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CONTENTS

TDMA For VoIP Applications over Wireless Lan Dr. Ela Kumar, Anuj Kumar	1
Wind Turbines Design A Feasibility Study and Scope of Improvements Er. Hari Pal Dhariwal, Er. Dharampal Yadav, Er. Vivek Sharma	6
HTS Motors Milestone for Indian Industries Ashish Siwach, Sunil Kumar	11
Comparative Study of Web Personalization Techniques Dr. Ravinder Rathee, Devender Kumar	14
Employee Engagement - Need of Hour Rohit Bansal, Sandeep Tayal	18
Evaluation of Web Personalization Techniques Dr. Ravinder Rathee, Pardeep	24
Proper Utilization And Sizing Of Solar Energy : An Approach to Manage the Demand Of Electricity Dr. Barun Kumar Roy, Mrs. Monalisa Roy & Mr. Amit Kumar	29
Teacher Empowerment: Needs And Initiatives Dr. Sanjay Kumar, Sangeeta Rani	35
Wind Energy A Safe, Non-Polluting & Renewable Power Resource Er. Dharampal Yadav, Er. Hari Pal Dhariwal	39
Green Chemistry In Service Of Mankind Sharwan K Dewan, Vinay Batra	58
Nanotechnology and Its Applications Sharwan K Dewan, Vinay Batra	62
Experimentally Modified Protocols with Transmission Count Metric For Efficient Throughput In Ad-Hoc Networks Arun Kumar Singh, Jitender Kumar Khurana	64
Diligence-Specific Protocol Design In Wireless N/W Jitender Kumar Khurana, Arun Kumar Singh	70
Fuzzy Logic: Instrument For Intellectual Knowledge Management Er. Savita Bishnoi, Er. Seema Sharma, Kuldeep Singh Kanswan, Sankalp	77
WIRELESS SENSOR NETWORK FOR BORDER SURVEILLANCE MANOJ DUHAN, R S DUHAN, PRATEEK NARULA	84
Impact of Emerging Mobile Technologies on Management Practices Er P.Kothari, Er Ravinder Chanana , Dr H.M.Rai and Prof. Jitender khurana	90
Role of Motivator in Human Resources Development Dr. AJAY PAL KAUSHIK, ASSOCIATE PROFESSOR	94
PARASITIC COMPUTING Tarun Ahuja, Navdeep Virk	98

TDMA FOR VOIP APPLICATIONS OVER WIRELESS LAN

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Abstract :

An emerging killer application for enterprise wireless LANs (WLANs) is voice over IP (VoIP) telephony, which promises to greatly improve the reachability and mobility of enterprise telephony service at low cost. Most commercial IEEE802.11 WLAN-based VoIP products cannot support more than ten voice conversations over a single IEEE 802.11b channel, even though its peak transmission rate is more than two orders of magnitude higher than an individual VoIP connection's bandwidth requirement. There are two main reasons why these VoIP systems' effective capacity is lower than expected: stringent latency requirement and substantial per-WLAN-packet overhead. Time-Division Multiple Access (TDMA) is a well-known technique that provides per-connection QoS guarantee as well as maximizes the radio channel utilization efficiency. This paper presents a software-based TDMA (STDMA) protocol that is designed to support VoIP applications and successfully work on commodity IEEE802.11 WLAN interfaces. The resulting STDMA prototype can support more than 50 two-way G.729 voice conversations over a single IEEE 802.11b channel.

1. Introduction:

Voice over Wireless LAN (VoWLAN) is touted as a killer application for enterprise WLANs because it significantly improves the coverage and mobility of enterprise telephony services. In fact, vendors such as Aruba Networks, Symbol, SpectraLink and Cisco have been shipping VoIP phones specifically designed for IEEE 802.11-based WLANs. However, there are still several technical barriers facing the VoWLAN technology that need to be overcome before it can truly take off. The first barrier is lack of Quality of Service (QoS) support. ITU-T G.114 [1] recommends the the maximum oneway voice packet delay be below 150 msec. Because this corresponds to end-to-end path delay, the delay due to wireless LAN channel access must be considerably less than 150 msec. In addition most voice codec specifications such as G.729 [2] require the packet loss ratio in voice connections to be less than 1 % to avoid audible errors. The original IEEE802.11 WLAN standard supports only best-

effort service model. Almost all existing WLAN deployments operate in the DCF (Distributed Coordination Function) mode, in which each wireless station accesses the shared radio channel using an Ethernet-like medium access mechanism, which is inadequate for real-time voice applications for the following reasons. First, it is impossible to have precise control over the exact transmission timings of voice frames because of collision and random back-off. When the injected traffic load is high, there is more collision and interference, which increase packet loss rate, packet delay and packet delay jitter. Second, it is impossible to prioritize traffic flows. Consequently, large volume non-real-time data traffic such as FTP may consume a large proportion of the network capacity, leaving time-sensitive voice traffic to suffer the consequences. The second barrier associated with IEEE802.11 WLAN is substantial per-packet transmission overhead. Because the maximum transmission rate of an IEEE802.11b WLAN link is 11 Mbps, in theory an IEEE802.11b link should be able to support hundreds of VoIP connections if each of them requires 8 Kbps such as G.729. In practice, several benchmarking tests [3], [4] reported that existing VoWLAN products on the market cannot support more than ten concurrent VoIP calls with comparable quality to toll calls over a single IEEE802.11b channel. A major cause for this gap between theory and practice is the considerable overhead associated with a WLAN packet's transmission. This overhead includes per-packet header bits, link-layer acknowledgment, back-off delay to avoid contention, retransmission cost due to interference and inter-frame spacing for synchronization. IEEE 802.11e [5] is designed to provide QoS support for time-sensitive applications on IEEE802.11 WLAN. It supports two new channel access mechanisms: EDCA (Enhanced Distributed Channel Access) and HCCA (Hybrid coordination function (HCF) Controlled Channel Access). EDCA improves upon DCF (Distributed Coordination Function) by introducing four queues, each of which corresponds to a different priority of accessing the shared radio channel. More specifically, each queue is assigned a different combination of medium access parameters, including AIFS (Arbitrary Inter-Frame Space), CWmin and CWmax. Although EDCA can effectively prioritize voice traffic over data traffic, it cannot guarantee the QoS of

individual VoIP connections when they are competing with one another for a shared medium. In fact, when the number of voice connections contending for access to a radio channel increases, EDCA actually increases the probability of collision because of its aggressive medium access parameters such as smaller CW_{min} and CW_{max}. HCCA is an enhanced version of PCF (Point Coordination Function), and supports a centralized polling scheme that could schedule network connections according to their bandwidth demand and priority. Unfortunately, most commodity WLAN interface products do not implement HCCA or PCF. In summary, IEEE 802.11e takes the right first step toward solving the IEEE 802.11 WLAN's QoS problem by supporting traffic prioritization. But it is ineffective in the face of a large number of voice connections. Neither does it solve the problem of substantial per-packet transmission overhead. This project aims to simultaneously solve the QoS and per-packet transmission overhead problem associated with infrastructure-mode IEEE 802.11-based wireless LAN by layering a software-based Time Division Multiple Access (TDMA) protocol on top of DCF, which is the default operating mode of most IEEE 802.11 WLAN interfaces. Measurements from a fully operational software-based TDMA (STDMA) prototype show that this approach drastically improves an IEEE 802.11 WLAN channel's capacity for VoIP traffic because it reduces the collision probability to the minimum and because it largely eliminates the back-off overhead. In addition, this STDMA approach provides QoS guarantee for individual VoIP connections regarding packet loss, packet delay and delay jitter.

2. Related Work:

The Wireless Rether project [6] tried to provide a hard QoS guarantee on 802.11-based WLANs through a software-based token passing scheme. Unfortunately software-based token passing incurs too much overhead to be practical. The IEEE 802.11e standard [5] enhances WLAN's QoS by supporting traffic prioritization. Its EDCA mechanism can give better QoS to voice traffic when compared with data traffic. However, this mechanism is not at all effective when all traffic sources carry voice traffic. Gu and Zhang [7] simulate the EDCA mechanism to evaluate its effectiveness in supporting voice connections' QoS. They used 4 stations each transmitting at a different priority, and found that EDCA indeed can provide higher throughput and lower latency to high-priority traffic. But they didn't test EDCA under the scenario in which all 4 stations transmit at the highest priority. In addition to EDCA, Garg et al. [8] also evaluated

the HCCA, and found that HCCA can improve channel utilization and provide better QoS support. They also found that EDCA may require significant tuning to offer better QoS for high priority traffic. SpectraLink [9], a leading VoWLAN phone vendor, proposes a simple QoS enhancement mechanism called SpectraLink Voice Priority (SVP), which features two basic ideas: AP transmitting voice frames with backoff value of zero and always queuing voice frames in the head of the transmission queue. This solution is used to improve the AP's priority of acquiring the WLAN channel for downstream voice traffic. Unlike PCF and HCCA, which relies on explicit polling to support contention-free access to the shared radio medium, TDMA uses implicit time slotting to achieve the same effect without incurring a per-STA polling frame overhead. In exchange, STDMA needs a per-scheduling-cycle announcement frame to avoid scheduling the radio channel for STAs that are idle. Given the limited capacity of existing VoWLAN systems, it is not surprising that many researchers try to improve its capacity. Wang et al. [10] proposes to aggregate downstream voice traffic into a smaller number of

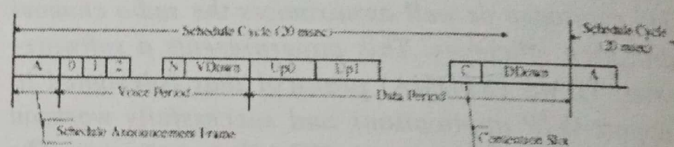


Fig.1 The channel time allocation of the proposed software-based TDMA protocol. Time is divided into cycles, each of which consists of a schedule announcement slot, which notifies all STAs of their channel time slots during a schedule cycle, a voice period, which is for voice frames, and a data period, which is for non-voice data frames.

Larger frames that are then multicasted. This scheme can nearly double the capacity of VoWLAN systems because it dramatically decreases the transmission overhead of downstream voice frames. The Atheros chipsets [11] support several new features to improve the capacity of WLAN links. The bursting feature allows a WLAN card to transmit frames back to back without incurring the per-frame backoff overhead. The fast frame feature allows a WLAN card to aggregate two frames into one larger frame. The compression feature allows a WLAN card to compress data frames. But these techniques cannot be applicable to VoIP traffic because typically consecutive frames within a voice connection are spaced out by 20 to 30 msec. It is difficult to aggregate them to larger frames or to exploit bursting. Compression is not that useful either because voice data is already compressed. Neufeld et al. [12], [13] in their SoftMAC project mentioned some

techniques to override the 802.11 MAC, for example, controlling ACK and backoff through software. They also mentioned a TDMA MAC project on 802.11-based WLAN NIC without providing concrete design and implementation details. Furthermore, SoftMAC requires each WLAN card to work in the RF monitor mode, and therefore could not be applied to VoWLAN phones. Rao and Stoica [14] proposed an overlay MAC layer on 802.11-based WLAN NIC to mitigate the poor fairness and performance problem due to hidden nodes and to mitigate other 802.11 MAC anomalies. It also uses TDMA to regulate frame transmission but its design is not geared towards VoIP applications. Its scheduling slot size is 10 msec and detects inactive nodes through long timeout. This coarse timing granularity control method cannot be reused in VoWLAN traffic.

3. STDMA Protocol Design :

As shown in Figure 1, the proposed STDMA protocol divides the channel time into schedule cycles, each of which is set to 20 msec in the current prototype and corresponds to the packetization interval of VoIP applications. Each schedule cycle in turn is broken down into three parts: a schedule announcement frame, a voice period, and a data period. The schedule announcement frame specifies how the channel time is allocated among WLAN nodes in the current schedule cycle. The voice period consists of multiple time slots, one for each active voice connection's upstream traffic. The AP transmits all downstream voice traffic in a single time slot, which is at the end of the voice period. The data period is also divided into time slots, each of which is used for transmission of non-voice data frames. Again upstream data traffic is scheduled first, then a contention slot is scheduled for non-active STAs to send their traffic request frames (explained later), and finally comes the downstream data time slot allocated to the AP. For example, in Figure 1, the first frame in the schedule cycle is the schedule announcement frame. Then the voice period starts. Each voice traffic-carrying STA uses one of the N voice time slots to transmit upstream voice frames. At the end of the voice period, the AP uses the V_{Down} slot to transmit downstream voice frames. In the data period, STAs transmit upstream non-voice data frames in time slots Up_0 , Up_1 , etc. After the upstream time slots, STAs that are not scheduled in the current cycle can send traffic request frames in the contention slot, C . Finally the AP uses the downstream data time slot, D_{Down} , to transmit non-voice data frames to STAs.

A. The Schedule Announcement Frame: The AP broadcasts a schedule announcement frame at the

beginning of each schedule cycle. This frame serves the double purposes of synchronizing STAs and telling each STA its associated channel slot times for upstream voice and data transmission. Because each STA is guaranteed its own slots, upstream data transmission is largely free of collision. Consequently, the packet loss, delay and jitter can be strictly controlled.

B. The Voice Period: In each voice period, every active STA transmits its upstream voice traffic in its own slot according to the schedule announcement frame. The AP aggregates and transmits all downstream voice frames in one voice slot. Ideally, if silence suppression works well, a voice connection only needs one channel slot for both upstream and downstream traffic because voice communication is half-duplex in nature. Unfortunately, several studies showed that state-of-the-art silence suppression cannot effectively suppress most of the background noise. As a result, VoIP traffic is largely full-duplex in practice and therefore downstream and upstream traffic of a voice connection cannot be time-multiplexed on a single channel time slot. One way to transport a voice connection's downstream traffic is to allocate a separate downstream time slot immediately after each STA's upstream time slot. This design saves power because each voice traffic-carrying STA in principle only needs to wake up during its associated time slots in each schedule cycle. However, it is inefficient. A more efficient design, which the current STDMA prototype chooses, is to aggregate and transmit all downstream voice traffic to all STAs in one time slot. This design allows an AP to exploit statistical multiplexing among multiple voice connections, to aggregate multiple voice frames into one physical frame to reduce per-packet transmission overhead [10], and to use 802.11e's TXOP mechanism [5] to transmit a batch of frames consecutively at the physical layer.

C. The Data Period: The data period is used for STAs and the AP to transmit non-voice data frames. Unlike voice traffic, which has constant per-connection bandwidth requirement, the bandwidth demand of data traffic fluctuates considerably. The key challenge in scheduling the data period is how to maximize its channel utilization efficiency without disrupting the timing of voice frames. Without proper control, too many STAs may try to transmit frames during a data period, stretch the data period into the next schedule cycle and disrupt the QoS guarantee of subsequent voice frames. To avoid this disruption, STDMA first schedules upstream data traffic from STAs, then a contention slot C and finally downstream data traffic from the AP. STAs that did not transmit data in previous schedule cycles submit a traffic request frame to the AP

during the contention slot. Because traffic request frames are small, even though they could cause collision, they are not likely to stretch the contention slot significantly. Even if a contention slot is stretched, the following downstream data slot in the same data period can be shortened to accommodate any such stretch. In the initial state, as soon as an STA has data to transmit, it submits a traffic request frame in the next available contention slot. The traffic request frame includes traffic load information, i.e., the amount of time required to empty the data currently in its queue. From an STA's traffic request frame and its physical transmission speed, the AP could determine the amount of channel time allocated to this STA and schedules a data slot for it in the following data period. After an STA starts transmitting upstream packets, whenever it transmits an upstream packet, it piggybacks into the packet a report of its current traffic load. Based on load information in traffic requests and piggybacked reports, the AP could accurately keep track of each STA's load, and schedules their packets in a way similar to weighted fair queuing [17]. After an STA reports to the AP that its transmission queue is empty, the AP will stop scheduling for the STA until receiving a traffic request frame from the STA in some future contention slot.

Compared with polling, which is used in PCF and requires the AP to constantly poll all STAs to determine their load and transmission schedule, TDMA is much more efficient especially for software implementation, because the overhead associated with software-based polling on WLAN is quite high [6]. In addition, because data traffic load tends to be sparse and bursty, constantly polling STAs incurs a great deal of scanning overhead without producing any obvious benefits.

4. Performance Evaluation:

We used the testbed shown in Figure 2 to evaluate the performance of the STDMA prototype and compare it with the IEEE802.11e standard. There are four computers connected through a 100Mbps Ethernet switch. All of them are DELL PowerEdge 400SC, which features a 2.26 GHz Pentium-4 CPU and 256 Mbytes of memory. One computer serves as an AP and the other three serve as STAs. Each STA computer hosts 12 Wistron NeWeb IEEE802.11a/b/g mini-PCI cards (Model No. CM9),

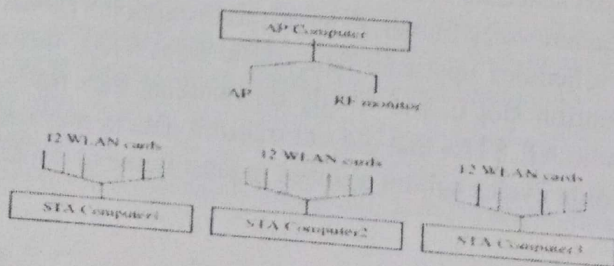


Fig. 2. The testbed used to evaluate the performance of the STDMA prototype and the IEEE802.11e standard. There are totally 36 WLAN cards associated with one AP, each of which logically corresponds to a distinct STA. The 36 WLAN cards transmit voice frames to the AP and the QoS of each voice connection in terms of packet delay and delay jitter is measured and reported, which are connected to the computer through three 4-port mini-PCI to PCI adaptors. The NeWeb IEEE802.11a/b/g mini-PCI card uses the AR5004X chipset, which consists of an AR5213 MAC controller chip supporting IEEE802.11e's EDCA, and an AR5112 dual-band radio. The AP computer hosts two Wistron NeWeb IEEE802.11a/b/g mini-PCI cards, one of them working as an AP while the other working as an RF monitor to verify that the STDMA prototype indeed works as expected. All WLAN cards operate in the IEEE802.11b mode with short preamble support enabled. ACK frames are encoded in 11Mbps. These computers are located within a 5-meter range and thus always transmit frames at the encoding rate of 11Mbps. All computers run Linux 2.6.10, which includes the Mad-Wifi driver madwifi-ng-r1457 and the High Res POSIX timer i386-hrt-2.6.10.patch, and use NTP to synchronize their clocks over the wired Ethernet link so that we can measure the one-way packet latency. We use a UDP sender program to generate traffic at a specific packet rate (packet per second), per-packet payload size, sequence number, and time stamp. To emulate VoIP traffic, we set the UDP payload size to 32 bytes (12 bytes RTP + 20 bytes G.729 voice). An UDP receiver program measures the throughput and packet loss ratio based on the sequence number. The packet delay and delay jitter are computed based on the time stamps taken at the socket send/receive interface to reflect the end-to-end delay perceived by the VoIP application. Packet delay jitter is the difference between maximum and minimum packet delay measurements. The goal of this experiment is to compare the effective throughputs of STDMA, IEEE802.11e and IEEE802.11 in terms of the number of two-way 8Kbps voice connections they can support over a single channel of an IEEE802.11b WLAN. In this experiment, each WLAN card on the STA computers transmits to the AP packets of the total size of 98 bytes and at a rate of 50 packets per second (pps). At the same time, the

MAC	Cards	Direction	Loss Ratio (%)	Latency (msec)	Jitter (msec)
802.11	18	Up	0.23	23	30
802.11	18	Down	0.8	14	28
802.11	19	Up	0.26	18	44
802.11	19	Down	6	40	36
802.11e	22	Up	0.07	26	54
802.11e	22	Down	0.01	1	6
802.11e	23	Up	3.1	30	121
802.11e	23	Down	0.01	3	30
STDMA	50	Up	1.4	20	6
STDMA	50	Down	0.4	20	6

TABLE I

Comparison among IEEE802.11, IEEE802.11e and STDMA in terms of the number of voice calls that they can support over a single channel of an IEEE802.11b WLAN assuming each call is a two-way 8Kbps voice connection.

AP transmits packets to each WLAN card on the STA computers with the same packet size and rate. This set-up emulates a constant-rate two-way voice communication. To emulate IEEE802.11, we use the Atheros chipset's best effort queue. To emulate 802.11e, we use the Atheros chipset's voice queue, which is the same as in the baseline test. For STDMA, we use the Atheros chipset's voice queue and use a 200- μ sec voice slot size. To emulate more than 36 STAs using 36 WLAN cards, some of them need to support two voice connections, i.e., transmit/receive every 10 msec rather than every 20 msec. Table I summarizes the number of concurrent 8Kbps voice connections that IEEE802.11, IEEE802.11e and STDMA can support on a single IEEE802.11b channel whose transmission rate is 11 Mbps. Our measurement shows that the IEEE802.11 standard can actually support up to 18 simultaneous voice connections. When the 19th voice connection is added, the packet loss ratio of downstream voice traffic from the AP goes up drastically, but the upstream voice traffic experiences much fewer losses. In IEEE802.11, the AP uses the same AIFS and CWmin as the STAs, and therefore is not given a higher priority than STAs as far as accessing the shared channel is concerned. When the input traffic load of a WLAN channel is close to its capacity, the AP is given less channel time share than it needs to transmit downstream packets and thus becomes the bottleneck. For IEEE802.11e, it can support 22 concurrent voice connections. When the 23rd voice connection is added, unlike IEEE802.11, the packet loss ratio of upstream traffic from STAs goes up while the downstream traffic experiences much fewer losses. In IEEE802.11e, the AIFS of the AP's voice queue is PIFS, which is smaller than DIFS, the AIFS of STAs' voice queue. In addition, the AP's voice queue uses a large TXOP limit to transmit multiple frames once it acquires the channel. This is why it is the STAs rather than the AP that become the bottleneck when a WLAN channel is fully loaded. STDMA can support 50 voice calls successfully. Because downstream voice traffic can effectively leverage the TXOP mechanism, the STDMA prototype can transmit downstream packets associated with 50 voice calls within 9.3 msec, leaving 0.7 msec for the schedule announcement frame and the contention slot in each schedule cycle, whose length is 20 msec. The throughput improvement of STDMA over IEEE802.11e

mainly arises from two optimizations: TDMA based medium access control and ACK elimination. To isolate out the throughput improvement contribution due to TDMA based medium access control, we ran the same test with IEEE802.11e but disabled link-layer ACK this time. Under an offered load of 1 Kpps from 4 WLAN cards, IEEE802.11e with link-layer ACK disabled experiences a packet loss ratio of more than 25%! In contrast, the same 4 WLAN cards can achieve around 3 Kpps throughput with 0.4% loss ratio under IEEE802.11e without disabling link-layer ACK. In summary, compared with IEEE802.11 and IEEE802.11e (22 voice calls), STDMA (50 voice calls) can improve the voice capacity by a factor of 2.8 and 2.3, respectively, while offering comparable packet delay and smaller delay jitter. The packet loss ratio of the upstream traffic under STDMA is slightly higher than those in IEEE802.11 or IEEE802.11e, mainly because of the mysterious collision behavior when link-layer ACK is disabled. For IEEE802.11 and IEEE802.11e, they also show decent capacity (18 and 22 voice calls, respectively). The result for IEEE802.11 is somewhat surprising because previous tests [3], [4] showed that state-of-the-art IEEE802.11-based VoWLAN products can only support around 10 concurrent voice calls over a single IEEE802.11b channel. The performance difference between STDMA and these commercial systems is mainly attributed to careful reduction in per-packet transmission overhead and downstream voice traffic batching at the AP. The performance improvement of IEEE802.11e over IEEE802.11 mainly comes from the fact that 802.11e gives the AP a higher priority over the STAs and thus significantly reduces the packet loss ratio of downstream voice traffic.

5. Conclusion:

The number of VoIP calls that existing VoWLAN products can support on an IEEE802.11 WLAN channel is disappointingly small because of lack of QoS support and inefficient WLAN packet transmission. Real world experiments [3], [4] showed that they can support up to ten concurrent VoIP calls on a vanilla IEEE802.11b link. To overcome this VoIP capacity problem, this paper proposes a software-based TDMA approach to simultaneously solve the QoS and transmission efficiency problems of commodity IEEE802.11 WLAN interface hardware. Although STDMA is conceptually simple, implementing it on commodity operating system and WLAN hardware poses substantial challenges, specifically, how to synchronize WLAN nodes and how to support fine-resolution timer. We have successfully implemented the first known STDMA prototype on Linux



WIND TURBINES DESIGN A FEASIBILITY STUDY AND SCOPE OF IMPROVEMENTS

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Abstract

Increasing cost of energy and limited resources, non conventional sources are the best options for the future needs of the human beings. A wind turbine converts the energy of wind into kinetic energy. Wind energy is estimated to have the lowest cost of all renewable options. Governments and private businesses have been investing in this fastest growing energy technology research especially in wind turbine design and results are positive. Keywords : WPD-Wind Power Density, WTD-Wind Turbine Design, TCM-Topping Cycle Mode, FGET- Fastest Growing Energy Technology.

Introduction

A wind turbine converts the energy of wind into kinetic energy that produces electricity, it typically has one, two, or three blades. Wind turbines can be classified into the vertical axis type and the horizontal axis type. Most modern wind turbines use a horizontal axis configuration with two or three blades, operating either downwind or upwind.

Wind turbines can be used for stand-alone applications, or they can be connected to a utility power grid or even combined with a photovoltaic system, batteries, and diesel generators, called hybrid systems. Stand-alone turbines are typically used for water pumping. However, homeowners and farmers in windy areas can also use turbines to generate electricity. For utility-scale sources of wind energy, a large number of turbines are usually built close together to form a wind farm.

Useful Life of a generating station including evacuation system shall mean the following duration from the date of commercial operation of such generation facility, namely:

- Wind energy power project 25 years.
- Biomass power project, non-fossil fuel cogeneration 20 years.
- Small Hydro Plant 35 years.
- Solar PV/Solar thermal power plants 25 years.

A wind turbine can be designed for a constant speed or variable speed operation. Variable speed wind turbines can produce 8% to 15% more energy output as compared to their constant speed counterparts; however, they

necessitate power electronic converters to provide a fixed frequency and fixed voltage power to their loads. Most turbine manufacturers have opted for reduction gears between the low speed turbine rotor and the high speed three-phase generators. Direct drive configuration, where a generator is coupled to the rotor of a wind turbine directly, offers high reliability, low maintenance, and possibly low cost for certain turbines.

Wind Turbine Design (WTD) Methodology

A few basic calculations provide good insight to the issues of WTD. Wind is an air mass moving from a high-pressure area to one of low pressure. To calculate the energy in wind, consider a segment of air shaped like a horizontal cylinder. The energy in it depends on the volume of air, density, and wind speed. The mass per unit time for a slice of the cylinder is:

$$M = \rho AV \quad (1) \text{ where}$$

M = mass in kg

ρ = density in kg/m³

A = area in meter

V = wind speed meter per second

The function of a wind turbine is to transform the wind's kinetic energy into electricity. Therefore, we start with a calculation of kinetic energy or E_k , where:

$$E_k = \frac{1}{2} MV^2 \quad (2)$$

Substituting the mass of the air cylinder ($\rho AV = M$) gives

$$E_k = \frac{1}{2} \rho AV^3 \quad (3)$$

Thus, the amount of energy in the wind depends on the density of the air, area (in this case, the area swept by the wind-turbine rotor) and the cube of the wind velocity. The equation signifies the point that selecting an area of strong winds is advantageous because the power in the wind increases with the cube of its speed.

The wind turbines are not 100% efficient. If a turbine was completely efficient it would transform all kinetic energy from the wind into electricity. This would mean the wind velocity would drop to zero behind the blade. We know that is not the case. In fact, Albert Betz published a book in 1926 that showed it is only possible to extract 16/27 or 59% of the energy from a wind turbine. This is Betz' law. Therefore the theoretical energy model for a wind turbine is:

$$E_{k \max} = \frac{16}{27} \left(\frac{1}{2} \rho AV^3 \right) \quad (4)$$

In practice, however, the amount of extractable energy ranges from only 40 to 47%.

Reducing costs

A brief recap is that we can extract less than half the energy from the wind and that depends on air density and wind speed. So the next question is: How can we further reduce the cost of producing electricity from the wind?

Three main considerations are :-

- (i) Site selections .
- (ii) Swept surface or rotor diameter, and
- (iii) Reducing a turbine's cost for capital, installation, and maintenance.

Site selection

It is obvious from the wind-power equation that it is best to place wind turbines in areas of strong sustainable winds. Low wind speeds have no significant extractable energy when compared to areas of even moderate wind speeds. Site selection requires extensive study of an area's topology, and annual wind speeds and directions. Wind analysts study meteorological trends and generate tools such as a wind rose that show annual distributions of wind speeds and their direction frequencies. Wind-farm investors are then presented with cost justifications based on farm locations. Turbine engineers can select a best design based on the type of winds at the location. One trend is to place wind turbines offshore to take advantage of the unobstructed winds over water.

Swept surface

The amount of energy extracted from the wind is directly proportional to the swept surface area. Large wind turbines leverage economies of scale with an increased blade diameter. The industry has seen a continual increase in diameters from 40 meters (131 ft) and 20 to 60-kW outputs in the 1970s to modern 90 m (295 ft) 3-MW designs. The largest wind turbine today is a 7+ MW 126 m (413 ft) three bladed design engineered by German based Enercon for a research and development project. For wind energy, through improved manufacturing methods we could see 250-m (820 ft) rotors on 20 MW machines by 2020.

Swept surfaces usually lead to confusion regarding a best wind-turbine design. An important factor in rotor design is the tip-speed ratio (Rts). This refers to the ratio between the wind speed and the blade-tip speed:

$$Rts = V_{blade\ tip} / V_{wind} \quad (5)$$

where

$V_{blade\ tip}$ = speed of the blade tip

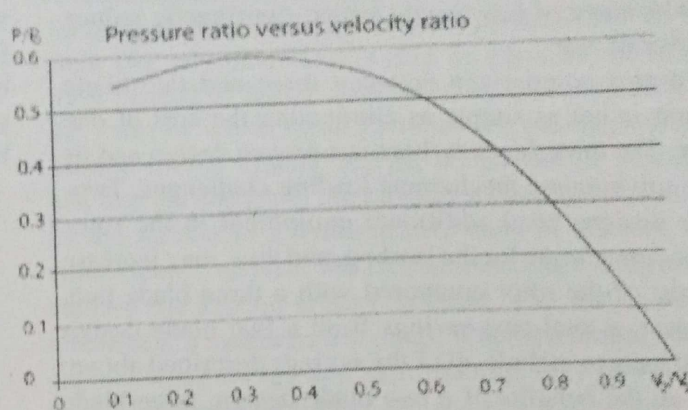


Fig.1 Pressure ratio v/s velocity ratio

This important as imagine a wind turbine spinning slowly, say 1 rpm. Most of the wind energy would pass through the space between the blades, thus "wasting" the energy and reducing the efficiency of the turbine.

On the other hand if the turbine spins "too" fast, two problems arise. The first is that the fast spinning blades acts like a wall to the wind. This reduces wind velocity in front of the blade much as the wind slows in front of a large building. This is a negative condition because the power of the wind is proportional to the cube of the wind speed. The second problem is that each blade of the turbine creates some turbulence in the air. When the blades spin too fast, each "slices" into the turbulence of the proceeding blade, again reducing the turbine efficiency.

A best tip-speed ratio depends on the number of blades in the rotor. The fewer blades, the faster the wind turbine spins to extract maximum power from the wind. Early experiments showed that a two-blade rotor has an optimum tip-speed ratio of about 6, a three-blade design about 5, and four blades, about 3. However, more recent highly efficient aerofoil designs have increased the numbers by 25 to 30%, which allows increasing rpm and therefore generating more power.

One consideration leverages the advantages of a two-blade turbine. The obvious is the reduced cost of one blade. As the trend of larger rotor diameters continues, material use and blade cost will also increase. Other advantages of a two-blade design include savings on smaller mechanical equipment due to the lower torque of faster rotor speeds. A lower turbine weight then allows reducing the size or eliminating yaw controls. Lower installation costs come from only one top-lift. And less equipment means lower maintenance costs. Also as more

turbines are installed offshore, two bladed designs offer the advantage of less weight which can directly reduce the overall cost.

