After the route of connection establishment is finished, the MS can copy a bandwidth request. The connection classifier then classify the service data units into different scheduling classes according to their service flow identifier and connection identifier. The uplink bandwidth needs by users are performed on a per connection basis, while the BS grants bandwidth on a per subscriber station basis (GPSS). After the BS allocate a assured amount of bandwidth to each of the MSs, the packet scheduler at each MS will reallocate the bandwidth to the parallel connection. By means of the connection-admission-control mechanism and request-grant bandwidth-allocation method, QoS for dissimilar scheduling classes can be guaranteed. The IEEE 802.16e standard divides all service flows into five scheduling classes, every of which is linked with a set of QoS parameters for quantifying its bandwidth prerequisite. The five scheduling classes are described as follows.

A. UGS
UGS is designed to support real-time service flows with fixed-size packets generated at periodic intervals (i.e., constant bit rate–CBR), such as T1 services and voice- over- Internet- Protocol applications without stillness suppression. This service can grant a permanent amount of bandwidth for CBR real-time applications without any requests.

B. rtPS
rtPS is designed to support real-time service flows with variable-size packets generated at periodic intervals (i.e., variable bit rate–VBR), such as Motion Pictures Experts Group (MPEG) video. Based on a poll mechanism to ask for bandwidth periodically, this service can promise QoS such as the minimum data rate and maximum latency for VBR real-time applications.

C. ertPS
The characteristic of this service class is between UGS and rtPS. On detecting with the intention of the allocated bandwidth is either insufficient or excessive, ertPS can send a appeal to change the amount of allocated bandwidth like rtPS does. or else, if the bandwidth order remains unaffected, ertPS behave as UGS. ertPS is designed to support VBR real-time data services such as VoIP applications with silence suppression.

D. nrtPS
This service class is to support non-realtime VBR services which require minimum-data-rate guarantees but can be tolerant to delay, such as File-Transfer-Protocol (FTP) applications.

E. BE
The BE service is designed for best-effort applications which have no explicit QoS requirements, e.g., web services or e-mail. The QoS parameters and the supporting application types associated with each of the WiMAX scheduling classes.

III. Bandwidth Allocation Mechanism
The IEEE 802.16e Physical Layer (PHY) adopts an Orthogonal Frequency Division Multiple Access (OFDMA) slot as the minimum possible resource. The IEEE 802.16 PHY supports Frequency Division Duplex (FDD) and Time Division Duplex (TDD) for bandwidth allocation mechanisms. In FDD mode, the uplink (UL) and downlink (DL) channels are located on divided frequencies, with which a fixed period frame is used for both UL and DL transmissions. In TDD approach, the UL and DL transmissions are arranged at different time periods using the same frequency. In this TDD mode is for IEEE 802.16e bandwidth allocation mechanism. In TDD mode, Time Division Multiplexing (TDM) is used for DL transmissions and Time Division Multiple Access (TDMA) is used for UL transmissions. A TDD frame has a fixed duration and contains one DL subframe and one UL subframe whose durations can adapt to the traffic loads of UL and DL transmission. The DL sub frame consists of a preamble, Frame Control Header (FCH), and a number of data bursts. The FCH specify the profiles of the DL bursts that instantly follow it. The broadcast messages together with downlink map (DL-MAP), uplink map (ULMAP), DL Channel Descriptor (DCD), UL Channel Descriptor (UCD), etc., are sent at the beginning of these DL bursts. The UL sub frame contains a contention interval for initial ranging and bandwidth request and UL PHY protocol data units (PDUs) from different MSs. The DL connections are programmed by BS in a broadcast manner, while the UL connections be valid a request grant mechanism for bandwidth allocation in a public manner. The UL bandwidth needs are performed on a per connection basis, while the BS grant bandwidth on a per subscriber station basis (GPSS). After the BS allocates a certain amount of bandwidth to each of the MSs, each MS will restructure the bandwidth to the corresponding connection