But a cost comparison between three and two-blade designs is not as simple as eliminating the cost of one blade. The three-blade turbine is a proven design and its rotor solves some mechanical loading challenges. Two-blade designs need additional equipment in the rotor hub to compensate for the loading, and thus, may increase the cost of the rotor compared with a three-blade hub. However, a total cost savings from a two blade design would have to include all of the savings described above. With all the benefits of a two blade design, three blade designs are in such wide use because of Gyroscopic tendencies. Spinning rotors act like gyroscopes in their plane of rotation. That is, they are content to rotate in a plane but offer great resistance when changing directions (yawing) out of that plane. This is problematic when wind direction changes and the wind turbine yaws into the wind to maximize power generation and equalize blade loads.

Two and three-blade rotors both generate gyroscopic forces. However, the advantage of a three blade design is that at least two of the blades are always out the vertical plane at one time, thus reducing shaft and gearbox stresses when the turbine yaws.

When the wind changes direction and the blades of a two-bladed design are in the vertical, 6 o'clock position, there is a minimal amount of force on the hub because the loading of the blades are relatively equal. However when the blades begin to move to the horizontal position it generates unequal loading that adds stress to the hub and gearbox.

To solve the problems, most modern two-blade designs use a hub that is not rigidly fixed to the turbine shaft, so it "teeters" a few degrees to reduce stresses. As manufacturers build larger and heavier wind turbines, gyroscopic forces will increase requiring larger and stronger two and three-blade hubs and thus increasing costs.

There is, however, an idea that with proper research and investment could eliminate the large gyroscopic forces on two-blade windmills, thereby making them viable for 5 to 20MW machines. It can be used for keeping a wind turbine facing into the wind without hub and gearbox stresses. The idea is to control pitch of individual blades, thereby decreasing gyroscopic forces on the rotor when yawing. This would take advantage of the wind's kinetic energy on the blade to assist in turning the turbine into the wind. Such a control feature cyclically alters blade pitch as the wind direction changes so as to present different angles of attack between the blades and wind.

Another plus for the design: it eliminates the need for yaw drive motors.

Experiments with cyclical feathering on wind turbines have been conducted on a small scale and show great potential. Continued research and investments are needed before this technology reaches large-scale wind turbines.

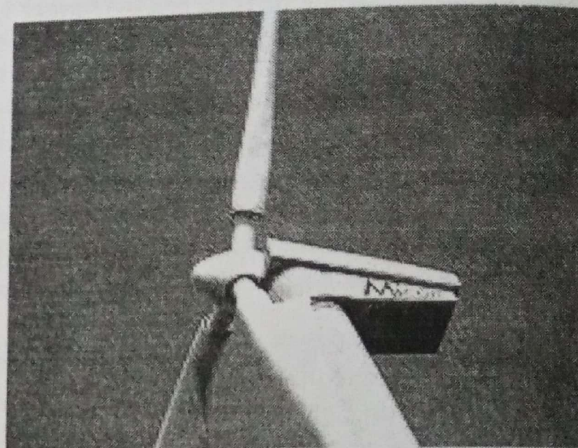


Fig.2 Modern wind turbines

Three bladed wind turbine

Turbines used in wind farms for commercial production of electric power are usually three-bladed and pointed into the wind by computer-controlled motors. These have high tip speeds of over 320 km/h (200 miles per hour), high efficiency, and low torque ripple, which contribute to good reliability. The blades are usually colored light gray to blend in with the clouds and range in length from 20 to 40 meters (65 to 130 ft) or more. The tubular steel towers range from 60 to 90 meters (200 to 300 feet) tall. The blades rotate at 10-22 revolutions per minute. At 22 rotations per minute the tip speed exceeds 300 ft per second. A gear box is commonly used to step up the speed of the generator, although designs may also use direct drive of an annular generator. Some models operate at constant speed, but more energy can be collected by variable-speed turbines which use a solid-state power converter to interface to the transmission system. All turbines are equipped with shut-down features to avoid damage at high wind speeds.

WTD and construction

The simplest possible wind-energy turbine consists of three crucial parts:

" Rotor blades - The blades are basically the sails of the system; in their simplest form, they act as barriers to the wind (more modern blade designs go beyond the barrier method). When the wind

forces the blades to move, it has transferred some of its energy to the rotor.

Shaft - The wind-turbine shaft is connected to the center of the rotor. When the rotor spins, the shaft spins as well. In this way, the rotor transfers its mechanical, rotational energy to the shaft, which enters an electrical generator on the other end.

Generator - At its most basic, a generator is a simple device. It uses the properties of electromagnetic induction to produce electrical voltage - a difference in electrical charge. Voltage is essentially electrical pressure - it is the force that moves electricity, or electrical current, from one point to another. So generating voltage is in effect generating current. A simple generator consists of magnets and a conductor. The conductor is typically a coiled wire. Inside the generator, the shaft connects to an assembly of permanent magnets that surrounds the coil of wire. In electromagnetic induction, if you have a conductor surrounded by magnets, and one of those parts is rotating relative to the other, it induces voltage in the conductor. When the rotor spins the shaft, the shaft spins the assembly of magnets, generating voltage in the coil of wire. That voltage drives electrical current (typically alternating current, or AC power) out through power lines for distribution.

Wind Power Working

Imagine air as a fluid. It just seems invisible. But air is a fluid like any other except that its particles are in gas form instead of liquid. And when air moves quickly, in the form of wind, those particles are moving quickly. Motion means kinetic energy, which can be captured, just like the energy in the moving water can be captured by the turbine in a hydroelectric dam. In the case of a wind-electric turbine, the turbine blades are designed to capture the kinetic energy in wind. The rest is nearly identical to a hydroelectric setup: When the turbine blades capture wind energy and start moving, they spin a shaft that leads from the hub of the rotor to a generator. The generator turns that rotational energy into electricity. At its essence, generating electricity from the wind is all about transferring energy from one medium to another.

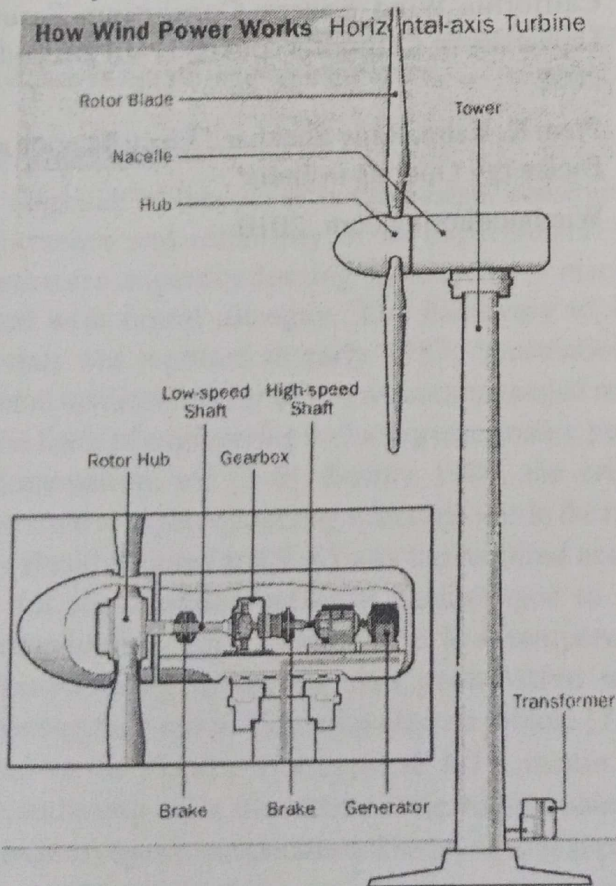


Fig.3 Horizontal Axis Wind Turbine

How Wind Power Works Turbine Aerodynamics

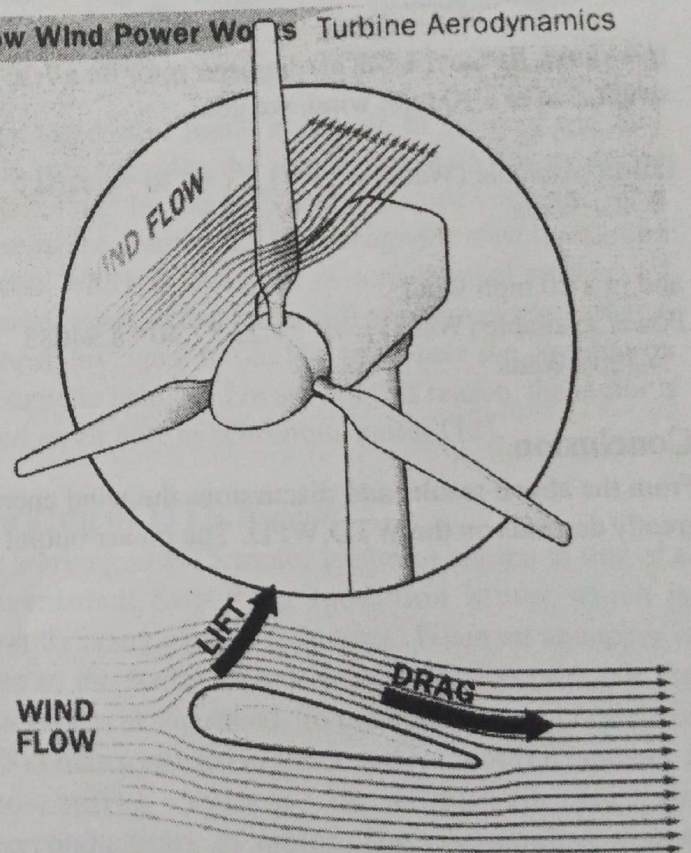


Fig.4 Wind flow and work

Consider a design of 5 feet diameter turbine working in 10 mph wind we will calculate the Power available in wind (in Watts)

Consider air density is 1.23 kg per cubic meter
swept area = $\pi \times r^2 = 1.8241 \text{ m}^2$

5 feet = 1.524 m and wind Speed = 10 mph = 4.4704m/s
 Inserting values in equation (3) we get
 Power available (Watts) = $\frac{1}{2} * 1.23 * 1.8241 * 4.47043$
 = 100.22 Watts

From equation (3) it shows that when the wind speed doubles, the power available increases by a factor of 8. That means there's very little power available in low winds. Increase the wind speed for this 5-foot rotor to 20 mph (8.9408 m/s) and we get:

Power available (Watts) = $\frac{1}{2} * 1.23 * 1.8241 * 8.94083$
 = 802 Watts

The other way to increase the available power in low winds is by sweeping a larger area with the blades and that's the second key concept from this formula. Power available increases by a factor of 4 when the diameter of the blades doubles.

If we use a 10-foot (3.048 m) diameter rotor for a 7.30 m² swept area in a 10 mph wind, we get:

Power available (Watts) = $\frac{1}{2} * 1.23 * 7.30 * 4.47043$
 = 401 Watts

and in a 20 mph wind:

Power available (Watts) = $\frac{1}{2} * 1.23 * 7.30 * 8.94083$
 = 3209 Watts

Conclusion

From the above results and discussions the wind energy greatly depends on the WTD, WPD. The power output of

the overall project can be enhanced by the Topping cycle mode (TCM) of co-generation in which we can use both wind power and solar energy. Wind power is generated by clusters of wind turbines, typically each 100-1500 kW in size, connected into wind farms. Wind power is now the fastest growing energy technology (FGET) in the world.

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HTS MOTORS MILESTONE FOR INDIAN INDUSTRIES

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Abstract:

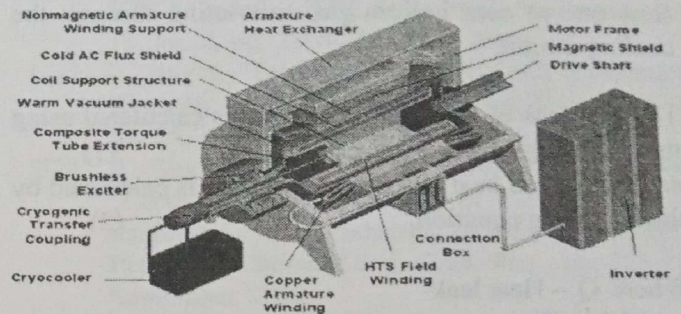
Super Machines are a new class of synchronous rotating machines which are enabled from high temperature superconductor (HTS). Its features are less expensive, lighter, more compact, efficient and stable operation in a power system. They are used in large power applications area such as industrial end - users and electric utilities. The high current density at low electric losses property of HTS is important for mentioned applications. HTS conductor material BSCCO, (Bismuth strontium calcium copper oxide), or Bi-2223 operates at very high temperature. Bi-2223-OPIT (Oxide Powder in Tube) is the advanced method of manufacturing for flexible composite conductor. Average critical current performance above 115A at 77K which is equivalent to a current density of 13.8 had been made in HTS [1]. In this paper a comparison of HTS motor with conventional one and a report on performance and reliability is done.

Key Words: High temperature superconductor, synchronous motor, energy efficiency.

Introduction:

The objective of this paper is the design, construction, performance and reliability of an experimental high temperature superconducting synchronous machine cooled with liquid nitrogen. The discovery of HTS materials was reported in early 1987. Speculation on potential applications for this new science ranged across diverse fields of engineering including electronics, power, instrumentation, etc [2-6]. Before 1986, the critical temperature of superconducting materials was in the range where liquid helium (at 4.2 K) was the required cooling fluid for superconducting coils helium cost to cool superconducting coils using these low-temperature superconducting materials was prohibitive when considering their use in industrial electric motors [7-11]. As shown in Figure 1 a typical HTS motor has superconducting coils mounted on the rotor, cooled by cryogen at cryogenic temperature. The cryogen is supplied to the rotor through a rotating cryogenic transfer coupling. The cold space of the rotor cryostat, an apparatus containing cryogenic environment, is insulated from the ambient by a vacuum space. Torque is transmitted through

the vacuum space via torque tube extensions that connect the cold space to the motor shaft. The stator winding is a copper winding supported by a nonmagnetic and non conductive core.



A laminated steel frame is outside of the core and flux shield that provides the return flux path for magnetic fields created by the HTS and armature windings. This frame can be constructed from magnetic steel lamination material which is also used in conventional motors. All materials inside of this frame will be nonmagnetic (relative permeability equal to one) so as to ease the distribution of magnetic field, as if in air. For this reason, the motor is called an air core synchronous motor [12].

Working of HTS Motor

The working of HTS motor is almost similar to that of a conventional Slip Ring Induction Motor which is currently being used in industries. When an ac supply is given to the starter of motor by induction principle the rotor rotates at slip speed. To maintain the temperature of HTS conductors used in stator and rotor of HTS motors, a cryo-cooling system is employed for the superconductivity of motor. The cryo-cooling system circulates the liquid helium to dissipate heat transfer [13-17]. Large synchronous motors with HTS field windings will be more efficient than conventional motors. To illustrate this point, parametric-

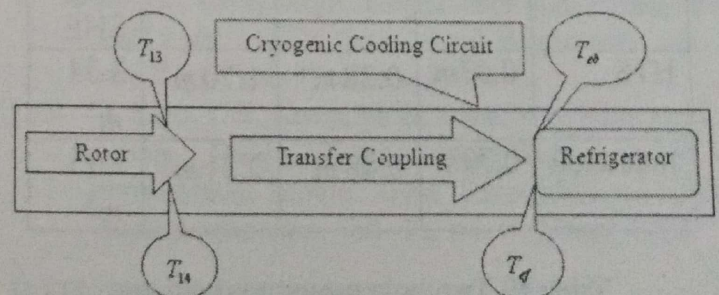


Figure 2: Cryogenic Temperature Sensor Locations

design studies were conducted. The full-load loss of the HTS motor is 44% less than the full load loss of the high-efficiency induction motor. HTS motor has only 39% active volume of the induction motor. As if there is less material in the HTS machine, these losses are reduced [7-9]. In order to characterize the thermal performance of the rotor cryostat, two pairs of cryogenic temperature sensors are mounted at strategic locations as shown in Figure 2. Losses at cryogenic temperature are commonly referred to heat leak, are attributed to the refrigeration load. Heat leak calculations are based on temperature readings from the cryogenic temperature sensors in proportion to mass flow rate of cold helium gas circulating through the cooling circuit.

The heat leak of the rotor cryostat is calculated using the following equation, (1)

and the overall heat leak into the system is calculated by the following equation, (2)

Where Q – Heat leak

m – Mass flow rate of cold helium

T_{in} – Temperature sensors on inlet and outlet of the cooling circuit of rotor cryostat.

T_{ref} – Temperature sensors on inlet and outlet of the refrigerator [12]

Comparison

The most influential parameters to accomplishing a high performance product are the phase content of the precursor powder, the deformation parameters of the composite during the cold working process, and the heat treatment parameters (time, atmosphere, temperature). The final base product provides specifications as summarized in Table I and Table II.

Motor	Full Load Efficiency	Active Length	Rotor OD
HTS	98.5%	0.41m	0.26m
Induction	96.6%	0.99m	0.45m

Table I: Two pole motor comparison

Motor	Stator Core OD	Active Volume	Vol. without SHE	Vol. including SHE
HTS	0.67m	0.28 m ³	1.70 m ³	3.34 m ³
Induction	0.79m	0.48 m ³	2.21 m ³	7.95 m ³

Table II: Two pole motor comparison

Where SHE – Stator Heat Exchangers

For an ideal superconductor, the longitudinal electric field generated by the flow of current follows a power law

$$E(J) = E_c \cdot \left(\frac{J}{J_c}\right)^n \quad (3)$$

Where J_c denotes the critical current at which the longitudinal field, E , reaches the value of E_c . The parameter n is commonly $n = 10-6$ V/cm. The index value, n , is usually determined as the slope in the log E versus log J plot. This definition is certainly useful to mark progress with compare conductors of different sections, but it can also be misleading, especially for large liquid cooled systems. Operation of the conductor at J_c would lead to often unacceptably large volumetric dissipation rates. In these applications the wire manufacturers seek to guide its products below J_c at which localized damage to the superconductor becomes apparent. Considering localized defects such as filaments breaks, (3) needs to be expanded to incorporate an ohmic component

$$E(J) = E_c \cdot \left(\frac{J}{J_c}\right)^n + \rho \cdot J$$

which manifests itself as a deviation from the straight line behavior in the double logarithmic plot (11A13).

Benefits of HTS motor

There are numerous numbers of benefits of HTS motors, a few are listed below:

1. The HTS field Winding produces higher magnetic fields than the conventional machines (a high power density) resulting in smaller size and weight.
2. The HTS motor has higher efficiency at part load (Down to 5% of full load) that results in saving a fuel use and operating cost. The advantage in efficiency can be over 10% at low speed.
3. The HTS motor has lower sound emission than the conventional machines.
4. The HTS air-core motors are characterized by a low synchronous reactance which results in operation at very small load angles. Operating at a small load, the angle provides greater stiffness during the transient and hunting oscillation.
5. The HTS motors tolerate power grids with high harmonics content.
6. The HTS motors, compared to conventional motors, will not require the common method of rewinding or re-insulation.

Conclusion

High-temperature superconductors can be used in large industrial motors to reduce motor losses by over a factor of two and reduce overall motor weight and volume. A two-pole motor comparison showed loss reduction of more than 55% and active volume reduction of more than 40% as compared to an energy-efficient induction motor of the same rating. Benefits due to the adjustable-speed nature of superconducting motor systems can result in a reduction of operating costs and wear and tear of pump and fan systems. The successful design, fabrication and operation of two Super Motors prove that the key technologies essential for the commercial introduction of HTS motors and generators are high performance, sufficiently robust, and affordable. HTS Super Machines will be more compact, lighter, and more efficient than the conventional machines. Their small size and weight will translate to lower cost. Continued progress is needed in HTS development for successful utilization of this technology in rotating machinery in the coming future.

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COMPARATIVE STUDY OF WEB PERSONALIZATION TECHNIQUES

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ABSTRACT

The purpose of this paper is to explore the various basic and some newly proposed web personalization technique currently being used. As the field of web personalization is flooded with various techniques and software tools, it becomes necessary to explore all the available techniques and software tools. Though, it is hard to find and compare all the techniques and tools, because the research field is so dynamic that new techniques are recommended rapidly.

INTRODUCTION

Basically the Web Personalization process is followed under the following four basic techniques. They are:

1. The handicraft decision technique
2. Hyperlink-based technique
3. Content-based filtering
4. Collaborative filtering

The handicraft decision technique means that website managers establish decision rules according to the statistics of users or session history. To take advantage of these rules, the contents and web structures to particular sorts of users. This kind of system functions easily, but its efficiency is low and it is difficult to renew in a timely fashion.

The hyperlink-based technique generally uses an algorithm related to diagram theory to discover the most representative elements provided by the user input or information request. Search engines mostly use this technique. The famous Google search engine is one notable example.

Content-based filtering examines the relationship between resources and users. It takes advantage of the similarity of information and users' interests to filter information. The weakness of the approach is that it is difficult to discern the quality and form of the information sought in current user sessions and it can only recommend information similar to the user's previously identified interests, rather than advising on newly identified resource needs arising from concurrent sessions. Content-based

filtering establishes user profiles according to each user are visiting history and content searches and then classifies website content on this basis. When a user visits the website and seeks resources that match the established profile, the related information is retrieved.

Collaborative filtering compares the relationship between one user and another. It makes use of similarities among users to filter information and provides the similar user with commonly-sought information. Its advantage is that it can discover new information a user may be interested in but is not asking for. However, there are two problems: one is scarcity, since when the system is initiated the lack of system resource evaluations means the system will not easily identify similar users. The other is extensibility. As the system users and resources increase, the performance demands on the system will increase.

Compared to content-based filtering, collaborative filtering is more convenient for analyzing users' behaviors. What is analyzed is the click rate of the web page or the content in the web page, not the web page content, itself. Click rates could represent user favorites. It is generally thought that for similar web page content, users with similar click rates will exhibit similar visiting habits and usage patterns. Hence, systems can sort users based on the click rate of the web page content

Content-based filtering (also content-based prediction) was the first attempt at using AI for achieving personalization in a more intelligent manner. Consider a person reading online sport news. What we would like is a system that observed what sport news the user has read - and, more importantly, has not read - and learns to present the user with new articles the user will want to read. Although there is clearly systematization in the user's actions, here the patterns require deeper analysis. Rather than mimicking user actions taken in the past, a system that effectively personalizes itself to a user's sport news interests must look inside the news to understand how to distinguish those news that interest the user from those that do not. Systems that personalize in such a fashion are often said to be "content-based," in that they base their predictions on the contents of the artifact about which they are concerned.



Content-based filtering originates from information retrieval and case-based reasoning research (Hammond et al, 1996). The success of the content-based method relies on an ability to accurately represent recommendable items in terms of a suitable set of content features, and to represent user profile information in terms of a similar feature set. The relevance of a given content item to a specific target user is proportional to the similarity of this item to the user's profile; content-based filtering methods select content items that have a high degree of similarity to the user's profile. A major drawback of the above-mentioned technique is that the content description requirement can be problematic and time consuming. Additionally, content-based techniques also suffer from a number of shortcomings in the way they select items for recommendation. Limited set of items representing user profiles, especially immature new user profiles, will result into future recommendations to display limited diversity.

In summary, content-based approaches typically offer us a means for describing items of user interest and a means for comparing item descriptions to locate close matches. However, when using these approaches, we also usually find ourselves considering the preferences of a single user. This is in contrast to our expectations, that we should be able to exploit such additional information in learning to predict a user's interests (Hirsh et al, 2000).

A recent alternative to content-based strategies is collaborative filtering techniques (Balabanovic & Shoham, 1997) (Coldberg et al, 1992) (Maltz & Ehrlich, 1995). This allows users to take advantage of other users' behavioural activities based on a measure of similarity between them. These techniques require users to divulge some personal information on their interests, likes and dislikes, information that many Web users would not necessarily wish to divulge (Mulvenna et al, 2000). Consider how you decide whether to read a particular book. Sometimes our decisions are based on publishers reviews, but often we are triggered by "word-of-mouth", based our decisions on feedback from others whose opinions we value and share. This is the basic idea underlying the collaborative filtering method. According to (Smyth & Cotter, 2000), the basic idea is to move beyond the experience of an individual user profile; instead, to draw on the experiences of a population or community of users. Typically, each target user is associated with a set of nearest-neighbor users by comparing the profile information provided by the target user to the profiles of other users. Collaborative filtering techniques look for correlations between users in terms of their ratings assigned to items in a user profile. The nearest-neighbor users are those that display the strongest

correlation to the target user. These users then act as "recommendation partners" for the target user, and items that occur in their profiles (but not in the target user profile) can be recommended to the target user. In this way, items are recommended on the basis of user similarity rather than item similarity. "In summary, collaborative filtering compares ratings of a present user's interests and decisions with those of past users to offer content relative to the present user's interests. Music and book sites often use collaborative filtering to make recommendations to their customers" (Deitel, 2001).

Finally, another alternative is observational personalization, which attempts to circumvent the need for users to divulge any personal information. The underlying assumption in this approach is that within records of a user's previous navigation behavior there are hidden clues to how services, products, and information need to be personalized for enhanced Web interaction. According to (Mulvenna et al, 2000), there are three principal components to observational personalization: analytics, representation, and deployment. Web mining provides the tools to analyze Web log data in a user-centric manner such as segmentation, profiling, and clickstream discovery. The knowledge mined by using these tools is increasingly being represented using W3C standards such as XML and the deployment of the knowledge on Web servers may be carried out through personalization or recommender systems.

In general, personalization techniques can be analyzed in Offline and Online. Offline personalization is based on simple user profiling and manual decision rule systems. Manual decision rule systems, allow Web site administrators/marketers to specify business rules based on user demographics or static profiles, collected through a registration process or session history. "Rules-based personalization is the delivery of personalized content based on the subjection of a user's profile to set rules or assumptions" (Deitel, 2001). The rules are used to affect the content served to a particular user, based on relationship analysis. Online personalization demands advanced real-time adaptive user profiles in order to identify and observe the customer, define the objectives, identify the value and provide the personalized content. A slightly different description, hierarchy and categorization of personalization techniques are presented by a report from Gartner Group (Gartner Group, 2000). More specifically the personalization techniques according to Gartner Group are:

- ❖ Relationship Analysis: Analyses of previous interactions with the customer based on online and offline purchases.
- ❖ Contextual Inference: Analysis of the content being viewed and then displaying related content.
- ❖ Click stream Analysis: Collects data about what the visitor is viewing and then displays related content.
- ❖ Profiling (Content-based filtering): Collects explicit preference data from visitor and then matches the resulting profile to predefined content.
- ❖ Preference Matching (Collaborative filtering): Explicit collection of preferences that are then matched to other people's preferences.

Looking critically at the advantages and disadvantages of the personalization techniques mentioned above, the following can be identified.

Collaborative filtering has a number of advantages over content-based methods.

- ❖ Firstly, since explicit content representations are not needed, the knowledge engineering problem associated with content-based methods is mitigated.
- ❖ Secondly and more importantly, perhaps, the quality of collaborative filtering typically increases with the size of the user population, and collaborative recommendations benefit from improved diversity when compared to content-based recommendations.

However collaborative filtering does suffer from a number of significant downsides.

- ❖ Firstly, it is not suitable for recommending new items or one-off content items because these techniques can only recommend items already rated by other users. If a new or one-off item is added to the content database, there can be a significant delay before this item will be considered for recommendation. It is only until many users have seen and rated an item, that this item will find its way into enough user profiles to become available for recommendation. This so-called "latency problem" is a serious limitation that often renders a pure collaborative recommendation strategy inappropriate for a given application domain.
- ❖ Secondly, collaborative recommendation can also prove unsatisfactory in dealing with what might be termed an "unusual user."

In short, there is no guarantee a set of recommendation partners will be available for a given target user, especially if there is insufficient overlap between the target profile and other profiles. If a target profile contains only a small number of ratings or contains ratings for a set of items that nobody else has reviewed, it may not be possible to make a reliable recommendation using the collaborative technique.

So if content-based methods exploit one kind of information (about the contents of each item the user accesses) and collaborative methods exploit a second kind of information (about what others thought of each item), then combining both sources of information should do even better? Hirsh argues positively (Hirsh et al, 2000), but how to do so is not immediately clear. Content-based methods don't provide obvious ways to exploit information about other users, and collaborative methods don't provide obvious ways to exploit information about the contents of the items under consideration. Both content-based and collaborative personalization methods suffer from a number of significant disadvantages. However, taken together, both techniques complement each other perfectly. For example, content based filtering can solve the latency problems associated with collaborative filtering. Furthermore, introducing a collaborative component solves the diversity problem associated with content-based methods.

Content-based methods build models that link information about the contents of items a user manipulates to the user's preferences concerning those items. Collaborative filtering methods build models that link information about other users' preferences to those of a given user. By integrating both content-based and collaborative filtering strategies, a personalization engine could provide a unique and powerful personalization solution.

-Personalization Recommender System (Jong-Hwan Seo, Kun-Pyo Lee)

A recommender system is basically a system that can learn about a user's personal preference based on the user's characteristics and behaviors and can then provides the most appropriate content to meet the user's needs.

Recommender systems have been applied to various websites and recognized to be useful in recent years. For instance, Netflix.com, a DVD rental site in the United States, developed their recommender system, called

Cinematch, which is a service that suggests DVD titles a user, may like to rent based on the user's own tastes and the tastes of past users. Netflix.com has become the world's largest DVD rental site due to its personalization service using Cinematch.

A recommender system consists of three elements: First, various recommendation content which is presented to users has to be made. Then, users' preferences or behavioral data on these contents must be gathered. Finally, it needs to choose type of recommendation technique about how to analyze these user data and select the optimal content to each user [8].

The proposed (Jong-Hwan Seo, Kun-Pyo Lee) recommender system is based on collecting explicit user preference data by means of user's direct participations such as user ratings; however, implicit user preference data obtained by analyzing a user's usage and behavior should be mixed with explicit user data to build a more sensitive and effective recommender system and support lifecycle personalization. Therefore, our future work in this area is to include the implicit user preference data in our recommender system.

CONCLUSION:

All the aforementioned techniques have their respective advantages and disadvantages. They can be applied to various different aspects of web personalization, but this should be done after analyzing the requirements of personalization of a particular business type or purpose of a particular website.

Further work in this direction is required to be done to make distinction between the available techniques and tools, so that one is able to choose a web personalization technique that suits the requirements.

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EMPLOYEE ENGAGEMENT - NEED OF HOUR

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Abstract

Employees' actions and reactions are based upon their perceptions. Most organizations that do not regularly quantify their employees' feelings and concerns essentially make managerial decisions based upon anecdotal or grapevine information. It is imperative that an organization make decisions based upon data, not hearsay. Investigating the satisfaction and engagement levels at an organization can lead to a more productive workforce with low attrition rate. Employee engagement, also called work engagement or worker engagement, is a business management concept. An "engaged employee" is one who is fully involved in, and enthusiastic about, his or her work, and thus will act in a way that furthers their organization's interests. This paper examines the concept of employee engagement, need of employee engagement, strategies leading to employee engagement, employee engagement activities, measuring employee engagement and increasing employee engagement.

Keywords: Employee Engagement, Engaged Employee, Not-Engaged Employee, Actively Disengaged Employee, Employee Engagement Strategies.

Introduction

Engagement at work was conceptualized by Kahn, (1990) as the 'harnessing of organizational members' selves to their work roles. In engagement, people employ and express themselves physically, cognitively, and emotionally during role performances. Employee engagement is the thus the level of commitment and involvement an employee has towards their organization and its values. An engaged employee is aware of business context, and works with colleagues to improve performance within the job for the benefit of the organization. The organization must work to develop and nurture engagement, which requires a two-way relationship between employer and employee.'

Employee engagement, also called work engagement or worker engagement, is a business management concept. An "engaged employee" is one who is fully involved in, and enthusiastic about, his or her work, and thus will act in a way that furthers their organization's interests. Engagement is most closely associated with the existing construction of job involvement. Job involvement is defined as 'the degree to which the job situation is central

to the person and his or her identity. Job involvement is thought to depend on both need saliency and the potential of a job to satisfy these needs. Thus job involvement results form a cognitive judgment about the needs satisfying abilities of the job. Engagement differs from job involvement as it is concerned more with how the individual employees his/her self during the performance of his / her job. Furthermore engagement entails the active use of emotions. Finally engagement may be thought of as an antecedent to job involvement in that individuals who experience deep engagement in their roles should come to identify with their jobs. When Kahn talked about employee engagement he has given important to all three aspects physically, cognitively and emotionally. Whereas in job satisfaction importance has been given more to cognitive side.