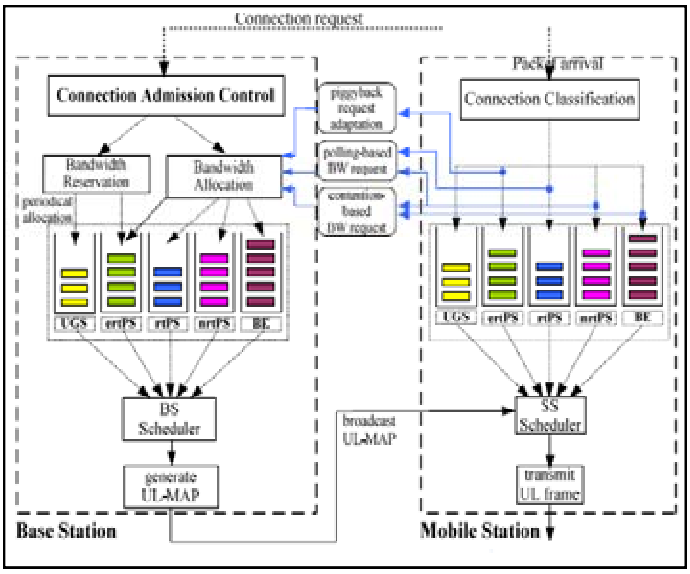


Fig. 1: IEEE802.16e Uplink Scheduling Framework

The information about bandwidth allocations for DL and UL transmissions is broadcast to the MSs through DL-MAP and UL-MAP messages at the beginning of each frame. Therefore, each MS can get from and spread data to BS in the predefined OFDMA slots.

IV. Architecture

A. Bandwidth Reservation
A Dynamic Resource Reservation scheme [2] is introduced to reserve bandwidth. Every subscriber station in network should reserves the bandwidth in order to transfer the application by maintaining the quality of service. So, each subscriber station should send request to base station as Bandwidth request, base station allocate the bandwidth on priority bases to the subscriber station.

Dynamic reservation [5] is to limit the cost of signalling and configuration while adapting to varying levels of offered load for a single CB class of traffic. WIMAX network is a WAN that collects the traffic from primary (WiMAX) SS, while each primary SS directly connects one or several Access Points on which actual subscribers are directly connected through secondary SS. In this type of architecture, if the configuration of a primary SS has to be modified every time a new CB flow is activated at a secondary SS, the signalling load between the primary BS and SS would possibly be overly important. Therefore, it makes sense to limit the configuration load for primary SS by implementing a semi-static configuration that is seldom modified, but can still support CB traffic with good QoS, both in the command plane (by limiting the blocking probability) and in the transfer plane (by ensuring that enough resources are available for each non-blocked CB flow).

B. Bandwidth Allocation
For every subscriber station, base station will allocate the bandwidth on priority based. So priority based scheduling algorithm introduce. Priority based Scheduling algorithm is described to schedule a SS with the highest priority as the CS. The Scheduling Factor (SF) is defined as the ratio of the Current Requested bandwidth (CR) to the Current Granted bandwidth (CG). Based on the SF, the priority of each candidate is decided. High priority is given to the SS when bandwidth demand is increased by the SS with privileged SF. The SS with zero CG has the peak priority. Because of the quality of service requirements, the peak priority is given to the non real time polling services, then Best effort services.

C. Packet Creation and Scheduling
Split data into 'n' number of fixed size packets with maximum length of 48 characters[8]. By splitting, data can be easily transmitted to great extent without interruption in network across the different nodes.

D. Bandwidth Recycling Module
Subscriber Stations scheduled on the Uplink (UL) map should have transmission opportunities in the current frame. Those SSs are called Transmission SSs (TSs). The main idea is to allow the BS to schedule a backup SS for each TS. The backup SS is assigned to reserve for any opportunities to recycle the unused bandwidth of its matching TS. We call the support SS as the Complementary Station (CS).BRs are made in per-connection basis. but, the BS allocates bandwidth in per-SS basis. It gives the SS elasticity to distribute the granted bandwidth to each connection locally. Therefore, the unemployed bandwidth is defined as the granted bandwidth

which is still available after serving all connections running on the SS. TS has unused bandwidth, it should transmit a message, called Releasing Message (RM), to inform its corresponding CS to recycle the unused bandwidth and transmit to base station.

E. Bandwidth Utilization Module

Bandwidth utilization improvements have been proposed in the literature. It can dynamically modify the amount of reserved resource depending on the actual number of active connections. The examination of dynamic bandwidth reservation for hybrid networks is presented.

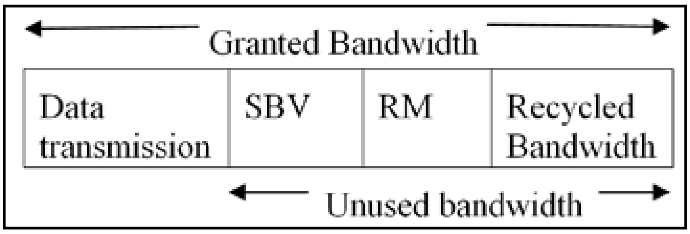


Fig. 2: Bandwidth Utilization Module

Evaluated the performance and effectiveness for the hybrid network, and proposed proficient methods to ensure best reservation and utilization of bandwidth while minimizing signal blocking probability and signaling expenditure. In, the improved the system throughput by using concurrent transmission in mesh mode[6].