HR practitioners believe that the engagement challenge has a lot to do with how employee feels about the work experience and how he or she is treated in the organization. It has a lot to do with emotions which are fundamentally related to drive bottom line success in a company. There will always be people who never give their best efforts no matter how hard HR and line managers try to engage them. "But for the most part employees want to commit to companies because doing so satisfies a powerful and a basic need in connection with and contribute to something significant".

Need of Employee Engagement

Engagement is important for managers to cultivate given that disengagement or alienation is central to the problem of workers' lack of commitment and motivation. Meaningless work is often associated with apathy and detachment from ones works (Thomas and Velthouse). In such conditions, individuals are thought to be estranged from their selves (Seeman, 1972). Other Research using a different resource of engagement (involvement and enthusiasm) has linked it to such variables as employee turnover, customer satisfaction - loyalty, safety and to a lesser degree, productivity and profitability criteria (Harter, Schmidt & Hayes, 2002).

An organization's capacity to manage employee engagement is closely related to its ability to achieve high

performance levels and superior business results. Some of the advantages of Engaged employees are:

- Engaged employees will stay with the company, be an advocate of the company and its products and services, and contribute to bottom line business success.
- They will normally perform better and are more motivated.
- There is a significant link between employee engagement and profitability.
- They form an emotional connection with the company. This impacts their attitude towards the company's clients, and thereby improves customer satisfaction and service levels..
- An engaged employee will also try to motivate disengaged employees ultimately increasing the profitability.
- An engaged employee will create feeling of passion, creativity and enthusiasm amongst other employees.
- Creates a sense of loyalty in a competitive environment
- Provides a high-energy working environment
- Boosts business growth
- An engaged employee will try to take the business to new heights of success.
- Makes the employees effective brand ambassadors for the company

A highly engaged employee will consistently deliver beyond expectations. In the workplace research on employee engagement (Harter, Schmidt & Hayes, 2002) have repeatedly asked employees 'whether they have the opportunity to do what they do best everyday'. While one in five employees strongly agree with this statement. Those work units scoring higher on this perception have substantially higher performance. Thus employee engagement is critical to any organization that seeks to retain valued employees.

Categories of Employees

According to the Gallup, the Consulting organization, there are three different types of Employees in an organization:

Engaged--"Engaged" employees are builders. They want to know the desired expectations for their role so they can meet and exceed them. They're naturally curious about their company and their place in it. They perform at consistently high levels. They want to use their talents and strengths at work every day. They work with passion

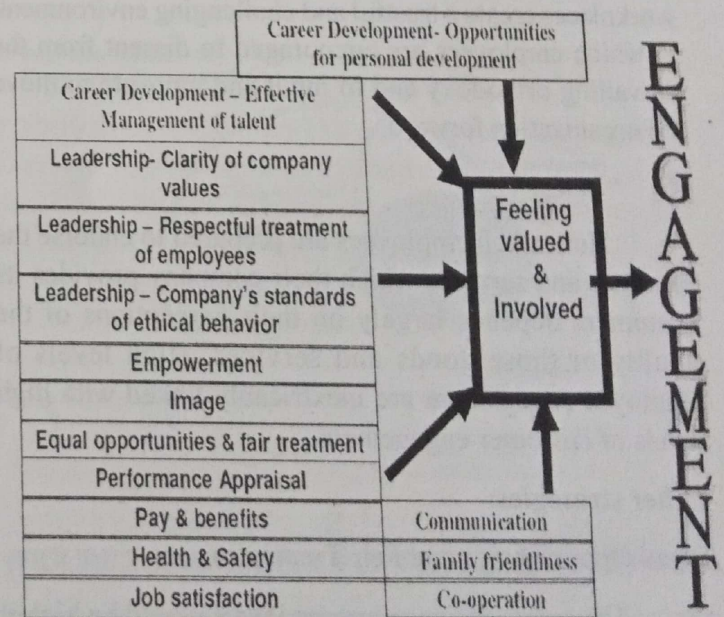
and they drive innovation and move their organization forward.

Not Engaged--"Not-engaged" employees tend to concentrate on tasks rather than the goals and outcomes they are expected to accomplish. They want to be told what to do just so they can do it and say they have finished. They focus on accomplishing tasks vs. achieving an outcome. Employees who are not-engaged tend to feel their contributions are being overlooked, and their potential is not being tapped. They often feel this way because they don't have productive relationships with their managers or with their coworkers.

Actively Disengaged--The "actively disengaged" employees are the "cave dwellers." They're "Consistently against Virtually Everything." They're not just unhappy at work; they're busy acting out their unhappiness. They sow seeds of negativity at every opportunity. Every day, actively disengaged workers undermine what their engaged coworkers accomplish. As workers increasingly rely on each other to generate products and services, the problems and tensions that are fostered by actively disengaged workers can cause great damage to an organization's functioning.

Strategies Leading to Employee Engagement

Studies have shown that there are some critical factors which lead to Employee Engagement. Some of them identified are



(Fig 1: Critical Factors which lead to employee engagement)

(A) Career Development- Opportunities for Personal Development

Organizations with high levels of engagement provide employees with opportunities to develop their abilities, learn new skills, acquire new knowledge and realize their potential. When companies plan for the career paths of their employees and invest in them in this way their people invest in them.

(B) Career Development - Effective Management of Talent

Career development influences engagement for employees and retaining the most talented employees and providing opportunities for personal development.

(C) Leadership- Clarity of Company Values

Employees need to feel that the core values for which their companies stand are unambiguous and clear.

(D) Leadership - Respectful Treatment of Employees

Successful organizations show respect for each employee's qualities and contribution- regardless of their job level.

(E) Leadership - Company's Standards of Ethical Behavior

A company's ethical standards also lead to engagement of an individual.

(F) Empowerment

Employees want to be involved in decisions that affect their work. The leaders of high engagement workplaces create a trustful and challenging environment, in which employees are encouraged to dissent from the prevailing orthodoxy and to input and innovate to move the organization forward.

(G) Image

How much employees are prepared to endorse the products and services which their company provides its customers depends largely on their perceptions of the quality of those goods and services. High levels of employee engagement are inextricably linked with high levels of customer engagement.

Other strategies:

Equal Opportunities and Fair Treatment

The employee engagement levels would be high if their bosses (superiors) provide equal opportunities for growth and advancement to all the employees.

Performance appraisal

Fair evaluation of an employee's performance is an important criterion for determining the level of employee

engagement. The company which follows an appropriate performance appraisal technique (which is transparent and not biased) will have high levels of employee engagement.

Pay and Benefits

The company should have a proper pay system so that the employees are motivated to work in the organization. In order to boost his engagement levels the employees should also be provided with certain benefits and compensations.

Health and Safety

Research indicates that the engagement levels are low if the employee does not feel secure while working. Therefore every organization should adopt appropriate methods and systems for the health and safety of their employees.

Job Satisfaction

Only a satisfied employee can become an engaged employee. Therefore it is very essential for an organization to see to it that the job given to the employee matches his

Career goals which will make him enjoy his work and he would ultimately be satisfied with his job.

Communication

The company should follow the open door policy. There should be both upward and downward communication with the use of appropriate communication channels

How to Measure Employee Engagement

Researches consistently confirms that engaged work places compared with least engaged are much more likely to have lower employee turnover, higher than average customer loyalty, above average productivity and earnings. These are all good things that prove that engaging and involving employees make good business sense and building shareholder value. Negative workplace relationships may be a big part of why so many employees are not engaged with their jobs.

Step I: Listen

The employer must listen to his employees and remember that this is a continuous process. The information employee's supply will provide direction. This is the only way to identify their specific concerns. When leaders listen, employees respond by becoming more engaged. This results in increased productivity and employee retention. Engaged employees are much more likely to be satisfied in their positions, remain with the company, be

promoted, and strive for higher levels of performance.

Step II: Measure current level of employee engagement

Employee engagement needs to be measured at regular intervals in order to track its contribution to the success of the organization. But measuring the engagement (feedback through surveys) without planning how to handle the result can lead employees to disengage. It is therefore not enough to feel the pulse-the action plan is just as essential.

Knowing the Degree in which Employees Are Engaged?

Employee engagement satisfaction surveys determine the current level of employee engagement. A well-administered satisfaction survey will let us know at what level of engagement the employees are operating. Customizable employee surveys will provide with a starting point towards the efforts to optimize employee engagement. The key to successful employee satisfaction surveys is to pay close attention to the feedback from the staff. It is important that employee engagement is not viewed as a onetime action. Employee engagement should be a continuous process of measuring, analyzing, defining and implementing.

Step III : Identify the problem areas

Identify the problem areas to see which are the exact areas, which lead to disengaged employees.

Step IV: Taking action to improve employee engagement by acting upon the Problem areas

Nothing is more discouraging to employees than to be asked for their feedback and see no movement toward resolution of their issues. Even the smallest actions taken to address concerns will let the staff know how their input is valued. Feeling valued will

Boost morale, motivate and encourage future input. Taking action starts with listening to employee feedback and a definitive action plan will need to be put in place finally Understanding Employee Engagement

(JRA MODEL OF EMPLOYEE ENGAGEMENT)

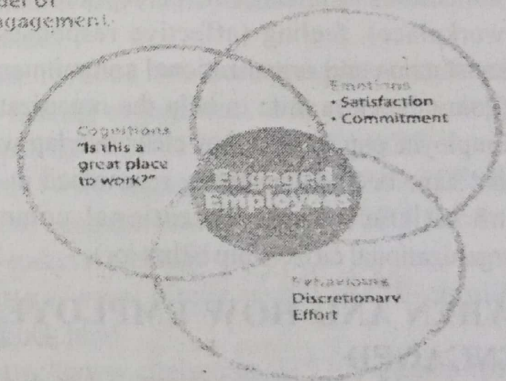
The pursuit of greater employee engagement has been firmly placed on the agenda of an ever growing number of organizations. Why? Because an engaged workforce is without doubt a crucial source of competitive advantage in a business environment characterized by an increasingly limited labor supply and an increasingly competitive labor market.

'Engaged' employees are the ones displaying enthusiasm, indeed real passion about their job and for the organization

that employs them. Such people really do enjoy their work and always seem willing to give their all in helping their organization succeed. Part of this enthusiasm stems from having a higher sense of connectedness with the organization, and another part comes from the positive experiences that emerge from an organization that knows how to create a workplace that is both fulfilling and enjoyable for its people. No surprise therefore that 'employee engagement' has emerged as an important indicator of how employees feel about their workplace.

JRA (John Robertson & Associates) uses a three-component model of engagement to describe the active use of cognitions, emotions, and behaviors that together form the basis of the 'engaged' employee. Cognitively, employees actively appraise their work environments, and it is through this interpretive sense-making process that they develop their judgment on what the organization is like to work for. More positive appraisals of important workplace features like leadership, communication, job design, and supervision contribute to a favorable summary belief that they work for a great organization. When employees actively perceive their organization in a favorable manner they are then more likely to respond with feelings of greater job satisfaction and emotional attachment to the organization. When employees display cognitive and emotional engagement to the organization, they are far more likely to engage in discretionary behaviors - 'going the extra mile' to ensure they and others do all they can to help organization reach its objectives.

The JRA Model of Employee Engagement.



(FIGURE 2: JRA MODEL OF EMPLOYEE ENGAGEMENT)

THREE COMPONENTS OF EMPLOYEE ENGAGEMENT:

The first component of the JRA model of employee engagement refers to the cognitions that underpin employees' rational sense-making in the workplace. Employees actively perceive their work environment and

it is through this interpretive sense-making process that employees develop an appraisal of what their organization is like to work in. More positive appraisals of important workplace features like leadership, communication, job design, supervision, and support contribute to more a favorable summary belief that they work for a great organization.

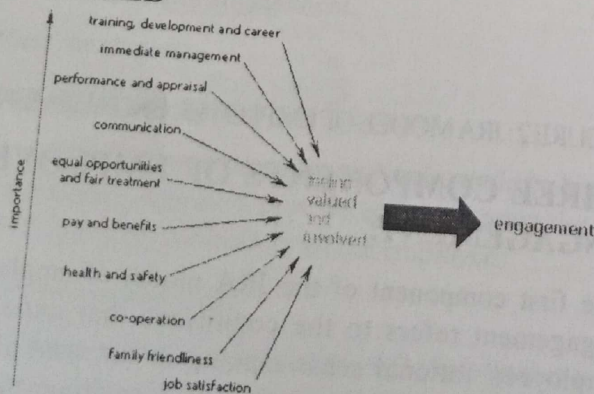
It is this summary belief or underlying cognition that affects peoples' attitudinal responses to the organization, or the second component of the JRA model of employee engagement.

The second component of the JRA model of employee engagement refers to the emotions employees feel in response to their perceptions of the workplace. When employees actively perceive their organization in a favorable manner (e.g., the organization has good communication processes, positive leadership, provides rewarding jobs, etc.) then they respond affectively with greater job satisfaction and emotional attachment (commitment) to the organization.

The third component of the JRA model of the employee engagement refers to the behaviors that employees display when cognitively and emotionally engaged with the organization. The behavioral action that JRA considers most important to an engaged employee is their discretionary work effort, or willingness to go beyond simple contractual requirements in order to help the organization reach its objectives.

employee engagement reflects three overlapping dimensions - thinking (the perception that this is a great workplace), feeling (affective responses such as job satisfaction and organizational commitment), and acting (going the extra mile to help the organization succeed). Employee engagement has clear overlap with constructs that have been exhaustively researched in the past (i.e., job satisfaction, organizational commitment and organizational citizenship behavior).

WHEN AND HOW EMPLOYEES FEEL ENGAGED



(Figure 3: IES Engagement Model)

The IES engagement model illustrates the strong link between feeling valued and involved and engagement.

Employee Engagement Activities

Training and development:

- Employee counselling services
- Team building activities
- Leadership development activities
- Provide opportunities for people to develop their potential
- Keep the pressure to perform and achieve more with less realistic
- Training Session
- Excellence in execution along with consequence management.
- Quality assurance committee
- Mentoring process
- Cross functional teams for business development/ improvement processes
- Train people how to resolve interpersonal conflicts
- Be flexible; help people to actively balance work and home responsibilities

Immediate Management:

- Appointment of emergency management team

Performance & Appraisals:

- Give real recognition and/or reward
- Employee of the month or Annual awards
- Promote & recognize team performance
- Evolve an employee friendly & business focused policies
- Monthly staff awards
- Annual staff awards
- Provide long-term strategic vision for business growth

Communication:

- Provide feedback and guidance.
- Make real time to discuss problems.
- Seek ideas and input from everyone.
- A weekly or monthly column should be written by CEO/GM, on the intranet with company announcements, programs etc.
- Employee suggestion systems / quick responses.
- Replay on the intranet about the CEO's/GM's press conference.
- Live version of internal house magazine.
- Provide opportunities for social interaction.

- CEO/GM should spend time in face-to-face communication with staff.
- Daily Co-ordination Meeting with Head Of the departments.
- CEO/GM based FAQ questions on company business.
- ONLINE "asks the CEO/GM" mailbox.
- Weekly blog related to serious business issues and staff to read / comments. Appointment of disaster management team.
- Problem solving committee.
- Online real-time tracking of progress. Employees can view company progress towards targets / goals.

Family Friendliness:

- Promote joy and appropriate humor within the office.
- Employees and Their Families - Family Day
- Treating employees as a member of the company by giving a day off on their Birthday and anniversaries
- Provide play and Meditation courts for the employees to combat the work stress.
- Employees Kids participating in Painting Competition.
- Festival Celebration.
- Create a culture of fun & spark at work
- Joy at work place(campaigns like creative posters, jam sessions etc)

Job Satisfaction:

- Provide the resources to solve problems or to do a job well.

Increasing Employee Engagement

Provide variety: Tedious, repetitive tasks can cause burn out and boredom over time. If the job requires repetitive tasks, look for ways to introduce variety by rotating duties, areas of responsibility, delivery of service etc.

Conduct periodic meetings with employees to communicate good news, challenges and easy-to-understand company financial information. Managers and supervisors should be comfortable communicating with their staff, and able to give and receive constructive feedback.

Indulge in employee deployment if he feels he is not on the right job. Provide an open environment.

Communicate openly and clearly about what's expected of employees at every level - your vision, priorities, success measures, etc.

Get to know employees' interests, goals, stressors,

etc. Show an interest in their well-being and do what it takes enable them to feel more fulfilled and better balanced in work and life.

Celebrate individual, team and organizational successes. Catch employees doing something right, and say "Thank you."

Be consistent in your support for engagement initiatives. If you start one and then drop it, your efforts may backfire. There's a strong connection between employees' commitment to an initiative and management's commitment to supporting it.

Conclusion

Thus employee engagement is a barometer that determines the association of a person with the organization. Engagement has clear overlaps with the more exhaustively researched concepts of commitment and organizational citizenship behavior, but there are also differences. In particular, engagement is two-way: organizations must work to engage the employee, who in turn has a choice about the level of engagement to offer the employer. Employee engagement is critical to any organization that seeks to retain valued employees. The Watson Wyatt consulting companies has been proved that there is an intrinsic link between employee engagement, customer loyalty, and profitability. As organizations globalize and become more dependent on technology in a virtual working environment, there is a greater need to connect and engage with employees to provide them with an organizational 'identity'.

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EVALUATION OF WEB PERSONALIZATION TECHNIQUES

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Abstract

There are various personalization techniques and lots of them have been applied to the services provided on the web. In this paper we suggest the proper method of personalizing the web services and a method for evaluation of the same after applying the personalization.

Introduction:

Evaluation of Personalized web services

- There are seven stages to implementing an effective personalization effort. The section that follows covers three of the initial steps: Defining online personalization goals, evaluating personalization approaches, and planning for data collection and management. The core value of online personalization lies at delivering businesses the capability of establishing customer relationship and customer value management lifecycles. It may seem obvious; however, no personalization effort is complete without a mechanism for assessing each initiative's effectiveness and a process by which subsequent efforts can be optimized to achieve higher level of success. Companies must first assess the impact of each initiative - whether that is a sitebased promotion or an e-Mail campaign - and second, they must be diligent in modifying and improving initiatives in an iterative fashion.
- To accomplish this in a more general approach, organizations should follow the steps outlined below - the first few of which are the basis of the initial data collection and management effort:
 - Identify business objectives for which personalization should have a leveraging effect
 - Define personalization goals - some of them could be:
 - Visibility & Readability
 - Make primary links and actions visible and obvious.
 - Design pages for scanning, using highlighted text, bulleted lists, and short sentences.
 - Simplicity
 - Keep frequent or critical tasks short and simple.
- Terminology should be based on the user's language. Remember, less is more.
- Performance
 - Design pages to download quickly, for more than half of the user population till accesses the internet at 33.6kb or lower.
- Navigation & Organization
 - Provide clear methods of continuing, canceling or going back, and going home on every page. Provide effective page titling to keep the user informed of location.
 - Organize pages so that related information is grouped together and easily accessed.
- Consistency
 - Similar tasks should be performed similarly. Reduce the need for users to learn multiple behaviors and navigation paths.
- Feedback
 - When there is a problem, a message should tell the user exactly what's wrong and how to fix it in language they understand.
- Tolerance
 - Provide forgiving systems that minimize the cost of user mistakes and allow users to undo their actions.
- Determine the metrics the organization is looking to apply (e.g., customer profit per ad campaign)
- Identify the data the organization needs to determine the data required for the evaluation process (e.g., number of customers, sales volume, gross margin, ad campaign cost, operating overhead, click through rates, conversion rates)
- Develop a solution which is appropriate for the specific personalization goals to analyze the data (e.g., NetGenesis, OLAP tools)
- Identify the location of that data (e.g., Web logs, application logs, event logs)
- Deploy the solution to target the right customer segment
- Produce metrics reports, and.
- Automatically feed the metric results back to the personalization goals and techniques used.

STEPS OF BUILDING A PERSONALIZATION INITIATIVE

In more detail the steps of building a personalization initiative include:

■ PLAN

- **Defining Personalization Goals:** Before an organization begins to plan their approach to personalization, they must first define they are setting out to accomplish, because the organization cannot measure what they cannot define. Personalization initiatives must begin with an understanding of what personalization means to the organization. The type of business they are in, the customers they sell to and even the products they bring to market will all impact the ways in which they will use personalization and the benefits they seek to gain from it. Personalization initiatives should be tied to discrete business goals.
- **Choosing Personalization Approaches:** After determining the scope and magnitude of the effort, organizations must then match the ends with the means. Having set the benchmarks related to specific desired outcomes, companies must then assess which approach or combination of approaches to personalization will best suit their needs. Earlier in this section we have presented a critical extensive description of various distinct personalization approaches as well as a framework for building online consumer relationships using personalization techniques.
- **Planning for Data Collection and Management:** It is a way to deliver to the organizations customers' information, incentives and sales opportunities that are timely and pertinent. In order to do this well, it is necessary to understand who the organizations customers are, what they one of their channels.

■ DO

- **Data Sources for Online Personalization Efforts:** The primary means for data collection to support the online effort are research, site behavior and usage, marketing campaigns and enterprise data. Through research, both primary and secondary, companies can gain information that will assist them in building the foundation for initial customer management and messaging strategies. Secondary research is often considered a good starting point.
- **Customer Profiles:** The product of these

combined efforts will be information about the organizations' customers that can be used to establish customer profiles - centralized sources of information about each customer. Profiles are the collection of attributes that characterize the explicit, implicit, demographic and psychographic elements of each customer's interaction with the organization. These profiles are the product of the entire data collection and management effort and will be the foundation of their personalization strategies.

- **Data Management:** Significant energy will need to be dedicated to determining the best strategies for storing the information that organizations collect. The information that will be relied upon most for generating reports and driving personalization should be stored in such a way that it remains easily accessible. Less frequently used data can be stored elsewhere.
- **CHECK:** Through this evaluation phase, organizations will be able to compare each initiative's results with the business objectives initially sought and, hopefully, collect the metrics' results to feed the personalization techniques for optimization.
- **ACT:** As a result, companies must continue to optimize campaigns, sites and business initiatives over time, always making improvements based on proven success records and the information provided by ongoing data collection and analysis.

Looking at the evaluation of personalized web services through a more e-business perspective the criteria for measuring success and feedback differ. How can we measure success in the design and evolution of personalized interactive services for e-business?

The ability to design, implement, and maintain user interfaces and user navigation in personalized interactive services requires defining meaningful metrics and feedback techniques.

In order to enhance the evaluation methodology of e-business personalized web sites we need to utilize e-business intelligence. E-business intelligence is the analysis and use of information collected about visitors to an e-business Web site.

According to Schonberg (Schonberg et al., 2000) good business practice dictates the use of effectiveness measurements to guide the design of all Web site features.

For Web sites with personalized interactive content,

the process must take the highly dynamic nature of the content into account and the outline of a complete process for a design-measure-analyze feedback cycle.

In order to measure and evaluate the successful provision of personalized e-services to the end customer we need to understand what success means. Success of an e-business site usually resides to the answers on a set of questions such as:

What types of visitors does an e-business want to attract, what messages need to be conveyed, what should the visitor be able to accomplish, and what does the e-business want the visitor to do? The metrics required to evaluate success follow directly from the goals.

Particularly, measuring the success of personalization initiatives can now expand the simple customer acquisition metrics that dominated the 1990s. Focus is now on correlating campaign/promotion metrics, such as acquisition and conversion rates, to the primary goal of each initiative (e.g., actual or ongoing sales, registration, data collection, in-store traffic, etc.). In the same manner that the strength of online personalization efforts can be bolstered through the use of enterprise data, their impact can now be better understood, determined and justified by evaluating them, in part, with traditional business metrics (e.g., sales volume, gross profit, ROI, etc.).

By basing evaluation on the same metrics, this approach to measurement enables organizations to align their online and enterprise initiatives and to also learn the most successful tactics for managing profitable customer relationships. At the end, it is a company's ability to effectively fine-tune its personalized approach to customer management with its most profitable segments that will more definitively result in the benefits described earlier. By closely monitoring the effectiveness of certain marketing campaigns or discrete initiatives as well as the behavioral and transaction history of customers, companies will also have the added benefit of being able to track ROI at a much more granular level than in the past.

An interesting question is what metrics are best for evaluating the effectiveness of Web site design features? An interesting and worthy approach for evaluating the effectiveness of Web site design and personalization features can be based on clickthrough and look-to-buy metrics. Using an example from the online ad-banner industry, click-through data measures the ratio of clicks to impressions, where an impression is simply the display of an ad banner on a Web page. A high clickthrough rate means visitors who see the ad click on it frequently, therefore, the ad is bringing many visitors to the site. Look-to-buy data compares ad banner impressions with sales

transactions and revenue directly attributable to the ad banner. It is a better measure of ad banner effectiveness, since the quality of visitors coming from the ad banner is captured and return on investment more accurately measured.

Look-to-buy metrics work well for dynamic, personalized content. In fact, ad banners fall into this category - ads typically are dynamically rotated and may also be personalized. With look-to-buy metrics, each personalized component on a page can be counted and its effectiveness evaluated. Generally, however, if the goal is something other than maximizing sales, the appropriate metric would be look-to-X, where X is the goal. In addition to the metrics mentioned above, additional supportive metrics should be defined in order to provide a more structured and concrete evaluation feedback. Such metrics include: Repeat business, Clickthrough ratio, Time spent, Order Size, Buying frequency, Satisfaction/return rate, Web-influenced purchases.

Since success can only be implicitly inferred from the user actions, evaluating the success of personalized propositions is unavoidably based on assumptions. For example a newspaper filtering and personalization system that .Re-orders each major index session (e.g. international news), including the front page, according to the user preferences., assumes that .since the user followed a link to the articles body they must have found the lead relevant, even if the actual body proved not to be interesting upon further reading. (Kolcz, 1999).

According to Schonberg (Schonberg et al., 2000), the ability to collect and combine customer data from multiple sources enables richer analysis. Click - stream data, which captures the sequence of Web pages seen by each visitor to a Web site, is the standard data source for tracking visitors browsing behavior.

However, voluminous as this data is, it is low level and contains limited information. Many useful metrics cannot be calculated with click - stream data alone. Integrating click - stream data with other sources considerably expands the quality of information. Furthermore, newer technologies and services make large-scale collection and sharing of data possible. Once goals, metrics, and data sources are identified, the Web site must be designed to collect and correlate data, extract information, and calculate metrics. When considering metrics and building user profiles from the visitor's perspective, it is imperative to consider the entire user experience at the Web site. In addition to personalization features, the user experience includes the tasks, services provided, navigation, design, and the overall value the visitor gains by visiting the site. To the extent that metrics

gathered can be interpreted to enhance the user experience in these areas the more satisfied the visitor would be with the site, which will encourage future returns to the site.

The solution proposed by this section, takes into account the state-of-the-art critical review in personalization techniques conducted in this chapter as well as the evaluation methodologies e-metrics as they have been described above. Already existing personalization architectures should be extended to include an evaluation layer. For example, an extension of an information architecture based framework for a personalization system by Instone (Instone, 2000) is provided in figure 3, including an extra layer for measuring a personalization initiative's success. In a similar manner, all personalization frameworks should be extended to accommodate the optimization / self-adaptivity stage. Otherwise, the personalization initiative's success cannot be improved. To achieve optimized results, the personalization techniques are fed with the results of the evaluation metrics, and, thus, any personalization architecture and / or framework has to reflect the plan-do-check-act cycle explained previously. The feedback input to the personalization techniques is an open research issue that we are currently working on.

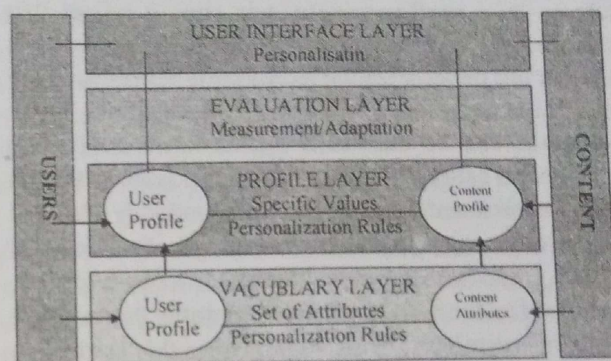
Within the context of personalization, attributes and attribute values provide the "glue" which links together the users and the content and forms the personalized user interface. Attributes of the content are matched up with attributes of users. Specific attribute values about a user are paired with content meta-information to determine which content to display and how to present it at any given time. In this framework, we have users and the content meeting at the user interface through the process of personalization.

In more detail:

- Users: Users have profiles that represent their interests and behaviors. Specific values for a profile are determined by the set of defined attributes and the possible values for each attribute.
- Content: Likewise, content is profiled, based on a set of attributes and assigned specific values.
- Underneath the user interface is the profile layer, where specific values for the attributes are used to determine what content to present to which user under what conditions. A user's profile exists here and can be changed explicitly by user actions (such as filling out a form that requests particular profile information), or implicitly by certain actions (such as buying certain products).

Likewise, a profile of the content exists and is matched with user profiles through a set of rules.

Figure 3: An Information architecture - based framework for evaluative personalization systems (Adapted from Instone)



- Beneath the profile layer are the vocabularies which regulate the assignment of attribute values. At the vocabulary layer, the attributes themselves are defined and the set of acceptable values (preferred terms) are specified. The relationships between attributes are defined, such as child and parent attributes.
- The personalization rules are what leverage the profiles, attributes and values in order to make the personalized user experience. The most powerful rules operate on the set of attributes as a whole, at the vocabulary layer. When user and content profiles share the same attributes, then we can make rules that work for all values of those attributes.
- The evaluation layer filters the interactivity of the end user through its personalized interface and collects results based on the predefined e-metrics defined at design level and the feedback provided by the end user/customer. The data collected in conjunction with Web server log files are analyzed using Web Usage Mining techniques and the results obtained are filtered back into the personalization rules that were described above.

In general, this architecture defines a personalization system as any piece of software that applies business rules to profiles of users and content to provide a variable set of user interfaces. Nevertheless, one should always bear in mind that certain issues might affect the evaluation procedure such as the sequence of sessions used by a user to contact a site, the fact that eCRM should observe the individual sessions of a user as well as the whole lifecycle of the user and the web-structure usually affects the behavior and navigation of a user.

The Methodological Framework for Evaluating and Guiding Personalization

Process

In general, during the personalization evaluation process we can be interested to answer questions of two types; (1) whether a personalization technique has positive effect, i.e. a performance metric should reflect that personalizing is better than not personalizing, and (2) whether this personalization technique is better than some other alternative approach for personalization. These questions can be answered with classic controlled experiments called AB and multivariable tests. In the AB type of experimental design, users are randomly allocated into a treatment group that assumes personalization and a control group with no personalization. In both groups, the desired metric is observed before and after the treatment group intervention. For example, using this method to evaluate personalization technique used in the CHIP project would mean randomly selecting two groups of users (see Figure 3), then measuring the number of browsed artworks (or some other metrics) in the first period, characterized by no personalization for both groups, followed by measuring the number of browsed artworks in the second period where one of the groups has a personalized content. Following such scenario, the analysis of performance estimates in the two periods for both groups indicates whether personalization was successful or not. The results of such guided personalization can be stored for further analysis and the application of inferencing (meta-learning) techniques. This leads to discovery of knowledge that can be used for further improvement of personalization strategies and directing the continuation of the controlled experiments.

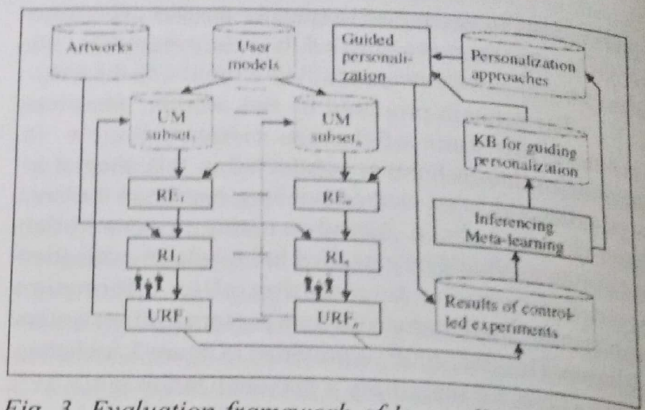


Fig. 3. Evaluation framework of 'controlled experiment'-based guided personalization (RE - recommendation engine, RI - recommended items, URF - user relevance feedback).

Such experimental design in e-commerce applications in the natural settings is less acceptable, since having a period without personalization implies the risk of losing customers. In educational and entertainment applications, however, it can be more freely used, especially if the visitors are aware of such procedures and can treat them as a natural part of the personalization process during which the recommendation system learns to improve a personalization technique or to select the most appropriate personalization techniques among available.

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PROPER UTILIZATION AND SIZING OF SOLAR ENERGY : AN APPROACH TO MANAGE THE DEMAND OF ELECTRICITY

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Abstract-

As the demand of electricity increases every year, pushing the current power plants and power distribution grids to their limits. To meet this growing need, more fossil fuel power plants are being constructed, thus increasing the pollutants dispensed into the environment. The need to develop clean energy- producing systems that can perform as reliability as fossil fuel plants must be implemented throughout the world in order to decrease the effects man has on the planet. In order for a renewable energy source to be added to a power utility, the three conditions to be met are reliability, cost and life span. Due to the high initial cost of building a renewable power source and a slower rate of return than fossil fuel plants. The sun is the source of energy for the continuation of life on earth. It is a sphere of intensely hot gaseous matter. It is a fusion reactor. Its most important reaction is the combination of hydrogen to form helium; the difference in mass being converted to energy. This energy is produced in the interior of the solar sphere at a temperature of many millions of degrees. This energy is transferred to the surface of sun by radiation and convection. The surface is opaque. Solar energy is a clean, cheap and abundantly available renewable energy. Even it has greatest potential of all source of renewable energy and if only a small amount of his form of energy could be used, it will be one of the most important supplies of energy especially when other sources in the country have depleted.

Energy comes to the earth from the sun. This energy keeps the temperature of earth above that in colder space, causes current in the atmosphere and in ocean, causes the water cycle and generates photosynthesis in plants.

The total radiant energy of the sun is vast, out of which only small fractions get incident on the outside of the earth's atmosphere. The 30% of it is directly reflected back to outer space in the short wave radiation, 47% of it is directly converted to heat that is lost to outer space in the of long wave radiation and major portion of the rest 23% causes evaporation, precipitation and circulation of water in the hydrologic cycle of the earth. Two-third of the solar energy falling on the whole earth land surface,

fall on the northern hemisphere and one-third on the southern hemisphere. The solar power where sun hits atmosphere is watts where as we have the solar power on earth's surface is 10¹³ watts. The total worldwide power demand of all needs of civilization is 10¹³ watts. Therefore, the sun gives us 1000 times more power than we need. If we can use 5% of this energy; it will be 50 times what the world will require. Thus, solar energy could supply all the present and future energy needs of the world on a continuing basis. This makes it one of the most promising of the unconventional energy sources.

In addition to its, solar energy has two other factors in its favor. Firstly, unlike fossil fuels and nuclear power, it is an environmentally clean source of energy. Secondly, it is free and available in adequate quantities in almost all parts of the world where people live. However there are many problems associated with its use. The main problem is that it is a dilute source of energy. Even in the hottest regions on earth, the solar radiation flux available rarely exceeds 1kw/rn and the total radiation over a day is at best about 7kwh/m. These are low values from the point of view of technological utilization. Consequently, large collecting areas are required in many applications and these results in excessive costs.

A second problem associated with the use of solar energy is that its availability varies widely with time. The variation in availability occurs daily because of day-night cycle and also seasonally because of the earth's orbit around the sun. In addition, variations occur at a specific location because of local weather conditions consequently, the energy collected when the sun is shining must be stored for use during periods when it is not available. The need for storage also adds significantly to the cost of any system. Thus, the real challenge in utilizing solar energy as an energy alternative is of an economic nature. Methods of collection and storage so that the large initial investments required at present in most applications are reduced, been slow in the construction of renewable energy plants

As solar energy is a part of widely recognized renewable energy sources; the solar energy source are

free of cost and clean energy whereby environmental impacts are negligible. In developing countries like India. Solar energy potential has been utilized in wide range of applications of remote and urban areas and has been growing rapidly. There are also new research interests shown by the universities and R & D institutions to assess the solar energy application potential in India for proper utilization. But it has not fully utilized till. However the main problems limiting the solar utilization are the use of costly equipment and the selection of wrong peak sunshine data that results wrong sizing of equipment for the solar energy projects. For instance, peak sunshine and isolation figures in daily, weekly and yearly basis of the same location are different from one data to another if accuracy of the solar energy data is not compromised. This is because the data available is based on average with year basis, which has nothing to do with actual data available in specific place and a specific date, it is therefore, very important to form proper design procedure and solar energy component sizing to do exact calculation for the solar power production before opting any actual implementation of solar energy scheme. Universal and local data will be compared to come up with the required peak sunshine figure in order to get the exact amount sunshine in a panicle zone and in a particular day. The problem involved in right sizing and using the right data are the k success to solar energy applications, improve its performances and reduce unnecessary costs. For this reason, carrying out proper design and sizing procedure for practical solar energy scheme are necessary.

In this paper proper design procedure and system sizing are the main focus. Moreover, proper design procedures are proposed and supporting facts and figures are presented.

INTRODUCTION

As the fears of climate change increase, the demands for devices that generate electricity that are environment friendly will steadily increase. Most of the electric power generated in the world comes from the burning of fossil fuels to generate a consistent supply of energy. Every year, the demand for electricity increases, pushing the current power plants and power distribution grids to their limits. To meet this growing need, more fossil fuel power plants are being constructed, thus increasing the pollutants dispensed into the environment. The need to develop clean energy- producing systems that can perform as reliability as fossil fuel plants must be implemented throughout the world in order to decrease the effects man has on the planet. In order for a renewable energy source to be added to a power utility, the three

conditions to be met are reliability, cost and life span. Due to the high initial cost of building a renewable power source and a slower rate of return than fossil fuel plants progress has been slow. There are many forms of renewable energy resources that are currently available for integration into the power grid. The top four renewable energy sources are wind, water, geothermal and solar. The sun is the source of energy for the continuation of life on earth, it is a fusion reactor; the most important of its reaction is the combination of hydrogen to form helium; the difference in mass being converted to energy. This energy is produced in the interior of the solar sphere at a temperature of many millions of degrees. This energy is transferred to the surface of sun by radiation and convection. Solar energy a clean, cheap and abundantly available ropewalk energy. Energy comes to the earth from the above This energy keeps the temperature of earth above that in colder space, causes current in tie atmosphere and in ocean, causes the water cycle and generates photosynthesis in plants.

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An effort is made to design a programmed to overcome the associated problems. The designing will not only reduce the cost but undoable will increase the efficiency of the system. This software package will then be tremendously in use in modern age.

SUN-EARTH RELATIONSHIP

The earth is shaped as an oblate spheroid—a sphere flattened at the poles and bulging in the plane normal to the poles. For most practical purposes, we consider the earth as a sphere with a diameter of nearly 12,800 km. The earth makes one rotation about its axis every 24 hrs and completes a revolution about the sun in a period of approximately 365.25 days.

The mean density of the earth is about 5.517 g/cm^3 . It is believed that the earth has a central core of about 2,560 km in diameter which is more rigid than steel. Beyond the central core is the mantle, which forms about 70% of the earth's mass, and beyond this is the outer crust, which forms about 1% of the mass. The earth revolves in an elliptic orbit round the sun, with the latter at one of the foci of the ellipse. The apparent path of the sun as seen from the earth is known as the elliptic.

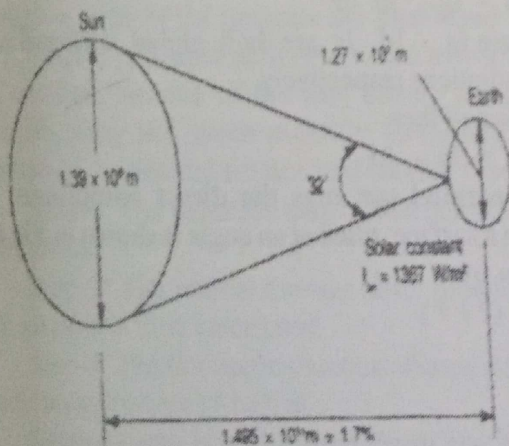


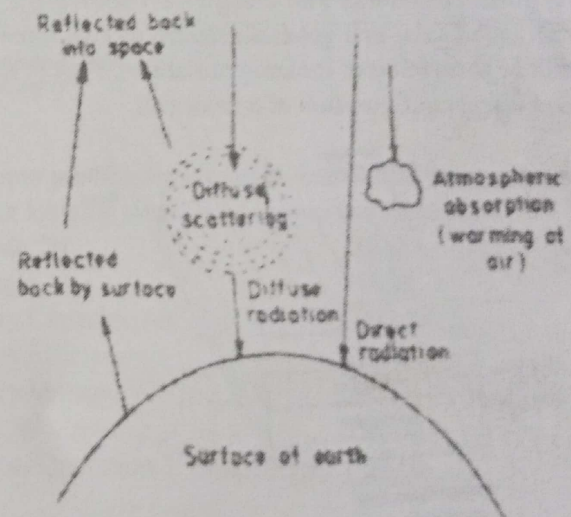
Fig. 1: Sun-Earth Relationship

Fig (1) shows schematically the geometry of sun earth

relationship. The eccentricity of the earth's orbit is such that the distance between the sun and earth varies by 1.7%.

At a distance of astronomical unit, $1.495 \times 10^{10} \text{ m}$, the mean earth sun distance, the sun subtends an angle of $32'$ on earth. The radiation emitted by the sun and its relationship to the earth result in a nearly fixed intensity of solar radiation outside the earth's atmospheres.

Solar Radiation at the Earth's Surface Solar radiation is received at the earth's surface is an attenuated form because it is subjected to the mechanism of absorption and scattering as it passes through the earth's atmosphere (fig 2). Absorption occurs primarily because of the presence of the ozone and water vapors in the atmosphere, and to a lesser extent due to other gasses (like CO NO CO O and CH and particulate matter. It results in an increase in the internal energy of the atmosphere. On the other hand, scattering occurs due to all gaseous molecules as well as particulate matter in the atmosphere. The scattered radiation is redistributed in all directions, some going back into space and some reaching the earth surface.



The atmosphere at any location on the earth's surface is often classified into two broad types- an atmosphere without clouds and an atmosphere with clouds. In the former case, the sky is cloudless everywhere, while in the latter, the sky is partly or fully covered by clouds. The mechanism of absorption and scattering are similar with both types of atmosphere. However it is obvious that less attenuation take place in a cloudless sky. Consequently maximum radiation is received on the earth's surface under the condition of a cloudless sky.

Beam Solar Radiation

Solar radiation that has not been absorbed or scattered and reaches the ground directly from the sun is called

"Direct Radiation" or "Beam Radiation".

Diffuse Radiation

It is that solar radiation received from the sun after its direction has been changed by collection and scattering by the atmosphere.

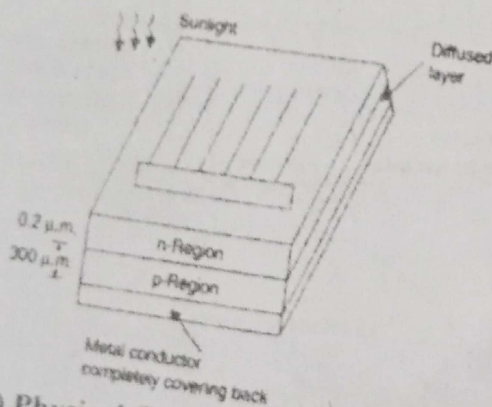
Global Radiation

The sum of the beam and diffused radiation is called as Global radiation. It is defined as the total solar radiation energy received on a horizontal surface of unit area on the ground in unit time.

Solar Photovoltaic Solar Cell

The production of electricity from photovoltaic continues to attract worldwide interest, more recently as a power source for distributed energy generation. Today's photovoltaic system are already being used effectively for smaller power needs in remote applications.

So solar photovoltaic field is getting high priority in countries like England, France, Germany, Italy, India, USA etc and there is considerable interest, research, effort in this field. This worldwide interest is attributed to a variety of factors such as search for new energy sources due to heavy pressure on conventional fuels, simplicity, cleanness and direct conversion into electricity. Photovoltaic cells or so called solar cell generate electro motive force as a result of absorption of ionizing radiations. Fig-(3) shows the physical configuration of a solar cell.



g.(3) Physical Configuration Of a Solar Cell

Adopted Methodology

Photovoltaic power units that are in u generally comprise a relative arrangement of solar cell array, blocking storage battery and a load. It permits generated electrical power to be delivered local load.

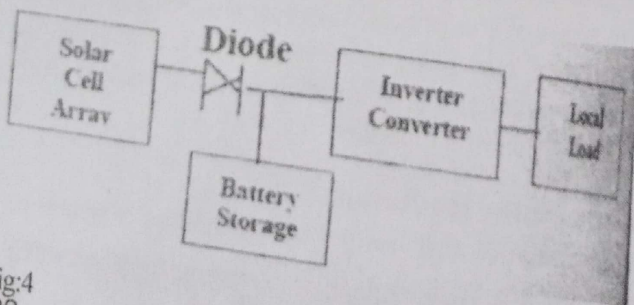


Fig:4
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This system converts solar energy which meets the demand for a particular load. The electrical energy is obtained in a variable dc form and it needs to be stored in a battery, if the energy is to be supplied continuously.

In a standalone PV power supply, the solar array needs the use of an optimum load into which it can deliver its maximum power. But the requirement varies with insulation and temperature. The battery is turn offers a load to the array that varies with its state of charge and temperature. Therefore, an interconnection of these power system components matched under all conditions is difficult to be realized I normal practice.

The mismatch of different system components offers problem in optimum sizing of the system and result in loss of energy and degradation of components.

Here, the mismatch between the different system components has been minimized by computer modeling and simulating the power supply operation.

It assumes an initially matched condition for optimum flow of energy into the system and calculates the peak array current which is subsequently modified by an iterative process in accordance with the year round performance of the system under given climatologically conditions.

The photovoltaic system should be sized a such a way so that it can deliver power to the required load without failure of the system. Any undersized array will cause total discharge of the battery and an oversized array involves waste of capital.

The idea of the system sizing is to have optimum array size for the stand alone 1W system which meets the particular demand of the load through out the year allowing the battery to be discharged up to a minimum acceptable level. The array output depend on many climatologically factors and site conditions such as latitude, tilt angle of the array and number of clear sunshine

The mean direct daily solar radiation I_b falling on horizontal surface may be expressed as

$$I_b = I_g - I_d - I_r$$

Where I_g , I_d , I_r are daily global, diffused and reflected radiations respectively.

If I_r is neglected then

$$I_b' = I_g - I_d$$

For parallel sun rays the direct component of radiation on a surface, tilted at an angle is shown in Fig (5) and is given by

$$I_b = I_b \sin(? + ?)$$

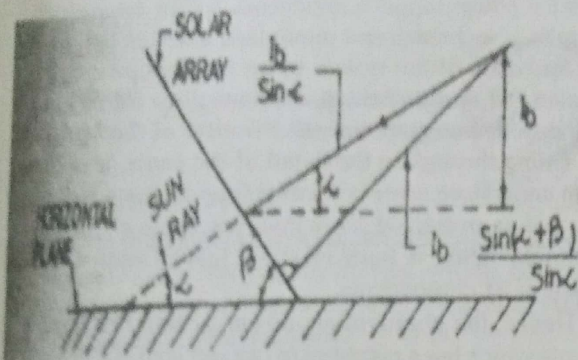


Fig. 5: Solar Radiation on a Surface Tilted at an Angle β to Horizontal

The solar elevation angle on tilted surface is given by the equation. Where α is the midday solar elevation angle and may be expressed as

$$\alpha = 90^\circ - \phi - \delta$$

Where ϕ is the latitude of the place and δ is the declination of the sun and is given by the relation

$$\delta = 23.45 \sin(360/365(284+n))$$

Where n is the number of days of an year starting from 1st January i.e. $n=1$

The component of diffused radiation on a surface tilted at an angle α is given by

$$I_d' = I_d (1 + \cos \alpha)$$

The total component of radiation, I_{Total} on the tilted surface is

$$I_{Total} = I_b' + I_d'$$

System Sizing

A computer program 'Solar C' has been developed to calculate approximate array size for a given load and battery capacity with the main idea that the charge of the battery should not fall below 50% of its rated capacity even during the poor weather.

The program has been written in C. The different successive steps of the program are mentioned below:

Step-1: The input parameters such as average load, load voltage, latitude of the site, battery capacity, and optimum array tilt, mean monthly direct and diffused radiation on horizontal surface and entered first.

Step-2: The radiation data is then corrected for the tilted surface.

Step-3: The annual average daily radiation on the tilted surface is then calculated.

Step-4: The first approximation of array size in terms of peak array current (Amp) at

100mW/cm is calculated from the following relationship.

$$I_p = AdK / Rd$$

Where A_d is the average daily load, R_d is the annual average daily radiation in mWh/cm²

$$K = 100/K'$$

And K' is the battery efficiency.

Step-5: The monthly array output is calculated and the monthly system simulation is done for the whole year to get state of charge (SOC) of the battery at each month.

Step-6: If SOC is less than 50% of the rated battery capacity, then the array size is increased by 0.1% and the simulation is repeated.

Step-7: The final results are printed.

Input Parameters

TABLE 1. SOLAR RADIATION DATA FOR NEW DELHI

Sr. No	Month	No. of Days	Direct Radiation (mWh/cm ²)	Diffused Radiation (mWh/cm ²)
1	January	31	275	124
2	February	28	353	147
3	March	31	428	186
4	April	30	446	247
5	May	31	437	292
6	June	30	300	354
7	July	31	220	314
8	August	31	237	273
9	September	30	345	215
10	October	31	389	147
11	November	30	338	114
12	December	31	273	112

The Input parameters are given below and solar radiation data for location New Delhi is given in Table (1)

Latitude, °N	=	28.58
tilt Angle, °N	=	45.00
Battery Capacity, Ah	=	900.00
Battery Efficiency	=	0.85
Battery Voltage, V	=	12.00
Load, W	=	30.00
Hour of Operation	=	24.00

Result and Discussion

The system sizing of a 30 W, 12 V photovoltaic power supply at New Delhi is considered. The system operates on a continuous basis and the storage capacity of the battery is calculated to be 900 Ah which can store energy for 15 days even during poor sunshine days. The results of computation are given in Table (2)

RESULTS

Load Current	=	2.50 Amp
Day load	=	60.00 Watt
The first Approximation of Array Current	=	12.57 Amp

TABLE 2: CALCULATIONS OF TOTAL SOLAR RADIATIONS

Month	Delta	Alfa	Corrdirect	Corrdifuse	Trad	Monthload
1	-21.27	82.69	219.40	105.84	325.24	1860.00
2	-13.29	74.71	317.85	125.47	443.32	1680.00
3	-2.82	64.24	448.69	158.76	607.45	1860.00
4	9.41	52.01	561.71	210.83	772.54	1800.00
5	18.79	42.63	644.71	249.24	893.95	1860.00
6	23.31	38.11	482.62	302.16	784.78	1800.00
7	21.52	39.90	341.60	268.02	609.62	1860.00
8	13.78	47.64	320.42	233.02	553.44	1860.00
9	2.22	59.20	389.37	183.51	572.88	1800.00
10	-9.60	71.02	369.68	125.47	495.15	1860.00
11	-19.15	80.57	278.71	97.31	376.02	1800.00
12	-23.34	84.76	210.76	95.60	306.36	1860.00

Annual Radiation = 561.73 mWh/cm²
 Enter Increment Factor = .001
 Number of iteration = 27.00

TABLE 3: CALCULATION OF PEAK ARRAY, CURRENT FOR 30 W

Month	Array Output	Monthly Load	Monthly Array o/p	Difference	SOC
1	50.27	1860	1558.22	-301.7	598.22
2	68.51	1680	1918.39	238.39	836.61
3	93.88	1860	2910.25	1050.25	900.00
4	119.39	1800	3581.80	1781.80	900.00
5	138.16	1860	4282.86	2422.86	900.00
6	121.28	1800	3638.54	1838.54	900.00
7	94.21	1860	2920.64	1060.64	900.00
8	85.53	1860	2651.50	791.50	900.00
9	88.54	1800	2656.10	856.10	900.00
10	76.52	1860	2372.25	512.25	900.00
11	58.11	1800	1743.36	-56.64	843.36
12	47.35	1860	1467.76	-392.24	451.12

Peak Array Current = 15.45 Amp

In this paper, the mismatch between the different system components has been minimize by computer modeling and simulating the power supply operation. So with the help of this rsteIn! sizing we can get optimum array size for the stand alone photovoltaic system which meets the particular demand of the load throughout the year allowing the battery to be discharged up to a minimum acceptable level.

CONCLUSION

The paper work is an effort to provide some recommendation and proposal for optimum sizing of standalone photovoltaic power system. The present computer program and simulation approach has described the size of photovoltaic system. This software package, based on a model which initially calculates the array current

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required meeting the given load in completely matched state of the power supply components. It then determines the degree of mismatch and minimized it during the year round operation of the system by an iterative process to determine the appropriate size. Simulation results are provided to demonstrate the effectiveness of the design.

Going through to the detail of the paper, it is felt that ban undersized array will cause total discharge of the battery and an oversized array involves waste of capital. So optimum sizing is must to avoid loss of energy and degradation of components.

Hence, the photovoltaic power system can play a major role which has a potential to convert sunlight energy directly to electrical energy at low operating and maintenance costs and without noise and environment pollution. Hence, this power system is eco-friendly, reliable and a sustainable solution for the near future of the world.

The heightened concern about global warming and recent rapid increase in the unit cost of fossil the Solar energy will play more significant role in the future. The input parameters in this study were chosen for Delhi region. Similarly, in the future we can calculate Photovoltaic array size for various regions and can use to fulfill the future electrical requirements. We believe that this program should be used as an application of solar energy in wide areas so that we can look forward for bright future.

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TEACHER EMPOWERMENT: NEEDS AND INITIATIVES

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INTRODUCTION

In Indian thinking, a human being is a positive asset and a precious national resource, which needs to be cherished, nurtured and developed with tenderness and care, coupled with dynamism.

"Education has continued to evolve, diversify and extend its coverage since the dawn of history. Every country develops its system of education to express and promote its unique socio-cultural identity and also to meet the challenges of time".

.....NPE 1986 and POA 1992

The policy also emphasizes to review the education policy after every five years; the progress made and recommends guidelines for further development. In this result, the National Council for Teacher Education (NCTE), a statutory body, was established by the Government of India for the maintenance of standards and improvement of the quality of teacher education in the country, came out with a Curriculum Framework for Quality Teacher Education in 1998, 2009 and placed it before the nation.

The developments in social, economic, cultural, scientific and technological spheres have affected education, including teacher education necessitating review the teacher education policies time to time. The National Council for Teacher Education has to initiate suitable measures to make teacher education at various levels responsive to such developments as well as to quality concerns in future.

The status of teachers reflects the socio-cultural ethos of a society; it is said that no people can rise above the level of its teachers. It is with the objectives of raising the professional status of teachers, developing among them greater commitment to society, their students and their profession, increasing their professional competencies and performance skills and empowering them to face new challenges.

HISTORICAL PERSPECTIVE OF TEACHER EDUCATION

Teacher education in India has a long past but a short history. Gurukul-centred tradition of the Vedic period was somewhat modified and enriched under the influence of Budhistic vihara-based system. This continued till the 11th century A.D. The arrival of the Muslims witnessed

the rise of a paralled Maktab-based tradition and the two traditions thrived side by side till the coming of the British. Both the traditions underwent some modification during this period. Historical records of the decisions taken, the finances made available and their implementation and later evaluation became relatively more systematically organised because of the documentation by the British.

The independence of India on the 15th August, 1947 marks a defining moment in the history of our nation. Our long-drawn struggle for independence that preceded it witnessed much strife and bloodshed. Over the years people became unified as never before. Indians wanted Swaraj and had plans about how the nation would develop after the departure of the British. Indian educational system including that of teacher education saw greater reflection of national aspirations and needs of the people during the post-independence period. Much of what happened during the next two decades (1948-68) is crucial to fuller understanding of what is happening now and in which direction(s) our education system is moving and ought to move.

NCTE's FUNCTION FOR TEACHER EDUCATION

NCTE issued a Curriculum Framework for Quality Teacher Education in 1998; describing context, concerns. Its salient features were:

1. Increased duration and multiple models of teacher education;
2. Updating of theoretical and practical components of teacher education by giving new orientation and adding new inputs to the existing programmes;
3. Emphasis on developing professionalism, commitment, competencies and performance skills;
4. Optimal utilization of the potentialities of community, university and information and communication technology for preparation of teachers;
5. Making provisions for preparation of teachers for the neglected sections of society, and
6. Suggesting alternative educational programmes for teachers of gifted children, teachers of senior secondary schools and specialized programme of education for teacher educators.

Besides, there were other suggestions too which were well received by the nation. Some of its recommendations were implemented. But all of them could not be put into practice due to various reasons. NCTE committed for following functions of teacher education institutions (TEIs):

1. To provide qualified faculty, adequate infrastructure and learning resources, including print material, off-line IT material and computers as per prevalent NCTE norms for quality transaction of its teacher education programme;
2. To promote corporate institutional life based on values and ideals enshrined in the preamble of Indian Constitution for all stakeholders in the institution e.g. students, faculty, non-teaching staff etc;
3. To provide and use all necessary inputs for promoting the development of competent and committed professionals to students, faculty and other staff;
4. To create all necessary needed resource core and use these for institutional planning with mid-term appraisal for quality improvement of the TEI;
5. To function as the nodal agency for networking community and its schools with the TEI and use their resources for improving and enriching its teacher education programme(s);
6. To promote and strengthen action research and faculty research projects;
7. To organize on-campus and off-campus professional development activities and programmes for its faculty, faculty of sister TEIs and school teachers in networked schools; and
8. To make its teacher education programme(s) more and more school-based, vibrant and collaborative between schools and the TEI.

CHALLENGES OF TEACHER EDUCATION

As an integral part of educational system, teacher education in India has to be responsive to socio-cultural ethos and national development. It does not consist of institution-based activities only. Its scope has broadened. Therefore, it is expected to engage itself in all endeavors of social and national reconstruction and regeneration, address itself to the social and educational problems, fulfill the expectations of the people, and accelerate the process of nation building. The Indian Constitution provides a long-term perspective on our educational system including that of teacher education. To develop the skills and competencies of students for getting through the examination would not be enough. Teacher education curricula would accordingly need to be restructured.

Socialism

Socialism subsumes a variety of theories and movements and is the product of industrial revolution, humanism and science. Socialism as a political method of social re-arrangement would tantamount to its distortion. It is a cultural movement, a movement for making a new man. For a long time, India's attempt at building a socialistic society was influenced by Western doctrines without synthesizing and blending them with the Indian thought, traditions and culture. Socialism has to be harmonized with our cultural ethos and values. Ideas and ideologies like socialism are not the items of import; these have to emanate from our own soil and the realities of the Indian society. Teacher educators need to undertake research in this direction.

Teachers and teacher educators need to appreciate that socialism is not utopian ideology. A cultural movement which aims at the transformation of human existence including people's values and beliefs. Education can play a vital role in this regard. There are certainly some constraints in building a socialistic society in India. These can, however, be overcome. Teacher education can convince prospective teachers and with their help the community that socialism is desirable for them, for the posterity and well-being of the nation.

Secularism

Most of the religions are pluralistic in India; and each comprises of many sects. Mere imitation of an alien model of secularism may cause conflict between the state and the polity. In our context, secularism implies the practice of equal respect for all religions of the country or 'Sarva Dharma Sambhava'. Teachers and their educators need to be made aware of this. They need to be convinced that secularism is not a political exigency of modern India. Its roots are very deep in its culture and tradition. Teacher educators and prospective teachers should emphasize the commonality of religions and their 'essence'. They encourage man in pursuit of truth, value, morality and peace. Teacher educators need to bring home to their students that superstition, bigotry, and dogmatism are distortions and hence unworthy of pursuit. The teacher has to convince students and community that if secular forces are weak, India cannot remain strong.

Democracy

Democracy should not be confused with the representative government or rule of the majority. It is an antithesis of all kinds of tyrannical and despotic modes of governance. It presupposes separation of power, participation of people and building of consensus on national issues. It is a moral system that achieves balance between individual freedom and social compulsions.

Education is a means of empowering people. Teacher educators and teachers should realize that the first necessary step towards this goal is to develop the student's potential and promote his economic efficiency. Commitment to democratic values and their incorporation in life are essential.

Justice

Justice, liberty, equality and fraternity are interrelated and interdependent concepts and each of the four is essential for the realization of the others. Each one needs to be discussed separately. These concepts are considered to be the offshoot of French Revolution. India has been practising these since long. Indian Constitution describes it in unambiguous terms. Justice implies fair play and absence of discrimination. Discrimination can be made on different basis - political, economic, social, legal, and so on. It may be based on birth, status, religion, education etc.

Educational system and the state should take positive action for this purpose. Teachers have two-fold responsibility in this regard: first, to provide meaningful education to children of different potentialities without any discrimination and second, to create a demand for social justice among students and through them in the society.

Liberty

Liberty includes freedom of thought and expression and it has been considered important in the Constitution. Liberty or freedom implies provision of such conditions as are essential for the full flowering of human personality. In this sense, it is essential for man's development and building a civilized social order. Teachers and their educators have to inculcate necessary moral values for proper use of freedom with self-imposed discipline.

Real freedom allows expression of dissent but dissent has to be responsible and constructive. Liberty demands discussion and debate on public issues but no state or society can afford to permit endless discussion.

Equality

Equality sometimes described as 'fairness in treatment', is also a complex concept. In order to understand equality, one must understand inequality. Inequality is of two kinds - natural i.e. caused by nature and is man-made. For removing the natural, physical, genetic, biological and such other inequalities, not much can be done by teachers. On the other hand, man-made inequalities is the creation of society and there are enough possibilities in this area. To take measures for reducing man-made inequalities the function of the state. Teacher education can nevertheless facilitate it and consolidate its gains.

Equality of educational opportunity involves three components: access, retention, and achievement. The state has taken positive action with regard to access to education by launching certain schemes for making education available to the people but the goal of retention has not been achieved. Poverty, teacher's attitudes and some cultural and social constraints are responsible for poor retention. With regard to the quality, the situation is far more complex.

Fraternity

Fraternity is the extension and propagation of family feeling towards others and it calls for treating them as brothers in spite of differences. In India, where people of many races, ethnic groups, religions, classes, castes and creeds live together, development of the feeling of fraternity and recognition of the worth of a person as an individual without any distinction is a worthwhile educational objective.

Dignity

Man lives in society. In his development, society and the state play a vital role for his growth and development certain restrictions are imposed; otherwise the law of the jungle will prevail in society. In this regard, teacher education has two fold responsibility: to protect the dignity of the individual, and to ensure his proper socialization.

Teacher education cannot afford to neglect this responsibility. Indian thought favouring a happy synthesis between the dignity of the individual and his social obligations for building a strong nation. Developing awareness about human rights and preserving and protecting them from violation are additional challenges before teachers and the educators.

National Integration

To maintain the integrity and unity of the nation is an important constitutional commitment. India is a well-demarcated geographical entity and she has her distinct regional identity in the South Asia. Its plurality and diversity can be observed by any one but within this plurality and diversity, there is a strong undercurrent of unity. Despite our regional, racial, linguistic, religious and social differences, our cultural unity is the real asset for national cohesion and integration.

Teacher education curricula at all stages need to emphasize the cultural, political and economic unity of the country. The contribution of different racial, religious, social, linguistic and regional groups in developing India's composite culture and nationhood need to be clearly discussed in teacher education institutions. Students need to be acquainted with the commonalities of different

religions, languages, art, architecture, music, dance and drama.

SOLUTION TO THESE CHALLENGES

- * Manpower planning in teacher education should be enhanced.
- * Regional imbalances in teacher education should be removed.
- * Role of teacher association and teacher education association should be overcome.
- * Economics of education should be applied effectively.
- * Educational Planning should be appropriate and productive.
- * Social harmony; role of teacher education should be in this regards.
- * NGO's involvement should also be taken.
- * IGNOU'S community colleges are the examples for overcome the challenges of education.
- * Produce professionally more competent and performance oriented teachers and teacher educators.
- * Make teacher education broad based so as to meet the requirements of specialized areas.
- * Prepare teachers and their educators for transmission of the curriculum content of integrated subjects.
- * Empower teachers and their educators to integrate physical education, yogic education, aesthetic education and education for life skills, value transmission etc. with general education of teachers within the main stream of teacher education.
- * Adopt interdisciplinary approach in the preparation of teachers and teacher educators.
- * Orient the teachers and teacher educators to handle the challenged children in the inclusive environment.