F. Qos Guaranteed Service Module

Reservation of bandwidth is done due to gain the Quality of service [9]. Quality of service is the ability to provide different priority to different applications, users, or data flows, or to assurance a certain level of performance to a data flow.

V. Simulation Results

Our simulation model followed by introducing the definition of performance Metrics used for measuring the network presentation. The simulation results are shown as the third part of this segment. At the end, we provide the justification of Theoretical analysis and simulation outcome. The simulation for evaluating the presentation of the proposed scheme is based on the three metrics:

A. Throughput Gain (TG)

It represents the percentage of throughput which Is improved by implementing our method. The Formal definition can be articulated as:

$$TG = \frac{Trecycle - Tno\ recycle}{Tno\ recycle}$$

Where Trecycle and Tno recycle represent the Throughput with and without implementing our method, correspondingly. The higher TG achieved shows the higher performance that our scheme can make.

B. Unused Bandwidth Rate (UBR)

It is defined as the percentage of the unused bandwidth Occupied in the total granted bandwidth in the system without using bandwidth recycling. It can be clear officially as:

$$UBR = \frac{Bunused\ BW}{Btotal\ BW}$$

Where Bunused BW and Btotal BW are the unused Bandwidth and total allocated bandwidth, in that order. The UBR shows the room which can be improved by our scheme. The advanced UBR means The more recycling opportunities.

C. Bandwidth Recycling Rate (BRR)

It illustrates the percentage of bandwidth which is Recycled from the unused bandwidth. The percentage Can be verified formally as:

$$BRR = \frac{Brecycled}{Bunused\ BW}$$

The simulation results of recycling rate are presented from the above figures we observe that the recycling rate is very close to zero at the beginning of the recreation. It is because that only a few links transmit data during that time and the network has a light load. Therefore, only few associations need to recycle the unused bandwidth from others. As time goes on, many active associations join in the network. The existing bandwidth may not be able to satisfy the needs of relations. Therefore, there is a high probability that the CS recycles the unused bandwidth. It leads a higher BRR. The total bandwidth demand requested by SSs during the simulation. The dashed line indicates the system bandwidth capability. During the simulation, the BS always allocates the bandwidth to satisfy the demand of real time connections due to the QoS necessity. Therefore, the amount of bandwidth allocated to non-real time connections may be shrunk. The new non-real time information are generated. Therefore, the non-real time data are accumulate in the queue. It is the reason that the require of bandwidth keeps increasing. As one of the factors cause recycling. Failures are that the CS does not have data to send out while getting a RM. The other issue is that may affect the performance of bandwidth recycling is the probability of the RM to be received by the CS effectively. To increase this probability, a scheduling algorithm, name history-Based Scheduling Algorithm (HBA), is planned. According to our protocol, the CS transmits data or padding the rest of transmission interval if a RM is received.

VI. Results

The domino effect consists of the output screens for the given Transmission nodes and Complementary nodes in wireless broadband networks for recycling the bandwidth usage.