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38

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WIND ENERGY A SAFE, NON-POLLUTING & RENEWABLE POWER RESOURCE

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Abstract:-An energy crisis is the major problem in all over world. Most of energy requirement is fulfilled by thermal power plants based on coal & diesel, which leads to environment pollution. To avoid these polluting power sources we have to adopt alternate energy resources like solar power, wind power, tidal power, geothermal power etc. But out of all these alternative energy sources only solar & wind energy is preferred as domestic safe-energy resource. Due to high cost involvement in fabrication of solar cells & non availability of sunlight during night, the wind energy is preferred as non-polluting & economic power resource specially for domestic use in rural areas. In Indian rural areas scarcity of electrical supply is the major problem, which can be overcome by adopting small sized wind mills.

Key words:- WMS-Wind monitoring stations, MAWS-Mean annual wind speeds, WPD-Wind power density in watt/m², MW-mega watts

Introduction:-

The development of wind power in India began in the 1990s, and has significantly increased in the last few years. Although a relative newcomer to the wind industry compared with Denmark or the US, India has the fifth largest installed wind power capacity in the world.

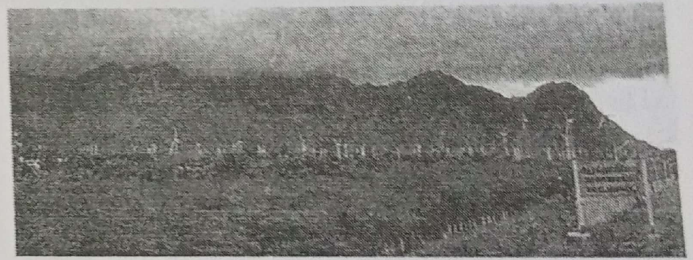
As of 31 October 2009 the installed capacity of wind power in India was 10,925 MW, mainly spread across Tamil Nadu (4889.765 MW), Maharashtra (1942.25 MW), Gujarat (1565.61 MW), Karnataka (1340.23 MW), Rajasthan (738.5 MW), Madhya Pradesh (212.8 MW), Andhra Pradesh (122.45 MW), Kerala (26.5 MW), Odisha (2MW), West Bengal (1.1 MW) and other states (3.20 MW). It is estimated that 6,000 MW of additional wind power capacity will be installed in India by 2012. Wind power accounts for 6% of India's total installed power capacity, and it generates 1.6% of the country's power, it must be improved by adopting domestic wind mills at rural areas.

The worldwide installed capacity of wind power reached 157,899 MW by the end of 2009. USA (35,159 MW), Germany (25,777 MW), Spain (19,149 MW) and China (25,104 MW) are ahead of India in fifth position. The short gestation periods for installing wind turbines, and the increasing reliability and performance of wind energy machines has made wind power a favored choice for capacity addition in India.

Large scale wind energy generating plants in India:-

India is the world's largest wind power producer, with an annual power production of 8,896 MW. The worldwide installed capacity of wind power reached 157,899 MW by the end of 2009. USA (35,159 MW), Germany (25,777 MW), Spain (19,149 MW) and China (25,104 MW) are ahead of India in fifth position. The short gestation periods for installing wind turbines, and the increasing reliability and performance of wind energy machines has made wind power a favored choice for capacity addition in India. Suzlon, as Indian-owned company, emerged on the global scene in the past decade, and by 2006 had captured almost 7.7 percent of market share in global wind turbine sales. Suzlon is currently the leading manufacturer of wind turbines for the Indian market, holding some 52 percent of market share in India. Suzlon's success has made India the developing country leader in advanced wind turbine technology.

There is the growing wind energy installations in the number of the states across the India.



India is keen to decrease its reliance on fossil fuels to meet its energy demand. Shown here is a wind farm in Muppandal, Tamil Nadu.

Tamil Nadu is the state with the most wind generating capacity: 4889.765 MW at the end of the March 2010. Not far from Aralvaimozhi, the Muppandal wind farm which the largest in Asia is located near the once impoverished village of Muppandal, supplying the villagers with electricity for work. The village had been selected as the showcase for India's \$2 billion clean energy program which provides foreign companies with tax breaks for establishing fields of wind turbines in the area. In February 2009, Shriram EPC bagged INR 700 million contract for setting up of 60 units of 250 KW (totaling 15 MW) wind turbines in Tirunelveli district by Cape Energy. Enercon is also playing a major role in development of wind energy in India. In Tamil Nadu, Coimbatore and Tiruppur Districts having more wind Mills from 2002 onwards, special

Chittipalayam, Kethanoor, Gudimangalam, Poolavadi, Murungappatti (MGV Place), Sunkaramudaku, KongalNagaram, Gomangalam, Anthiur are the high wind power production places in the both districts.

Maharashtra is second only to Tamil Nadu in terms of generating capacity. Suzlon has been heavily involved. Suzlon operates what was once Asia's largest wind farm, the Vankusawade Wind Park (201 MW), near the Koyna reservoir in Satara district of Maharashtra.

Gujarat (1782 MW)
Samana in Rajkot district is set to host energy companies like China Light Power (CLP) and Tata Power have pledged to invest up to Rs.8.15 billion in different projects in the area. CLP, through its India subsidiary CLP India, is investing close to Rs.5 billion for installing 126 wind turbines in Samana that will generate 100.8 MW power. Tata Power has installed wind turbines in the same area for generating 50 MW power at a cost of Rs.3.15 billion. Both projects are expected to become operational by early next year, according to government sources. The Gujarat government, which is banking heavily on wind power, has identified Samana as an ideal location for installation of 450 turbines that can generate a total of 360 MW. To encourage investment in wind energy development in the state, the government has introduced a raft of incentives including a higher wind energy tariff. Samana has a high tension transmission grid and electricity generated by wind turbines can be fed into it. For this purpose, a substation at Sadodar has been installed. Both projects are being executed by Enercon Ltd, a joint venture between Enercon of Germany and Mumbai-based Mehra group.

ONGC Ltd has commissioned its first wind power project. The 51 MW project is located at Motisindholi in Kutch district of Gujarat. ONGC had placed the EPC order on Suzlon Energy in January 2008, for setting up the wind farm comprising 34 turbines of 1.5-mw each. Work on the project had begun in February 2008, and it is learnt that the first three turbines had begun production within 43 days of starting construction work. Power from this Rs 308 crore captive wind farm will be wheeled to the Gujarat state grid for onward use by ONGC at its Ankleshwar, Ahmedabad, Mehsana and Vadodara centres. ONGC has targeted to develop a captive wind power capacity of around 200 MW in the next two years.

Karnataka (1340.23 MW)
There are many small wind farms in Karnataka, making it one of the states in India which has a high number of wind mill farms. Chitradurga, Gadag are some of the districts where there are a large number of Windmills. Chitradurga alone has over 200 wind turbines. The 13.2 MW Arasinagundi (ARA) and 16.5 MW Anaburu

(ANA) wind farms are ACCIONA'S first in India. Located in the Devangere district (Karnataka State), they have a total installed capacity of 29.7 MW and comprise a total of 18 Vestas 1.65MW wind turbines supplied by Vestas Wind Technology India Pvt. Ltd.

The ARA wind farm was commissioned in June 2008. ACCIONA signed a 20-year Power Purchase Agreement (PPA) with Bangalore Electricity Supply Company (BESCOM) for a take of 100% of the output. ARA and ANA are ACCIONA's first wind farms eligible for CER credits under the Clean Development Mechanism (CDM).

ACCIONA is in talks with the World Bank for The Green Carbon Fund which is assessing participation in the project as buyer for CERs likely to arise between 2010 and 2012. An environmental and social assessment has been conducted as part of the procedure and related documents have been provided. These are included below, consistent with the requirement of the World Bank's disclosure policy. Rajasthan (738.5 MW)

Gurgaon-headquartered Gujarat Fluorochemicals Ltd is at an advanced stage of commissioning a large wind farm in Jodhpur district of Rajasthan. A senior official of the Projectmonitor that out of the total 31.5 mw capacity, 20 mw had been completed so far. The remaining capacity would come on line shortly, he added. For the INOX Group company, this would be the largest wind farm. In 2006-07, GFL commissioned a 23.1-mw wind power project at Gadhwa village near Panchgani in Satara district of Maharashtra. Both the wind farms will be grid-connected and will earn carbon credits for the company, the official noted. In an independent development, cement major ACC Ltd has proposed to set up a new wind power project in Rajasthan with a capacity of around 11 mw. Expected to cost around Rs 60 crore, the wind farm will meet the power requirements of the company's Lakheri cement unit where capacity was raised from 0.9 million tpa to 1.5 million tpa through a modernisation plan. For ACC, this would be the second wind power project after the 9-mw farm at Udayathoor in Tirunelveli district of Tamil Nadu. Rajasthan is emerging as an important destination for new wind farms, although it is currently not amongst the top five states in terms of installed capacity. As of 2007 end, this northern state had a total of 496 mw, accounting for a 6.3 per cent share in India's total capacity.

Madhya Pradesh (212.8 MW)
Present Rs.3.97p/kwh coming down to Rs 3.30 from the 5th year to 20th year. In consideration of unique concept Govt. of Madhya Pradesh has sanctioned another 15 MW project to MPWL at Nagda Hills near Dewas. All the 25 WEGs (Wind Energy Generators) have been commissioned on 31.03.2008 and under successful operation.

Kerala (26.5 MW)

The first wind farm of the state was set up at Kanjikode in Palakkad district. It has a generating capacity of 23.00 MW. A new wind farm project was launched with private participation at Ramakkalmedu in Idukki district. The project, which was inaugurated by chief minister V. S. Achuthanandan in April 2008, aims at generating 10.5 MW of electricity.

The Agency for Non-Conventional Energy and Rural Technology (ANERT), an autonomous body under the Department of Power, Government of Kerala, is setting up wind farms on private land in various parts of the state to generate a total of 600 mw of power. The agency has identified 16 sites for setting up wind farms through private developers. To start with, ANERT will establish a demonstration project to generate 2 mw of power at Ramakkalmedu in Idukki district in association with the Kerala State Electricity Board. The project is slated to cost Rs 21 crore. Other wind farm sites include Palakkad and Thiruvananthapuram districts. The contribution of non-conventional energy in the total 6,095 mw power potential is just 5.5 per cent, a share the Kerala government wants to increase by 30 per cent. ANERT is engaged in the field of development and promotion of renewable sources of energy in Kerala. It is also the nodal agency for implementing renewable energy programmes of the Union ministry of non-conventional energy sources.

West Bengal (1.10 MW)

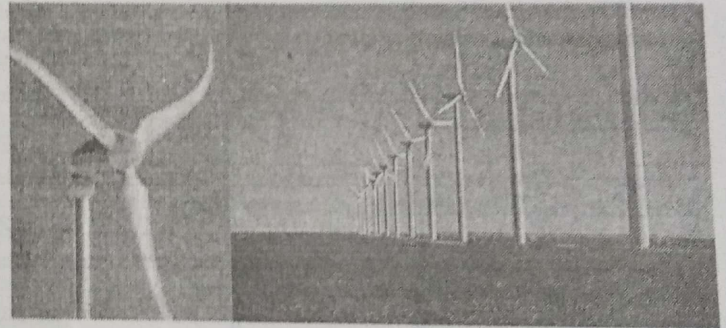
The total installation in West Bengal is just 1.10 MW as there was only 0.5 MW additions in 2006-2007 and none between 2007-2008 and 2008-2009

Bengal - Mega 50 MW wind energy project soon for country

Suzlon Energy Ltd plans to set up a large wind-power project in West Bengal Suzlon Energy Ltd is planning to set up a large wind-power project in West Bengal, for

which it is looking at coastal Midnapore and South 24-Parganas districts. According to SP Gon Chaudhuri, chairman of the West Bengal Renewable Energy Development Agency, the 50 MW project would supply grid-quality power. Gon Chaudhuri, who is also the principal secretary in the power department, said the project would be the biggest in West Bengal using wind energy. At present, Suzlon experts are looking for the best site. Suzlon aims to generate the power solely for commercial purpose and sell it to local power distribution outfits like the West Bengal State Electricity Board (WBSEB).

Suzlon will invest around Rs 250 crore initially, without taking recourse to the funding available from the Indian Renewable Energy Development Agency (Ireda), said Gon Chaudhuri. He said there are five wind-power units in West Bengal, at Frazerganj, generating a total of around 1 MW. At Sagar Island, there is a composite wind-diesel plant generating 1 MW. In West Bengal, power companies are being encouraged to buy power generated by units based on renewable energy. The generating units are being offered special rates. S Banerjee, private secretary to the power minister, said this had encouraged the private sector companies to invest in this field. 3.20 MW is installed in other states.



List of large onshore wind farms throughout the world

Farm	Current capacity (MW)	Country	Notes
Adair Wind Farm	175	USA	
Altamont Pass Wind Farm	596	USA	multiple farms

Alto Minho Wind Farm	240	Portugal	
Anse-à-Valleau Wind Farm	100	Canada	
Arada-Montemuro Wind Farm	112	Portugal	
Ashtabula Wind Farm	196	USA	
Barton Wind Farm	160	USA	
Barton Chapel Wind Farm	120	USA	
Bear Mountain Wind Park	102	Canada	
Benton County Wind Farm	130	USA	
Big Horn Wind Farm	200	USA	
Biglow Canyon Wind Farm	274.9	USA	
Bii Stinu Wind Farm	164	Mexico	174.8 MW under construction
Black Law Wind Farm	124	UK	
Bliss Wind Farm	100	USA	
Blue Canyon Wind Farm	225	USA	
Blue Sky Green Field Wind Farm	145	USA	
Brazos Wind Farm	160	USA	
Buffalo Gap Wind Farm	523	USA	
Buffalo Ridge Wind Farm	225	USA	completed 2008
Bull Creek Wind Farm	180	USA	
Callahan Divide Wind Farm	114	USA	
Camp Grove Wind Farm	150	USA	
Camp Springs Wind Farm	130	USA	

Capital Wind Farm	140	Australia	
Capricorn Ridge Wind Farm	662	USA	completed 2008
Carroll Wind Farm	150	USA	
Cedar Creek Wind Farm	300.5	USA	
Centennial Wind Farm	120	USA	
Centennial Wind Power Facility	150	Canada	
Century Wind Farm	150	USA	
Champion Wind Farm	126	USA	
Colorado Green Wind Farm	162	USA	
Crystal Lake Wind Farm	416	USA	completed 2009
Crystal Rig Wind Farm	180	UK	
Dalhousie Mountain Wind Farm	39	Pictou County Nova Scotia Canada	
Darjinghe Wind Farm	200	China	
Desert Sky Wind Farm	160	USA	
Dutch Hill/Cohocton Wind Farm	125	USA	
El Marquesado Wind Farm	198	Spain	
Elbow Creek Wind Project	122	USA	
Elk River Wind Farm	150	USA	
Enbridge Ontario Wind Farm	181	Canada	
Eurus Wind Farm	250.5	Mexico	
Fântânele Wind Farm	0	Romania	600 MW under construction
Fenton Wind Farm	206	USA	
Forest Creek Wind Farm	124	USA	

Forward Wind Energy Center	129	USA	
Fowler Ridge Wind Farm	599.8	USA	
Gardunha Wind Farm	106	Portugal	completed 2010
Glacier Wind Farm	210	USA	
Glenrock Wind Farm	118.5	USA	
Goodland I	130	USA	
Gray County Wind Farm	102	USA	
Green Mt. Energy Wind Farm	160	USA	
Gulf Wind Farm	283.2	USA	
Hackberry Wind Farm	165	USA	completed 2009
Hadyard Hill Wind Farm	120	UK	
High Winds Wind Farm	162	USA	
Higuerauela Wind Farm	161	Spain	
Hopkins Ridge Wind Farm	149	USA	
Horse Hollow Wind Energy Center	736	USA	
Huitengliang Wind Farm	300	China	completed 2006
Intrepid Wind Farm	160	USA	
Jardin d'Eole Wind Farm	127	Canada	
Jilin Tongyu Tongfa Wind Farm	100.5	China	
Ashtabula Wind Farm	135	USA	
Barton Wind Farm	132	USA	
Barton Chapel Wind Farm	281.2	USA	
Bear Mountain Wind Park	399	USA	completed 2003
		USA	completed 2008

Benton County Wind Farm	239	Australia	
Big Horn Wind Farm	159	USA	
Biglow Canyon Wind Farm	400	USA	completed 2008
Bii Stinu Wind Farm	100.8	Iran	completed 2009
Black Law Wind Farm	321.8	USA	completed 2006
Bliss Wind Farm	208	Spain	
Blue Canyon Wind Farm	140	USA	
Blue Sky Green Field Wind Farm	150	USA	
Brazos Wind Farm	199	Canada	
Buffalo Gap Wind Farm	203	USA	
Buffalo Ridge Wind Farm	264	USA	completed 2008
Bull Creek Wind Farm	168	Australia	
Callahan Divide Wind Farm	148	Japan	
Camp Grove Wind Farm	204	USA	
Camp Springs Wind Farm	106	USA	
Capital Wind Farm	126	USA	
Capricorn Ridge Wind Farm	150	Brazil	
Carroll Wind Farm	458	USA	completed 2009
Cedar Creek Wind Farm	180	USA	
Centennial Wind Farm	400.5	USA	completed 2008
Centennial Wind Power Facility	202	USA	
Century Wind Farm	120	USA	
Champion Wind Farm	144	Portugal	

Colorado Green Wind Farm	300.3	USA	completed 2009
Crystal Lake Wind Farm	196	USA	
Crystal Rig Wind Farm	101	Canada	
Dalhousie Mountain Wind Farm	195	Australia	
Danjinghe Wind Farm	100	USA	
Desert Sky Wind Farm	189	Canada	
Dutch Hill/Cohocton Wind Farm	143	New Zealand	
El Marquesado Wind Farm	100	USA	
Elbow Creek Wind Project	123	USA	
Elk River Wind Farm	118.5	USA	
Enbridge Ontario Wind Farm	781.5	USA	completed 2009
Eurus Wind Farm	615	USA	multiple farms
Fântânele Wind Farm	160	Mexico	
Fenton Wind Farm	150	USA	completed 2008
Forest Creek Wind Farm	300	USA	completed 2009
Forward Wind Energy Center	198	Spain	
Fowler Ridge Wind Farm	249	USA	
Gardunha Wind Farm	150	Norway	
Glacier Wind Farm	170	Australia	
Glenrock Wind Farm	104	Canada	
Goodland I	120	USA	
Gray County Wind Farm	300	USA	
Green Mt. Energy Wind Farm	150	USA	

Gulf Wind Farm	463	USA	<i>completed 2007</i>
<i>Hackberry Wind Farm</i>	<i>161</i>	<i>New Zealand</i>	
Hadyard Hill Wind Farm	180	USA	
High Winds Wind Farm	685	USA	<i>multiple farms</i>
Higueruela Wind Farm	150	USA	
Hopkins Ridge Wind Farm	169	USA	
Horse Hollow Wind Energy Center	396	USA	<i>completed 2008</i>
Huitengliang Wind Farm	201	India	
Intrepid Wind Farm	240	Portugal	
Jardin d'Eole Wind Farm	500	Albania	
Walnut Wind Farm	153	USA	
Waubra Wind Farm	192	Australia	
Wethersfield Wind Park	124	USA	
Whispering Willow Wind Farm	200	USA	
White Creek Wind Power Project	204	USA	
Whitelee Wind Farm	322	UK	<i>completed 2009</i>
Wild Horse Wind Farm	229	USA	
Wildorado Wind Ranch	161	USA	
Wolfe Island Wind Project	197.8	Canada	
Woodward Wind Farm	159	USA	
Woolnorth Wind Farm	140	Australia	

ANDAMAN &
NICOBAR ISLANDS

1	1	Keating Point	Nicobars	09	15	92	46	2	14/03/97	12/05/99	20	4.46	114	175
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ANDHRA PRADESH

(35 Stations)

2	1	Alangarapeta	Anantapur	14	46	77	47	360	16/09/00	17/10/02	25	5.77	244	272
3	2	Badhrampalli Kottala	Kurnool	14	55	77	24	440	25/09/94	22/01/98	25	5.92	248	277
4	3	Banderlapalli	Kurnool	15	01	78	04	438	23/03/97	30/04/99	25	5.78	240	320
5	4	Bhimunipatnam*	Visakapatnam	17	49	83	24	120	03/09/88	15/12/91	20	5.31	195	282
6	5	Borampalli	Anantapur	14	30	77	09	550	19/07/98	15/09/00	25	5.38	163	219
7	6	Burugula	Kurnool	15	08	77	57	540	18/09/98	25/11/00	25	5.11	147	216
8	7	Chinnababayapalli	Anantapur	13	57	77	37	750	21/07/98	23/11/00	25	5.14	132	206
9	8	Jamalamadugu*- 1	Cuddapah	14	49	78	23	195	12/12/92	28/12/95	25	4.86	161	265
10	9	Jamalamadugu- 2	Cuddapah	14	44	78	22	380	11/12/92	27/12/95	25	5.17	165	248
11	10	Kadavakallu*- 1	Anantapur	14	51	77	55	349	04/12/92	14/07/98	25	6.14	303	325
12	11	Kadavakallu - 2 (Ref.Stn.)	Anantapur	14	47	77	57	395	20/05/01	-	25	6.47	274	333
13	12	Kakula Konda	Chittoor	13	43	79	21	981	24/08/88	25/09/93	20	6.42	332	541
14	13	Kodumuru	Kurnool	15	43	77	45	410	18/09/00	19/10/02	25	5.79	225	270
15	14	Kondamithipalli*	Kurnool	15	03	78	03	449	22/03/97	30/04/99	25	5.89	252	349
16	15	Korrakodu	Anantapur	14	46	77	15	460	14/09/00	18/10/02	25	5.19	146	220
17	16	M.P.R. Dam*	Anantapur	14	53	77	31	400	27/08/88	29/09/93	20	5.53	228	269

18	17	Madugupalli	Anantapur	14	42	77	51	440	20/07/98	21/11/00	25	5.19	152	266
19	18	Mustikovada	Anantapur	14	15	77	32	600	18/08/92	21/05/01	20	5.61	201	237
20	19	Nallakonda*	Anantapur	14	07	77	34	757	20/11/94	20/01/98	25	6.33	276	324
21	20	Narasimha Konda	Nellore	14	30	79	52	100	31/08/88	26/09/93	20	5.58	186	403
22	21	Nazeerabad*	Rangareddy	17	11	77	55	670	10/11/94	29/05/97	25	5.83	176	232
23	22	Panpanoor Thanda*	Anantapur	14	38	77	24	490	24/09/94	23/11/97	25	5.44	182	232
24	23	Payalakuntla	Cuddapah	14	53	79	02	340	25/08/88	27/09/93	20	5.58	230	257
25	24	Ramagiri*-I	Anantapur	14	16	77	31	580	28/08/88	30/09/93	20	5.42	205	308
26	25	Ramagiri -II (Ref.Stn.)	Anantapur	14	17	77	31	573	21/05/01	28/06/05	25	5.88	197	226
27	26	Ramagiri - III	Anantapur	14	22	77	32	550	27/09/91	28/08/95	20	5.39	190	246
28	27	Siddanagatta	Kurnool	15	34	78	03	490	09/01/99	26/11/00	25	4.97	126	231
29	28	Singanamala	Anantapur	14	46	77	44	469	05/12/92	24/01/98	20	6.61	366	392
30	29	Talaricheruvu	Anantapur	14	57	78	03	360	19/03/97	29/04/99	25	5.03	144	298
31	30	Tallimadugula	Anantapur	14	22	77	32	540	20/09/94	21/01/98	25	6.17	260	288
32	31	Tirumala	Chittoor	13	40	79	22	880	21/11/87	19/06/92	20	5.67	226	374
33	32	Tirumalayapalli*	Cuddapah	14	54	78	11	442	26/03/97	01/05/99	20	5.28	154	285
34	33	Ulindakonda	Kurnool	15	38	77	59	430	19/09/00	19/10/02	25	4.87	130	225
35	34	Vajrakarur*-I	Anantapur	14	58	77	19	509	21/03/97	30/07/00	20	5.41	173	243
36	35	Vajrakarur - II	Anantapur	14	58	77	19	509	15/03/99	30/07/01	50	5.40	154	202
<i>GUJARAT</i>														
<i>(38 Stations)</i>														
37	1	Adesar	Kachchh	23	33	70	57	41	13/06/88	20/10/93	20	4.33	093	307
38	2	Amrapar* (Gir)	Junagarh	21	11	70	25	140	10/08/96	09/10/98	20	5.46	147	241
39	3	Amrapar (Seth)	Jamnagar	21	44	70	03	160	11/02/97	08/05/99	20	5.33	151	221
40	4	Bamanbore*- 2	Surendranagar	22	26	71	03	200	28/10/90	21/10/95	20	5.64	171	243
41	5	Bayath	Kachchh	22	56	69	11	20	14/06/97	13/07/99	20	4.90	118	300
42	6	Bhandariya*	Junagarh	22	04	69	41	80	22/12/92	08/12/96	20	5.42	162	208
43	7	Butavadar	Jamnagar	21	57	70	11	120	22/04/01	28/08/03	20	4.56	098	240

44	8	Dhank* - I-I (Ref.Stn.)	Rajkot	21	47	70	06	180	28/10/90	23/02/98	20	6.78	312	414
45	9	Dhank -2	Rajkot	21	48	70	07	208	28/10/90	21/10/95	20	6.97	327	367
46	10	Gala*	Jamnagar	22	15	70	07	124	07/08/98	15/11/00	20	5.49	175	254
47	11	Godhadhar*	Rajkot	22	03	71	19	240	13/02/97	07/05/99	20	5.40	144	345
48	12	Haripar*	Jamnagar	22	16	69	38	40	09/08/96	20/12/98	20	5.57	160	210
49	13	Harshad	Jamnagar	21	50	69	22	12	07/12/86	27/02/92	20	5.56	164	239
50	14	Jafrabad*	Amreli	20	54	71	24	20	15/06/88	25/10/93	20	4.86	137	242
51	15	Jamanvada*	Junagarh	23	35	68	36	60	22/02/93	11/12/96	20	5.17	149	299
52	16	Jasapar	Amreli	21	21	71	06	230	25/04/01	29/08/03	20	4.78	104	214
53	17	Kagavad	Rajkot	21	48	70	41	132	14/03/00	23/03/03	20	5.13	141	212
54	18	Kalyanpur*	Jamnagar	22	03	69	24	80	31/10/90	20/10/95	20	6.14	208	327
55	19	Khambada	Rajkot	21	48	71	08	180	20/11/99	24/12/02	20	4.86	126	204
56	20	Kukma*	Kachchh	23	10	69	40	220	14/08/90	22/10/93	20	5.33	150	239
57	21	Lamba	Jamnagar	21	54	69	19	20	22/12/92	10/02/97	20	5.56	164	232
58	22	Limbara	Surendranagar	22	32	70	59	160	25/12/92	09/12/96	20	5.31	166	227
59	23	Mahidad*	Surendranagar	22	17	71	12	330	23/12/98	18/04/01	25	5.97	178	231
60	24	Moti Sindholi*	Kachchh	23	09	68	47	10	28/05/88	21/10/93	20	4.86	118	311
61	25	Mundra*	Kachchh	22	47	69	43	2	29/05/88	21/10/93	20	5.42	168	303
62	26	Nani Kundal	Bhavnagar	21	55	71	28	154	13/04/97	08/07/99	20	5.56	163	278
63	27	Navadra-I (Ref.Stn.)	Jamnagar	21	57	69	16	24	23/12/92	10/02/97	20	5.78	183	297
64	28	Navi Bander*	Jamnagar	21	27	69	47	1	14/06/88	24/10/93	20	5.42	153	213
65	29	Okha*	Jamnagar	22	27	69	03	2	08/12/86	24/10/93	20	5.39	150	260
66	30	Okhamadhi	Jamnagar	22	06	69	06	12	14/06/88	24/10/93	20	5.28	129	209
67	31	Poladiya*	Kachchh	23	04	69	13	150	05/08/98	14/11/00	20	5.72	177	278
68	32	Ratabhe	Surendranagar	22	56	71	02	70	04/08/98	13/09/99	20	4.86	123	212
69	33	Rojmal - 2	Bhavnagar	-	-	-	-	-	20/11/99	24/12/02	20	5.11	129	317
70	34	Sanodar*	Bhavnagar	21	33	72	06	230	11/08/96	24/12/98	20	6.24	197	373
71	35	Sinai*	Kachchh	23	03	70	04	57	13/08/96	18/12/98	20	5.77	183	244

72	36	Surajbari*	Kachchh	23	13	70	42	10	13/06/88	22/10/93	20	5.42	184	444
73	37	Suwarda	Jamnagar	22	23	70	07	90	20/05/98	21/04/01	20	5.61	166	243
74	38	Warshamedi	Rajkot	22	58	70	34	3	11/11/00	27/08/03	20	5.67	192	>499
<i>KARNATAKA</i>														
<i>(27 Stations)</i>														
75	1	B.B. Hills*	Chikmangalur	13	26	75	46	1840	19/10/90	09/02/96	20	7.44	498	581
76	2	Chalamatti*	Dharwar	15	18	74	03	705	21/09/98	27/11/00	20	5.94	189	268
77	3	Channavadyanpura	Mysore	11	57	76	36	940	15/09/00	15/03/03	25	5.66	154	243
78	4	Chikkodi* (Ref.Stn.)	Belgaum	15	25	74	35	760	07/08/93	-	25	6.44	264	298
79	5	Gokak*	Belgaum	16	10	74	48	723	05/10/89	27/11/94	20	5.33	168	336
80	6	Hanamsagar*	Raichur	15	54	76	02	628	07/10/89	24/11/94	20	5.72	173	270
81	7	Hanumanhatti*	Belgaum	15	53	74	43	895	31/01/90	26/01/95	20	5.64	165	294
82	8	Horti*	Bijapur	17	07	75	44	620	07/07/93	16/07/99	25	5.50	173	202
83	9	Jogimatti* (Ref.Stn.)	Chitradurga	14	10	76	24	1120	08/10/89	-	20	8.42	498	632
84	10	Kappattaguda*	Gadag	15	14	75	43	959	22/09/00	13/03/03	25	6.92	311	423
85	11	Khamkarhatti*	Belgaum	15	47	74	36	841	09/07/93	15/07/99	25	5.64	159	217
86	12	Malgatti	Raichur	16	25	74	47	780	06/10/89	07/12/93	20	5.44	156	335
87	13	Mannikere*	Belgaum	15	58	74	28	923	19/05/99	17/08/01	20	6.75	252	315
88	14	Mavinhunda*	Belgaum	16	25	74	47	780	17/05/99	19/08/01	20	6.15	212	>212
89	15	Nargund	Gadag	15	44	75	22	788	09/10/03	20/01/05	25	8.37	530	652
90	16	Ramgad	Bellary	15	08	76	27	980	21/09/00	13/03/03	25	5.07	134	263
91	17	Sangundi*	Bijapur	16	15	75	44	625	06/07/91	02/08/94	20	5.19	153	259
92	18	Sogi	Bellary	14	54	75	59	890	21/05/99	21/08/01	25	6.61	246	284
93	19	Subramanyahalli*	Bellary	15	01	76	33	1026	20/09/00	13/03/03	25	5.87	214	409
94	20	Arasinagundi (KPCL)	Davanagar	14	29	76	21	780	__/11/95	__/08/96	30	7.50	392	>392
95	21	Bullenahalli - I (KPCL)	Tumkur	13	25	76	40	1060	__/07/95	__/09/96	30	5.89	168	>168
96	22	Bullenahalli - II (KPCL)	Tumkur	13	24	76	41	1060	-	-	30	5.65	195	>195
97	23	Gujannur (KPCL)	Bellary	14	58	75	54	684	__/06/96	__/08/97	30	6.49	240	>240

98	24	Jogimatti (KPCL)	Chitradurga	14	12	76	25	1040	_/11/95	_/10/96	30	8.62	582	>582
99	25	Madekeripura (KPCL)	Chitradurga	14	13	76	27	800	_/07/95	_/05/96	30	7.54	365	>365
100	26	Sogi - A (KPCL)	Bellary	14	55	75	59	845	_/06/96	_/08/97	30	7.38	415	>415
101	27	Sogi - B (KPCL)	Bellary	14	54	75	59	895	_/06/96	_/08/97	30	6.80	271	284
102	28	T B Dam	Bellary	15	16	76	21	619	11/06/06	-	50	6.54	322	319
103	29	T B Dam	Bellary	15	14	76	22	746	02/11/06	-	50	6.79	299	330
104	30	G R Hall-I	Chitradurga	14	18	76	24	831	29/04/07	-	50	-	-	261

KERALA

(17 Stations)

105	1	Karlasammedu	Idukki	09	51	77	10	1160	12/11/98	09/11/00	20	6.44	251	375
106	2	Kanjikode*	Palakkad	10	47	76	47	120	04/01/90	03/01/95	20	6.28	218	296
107	3	Kolahalamedu	Idukki	09	40	76	56	1000	25/11/92	29/12/95	20	4.69	146	222
108	4	Kotamala	Palakkad	10	40	76	36	150	23/09/90	04/01/94	20	5.33	154	239
109	5	Kottathara	Palakkad	11	07	76	39	750	08/01/90	02/01/95	20	5.47	207	297
110	6	Kulathummedu*	Idukki	09	45	77	10	1140	06/03/98	07/11/00	20	5.61	181	349
111	7	Kuttikanam	Idukki	09	35	76	59	1000	06/05/94	07/01/98	20	4.58	140	243
112	8	Nallasingam*	Palakkad	11	05	76	43	840	13/01/99	16/07/01	20	6.36	324	456
113	9	Panchalimedu	Idukki	09	32	76	57	950	23/11/92	03/09/97	20	5.61	258	327
114	10	Parampukettimedu	Idukki	09	54	77	12	1160	07/03/98	08/11/00	20	7.58	470	721
115	11	Ponmudi	Trivandrum	08	46	77	08	1074	19/09/90	29/10/95	20	5.14	216	226
116	12	Pullikanam	Idukki	09	44	76	52	1100	06/08/91	08/09/94	20	5.06	178	200
117	13	Pushpagiri	Idukki	09	51	77	04	1085	31/08/04	12/10/06	50	6.02	-	223
118	14	Ramakalmedu	Idukki	09	49	77	14	920	07/08/91	05/03/98	20	8.25	532	535
119	15	Sakkulathummedu	Idukki	09	52	77	13	1040	11/11/98	30/08/00	20	7.93	531	561
120	16	Senapathi	Idukki	09	57	77	11	1240	08/03/98	09/11/00	20	5.39	189	339
121	17	Tolanur	Palakkad	10	42	76	30	100	22/09/90	04/11/93	20	4.36	115	231

LAKSHADWEEP

(8 Stations)

146	10	Gawalwadi	Nasik	20	06	73	43	740	31/03/98	23/05/00	20	5.28	140	278
147	11	Gude Panchagani*	Sangli	17	07	73	59	903	17/01/93	24/10/97	20	5.50	178	296
148	12	Kankora	Aurangabad	19	59	75	27	920	22/11/01	13/07/04	25	5.56	127	204
149	13	Kas	Satara	17	44	73	49	1240	10/02/98	14/02/00	25	5.69	194	277
150	14	Kavdya Donger*	Ahmadnagar	19	00	74	32	900	03/04/98	13/12/00	25	6.44	224	277
151	15	Khandke*	Ahmadnagar	19	08	74	53	920	20/03/96	25/03/98	20	5.44	146	250
152	16	Kolgaon*	Ahmadnagar	18	50	74	43	800	02/05/95	04/06/98	25	5.69	177	238
153	17	Lonavla*	Pune	18	47	73	23	560	05/06/88	24/08/93	20	4.31	122	285
154	18	Mandhardeo	Satara	18	02	73	53	1280	09/02/98	13/02/00	25	5.39	153	206
155	19	Matrewadi*	Satara	17	11	73	56	898	26/03/96	05/04/98	25	5.78	211	253
156	20	Palsi	Satara	17	20	73	40	970	21/10/00	26/10/02	25	5.24	137	254
157	21	Panchgani	Satara	17	55	73	48	1372	10/12/88	28/08/93	20	5.11	133	205
158	22	Panchpatta	Ahmadnagar	19	44	73	53	1054	14/02/01	09/02/03	25	5.70	201	236
159	23	Raipur	Dhule	21	02	74	22	500	29/03/99	14/06/01	25	5.25	162	214
160	24	Rohina	Latur	18	27	76	56	676	15/11/03	-	25	5.57	149	226
161	25	Sautada*	Bid	18	48	75	20	800	15/03/96	01/04/98	25	5.89	167	223
162	26	Takarmauli*	Dhule	21	05	74	03	624	29/03/99	13/06/01	25	5.78	186	224
163	27	Thoseghar* (Ref.Stn.)	Satara	17	35	73	53	1140	05/05/95	01/06/05	20	6.03	229	>250
164	28	Vankusawade* - I	Satara	17	27	73	50	1100	25/03/96	10/12/98	25	5.89	231	293
165	29	Vankusawade - II	Satara	-	-	-	-	-	07/06/01	19/08/04	50	5.68	188	249
166	30	Varekarwadi	Sangli	17	13	73	59	920	26/03/96	12/10/98	20	5.84	204	216
167	31	Vijayadurg*	Sindhudurg	16	30	73	20	100	17/12/86	30/08/93	20	5.44	207	253
168	32	Vaspel	Sayli	17	06	75	21	681	20/10/03	_/12/06	50	5.62	156	220
<i>ORISSA</i>														
<i>(6 Stations)</i>														
169	1	Chandipur	Baleshwar	21	32	87	01	5	10/09/86	22/08/90	20	4.39	120	315
170	2	Chatrapur	Ganjam	19	18	84	58	9	15/09/86	24/08/90	20	4.00	106	264
171	3	Damanjodi* - 2	Koraput	18	50	83	00	1340	30/01/98	26/06/99	20	5.18	150	250

172	4	Gopalpur	Ganjam	19	16	84	54	7	15/09/86	24/08/90	20	4.50	124	265
173	5	Paradwip	Cuttack	20	23	86	41	6	11/09/86	30/08/90	20	5.06	153	289
174	6	Puri*	Puri	19	47	85	48	3	03/09/86	23/08/90	20	4.86	137	214
<i>RAJASTHAN</i>														
<i>(7 Stations)</i>														
175	1	Devgarh*	Chittorgarh	24	03	74	39	520	25/07/96	17/01/99	25	5.52	151	281
176	2	Harshnath	Sikar	27	30	75	10	910	20/09/96	13/11/98	25	5.73	206	206
177	3	Jaisalmer* - 1	Jaisalmer	26	56	70	55	231	08/06/88	16/08/93	25	4.94	159	274
178	4	Jaisalmer - 2 (Ref.Stn.)	Jaisalmer	26	56	70	54	231	20/01/99	03/12/05	20	5.50	182	311
179	5	Khodal	Barmer	26	22	71	13	200	23/12/88	17/08/93	20	4.72	135	229
180	6	Mohangarh	Jaisalmer	27	17	71	13	155	26/04/90	15/08/93	20	4.31	117	243
181	7	Phalodi*	Jodhpur	27	06	72	19	250	29/12/88	14/08/93	20	4.83	142	261
<i>TAMIL NADU</i>														
<i>(43 Stations)</i>														
182	1	Achankuttam*	Tirunelveli	08	57	77	29	139	20/03/96	11/03/98	20	5.17	270	437
183	2	Alagiyapandiyapuram*	Nellaikattabom	08	56	77	39	85	19/07/88	10/09/93	20	5.81	301	487
184	3	Andhiyur	Coimbatore	10	36	77	11	380	10/05/96	15/05/98	20	5.31	177	271
185	4	Andipatti*	Madurai	10	00	77	33	320	18/08/86	04/01/91	20	5.28	266	346
186	5	Arasampalayam	Coimbatore	10	51	77	02	370	24/05/90	10/05/95	20	5.69	195	291
187	6	Ayikudy*	Nellaikattabom	09	00	77	21	179	21/07/88	10/09/93	20	5.94	305	536
188	7	Edayarpalayam*	Coimbatore	10	51	77	02	370	25/05/90	11/05/95	20	6.22	273	398
189	8	Ennore*	Chengalpattu	13	15	80	20	1	23/03/92	20/04/95	20	5.36	139	243
190	9	Gangaikondan	Tirunelveli	08	51	77	46	40	14/09/94	10/01/98	25	5.11	246	338
191	10	Kalunir Kulam	Tirunelveli	08	55	77	27	119	30/09/04	31/07/06	50	5.86	285	390
192	11	Kannankulam	Tirunelveli	08	09	77	36	20	15/07/94	09/01/98	25	5.92	238	375
193	11	Kattadimalai	Kanyakumari	08	14	77	33	90	22/07/88	09/09/93	20	6.58	312	488
194	12	Kayattar-I	Chidambaranar	08	58	77	44	94	21/08/86	23/05/93	20	5.64	294	413
195	13	Kayattar-II (Ref.Stn.)	Chidambaranar	08	56	77	43	105	02/11/95	30/10/05	25	5.69	285	356

196	14	Kethanur-1	Coimbatore	10	55	77	15	439	21/05/90	15/08/00	20	5.86	259	376
197	15	Kethanur-2 (Ref.Stn.)	Coimbatore	10	55	77	15	403	15/08/00	29/11/05	25	5.47	189	345
198	16	Kumarapuram	Tirunelveli	08	16	77	35	80	03/12/92	06/09/97	25	6.11	288	408
199	17	Mangalapuram*	Tirunelveli	09	03	77	22	182	07/03/96	11/03/98	20	6.19	312	423
200	18	Meenakshipuram	Madurai	09	53	77	16	464	18/08/86	04/01/91	20	4.56	224	334
201	19	Mettukadai*	Periyar	10	53	77	23	350	22/05/90	17/09/93	20	5.00	184	281
202	20	Muppandal-1(Ref.Stn.)	Kanyakumari	08	16	77	33	105	21/08/86	21/05/93	20	7.08	406	712
203	21	Muppandal-2	Kanyakumari	08	15	77	33	103	03/05/97	27/10/05	25	6.19	243	410
204	22	Muttom	Kanyakumari	08	08	77	19	70	11/07/94	04/07/97	25	4.75	116	234
205	23	Myvadi*	Coimbatore	10	36	77	19	341	10/05/96	07/08/97	20	5.44	251	376
206	24	Naduvakkurichi*	Nellaikattabom	09	07	77	30	163	27/06/91	12/07/94	20	4.67	157	244
207	25	Nettur	Nellaikattabom	08	54	77	33	100	07/12/92	08/09/97	25	5.53	338	419
208	26	Onamkulam *	Chidambaranar	08	57	77	51	100	04/12/92	09/09/97	25	5.53	247	292
209	27	Ottapidaram*	Chidambaranar	08	54	78	01	40	25/06/91	07/07/96	20	5.14	221	378
210	28	Ovari*	Tirunelveli	08	17	77	52	21	03/03/96	10/03/98	20	5.08	160	221
211	29	Panakudi	Tirunelveli	08	19	77	33	140	05/07/96	13/09/98	20	6.36	366	469
212	30	Pongalur*	Coimbatore	10	58	77	21	388	23/05/90	11/05/95	20	5.31	213	309
213	31	Poolavadi*	Coimbatore	10	44	77	17	321	13/08/86	29/05/93	20	5.89	283	445
214	32	Poosaripatti*	Coimbatore	10	40	77	07	380	15/12/92	10/09/96	25	5.36	168	254
215	33	Puliyamkulam*	Nellaikattabom	08	19	77	44	35	26/08/86	21/05/93	20	5.25	188	343
216	34	Pushpathur-2	Dindigul	10	32	77	25	363	15/10/00	05/12/02	25	4.47	128	254
217	35	Rameswaram	Ramanathpuram	09	14	79	21	4	24/07/88	11/11/93	20	6.64	290	604
218	36	Sankaneri*	Tirunelveli	08	12	77	40	30	14/07/94	09/01/98	25	6.28	258	388
219	37	Sembagaramanpudur	Kanyakumari	08	15	77	29	40	22/08/86	27/10/91	20	6.03	300	476
220	38	Servallar Hills	Nellaikattabom	08	42	77	21	312	20/07/88	08/01/91	20	4.94	207	313
221	39	Sultanpet	Coimbatore	10	52	77	11	380	28/07/86	29/05/93	20	5.28	203	206
222	40	Talayathu	Nellaikattabom	08	48	77	40	105	18/07/88	10/09/93	20	5.69	324	422
223	41	Thannirpandal	Coimbatore	10	57	77	19	400	08/11/96	06/01/99	20	5.06	216	330

224	42	Tuticorin	Tuticorin	08	50	78	08	3	31/08/86	24/05/93	20	4.89	148	145
225	43	Vakkakulam*	Tuticorin	08	45	78	00	12	04/03/96	16/11/98	20	4.61	167	256
<i>UTTARANCHAL</i>														
226	1	Bachelikhal	Garhwal	30	09	78	34	965	04/05/97	29/04/99	20	5.02	144	244
<i>WEST BENGAL</i>														
227	1	Gangasagar*	24 Parganas	21	38	88	04	3	03/02/95	30/11/97	25	4.83	155	229

Barriers

Initial cost for wind turbines is greater than that of conventional fossil fuel generators. Noise produced by the rotor blades. There is interference on television signals. It causes significant bird and other avian deaths. Wind resources might not be available near cities and, even so, the space might be used for other purposes that can generate larger profits. Wind cannot be stored (unless batteries are used) Not all winds can be harnessed to meet the timing of electricity demands.

Conclusion:-

It is concluded that the scope of setting up of wind power units in India is bright in present scenario as well as to full fill future power needs. Especially in rural areas (villages) where no electric supply is available the domestic wind mills must act as power source. Govt. of India sets up "227" Wind Monitoring Stations (WMS) in all over India for the purpose of collection of average wind speed at (25&50 meter height) and relevant data to setting up of suitable size wind power unit. In future the composite system (Solar cell Panel+Domestic wind mills) may successfully supply power in remote rural areas.

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GREEN CHEMISTRY IN SERVICE OF MANKIND

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Abstract:

In this overview on green chemistry various facts of green chemistry have been discussed, particularly from the point of view of pollution prevention, development of greener processes, avoidance of chemicals by means of non hazardous substances, economics and biocatalysis.

Key Words: Green chemistry, pollution prevention, greener process, economics, biocatalysis

Green Chemistry or benign chemistry or clean chemistry means using a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemicals products in industries. In other words Green Chemistry is all about

- o Waste Minimisation at Source.
- o Use of Catalysts in place of Reagents.
- o Using Non-Toxic Reagents.
- o Use of Renewable Resources.
- o Improved Atom Efficiency.
- o Use of Solvent Free or Recyclable Environmentally Benign Solvent systems.

Problems caused by chemical industries are as follows:

Inside the Plant: Exposure of employees to carcinogenic fumes and toxics.

Pollution exiting the Plant:

- | | |
|-----------------|---------------------------------------|
| Air emissions | Fugitive emissions from storage tanks |
| | Evaporating solvents. |
| | Accidental releases (Bhopal in 1984) |
| Water pollution | Wastewater incompletely treated |
| | Groundwater contamination. |
| Solid waste | Sludge from wastewater treatment. |

Impacts of using the chemical products:

- | | |
|-------------------------|-------------------------------|
| Fertilizers | Eutrophication, soil erosion. |
| Herbicides & Pesticides | Residues in food, |
| | Groundwater contamination. |
| Chlorofluorocarbons | Ozone holes (skin cancer). |
| Gazoline | Urban pollution. |
| MTBE fuel additive | Underground water pollution. |

Impacts after use:

Flame-retardant materials
Paint pigments
Landfill hazard
Heavy metals in soils

The solution to all the above problems basically lies in following twelve standard sets of principles:

1. Prevention

It is better to prevent waste than to treat or clean up waste after it has been created.

2. Atom Economy

Synthetic methods should be designed to maximise the incorporation of all materials used in the process into the final product.

3. Less Hazardous Chemical Synthesis

Wherever practicable, synthetic methods should be designed to use and generate substances that possess little or no toxicity to people or the environment.

4. Designing Safer Chemicals

Chemical products should be designed to effect their desired function while minimising their toxicity.

5. Safer Solvents and Auxiliaries

The use of auxiliary substances (e.g., solvents or separation agents) should be made unnecessary whenever possible and innocuous when used.

6. Design for Energy Efficiency

Energy requirements of chemical processes should be recognised for their environmental and economic impacts and should be minimised. If possible, synthetic methods should be conducted at ambient temperature and pressure.

7. Use of Renewable Feedstocks

A raw material or feedstock should be renewable rather than depleting whenever technically and economically practicable.

8. Reduce Derivatives

Unnecessary derivatization (use of blocking groups, protection/de-protection, and temporary modification of physical/chemical processes) should be minimised or avoided if possible, because such steps require additional reagents and can generate waste.

9. Catalysis

Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.

10. Design for Degradation

Chemical products should be designed so that at the end of their function they break down into innocuous



degradation products and do not persist in the environment.

11. Real-time Analysis for Pollution Prevention

Analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.

12. Inherently Safer Chemistry for Accident Prevention

Substances and the form of a substance used in a chemical process should be chosen to minimise the potential for chemical accidents, including releases, explosions, and fires.

Systematic Approaches to Green Chemistry:

So, now a question arises as to what should be the Systematic Approaches in Green Chemistry? This can be summarized in the following approaches:

Pollution Prevention:

1. Improved operational practices which means lowering energy consumption and improving yields.
2. Batch to continuous processing as batch process may increase yield and continuous process may save energy.

Development of greener processes:

1. To use intermediates that come from better primary feedstocks for example Production of ethylene glycol.
2. To avoid chlorine compounds if chlorine is not in the final product for example Production of allyl alcohol.

Formulation of alternative products:

1. Chlorofluorocarbon substitutes.

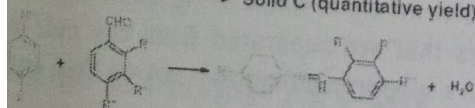
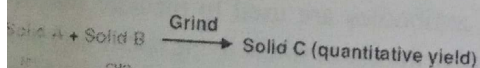
Avoidance of chemicals by means of new non hazardous substances :

1. To shift from herbicides and pesticides to genetic engineering for example Monsanto's "NewLeaf Plus" potatoes genetically improved to resist the Colorado beetle and leaf roll virus.
2. Switch to organic farming.
3. Shift from traditional to digital photography.
4. To use colored plastics instead of painted metals.
5. To shift from petroleum fuels to biofuels or hydrogen gas.

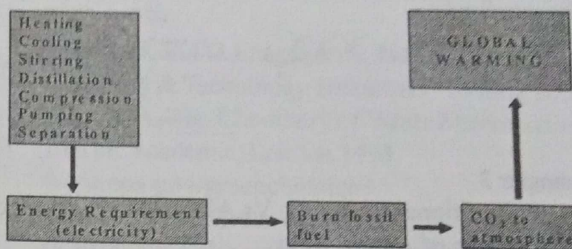
New Examples of Greener Routes :

Example 1: "The use of auxiliary substances (like solvents, separation agents etc.) should be made unnecessary wherever possible, and innocuous when used "

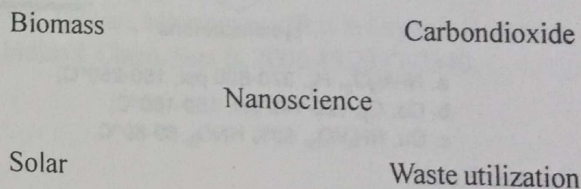
A solventless reaction:



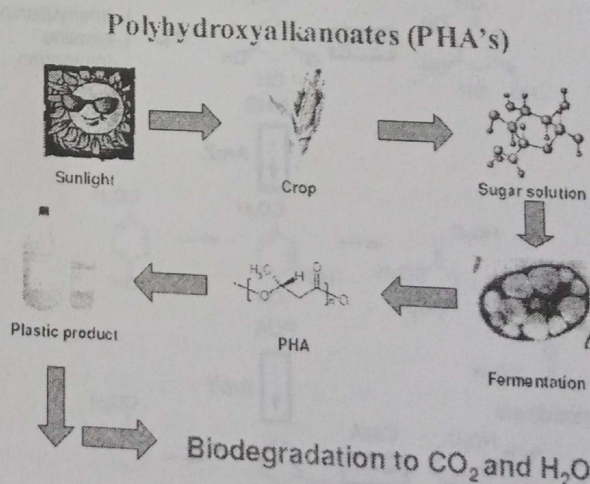
Example 2: As an answer to the principle of green energy requirement, the energy requirement should be recognized for their environmental impacts and should be minimized. Synthetic methods should be conducted at ambient pressure and temperature, this scheme may be followed:-



A raw material of feedstock should be renewable rather than depleting wherever technically and economically practical. Renewable resources can be made increasingly viable technologically and economically through green chemistry.



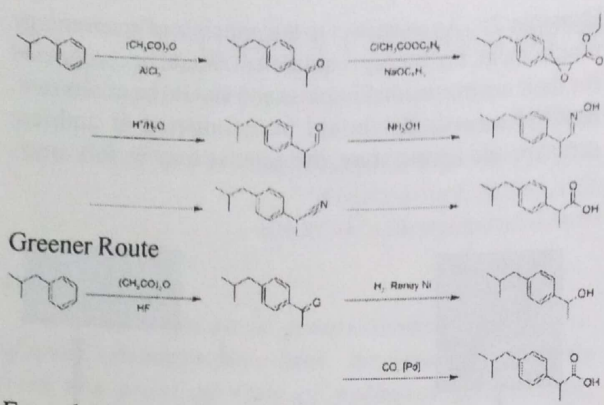
For example: Polyhydroxyalkanoates(PHA's)



In a nut shell, we can say that pathways to green chemistry should be

1. Create new ways to make desired materials- different feedstocks, different pathways.
2. Identify desired performance characteristics and create new materials.

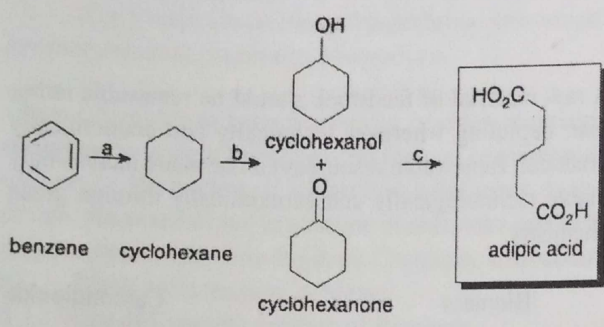
Examples: 1.Traditional Vs Green Synthesis of Ibuprofen



Example: 3 Production of styrene from benzene ring and CH=CH₂ tail

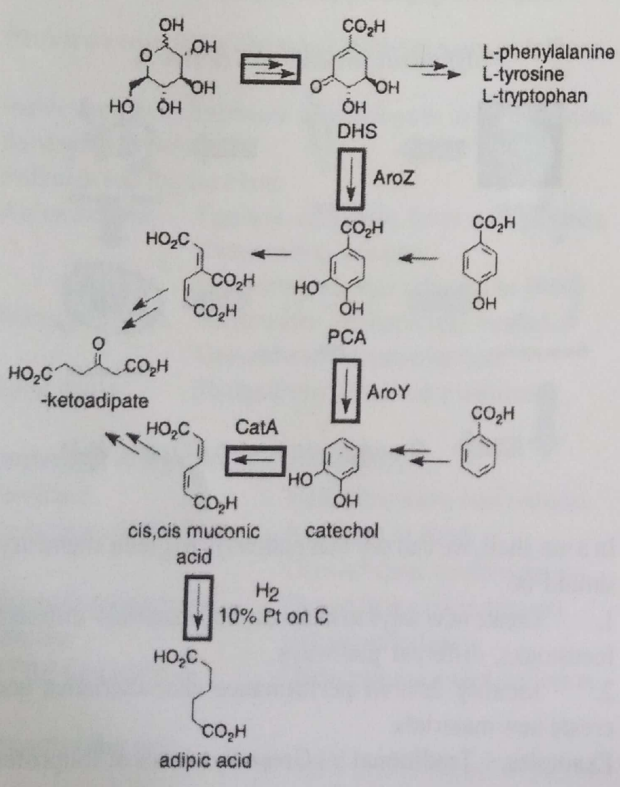
Traditional route: Two-step method starting with benzene and ethylene to form ethylbenzene
 $C_6H_6 + CH_2=CH_2 \rightarrow C_6H_5-CH_2-CH_3$
 This is followed by dehydrogenation to obtain styrene:
 $C_6H_5-CH_2-CH_3 \rightarrow C_6H_5-CH=CH_2 + H_2$
 Although both steps give high yields with low production of by-products, but benzene is a known human liver carcinogen.
 Greener method :It start with mixed xylenes which is cheapest source of aromatics and environmentally safer than benzene as well.

Example: 2 Traditional feedstock Vs Alternative feedstock in the synthesis of Adipic Acid.



- a. Ni-Al₂O₃, H₂, 370-800 psi, 150-250°C;
- b. Co, O₂, 120-140 psi, 150-160°C;
- c. Cu, NH₄VO₃, 60% HNO₃, 60-80°C.

Greener Route



GREEN CHEMISTRY AND ECONOMICS:

Green chemistry takes care of economics as is demonstrated by the production of carbaryl.

1) The way Union Carbide made carbaryl in our country by this method:

Methyl isocyanate + alpha-naphthol ? carbaryl

The economics of this method are as follows:-

Methyl-isocyanate (57 grams/mole) purchased at \$2.50/kg and
 Alpha-naphthol (144 grams/mole) purchased at \$3.99/kg
 Carbaryl (201 grams/mole) sold at \$5.81/kg
 So, Profit per kg of carbaryl = \$5.81 - \$2.50 x 0.057 x 4.98 - \$3.99 x 0.144 x 4.98
 = \$5.81 - \$0.71 - \$2.86
 = \$2.24

2) The greener solution from an environmental perspective is as follows:-

Methyl formamide + alpha-naphthol ? carbaryl + hydrogen

The economics of this method are as follows:-

Methyl formamide (59 grams/mole) purchased at 1.54/kg
 Alpha-naphthol (144 grams/mole) purchased at \$3.99/kg
 Hydrogen (2 grams/mole) sold at \$0.10/kg
 Carbaryl (201 grams/mole) sold at \$5.81/kg
 Profit per kg of carbaryl = \$5.81 + \$0.10 x 0.002 x 4.98 - \$1.54 x 0.059 x 4.98 - \$3.99 x 0.144 x 4.98
 = \$5.81 + \$0.001 - \$0.45 - \$2.86
 = \$2.50

BIOCATALYSIS

Enzymes and antibodies are used to mediate reactions which may involve the use of whole living micro-organisms or of enzymes that are separated from the cell and immobilized in a support medium. We can say that, entire

cells or cell components are used as micro-engines. The reactions using biocatalysis often proceed with exceptionally high selectivity and increase reaction rates between 9 and 15 orders of magnitude in comparison with uncatalyzed reactions in some reactions. Using Microwave energy in conjunction with dry media (solvent free) organic synthesis. This strategy works well in organic synthesis. The examples can be found in the article by Dewan given at reference 11. In fact, the use of microwaves has also demonstrated what is called specific microwave effect. This means reactions are found to occur at a much faster rate under microwave irradiation condition than under classical reaction conditions at the same reaction temperature. Dewan has given rules ("Dewan's Rule") that help us in predicting which organic reactions will show the specific microwave effect and which will not.

Conclusion:

To sum up, green chemistry has already started showing its effect on human health. The authors have no doubt that although the pace of green chemistry is slow at the moment, it will pick up momentum in future as more and more ordinary, political and scientific personnel around the world become convinced of its need and become part and parcel of this revolution.

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61



NANOTECHNOLOGY AND ITS APPLICATIONS

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What is nanotechnology?

It is the technology concern with the design, characterization, production, and application of structures, devices, and systems by controlled manipulation of size and shape at the nanometer scale that is to say atomic, molecular, and macromolecular scale that produces structures, devices, and systems with at least one novel/superior characteristic or property.

Lets have a feeling Nanoscale.

A nanometer (nm) is one thousand millionth of a meter. Note that a red blood cell is approximately 7,000 nm wide. A water molecule is almost 0.3nm across. People are interested in the nanoscale, from 100nm down to the size of atoms (approximately 0.2nm).

Why are we interested in nanosize materials?

This is because the bulk properties of materials often change dramatically with nano ingredients. For example, Composites made from particles of nano-size ceramics or metals smaller than 100 nanometers can suddenly become much stronger than predicted by existing materials-science models. Thus, metals with a so-called grain size of around 10 nanometers are as much as seven times harder and tougher than their ordinary counterparts with grain sizes in the hundreds of nanometers.

Why such changes are encountered?

The reasons for these changes can be understood from quantum physics. The bulk properties of any material are merely the average of all the quantum forces affecting all the atoms. When things become smaller and smaller, a point is reached where the averaging no longer works. At this point the properties of materials can be different at the nanoscale. Two main reasons at work are as follows , One nanomaterials have a relatively larger surface area compared to the same mass of material produced in a larger form, which makes materials more chemically reactive and affect their strength or electrical properties.

Second, quantum effects dominate the behaviour of matter at the nanoscale and affect the optical, electrical and magnetic behaviour of materials.

How can we make nanomaterials?

This can be done by following two techniques, 'top down' technique which means producing very small structures from larger pieces of material. An example is etching to create circuits on the surface of a silicon microchip. Second is the 'bottom up' technique which means atom by atom or molecule by molecule, by self-assembly, in which the atoms or molecules arrange themselves into a structure because of their natural properties. For example crystals grown for the semiconductor industry and chemical synthesis of large molecules. Another way is to use tools to move each atom or molecule individually that is the laborious 'positional assembly'. The real instrument behind making nanomaterials are 'the scanning tunneling microscope' and 'the atomic force microscope'. That's when nanoscience and nanotechnology really started to take off. Various forms of scanning probe microscopes based on these discoveries are essential for many areas of today's research.

Nano materials can be of three types i.e. one dimensional, two dimensional and three dimensional.

A) One dimensional nanomaterials , the thin films, layers and surfaces which are used as electronic device manufacture, chemistry and engineering.

Nanoscales in Two dimensions such as tubes and wires. These have novel electrical and mechanical properties.

Carbon nanotubes (CNTs) are extended tubes of rolled graphene sheets, single-walled (one tube) or multi-walled (several concentric tubes). These are few nanometres in diameter and several micrometres to centimetres long. They are mechanically very strong (their Young's modulus is over 1 terapascal which makes CNTs as stiff as diamond. They are flexible and conduct electricity extremely well. Due to these properties CNTs have many potential applications in reinforced composites, sensors, nanoelectronics.

B) Two dimensional Nanomaterials. Examples include Inorganic nanotubes and nanowires. These materials have

excellent tribological (lubricating) properties, catalytic reactivity, and high capacity for hydrogen and lithium storage, which suggest a range of promising applications. Similarly Oxide-based nanotubes are being explored for their applications in catalysis, photo-catalysis and energy storage. Titanium dioxide is under investigation.

Similarly nanowires have been made which are ultrafine wires or linear arrays of dots, formed by self-assembly. Semiconductor nanowires made of silicon, gallium nitride and indium phosphide have shown remarkable optical, electronic and magnetic characteristics. These have potential applications in high-density data storage (as magnetic read heads or as patterned storage media). Biopolymers like DNAs because of their variability and site recognition they offer a wide range of opportunities for the self-organization of wire nanostructures into much more complex patterns. Thus the DNA backbones may then, be coated in metal. Further there is the potential to link nano- and biotechnology in to give biocompatible sensors and small, simple motors.

C) Three Dimensions Nanomaterials- Example include nanoparticles which are often defined as particles of less than 100nm in diameter. Nanoparticles exist widely in the natural world. Examples are the products of photochemical and volcanic activity. Nanoparticles also arises as product of combustion and food cooking as well as from vehicle exhausts. Nanoparticles compared to large sized particles have new properties. Thus, titanium dioxide and zinc oxide become transparent at the nanoscale, however are able to absorb and reflect UV light Because of these they are used as sunscreens.

Nanoparticles have a range of potential applications in the short-term in new cosmetics, textiles and paints, in targeted drug delivery where in they could be to used deliver drugs to a specific site in the body.

Fullerenes, the C60. These are spherical molecules about 1nm in diameter, comprising 60 carbon atoms arranged as 20 hexagons and 12 pentagons: the configuration of a football. They find potential applications as miniature 'ball bearings' to lubricate surfaces, drug delivery vehicles and in electronic circuits.