Fig. 3: Screen 1 Login for Base Station Server

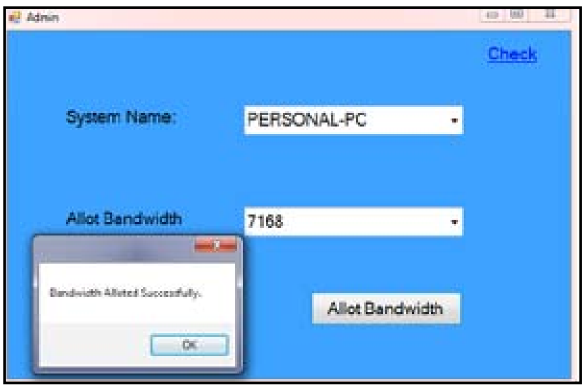


Fig. 4: Screen 2 Allot the Bandwidth for Clients

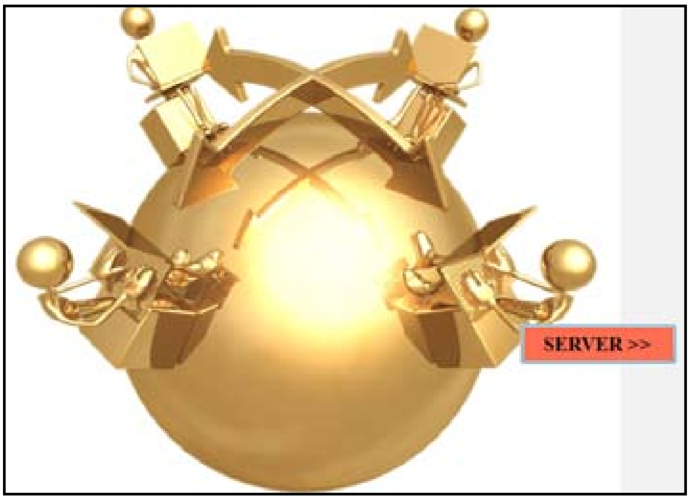


Fig. 5: Screen 3 Server Home Page

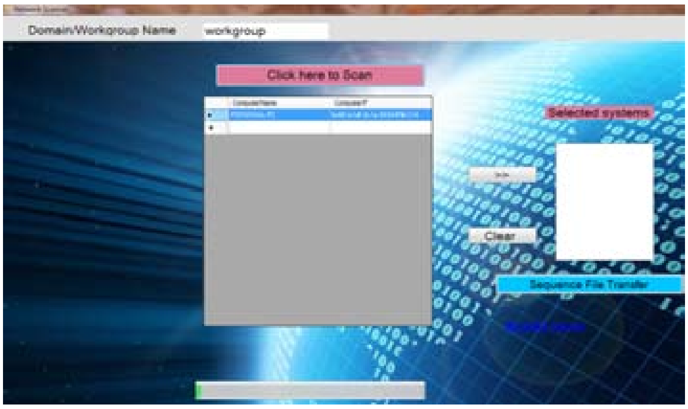


Fig. 6: Screen 4 Scan the Client Under Geographical Region of Base Station

Fig. 7: Screen 5 Selected File is Transferred

Fig. 8: Screen 6 Bandwidth Calculated in Bits Per Second

Fig. 9: Screen 5 Update Unemployed Bandwidth

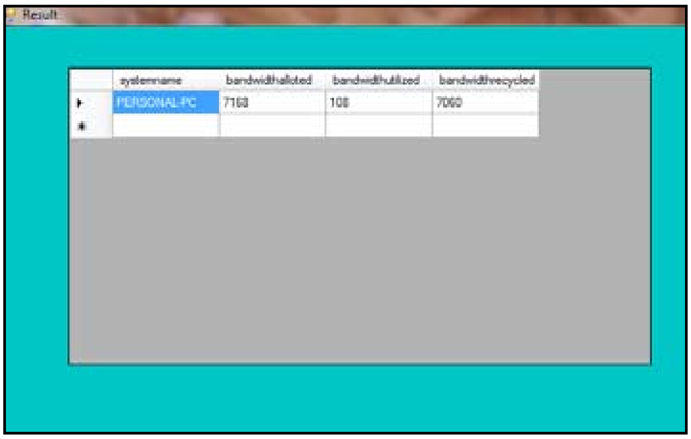


Fig. 10: Screen 6 Database Where Bandwidth Will be Updated i.e. Recycled

VII. Conclusion

Variable bit rate applications generate data in variant rates. It is very demanding for SSs to predict the amount of arriving data accurately. Although the existing method allows the SS to adjust the reserved bandwidth via bandwidth requests in each frame, it cannot evade the risk of failing to satisfy the QoS supplies. We proposed bandwidth recycling to recycle the unused bandwidth once it occurs Our mathematical and simulation results confirm that our scheme can not only improve the throughput but also reduce the delay with negligible overhead and satisfy the QoS requirements..

VIII. Future Enhancements

For Bandwidth recycling the problem is bandwidth allocation, and it is troubled with the ability to dynamically reconfigure a network in order to efficiently benefit from network resources., which is concerned with successful integration of link capacities through the different types of services. Given that a effective path is a logical direct link, composed of a number of effective circuits, between any two nodes .And recycling the unused bandwidth which is reserved but not used .The idea of proposed scheme is to provide security for bandwidth allocation and recycle the unused bandwidth in PMP mode.

References

[1] Sri M.Jaya Babu, Sri K.Gopinath Y.Tulasi Rami Reddy, “Data Caching between Mobile nodes in wireless Ad-Hoc networks”, International Journal of Modern Engineering Research, Vol. 2, Issue 5, pp. 3841-3849, Sep-Oct-2012.

[2] Eun-Chan Park, Hwangnam Kim, Jae-Young Kim, Han-Seok Kim,"Dynamic Bandwidth Request-Allocation Algorithm

 ISSN : 0976-8491 (Online) | ISSN : 2229-4333 (Print)

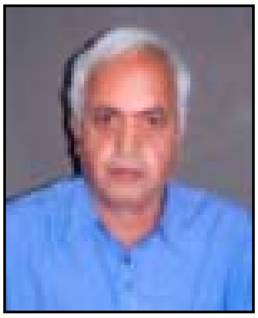
for Real-time Services in IEEE 802.16 Broadband Wireless Access Networks", INFOCOM 2008, pp. 852 - 860.
[3] IEEE 802.16 WG,"IEEE Standard for Local and Metropolitan Area Network Part 16: Air Interface for Fixed Boardband Wireless Access Systems", IEEE Std 802.16-2004 pp.1 - p.857
[4] IEEE 802.16WG,"IEEE standard for local and metropolitan area networks part 16: Air interface for fixed and mobile broadband wireless access systems, Amendment 2", IEEE 802.16 Standard, December 2005.
[5] Jianhua He, Kun Yang, Ken Guild,"A Dynamic Bandwidth Reservation Scheme for Hybrid IEEE 802.16 Wireless Networks", ICC'08, pp. 2571-2575.
[6] J. Tao, F. Liu, Z. Zeng, Z. Lin,"Throughput enhancement in WiMax mesh networks using concurrent transmission", In Proc. IEEE Int. Conf. Wireless Commun., Netw. Mobile Comput. 2005, pp. 871V874.
[7] Kamal Gakhar, Mounir Achir, Annie Gravey,"Dynamic resource reservation in IEEE 802.16 broadband wireless networks", IWQoS, 2006, pp. 140-148.
[8] Thomas G. Robertazzi,"Computer Networks and Systems: Theory and Performance Evaluation", Springer-Verlag 1990.
[9] Xiaofeng Bai, Abdullah Shami, Yinghua Ye,"Robust QoS Control for Single Carrier PMP Mode IEEE 802.16 Systems", IEEE TRANSACTIONS ON MOBILE COMPUTING, Vol. 7, No. 4, April 2008, pp. 416-429.

References Made From

[1] Professional C# Programming
[2] C# Complete Reference
[3] Data Communications and Networking, by Behrouz A Forouzan.
[4] Computer Networking: A Top-Down Approach, by James F. Kurose.
[5] Operating System Concepts, by Abraham Silberschatz.

Ram rajesh Maddineni studying M. Tech (CSE) in K L University, He has published four international journal papers and presented research papers in 3 international conferences and received best paper awards in various conferences and member of SDIWC. My research on cloud computing, Business Intelligence and software engineering.

Mr. A.V.Praveen Krishna currently working as Assistant Professor in KL University and pursuing the Ph.D in Computer Science & Engineering. He is actively engaged in research and publications in the areas of Computer Networks, Data Mining,Green Computing. He was awarded with "Best Computer Science Faculty"for year 2012 in all india basis by Government of Puddcherry and ASDF,Techno Forum. He was awarded with "Significant Contribution Award" for his outstanding contribution, by India's prestigious professional society "Computer Society of India (CSI)" for the year 2011 in Ahemadabad. He also acted as a panel of judge for South East Asia Regional Computer Confederation and Computer Society of India. In KL University, he has feedback as an excellent teacher and he is honoured with "Best Teacher Award". He is member of Academic Council of K L University.



Dr. G.Ramakrishna, Prof., CSE dept. KLU Vaddeswaram carried out research at Saha Institute, Calcutta for about five and half years from 1966-1971 in theoretical physics using computers at ISI, Calcutta, IIT Khargapur, IIT Kanpur, & IIT Madras extensively for solving problems in nuclear models and Obtained Ph.D. in 1975. Worked as a lecturer in NIT,Warangal in Physics Dept.From 1971-1975 teaching B.Tech and M.Sc.(tech) students .Taught computer programming for M.Phil (Computer Methods)students at University of Hyderabad ,Hyderabad from 1975 to 1980.Taught Computer programming and application analysis On leak detection in Oil and Gas Pipelines to the customers Of ONGC, IOC, OIL India, HPCL and BPCL at ECIL and Customer sites across India from 1975 to 2003