Dendrimers the other 3-D nonmaterial which are spherical polymeric molecules, formed through a nanoscale hierarchical self-assembly process. They are used in conventional applications such as coatings and inks. They also have a range of interesting properties which could lead to useful applications such as nanoscale carrier molecules and in drug delivery. Further environmental clean-up could be assisted by dendrimers as they can trap metal ions. These could then be filtered out of water with ultra-filtration techniques.

Quantum Dots, the nanoparticles of semiconductors were created in the early 1980s. As semiconductor particles are made small enough, quantum effects come into play, which limit the energies at which electrons and holes can exist in the particles. Because energy is related to wavelength or colour, this means that the optical properties of the particle can be finely tuned depending on its size. In other words particles can be made to emit or absorb specific wavelengths (colours) of light, by tailoring their size. Quantum dots are used in composites, solar cells, Gratzel cells and fluorescent biological labels.

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63



EXPERIMENTALLY MODIFIED PROTOCOLS WITH TRANSMISSION COUNT METRIC FOR EFFICIENT THROUGHPUT IN AD-HOC NETWORKS

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ABSTRACT

Wireless networks have many dimension devices which are connected by wireless communication links. The links are most often implemented with digital packet radios. Because each radio link has a limited communications range, many pairs of nodes cannot communicate directly, and must forward data to each other via one or more cooperating intermediate nodes. We will often use 'time count metric' to mean the minimum hop-count metric.

Modified protocols with the PTC (Potential transmission Count Metric) of a route is the total number of packet transmissions and retransmissions required to send a packet across the route, assuming that each link in the route retransmits the packet until it is successfully received across the link. PTC is designed for links with link-layer acknowledgments and retransmissions. The PTC metric for a route is calculated using measurements of the lossless of each link in the route. Routing protocols select routes with the minimum PTC. PTC improves the throughput of both Dynamic Source Routing (DSR), an on-demand source routing protocol, and Destination-Sequenced Distance-Vector (DSDV) routing, a proactive table-driven distance-vector routing protocol. We present a set of design changes and implementation techniques that allow DSR and DSDV to work well with PTC.

Keywords: - DSR, DSDV, Multi-hop, ad hoc, hop count metric, 802.11b, PTC, radio packets.

1. INTRODUCTION

Most existing wireless routing protocols use the minimum hop-count route metric: they select routes with the fewest links. The minimum hop-count metric implicitly assumes that links either work well, or do not work at all and that all working links are equivalent. Furthermore, most protocols assume links that deliver routing control packets such as DSDV route updates or DSR route queries will also successfully deliver data packets.

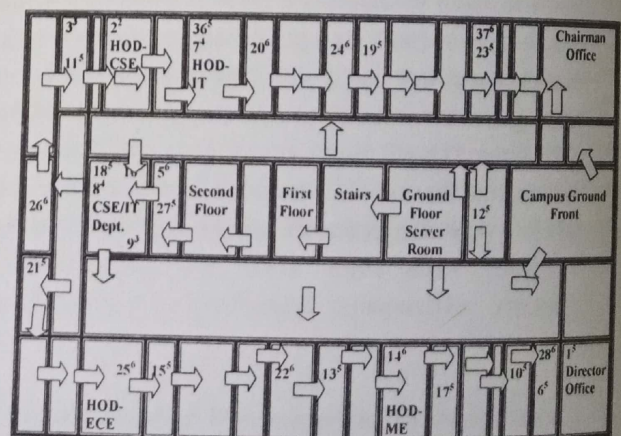
If the best route is a minimum hop-count route, there may be many routes with the same minimum hop-count, but with widely varying qualities. This paper shows that minimum hop-count routing typically finds routes with significantly lower throughput than the best available,

using measurements of the DSDV routing protocol on a test network. We explain why minimum hop-count does poorly by looking at the distribution of route throughputs and link loss ratios.

Experimental Test All the data in this paper are the result of measurements taken on a 29-node wireless test. Each node consists of a stationary PC with Intel processor 2.4 GHz (Core 2 Duo) PCI/PCI-X 802.11b card, Server with a Geon Processor (Core 2 Duo-4 Processor) Intel Pro/1000 MT PCI/PCI-X 802.11b card and an omnidirectional 2.2 dbi dipole antenna. Each PC runs the Linux operating system. The nodes are placed in offices and cabins on four consecutive floors of a campus building.

Distribution of Link Loss Ratios - Figure 1 shows the underlying delivery ratios of each link in the network, which helps explain why high-throughput paths are difficult to find. Each vertical bar corresponds to the direct radio link between a pair of nodes; the two ends of the bar mark the broadcast packet delivery ratio in the two directions between the nodes. To measure delivery ratios, each node took a turn sending a series of broadcast packets for two seconds, and counted the number of packets that the radio reported as transmitted.

The delivery ratio from node X to each node Y is calculated by 38 dividing the number of packets received at Y by the number sent by X. The loss ratio of a link is one minus its delivery ratio. We use the term 'ratio' instead of 'rate' to avoid confusion with throughput delivery rates, which are expressed in packets per second.



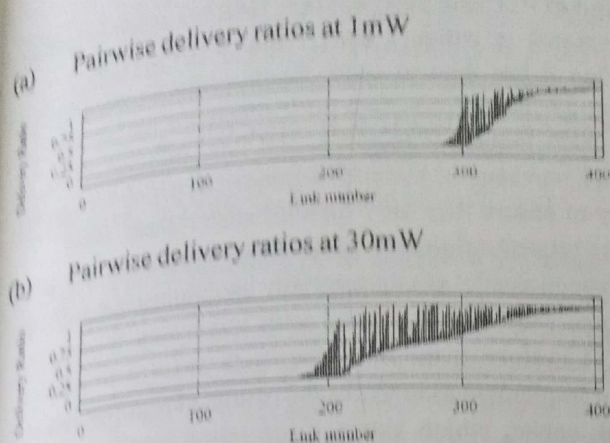


Figure 1: One-hop packet delivery ratios between each pair of nodes at 1mW and 30mW.

2. WIRELESS MODEL

This paper gives a simplified description of how digital radios transmit and receive data packets, along with a description of the sorts of problems radios face when transmitting packets. The purpose of this paper is two-fold: first, to give a rough sense of why the packet losses, and second, to explain the experimentally observed fact that packet loss probabilities vary with the size of the packet. As we will see the accuracy of the PTC metric with protocols proposed in Paper and can be improved by properly accounting for packet sizes. This paper describes a model that accurately predicts loss ratios at different packet sizes based on the measured loss ratios at two other sizes. Since the model is based on the operation of digital packet radios, we start with a description of how radios work.

2.1 DIGITAL PACKET RADIOS

There are essentially three main steps in transmitting the bits in a packet: coding and modulation, together with packet framing. Coding converts the stream of bits in the packet into a stream of symbols; modulation converts each symbol into a RF waveform which is then transmitted. Framing is the process of grouping bits into packets and transmitting them with extra information, which is used by the receiver to know when to start demodulation.

2.2 CHANNEL MODEL

The RF signal travels from the transmitter to the receiver over the RF channel. The channel could be a cable, free space, obstacles, or some combination of the

three. The channel model describes how the RF signal is affected by the channel. In general, a channel has two main characteristics: path loss and delay. In addition to these two characteristics, the receiver's version of the signal is affected by noise, which is received in addition to the transmitted signal. Although noise is not strictly part of the channel model, we consider it here as it also affects wireless link behavior.

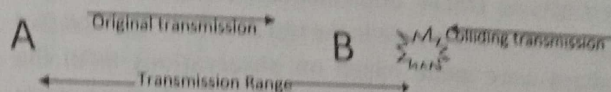


Figure 2: The hidden terminal problem. Because nodes A and C are out of range of each other, they are hidden terminals to each other, and neither can tell if the other is transmitting.

3. PROTOCOL IMPLEMENTATION

This paper describes the implementation details of DSDV, DSR, and PTC, as well as the route metric abstraction that enables these DSR and DSDV implementations to work with many different route metrics.

3.1 OPERATION OF DSDV

DSDV is a distance-vector protocol, which uses sequence numbers to ensure freshness, and a settling time mechanism to avoid unnecessarily propagating any routes with inferior metrics. We made four changes to the original DSDV design in order to ensure that it uses the path with the best known metric. Before describing those changes, we present an overview of how the published version of the protocol selects routes. Every node has a routing table entry for each destination D, which contains four fields: D's identifier (IP address), the next hop on the route to D, the latest sequence number heard for D, and the route metric. A node forwards packets to the next hop specified by the current contents of its routing table.

When a node receives another node's route advertisement broadcast, it updates its own route entries as follows. Suppose node X receives an advertisement from Y for destination D with metric m and sequence number n. If n is newer than the sequence number in X's current entry for D, X replaces its current entry with the new route through Y. X also accepts the new route if the sequence number is the same, but m is better than the metric of the current route. If X has no route to D, it accepts the new route.

Otherwise X ignores the advertised route. Each route entry has an associated weighted settling time (WST). The WST is the weighted average of the settling times for recent sequence numbers, and is updated whenever a route with a new sequence number is received.

4. CHANGES TO DSDV

The DSDV algorithm we implemented differs from the CMU's DSDV implementation in four ways that improve its performance in the test network. The first two changes were made based on observations from the literature, while the third and fourth changes were motivated by pathological DSDV behavior observed on the indoor network using detailed packet traces. The first change affects how the WST is used. The ns DSDV implementation does not advertise a route entry until $2 \times \text{WST}$ has passed since that particular route entry to the destination was heard. However, according to our interpretation of the original DSDV description [16], the waiting time before advertising a route should start when the first route of each sequence number is heard. Because each node's WST is an estimate of the time between when the node first hears a given sequence number for a destination and when the node hears the best metric with the same sequence number for that destination, the node assumes that it has the best route for a given sequence number after $2 \times \text{WST}$ has passed. Then it is likely that no better route will be heard for that sequence number, and the best route heard so far should be propagated. The second change is that our implementation does not use link-level feedback (i.e. 802.11 transmission failure notices) to detect broken links and produce broken-route advertisements. This makes the destination effectively unreachable from anywhere until its next route advertisement. Our implementation still generates broken-route advertisements when routing table entries time out, but this rarely occurs during the experiments. The third change is that full dumps are never sent on a triggered update, even if many routes have changed. Triggered updates contain only the changed routes, and full dumps are only sent at the full dump period. This change significantly decreases the routing protocol overhead on our network.

5. DSR IMPLEMENTATION

The implementation is derived from Click-based DSR implementations originally developed at the University of Colorado at Boulder. This section reviews DSR's basic operation and describes our modifications to

support PTC and other metrics. DSR is a reactive routing protocol, in which a node issues a route request only when it has data to send. Route requests are flooded through the network, each node appending its own address to each request it receives, and then rebroadcasting it. Each new request includes a unique ID, which forwarders use to ensure they only forward each request once. The request originator issues new requests for the same destination after an exponentially increasing back-off time. Route requests are issued with increasing time-to-live (TTL) values, to minimize the range and cost of flooding. Our implementation stores the results of route replies in a link cache, which stores information about each link separately. A node runs Dijkstra's shortest-path algorithm on its link cache to find the best route to a destination. DSR uses feedback from the link layer to react to link failures. When the 802.11 card signals that no acknowledgment was received after the maximum number of retries, the forwarding node issues a route error back to the source, which removes the link from its link cache and then computes a new route. If the source cannot find a route using its link cache, it issues a new route request.

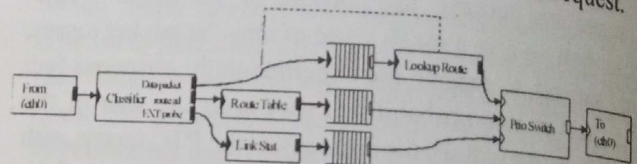


Figure 3: DSDV queuing configuration.

6. ROUTER CONFIGURATION DETAILS

The DSDV implementation looks up a packet's destination in the routing table after dequeuing the packet from the data queue, and just before handing the packet to the 802.11b card. This technique depends on the fact that the nodes have only one wireless interface. Figure 3 shows the DSDV queuing configuration.

The DSR implementation, on the other hand, adds the source-route header to data packets before inserting them into the queue. On a transmission failure or a received route error, a node removes and drops all enqueued packets which include the broken link in their source route. This ensures that the node experiencing the transmission failure does not spend additional time and spectrum retransmitting more packets over the broken hop.

7. PTC EVALUATION

This paper also presents experimental results that show

that PTC often finds higher throughput paths than minimum hop-count, particularly between distant nodes. It also explores the effects of a few individual design decisions in the PTC algorithm, and explains why there is a performance gap between the throughput of the routes with the lowest PTC, and the 'best' routes found by searching the network.

In DSR experiments with PTC or minimum hop-count, a source starts by sending one data packet per second for five seconds. This ensures that DSR sends route requests and finds a route before throughput measurements are taken. After the five seconds pass, the source sends packets as fast as possible for 30 seconds. In DSR experiments with PTC, the source waits an additional 15 seconds before initiating the route request, to give the nodes time to accumulate link measurements.

7.1 DSDV PERFORMANCE

Figure 5 compares the throughput CDFs of paths found by DSDV using PTC and minimum hop-count, between 100 randomly chosen node pairs. This data is taken from the same run as in Figure 4, and shows that DSDV using the PTC metric often finds much faster routes than the minimum hop-count metric.

Impact of Asymmetry Some fraction of PTC's gains comes from avoiding extremely asymmetric links. The problem of routing when there are asymmetric links has been addressed in previous work by Lundgren et al. and by Chin et al. These authors propose a link handshaking scheme to detect and avoid asymmetric links. In this scheme, a node X only accepts route updates from a neighboring node Y if Y is advertising a direct route to X. A node bootstraps the handshake by advertising provisional route entries, which indicate that the node has 'seen' another node, but not yet accepted routes from it. We implemented the handshaking scheme for DSDV with the minimum hop count metric.

Effects of DSDV Modifications Section 3 described modifications to DSDV designed to increase its responsiveness to metrics. The delay-use modification causes DSDV to delay using a newly received route until it is permitted to advertise the route (i.e. $2 \times \text{WST}$ has passed).

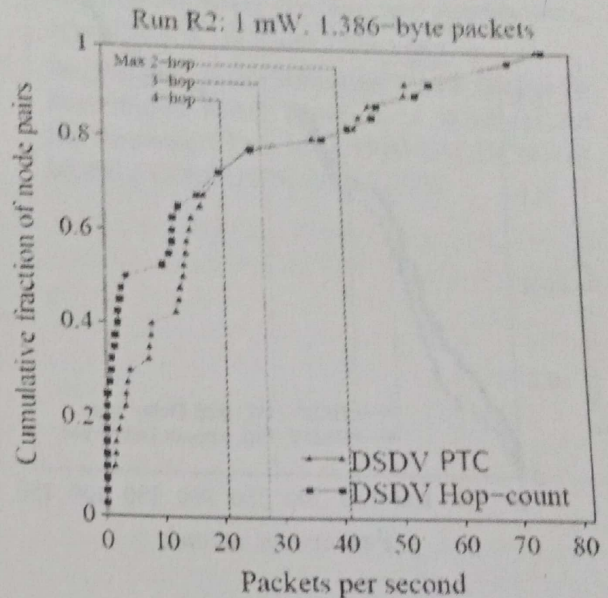


Figure 4: PTC provides less of a throughput advantage over minimum hop count when using large packets.

8. DSR PERFORMANCE

This section evaluates the performance of the DSR routing protocol with the PTC metric. As described DSR uses link-layer transmission failure feedback to avoid bad routes. To isolate the effects of using PTC with DSR, we evaluated DSR performance both with and without link-layer feedback enabled. The figure shows that PTC greatly improves initial route selection in DSR compared to minimum hop-count. Minimum hop-count essentially chooses randomly from all the shortest routes the source obtains from the initial route request. PTC provides a small benefit to some pairs in the intermediate and low throughput ranges (the middle and bottom of the CDF). However, failure feedback alone allows DSR to perform almost as well as DSR with PTC.

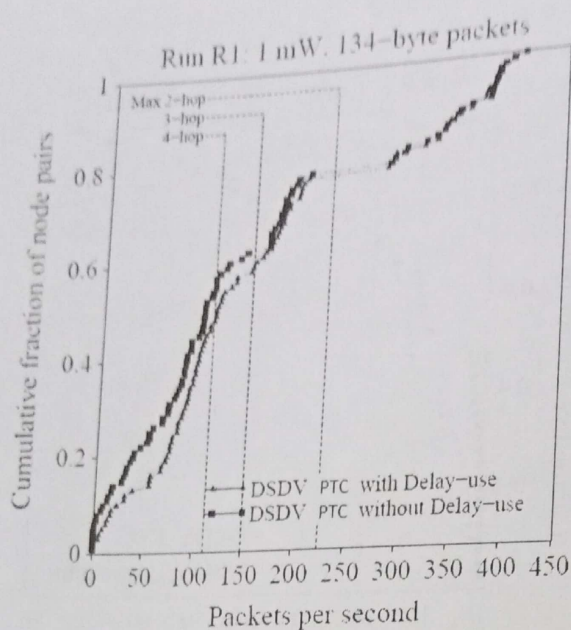


Figure 5: DSDV PTC with and without the delay-use modification to DSDV.

9. PROTOCOL EVALUATION SUMMARY

This paper showed how transmission count with protocol increases the throughput performance of the routing protocols. It also used more focused static throughput and single link experiments to understand the gaps between the throughputs of routes found using transmission count and the routes found using static routes.

10. CONCLUSION

The main contribution of this work is a simple way for multi-hop wireless routing protocols to choose high-throughput paths in networks with link-layer retransmissions. This work also characterized the delivery ratios and asymmetry of the network, and showed how lossy links and asymmetric links affect route throughput. Lossy links require more retransmissions, and therefore have lower effective throughput. However, a route with few lossy links can be preferable to a route with many higher-quality links, since contention between links also reduces route throughput. Modified protocols with the PTC (Potential transmission Count Metric) of a route is

the total number of packet transmissions and retransmissions required to send a packet across the route, assuming that each link in the route retransmits the packet until it is successfully received across the link. PTC is designed for links with link-layer acknowledgments and retransmissions.

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69



DILIGENCE-SPECIFIC PROTOCOL DESIGN IN WIRELESS N/W

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ABSTRACT:-

In recent years, advances in energy-efficient design and wireless technologies have enabled exciting new diligences for wireless devices. These diligences span a wide range, including real-time and streaming video and audio delivery, remote monitoring using networked micro sensors, personal medical monitoring, and home networking of everyday appliances. While these diligences require high performance from the network, they suffer from resource constraints that do not appear in more traditional wired computing environments. In particular, wireless spectrum is scarce, often limiting the bandwidth available to diligences and making the channel error-prone, and the nodes are battery-operated, often limiting available energy.

This paper is the part of my Ph.D. thesis is that this harsh environment with severe resource constraints requires a diligence-specific protocol design, rather than the traditional layered approach, to obtain the best possible performance. This dissertation supports this claim using detailed case studies on micro sensor networks and wireless video delivery. The first study develops LEACH (Low-Energy Adaptive Clustering Hierarchy), an design for remote micro sensor networks that combines the ideas of energy-efficient cluster-based routing and media access together with diligence-specific data aggregation to achieve good performance in terms of system lifetime, latency, and diligence-perceived quality. This approach improves system lifetime by an order of magnitude compared to general-purpose approaches when the node energy is limited. The second study develops an unequal error protection scheme for MPEG-4 compressed video delivery that adapts the level of protection applied to portions of a packet to the degree of importance of the corresponding bits. This approach obtains better diligence-perceived performance than current approaches for the same amount of transmission bandwidth.

Keywords :- LEACH, ad hoc, wireless hop count, 802.11b, radio packets.

1. INTRODUCTION

An important challenge in the design of wireless and

mobile systems is that two key resources communication bandwidth and energy are significantly more limited than in a tethered network environment. These restrictions require innovative communication techniques to increase the amount of bandwidth per user and innovative design techniques and protocols to use available energy efficiently. Furthermore, wireless channels are inherently error-prone and their time-varying characteristics make it hard to consistently obtain good performance. Communication protocols must be designed to adapt to current conditions instead of being designed for worst-case conditions. Diligences differ in which features are most important. For example, an diligence that supports wireless data communication might prefer longer latency in exchange for longer node life-time. On the other hand, long latency is unacceptable for a cellular phone diligence. Similarly, lossy compression is unacceptable for data transfers, but represents a good trade-off to extend node lifetime for voice transfers. These unique considerations for different diligences, coupled with the tight resource constraints of wireless systems, suggest the need for diligence-specific protocols.

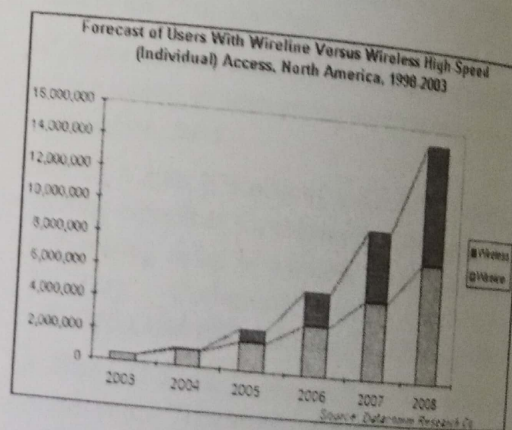


Figure 1-1: Predictions are that wireless data access will exceed wireline access by the year 2004 [reported by Data comm. Research Co., reprinted with permission from Wirelesstoday.com].

By intelligently combining the views of the nodes, the end-user can remotely monitor events in the environment.

The use of cross-layer design optimizations has been demonstrated in the context of wireless Internet delivery [8].

2. WIRELESS Micro sensor MODEL

A sensor is any device that maps a physical quantity from the environment to a quantitative measurement. Advances in sensor technology, low-power analog and digital electronics, and low-power radio frequency (RF) design have enabled the development of small, relatively inexpensive and low-power sensors, called micro sensors. Micro sensors are equipped with a sensor module (e.g., acoustic, seismic, image sensor) capable of sensing some quantity about the environment, a digital processor for processing the signals from the sensor and performing network protocol functions, a radio module for communication, and a battery to provide energy for operation. Each sensor obtains a certain view of the environment. For example, the oil industry uses large arrays of geophone sensors attached to huge cables to perform seismic exploration for oil [4, 8], as shown in Figure 1. Deploying hundreds or thousands of nodes in a wireless micro sensor network brings new benefits to these sensing diligences, including:

- ◆ Extended range of sensing. Single macro sensor nodes can only extract data about events in a limited physical range. In contrast, micro sensor networks enable large numbers of nodes to be physically separated; while nodes located close to each other will have correlated data (e.g., these nodes will be gathering data about the same event), nodes that are farther apart will be able to extract information about different events.
- ◆ Improved accuracy. While an individual micro sensor's data might be less accurate than a macrosensor's data, combining the data from nodes increases the accuracy of the sensed data. Since nodes located close to each other are gathering information about the same event, aggregating their data enhances the common signal and reduces the uncorrelated noise.
- ◆ Lower cost. Even though there are many micro sensors replacing each macrosensor, due to reduced size, reliability, and accuracy constraints on micro sensor nodes, these nodes are much cheaper than their macrosensor counterparts. Therefore, micro sensor systems are less expensive than macro sensor systems.
- ◆ Design Goals for Wireless Micro sensor Network Protocols
- ◆ In order to design good protocols for wireless micro

sensor networks, it is important to understand the parameters that are important to the sensor diligences. While there are many ways in which protocols are beneficial to the diligence, we use the following metrics:

- ◆ Ease of deployment. Sensor networks may contain hundreds or thousands of nodes, and they may need to be deployed in remote or dangerous environments. If these nodes are small enough and cheap enough, we can imagine throwing hundreds or thousands of micro sensors

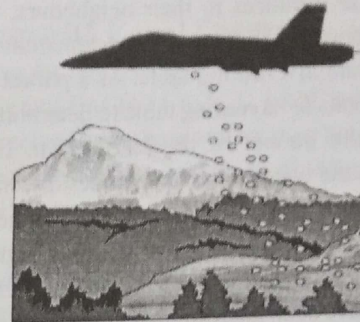


Figure 2: Micro sensor nodes can be dropped from planes to enable monitoring of remote or dangerous areas. This requires self-configuring protocols that do not rely on a fixed infrastructure. from a plane flying over a remote or dangerous area to allow us to extract information in ways that would not have been possible otherwise (see Figure 2).

- ◆ System lifetime. These networks should function as long as possible. System lifetime can be measured using generic parameters, such as the time until the nodes die, or it can be measured using diligence-specific parameters, such as the time until the sensor network is no longer providing acceptable quality results (e.g., there are too many missed events).
- ◆ Latency. Data from sensor networks are typically time-sensitive, so it is important to receive the data in a timely manner. Long delays due to processing or communication may be unacceptable.
- ◆ Quality. This parameter measures the accuracy with which the result of the sensor network matches what is actually occurring in the environment. Although this is an diligence specific and data-dependent quantity, one possible diligence-independent method of determining quality is to determine the amount of data (either actual or

aggregate) received at the base station. The more data the base station receives, the more accurate its view of the remote environment will be.

3. ROUTER CONFIGURATION DETAILS

Routing protocols for wireless networks can broadly be classified into two categories: multi-hop routing protocols and cellular/clustering approaches.

Multi-Hop Routing

Routing protocols for wired networks fall into two categories: distance vector routing and link-state [5]. Distance vector approaches route packets by having each node advertise distances to their neighbours, who then choose the shortest path to a given destination and store this information in a routing table. As a packet comes to the node, it looks in its routing table to determine the next hop to get the packet to its destination. Link-state protocols, on the other hand, have nodes disseminate the entire topology map and have the individual nodes use a shortest path algorithm (such as Dijkstra's Algorithm) to find the best route to a given destination. These routing approaches have been incorporated into wireless networks using minor modifications, resulting in destination-sequenced distance vector (DSDV) and ad hoc on-demand distance vector (AODV) routing protocols [7]. However, there are problems with using these routing approaches in wireless networks. The periodic messages needed to maintain valid routes may not only congest the network, they may also drain the limited battery supply of a portable node. Dynamic source routing (DSR), solves this problem by only creating routes on an on-demand basis [14]. This minimizes the amount of overhead needed in creating routes, at the expense of latency in finding a route when it is needed. These are ad-hoc, self-configuring protocols that are robust to node failures.

4. Analysis and Simulation of LEACH

For even moderately-sized networks with tens of nodes, it is impossible to analytically model the interactions between all the nodes. Therefore, simulation was used to determine the benefits of different protocols. Computation and communication energy dissipation models as well as new MAC algorithms were implemented in ns to support the design and simulation of the different protocol designs. In the experiments described in this chapter, LEACH is compared with LEACH-C (the centralized set-up algorithm), LEACH-F (the fixed cluster, rotating cluster-head algorithm), MTE routing (where data traverses multiple short hops to reach the base station), and static clustering (where clusters and cluster-head nodes are fixed) in terms

of system lifetime, energy dissipation, amount of data transfer (actual data for MTE routing, aggregate data for the LEACH protocols), and latency.

Simulation Models

In order to compare different protocols, it is important to have good models for all aspects of communication. This section describes the models that were used for channel propagation, communication energy dissipation, and computation energy dissipation.

Radio Energy Model

There has been a significant amount of research in the area of low-energy radios. Different assumptions about the radio characteristics, including energy dissipation in the transmit and receive modes, will change the advantages of different protocols. In this work, we assume a simple model where the transmitter dissipates energy to run the radio electronics and the power amplifier and the receiver dissipates energy to run the radio electronics [8]. As discussed in the previous section,

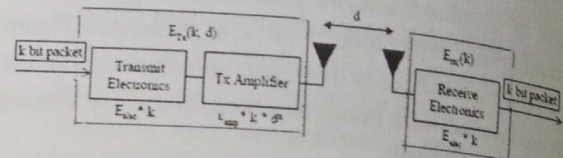


Figure 3: Radio energy dissipation model.

Attenuation is dependent on the distance between the transmitter and receiver. For relatively short distances, the propagation loss can be modelled as inversely proportional to d^2 , whereas for longer distances, the propagation loss can be modelled as inversely proportional to d^4 . Power control can be used to invert this loss by setting the power amplifier to ensure a certain power at the receiver. Thus, to transmit an l -bit message a distance d , the radio expends:

$$ETx(l, d) = ETx\text{-elec}(l) + ETx\text{-amp}(l, d)$$

as shown in Figure 3.

Beam forming Energy Model

The results of experiments described in [9] were used to model the computational costs of performing beamforming data aggregation. Alice Wang ran experiments implementing the least mean square (LMS) and Maximum Power beamforming algorithms on a StrongARM processor and measured the energy dissipation. Figure 4 shows the results of these experiments. This figure shows that the LMS beamforming algorithm requires much less energy than the Maximum Power beamforming algorithm. In addition, the energy for LMS beamforming scales

linearly with the number of sensors, while the energy for Maximum Power beamforming scales quadratically with the number of sensors. Therefore, the LMS beamforming algorithm is better-suited for implementation on a low-power micro sensor node. Figure 4 shows that implementing the LMS beamforming algorithm on the SA-1100 requires $5 \mu\text{J}/\text{sample}/\text{signal}$, or $625 \text{ nJ}/\text{bit}/\text{signal}$. It is reasonable to assume that there would be 1-2 orders of magnitude reduction in energy dissipation if the beamforming was implemented using an diligence-specific integrated circuit (ASIC) (as was shown for an encryption algorithm in [3]). Therefore, computation energy for beamforming BF

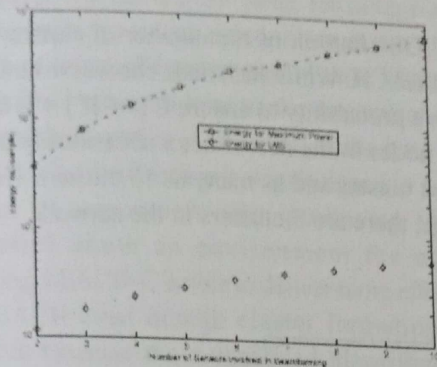


Figure 4: Energy dissipated using the StrongARM-1100 (SA-1100) to implement the LMS and Maximum Power beamforming algorithms. This plots shows that there is a linear relationship between the LMS beamforming algorithm and the number of sensors whereas there is a quadratic relationship between the Maximum Power beamforming algorithm and the number of sensors is set to $5 \text{ nJ}/\text{bit}/\text{signal}$.

ns Extensions

To implement LEACH and the general-purpose comparison protocols, we added several features to ns [7], an event-driven network simulator with extensive support for simulation of wireless network protocols. The extensions include MAC protocols, energy dissipation models for computation and communication, and the protocol designs discussed in this dissertation (LEACH, LEACH-C, LEACH-F, MTE routing, and static clustering). Detailed discussion of these extensions to ns can be found in Appendix A

5. EVALUATION SUMMARY

For the experiments described in this section, we implemented LEACH, LEACH-C, LEACH-F, MTE routing,

and static clustering. We will briefly summarize each of these protocols. In LEACH, nodes organize themselves into clusters using the distributed algorithm. Once the clusters are formed, the cluster-head nodes create TDMA schedules. Nodes transmit their data during their assigned slot, and the cluster-head aggregates all the data into a representative signal to send to the base station. This protocol has the advantage of being distributed, self-configuring, and not requiring location information for cluster formation. In addition, the steady-state protocol is low-energy. However, the draw-back is that there is no guarantee as to the number or placement of cluster-head nodes within the network.

Nodes Begin with Equal Energy

Figure 5 shows the total number of data signals (actual for MTE, effective for LEACH, LEACH-C, LEACH-F, and static clustering) received at the base station over time, the total energy dissipated over time, and the total data received at the base station per given amount of energy.

Figure 6 shows the total energy dissipated over time. LEACH, LEACH-C, LEACH-F, and MTE use up all the energy available in the network ($2 \text{ J}/\text{node} \times 100 \text{ nodes} = 200 \text{ J}$), while static-clustering is unable to take advantage of the energy remaining in the non-cluster-head nodes. While LEACH and MTE use the same total amount of energy over the simulation time,

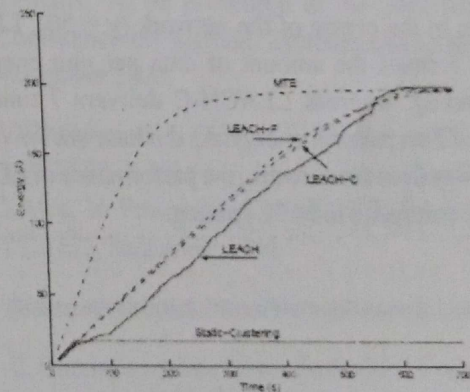
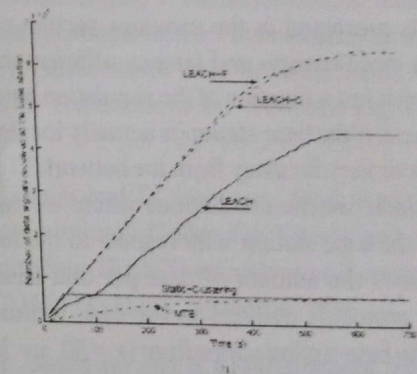


Figure 5: Data for the limited energy simulations, where each node begins with 2 J of energy. (a) The total amount of data received at the base station over time. (b) The total amount of energy dissipated in the system over time. (Figure continued on the next page.)

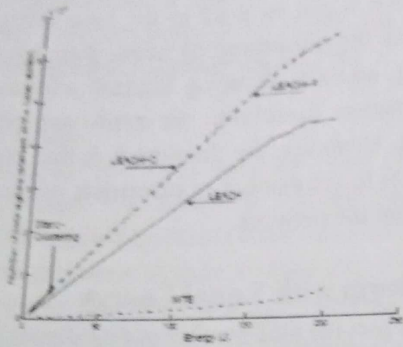


Figure 6: (Cont.) Data for the limited energy simulations, where each node begins with 2 J of energy. (c) The total amount of data received at the base station per given amount of energy. These graphs show that LEACH distributes an order of magnitude more data per unit energy than MTE routing, LEACH-C delivers 40% more data per unit energy than LEACH, LEACH-F performs similar to LEACH-C, and static-clustering does not perform well when the nodes have limited energy.

Varying the Base Station Location

The results presented in the previous section show that LEACH is more energy- and latency-efficient than MTE routing. Is this just a function of the simulation parameters? What happens if the base station is actually located within the network or very far away from the network? To answer these questions, we ran simulations where we varied the location of the base station with respect to the network. Figure 7 shows the amount of data per unit energy that each of the protocols delivers to the base station as the location of the base station varies from $(x = 50, y = 50)$ to $(x = 50, y = 300)$. From this plot, we see that when the base station is in the centre of the network ($y = 50$), LEACH delivers 5 times the amount of data per unit energy as MTE routing, whereas LEACH-C delivers 7 times the amount of data per unit energy. As the base station moves further away from the network, the performance of LEACH improves compared to MTE routing.

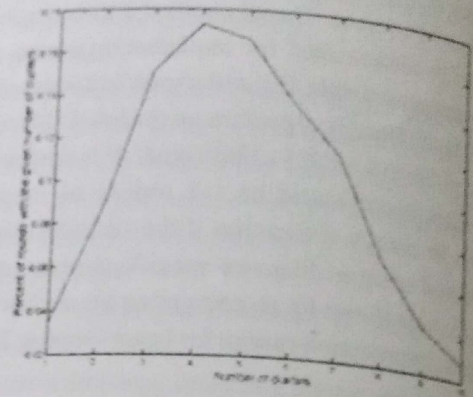


Figure 7: Distribution of the number of clusters in each round in LEACH. While each node chooses to be a cluster-head with a probability to ensure $E[\#CH] = 5$, there are only 100 nodes in the network, so occasionally there are as few as 1 cluster and as many as 10 clusters. However, on average, there are 5 clusters in the network.

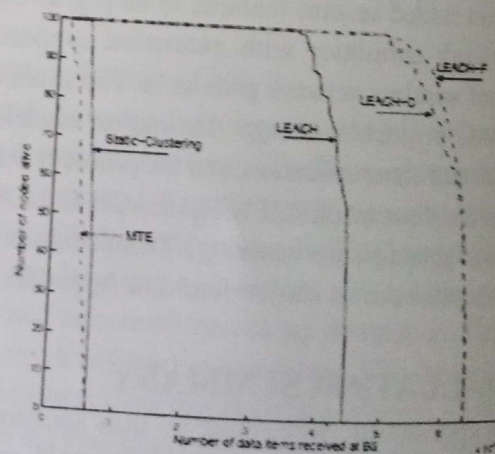
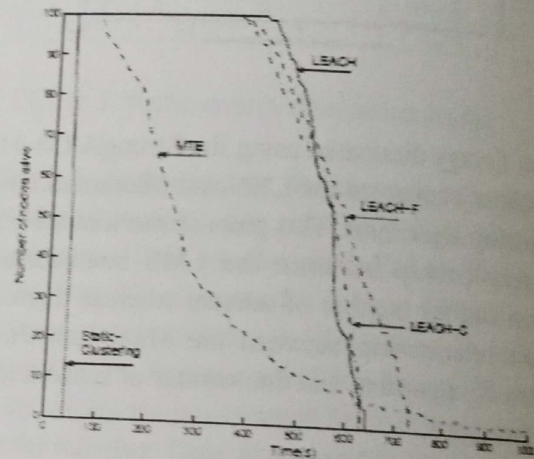


Figure 8: Data for the limited energy simulations, where each node begins with 2 J of energy. (a) Number of nodes alive over time. (b) Number of nodes alive per amount of data sent to the base station. LEACH can deliver 10 times the amount of effective data to the base station as MTE routing for the same number of node deaths. The benefit of rotating cluster-heads in LEACH is clearly seen by comparing the number of nodes alive in LEACH and static-clustering.

6. Summary and Future Work

This paperer has shown the large advantage of using LEACH versus a routing protocol or static clustering approach in terms of latency and system lifetime for a given quality (measured here as the amount of effective data whose information is received at the base station). LEACH is effective because it was designed to exploit the diligence of sensor networks: producing high-level information about an environment the nodes are monitoring. LEACH-C is able to deliver more effective data than LEACH even though cluster formation is more expensive because the centralized algorithm can use network topology information to form good clusters that require less energy for operation than the ad-hoc clusters formed in LEACH. However, this protocol comes at the price of having to know node location. Similarly, LEACH-F performs well, but this protocol is unable to adapt to new conditions, such as nodes being added to the network or node mobility. Therefore, this protocol does not meet the robustness requirements for wireless micro sensor networks.

This protocol works as follows:

- * Each node keeps track of its upstream neighbours, i.e., the nodes that will be sending it their data.
- * Each node that does not have any upstream neighbours uses a CSMA protocol to send data to its next-hop neighbour at the beginning of a round.
- * Once a node has received data from every upstream neighbour, the node aggregates the data together (along with its own data) and forwards the aggregate signal to its next hop neighbour (again, using CSMA).
- * This continues until the data works its way to the base station.

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FUZZY LOGIC: INSTRUMENT FOR INTELLECTUAL KNOWLEDGE MANAGEMENT

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ABSTRACT:

We have entered into an era where the present & future will be essentially determined by our ability to wisely use knowledge, a precious global resource that is the embodiment of human intellectual capital and technology. As we begin to expand our understanding of knowledge as an essential asset, we realize that in many ways our future is limited only by our imagination and ability to leverage the human mind. As knowledge increasingly becomes the key strategic resource of the future our need to develop comprehensive understanding of knowledge processes for the creation, transfer and deployment of this unique asset are becoming critical. This paper discusses the process through which knowledge acquisition, technical tools and organization actors can contribute to an organization development in developing knowledge as a systemic competitive weapon. It examines the relationships between the technology and human value, because they are vital instruments of the knowledge management (KM) process. KM is related to intelligent agents, information technology (IT), and strategic decision-support systems (SDSS) such as Fuzzy Logic controller. It attempts to provide useful insights on KM efficiency. A conceptual model of KM efficiency in the organizations supported by the combination of intelligent agents role and intelligent systems resources is presented

INTRODUCTION :

Knowledge management (KM) is an emerging field that has commanded attention and support from much of the industrial community. Many organizations are now engaging in KM in order to leverage knowledge both within their organization and externally to their shareholders and customers. KM deals with the process of reating value from an organization's intangible assets. These assets, or knowledge, can be classified as either tacit or explicit. Explicit knowledge is that which has been codified and expressed in formal language (Nonaka, 1991, 1994). It can be represented, stored, shared and effectively applied. Tacit knowledge is knowledge that is difficult to express,

represent and communicate (Nonaka, 1991, 1994). The distinction between types of knowledge is relevant because each type must be managed differently .Knowledge is a true asset of a organization, and its integration across departments and disciplines should be emphasized. Dealing with several technical tools and human values, knowledge management (KM) shows how learning organizations, intelligent organizations and enterprise management can re-engineer their processes using an applied knowledge-based approach. Intelligent agents (human value) and technical tools can provide the basis for long-term organizational effectiveness of firms that wish to institutionalise KM. The relationships among KM efficiency, intelligent agents and technological tools are highlighted. The purpose of this paper is to reinforce the roles of intelligent agents and technical tools in the building of KM efficiency. This paper discusses a conceptual model for KM efficiency and a framework for the roles of intelligent agents and technical tools.

FUZZY LOGIC: INSTRUMENT FOR INTELLECTUAL KNOWLEDGE MANAGEMENT

Rule based logic has been used to capture human expertise in classification, assessment, diagnostic and planning tasks. Probability has traditionally been used to capture decision making under uncertain conditions. For example, consider the rule:

IF Symptom-A is present THEN diagnosis is illness-X

There will be situations in which we are uncertain about the presence of Symptom-A. In such cases we can enter the probability of Symptom-A being present which will result in a confidence factor in our diagnosis of illness-X. A number of methods have been used to propagate probabilities during rule based inference. Many of these techniques are based on the probabilistic inference techniques used in Mycin and Prospector. The weakness of such techniques is that they do not reflect the way human experts reason under uncertainty. Expert Rule knowledge builder allows an alternative methodology to

the probabilistic reasoning approach. This involves defining Symptom-A and illness-X as logical attribute with values likely, unsure, unlikely. This allows the expert to dictate the relationship between the symptoms and diagnosis, instead of relying on the mathematical propagation of probabilities.

Many people confuse the above example of uncertain reasoning with fuzzy reasoning. Probabilistic reasoning is concerned with the uncertain reasoning about well-defined events or concepts such as Symptom-A and Illness-X. On the other hand, Fuzzy Logic is concerned with the reasoning about 'Fuzzy' events or concepts. Examples of fuzzy concepts are 'temperature is high' and 'person is tall'. When is a person tall, at 170 cm, 180 cm or 190 cm? If we define the threshold of tallness at 180 cm, then the implication is that a person of 179.9 cm is not tall. When humans reason with terms such as 'tall' they do not normally have a fixed threshold in mind, but a smooth fuzzy definition. Humans can reason very effectively with such fuzzy definitions, therefore, in order to capture human fuzzy reasoning we need fuzzy logic. An example of a fuzzy rule, which involves a fuzzy condition and a fuzzy conclusion, is:

IF salary is high THEN credit risk is low

Fuzzy reasoning involves three steps:

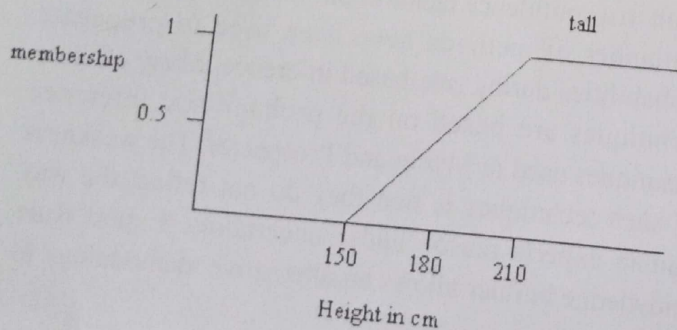
Fuzzification of the terms that appear in the conditions of rules.

Inference from fuzzy rules.

1. Defuzzification of the fuzzy terms that appear in the conclusions of rules.

Fuzzification

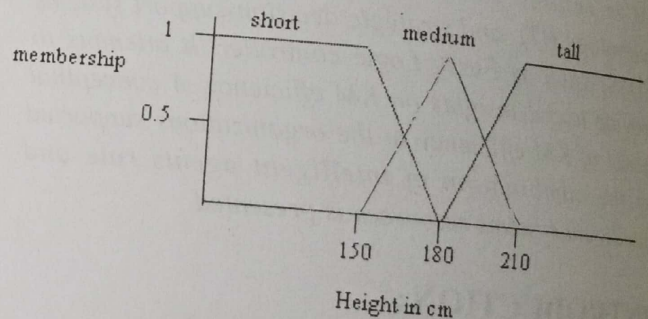
Lotfi Zadeh pioneered a method of modelling human imprecise reasoning using fuzzy sets. Using this technique, the concept 'tall' is related to the underlying objective term which it is attempting to describe; namely the actual height in centimetres. The transformation of an objective term into a fuzzy concept is called fuzzification. As an example, the term 'tall' can be represented in this graph:



It shows the degree of membership with which a person belongs to the category (set) 'tall'. Full membership of the class 'tall' is represented by a value of 1, while no membership is represented by a value of 0. At 150 cm and below, a person does not belong to the class 'tall'. At 210 cm and above, a person fully belongs to the class 'tall'. Between 150cm and 210cm the membership increases linearly between 0 and 1. The degree of belonging to the set 'tall' is called the confidence factor or the membership value. The shape of the membership function curve can be non-linear.

The purpose of the fuzzification process is to allow a fuzzy condition in a rule to be interpreted. For example the condition 'person = tall' in a rule can be true for all values of 'height', however, the confidence factor or membership value of this condition can be derived from the above graph. A person who is 180 cm in height is 'tall' with a confidence factor of 0.5 (membership value of the club 'tall'). It is the gradual change of the membership value of the condition 'tall' with height that gives fuzzy logic its strength.

Normally fuzzy concepts have a number of values to describe the various ranges of values of the objective term which they describe. For example, the fuzzy concept 'tallness' may have the values 'Tall', 'Medium height' and 'Short'. Typically, the membership functions of these values are as shown in the graph below:



Typically, fuzzy concepts have an odd number of values; 3, 5 or 7. We can extend the above values by adding very short and very tall. The real power of fuzzy logic systems, compared to crisp logic systems, lies in the ability to represent a concept using a small number of fuzzy values. This therefore reduces the number of rules required to capture the knowledge relating to that concept. To achieve the same accuracy with crisp logic, a large number of logical values would be required resulting in a large rule base.

Fuzzy Inference

Inference from a set of fuzzy rules involves fuzzification of the conditions of the rules, then propagating the confidence factors (membership values) of the conditions to the conclusions (outcomes) of the rules. Consider the following rule:

IF (applicant is young) AND (income is low) THEN credit limit is low

Inference from this above rule involves (using fuzzification) looking up the membership value (MV) of the condition 'applicant is young' given the applicant's age, and the MV of 'income is low' given the applicant's salary. The method proposed by Lotfi Zadeh is to take the minimum MV of all the conditions and to assign it to the outcome 'credit limit is low'. An enhancement of this method involves having a weight for each rule between 0 and 1 which multiplies the MV assigned to the outcome of the rule. This weight can be edited on the Pattern rules view, or assigned at run time. By default each rule weight is set to 1.0.

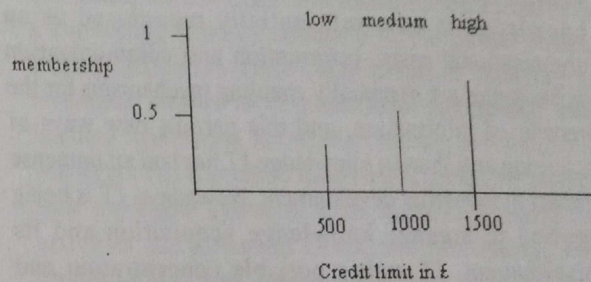
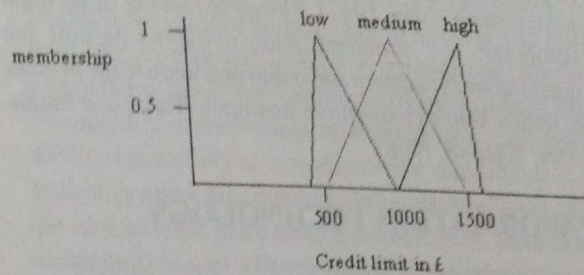
In a fuzzy rule base a number of rules with the outcome 'credit limit is low' will be fired. The inference engine will assign the outcome 'credit limit is low', the maximum MV from all the fired rules.

In summary fuzzy inference involves:

- " Defuzzification of the conditions of each rule and assigning the outcome of each rule the minimum MV of its conditions multiplied by the rule weight.
- " Assigning each outcome the maximum MV from its fired rules.
- " Fuzzy inference will result in confidence factors (MVs) assigned to each outcome in the rule base.

Defuzzification

If the conclusion of the fuzzy rule set involves fuzzy concepts, then these concepts will have to be translated back into objective terms before they can be used in practice. For a rules set including the credit limit rule described in the previous section, fuzzy inference will result in the terms 'credit limit is low', 'credit limit is medium' and 'credit limit is high' being assigned membership values. However, in practice, to use the conclusions from such a rule base we need to defuzzify the conclusions into a crisp credit limit figure. To do this we need to define the membership functions for the credit limit outcomes as shown in this diagram:



The defuzzified value of credit limit is calculated as the centre of gravity of the three Mvs (viewed) as weights placed at 500, 1000, and 1500.

While the main principles of fuzzy logic are broadly agreed on, there are a number of various methods of fuzzy inference and defuzzification. The methods described above are the most widely used and are the ones implemented in expert rule knowledge builder.

IMPROVING KNOWLEDGE THROUGH TECHNICAL TOOLS

A variety of tools can be used to create learning linkages, explainable models and handle KM. New learning tools are appearing that offer technological dimensions to human intellectual abilities, that is, they provide the mechanism for building sustainable KM systems. With these new tools, some knowledge can be formalised in a software program and made available to intelligent agents across the organisation. Such a system requires that the knowledge be accessible, understandable and storable by the intelligent agents.

In the last years, there have been significant advances in IT, which offered new possibilities to the KM processes. For example, the improved computer interfaces, higher capacity data storage, advances in knowledge engineering approaches, and computer-aided DSS have provided a significant contribution. The advent of electronic

performance support systems (EPSS) underscores this achievement (Gery, 1991). The great number of personal computers and communication networks permits the organisations to acquire and retain new knowledge in order to obtain better competitive positions (Halal and Smith, 1998; Tapscott, 1996).

INFORMATION TECHNOLOGY

Managerial work patterns have been affected by the advent of new information technologies, and the power of knowledge is now substantially recognised as an organisational asset. Information and communication technologies are essentially enabling mechanisms for the transfer of information, and this permits new ways of acquiring and sharing knowledge. IT has had an immense impact in industrial development. Nowadays, IT is being applied to manage knowledge acquisition and its development. IT makes possible concentration and diffusion of knowledge, and permits top managers to obtain information more quickly and accurately, but also allows middle managers to be better informed and make more timely decisions. The effective use of IT to communicate acquired knowledge requires an interpretative tool. The more the intelligent agents share similar knowledge and professional experience, the more effectively knowledge can be communicated via electronically mediated channels

STRATEGIC DECISION-SUPPORT SYSTEMS:

An organization should have the capacity to exploit its knowledge and learning capabilities better than its competitors if it decides to assume a given competitive strategy (Grant and Gnyawali, 1996; Roth, 1996). This capacity depends on its intelligent agents. In fact, they should believe that it is possible explicitly to link strategy, knowledge and performance in order to increase the probability of adding value. Some firms are able to define the needed links between the strategy and what their intelligent agents need to know, share and learn to operate during the strategy implementation.

Knowledge may be of several types, each of which may be made explicit. When the explicit causal knowledge is shared, often in the form of environment, competitors and situation analysis, it enables managers to co-ordinate the formulation of strategies and tactics for achieving objectives. Since the early 1970s, a growing number of

studies in the area of DSS decades have been reported (Eom, 1995), and they reflect the need to establish a substantive and coherent field of management information systems.

An effective DSS design may consider a common set of DSS elements, including DSS environment, task characteristics, access pattern, DSS roles and functions, and DSS components (Angehrn, 1993). Moreover, managers have to make decisions within complex scenarios, and to consider several strategic alternatives. This means that management activities need the contribution of specialised software and hardware (Mentzer and Gomes, 1991; Menton, 1991). SDSS may be included in an efficient KM in a co-operative and integrated way, for example in order to deal with sales strategy and new technology choices. The design of such SDSS should be developed according to management needs and intelligent agents' skills. SDSS can be useful even for planning in small business management (Moormann et al., 1993).

KNOWLEDGE OBTAINED BY INTELLIGENT AGENTS

In a management environment, agents are conceptually defined as entities that are able to understand the sense of a given situation and to act according to some orientations (Russell and Norvig, 1995). Other definitions refer to an environment where other agents exist and interaction takes place (Shoham, 1997; Wooldridge and Jennings, 1995). These interacting agents are owners of a great amount of knowledge, professional experiences and beliefs that they can share and constitute a ground, which may account for the achievement of useful co-ordination levels during interactions. Meaningful interactions in dynamic environments cannot be accomplished on the sole basis of message exchanging due to turbulence and uncertainty. In order to obtain better results, the communication among intelligent agents should assume a co-operative form and be supported by IT resources.

The study of intelligent agents has become one of the most important fields in understanding organisations' performance. Organisations depend on people for sustaining their knowledge levels. Since knowledge systems increase the professional performance of individuals, the individuals become prepared to create and embed knowledge in the organisation. Intelligent agents are playing a vital role in bringing about the rise of new

advantages and participating actively in consistent innovation, because this is the key to an organization's development (Pearson, 1991). They may be used as a promising solution for assisting the updating of knowledge in a timely manner (Rasmus, 1999; O'Leary, 1998).

The concept of the human intelligent agent is based on individual competence, that is, personal capacity to act in various situations according to rules, beliefs and professional procedures. It also includes education, experience, values and social skills. The success of organisations is supported by an organised and integrated set of competencies. The acquisition of new knowledge leads the intelligent agents to participate in a number of various knowledge relationships, creating multiple perspectives of the same situation. These perspectives may contribute to enlarge the number of possible solutions, which improves the quality of the decision-making process. The existing knowledge may be the point of departure to creative efforts, thereby creating links to new knowledge areas. If intelligent agents can access various databases for solving a problem, they may get a deeper understanding about the situation and they will be able to contribute more adequately to the decision-making process.

Moreover, intelligent agents use their unique competencies to deal with problems and opportunities. In fact, they can be prepared to convert data and information into meaningful knowledge, which is shared and focused on competitive strategies. Research on intelligent agents and co-ordination of multi-agents has drawn tremendous interest from business communities (Lin et al., 2000).

According to this perspective, an organisation can be better understood using intelligent multi-agent architecture. The development and the analysis of co-ordination and interactions among multiple intelligent agents allows to understand better the process of KM.

Team creativity depends on creative individual agents and is receiving considerable attention from some researchers involved in unstructured problems (Amabile et al., 1996). In fact, teams can bring together the right mix of intelligent agents who have the appropriate set of knowledge, skills, information and abilities to suggest solutions in what concerns difficult and unpredictable problems. The quality of their results depends on how well individual knowledge can be communicated among intelligent agents.

ORGANIZATIONAL EFFECTIVENESS:

Deciding the value of knowledge and learning may be the most effective approach to improving a solid and prevailing competitive basis for business organizations. Often, management effectiveness is attested by organizations' ability successfully to assimilate their acquisitions in the industries where they operate. Unless the intelligent agents are able to learn performance-related tasks, there can be no organizational effectiveness. If organizations take effective care of their KM, they become able to understand their strategic knowledge requirements and they can devise a knowledge strategy adequate to the global business strategy. Effective knowledge creation, sharing, and leveraging require an organisational culture that values learning, teamwork, knowledge sharing and innovation. Managers can formulate incentive schemes for engaging their intelligent agents in those knowledge-based roles, activities and processes (Zack and McKenney, 1995). Organisations can derive significant benefits from a proactive KM. This adoption orientation requires coherent planning of the combination of organisation's technical tools, intelligent agents, knowledge-processing requirements and KM strategy. In this point of view, the assessment of organisational effectiveness is essentially related to how well the organisation is matching its global offering to the identified needs of its target markets (Johnson and Scholes, 1999). The KM architecture provides a framework for guiding this important effort.

MANAGEMENT PERFORMANCE:

Organisational analysis often starts with a performance determine whether a strategy should be reviewed or changed, and to identify areas of organisational strength. analysis guided by objectives. Performance levels can help managers to Performance measurement is related with the organisation's key areas, such as expansion, innovation and productivity, which are critical to the development and prosperity of the organisation. Obtaining, creating and managing knowledge to support strategic decisions making and implementation is a practical problem that organisations should solve. A formal strategic KM system can enhance the organisational effectiveness and preserve data, ideas, operational solutions and acquired knowledge within the organisation. There is growing interest in building complex systems by co-ordinating and integrating intelligent systems. Some authors consider that systems co-ordination is essential to achieve a pre-determined objective. Co-ordination among different decision makers is quite advisable to achieve high performance levels, and

has also been suggested as a structure model for some types of organisations (Kappel et al., 1998; Ellis et al., 1991).

It is possible to create intelligent software objects and other technical resources that represent the realities with which the organisation has to deal in a competitive manner. Nowadays, intelligent systems are used to measure performance levels and intense efforts are being made to improve their features in order to obtain adequate conclusions and better decision-making activities. For example, DSS applications include:

- " strategic planning;
- " requirements analysis;
- " business process re-engineering;
- " business planning and control;
- " project management; and
- " performance measurement.

Much of the concern about management performance will be alleviated when KM attains adequate efficiency levels. Advances in processing hardware, software and intelligent systems will let organisations obtain the appropriate performance tuning for adaptations according to opportunities and competitors' movements.

Because the objectives of a strategy of an organisation may be stated in terms of expansion, differentiation, sales, market share or profitability, top managers have to monitor the performance measures as indicators of objectives' achievement. By examining performance according to an evaluation procedure, management will be better able to understand the reasons for the strategic results. If the evaluation procedure is sufficiently detailed, it will be possible to understand the reasons for differences in performance and to decide some corrective actions.

The value of performance measurement is ensuring ongoing organisational success. Thus, it is necessary to emphasise the importance of measuring organisational performance in ways that go beyond the limitations of traditional financial reporting systems. In fact, most organisations now recognise that some areas not covered by financial systems - such as customer satisfaction, employee morale and new product development - have a decisive influence on long-term performance.

CONCEPTUAL MODEL:

The model is divided in two areas: the area of technical tools for specification of intelligent systems resources

and the area of intelligent agents destined to focus their roles on organisations performance. The major factors are discussed and directions for future research are suggested. As can be seen in figure 1, a conceptual model for KM efficiency is proposed. It emphasises that problem-solving strategies, strategic decisions, organisational effectiveness and management performance can be the logical results obtained from KM efficiency based on intelligent agents and technical tools, namely IT and DSS. This model takes into account numerous determinants (determinant factors) of the relationships among various fields.

The top portion of the model shows the main sources where knowledge can be acquired (data, experience and information). KM has to deal with two domains:

- (1) Technical tools such as fuzzy logic controller and
- (2) Intelligent agents.

Technical tools include IT and SDSS because they contribute intensively to the formulation of competitive strategies. The factors that affect drastically the technical tools are development, differentiation and integration. As explained previously, intelligent agents are person whose functions imply learning efforts, creativity and decision capacities at different levels in the organization. Intelligent agents make knowledge progresses based on each individual's efforts and skills. Nevertheless, the behavior of each intelligent agent depends also on the motivation methodology adopted by the organization and on the actions that management takes. Within this architecture, technical tools and intelligent agents can contribute to knowledge-development decisions based on certain predictive modeling methods.

The adequate combination of IT, SDSS, and intelligent agents' activities can lead the organization to a particularly strong competitive set. In its architecture, the KM efficiency model uses intelligent agents to acquire and develop knowledge units, DSS for managing decision-making processes and IT to support those processes. Thus, the organization could obtain a solid basis for its strategic decisions, achieve higher levels of organizational effectiveness and provide impressive qualitative results of management performance.

Until now, this model has only been conceptualized according to literature review and our personal perspective. Further work will be required in order to validate this model. In the near future, it will be confirmed,

using the validation of several hypotheses based on the analysis of empirical research (data collected from technical experts and managers).

CONCLUSIONS:

This paper intends to provide insights to a better understanding of KM in what concerns the possibility of enabling organizations to attain higher performance levels and to experience several solutions to competitiveness problems. Its considerations provide considerable support for the importance of intelligent agents, IT and SDSS as a decisive contribution to KM efficiency. Consequently, these considerations intend to represent an important step forward in presenting KM efficiency as decisive support for the competitive development of organizations.

The architecture of the model proposed here should be improved in order to include new actors and the consideration of a wider set of technical tools, which could offer significant contributions to achieve better KM efficiency levels. A major short-term goal is to enhance and validate this model with real data suitable to dealing with the evolution of managers comprehension of the strategic value of KM.:

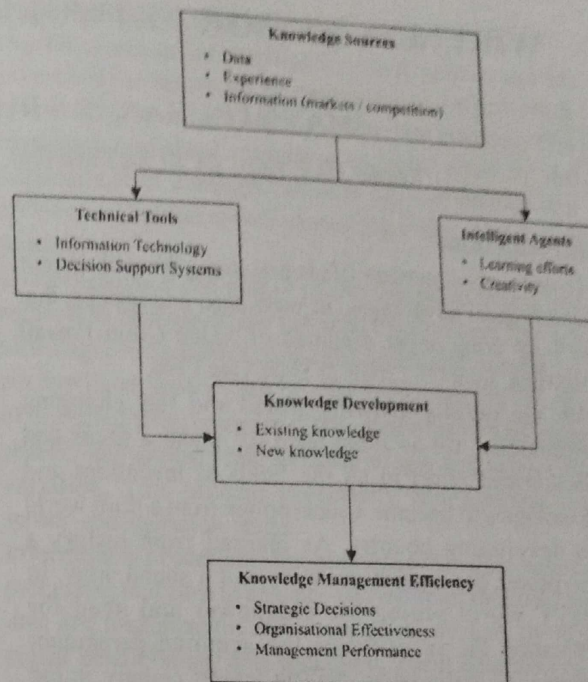


Fig. 1 Efficient model of Knowledge Management

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WIRELESS SENSOR NETWORK FOR BORDER SURVEILLANCE

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Introduction:

"To us, every American life is precious. We will use our technological advantages, in ways seen and unseen, that the Iraqi army never dreamed of." Gen Colin Powell Chairman, Joint US Chiefs of Staff, Dec 1990.

With the rapidly growing world and fast changing technologies, we as India need to make a focus and concentrated effort in all the fields of inventions and technologies to become a superpower from a third world and developing country. As learned from history a superpower has a great economy and a sound army. In today's world seeing the manpower and need for automation the surveillance has acquired paramount importance. India being the 7th largest country in the world has vast borders both in land and water, which poses a great problem of securing them. Similarly, with increasing threat from terrorist to our country all the places can't be physically manned and at the same time we require to guard important installations from terror threats. So in order to overcome these challenges we should use latest technologies. Wireless sensor networking is a promising and most futuristic technology available for the job. Sensor network surround us. We drive in cars (which have seat occupation and belt sensors) on roads (that have car presence sensors), to work in buildings (that have temperature and motion sensors) which are all part of tremendous infrastructure that we take for granted, in part because of the sensor networks that help to make it maintainable. We are increasingly surrounded by the wireless communications networks. The cell phones are the most relevant and obvious example. Microwave towers and satellite links have become so common that they are no longer noticed. We are surrounded by computation. Most of carry at least one computer on us all day long though very basic. For e.g. a wrist watch, cell phone, hearing aid etc. with these recent developments in fields of computer, sensing and communication let us understand the fruits of wireless networking under one umbrella. In today's geopolitical climate, ensuring the protection of secure facilities or key locations against resourceful and determined intruders is of paramount importance to the defence and industries. Wireless sensor networks are deployed at perimeter or border locations to detect unauthorized intrusions. For deterministic deployment of sensors, the quality of deployment can be determined sufficiently by analysis in advance of deployment.

However, when random deployment is required, determining the deployment quality becomes challenging. To assess the quality of sensor deployment, appropriate measures can be employed that reveal the weaknesses in the coverage of WSNs with respect to the success ratio and time for detecting intruders.

Different types of sensors may be utilized in a WSN at critical locations, both on land and underwater, to enable the quick, accurate and secure localization of a threat. The border to be monitored maybe a huge area where the width is smaller than the length. The area need not be a straight line either, and there may be curling regions. The altitude may vary significantly. Moreover, some natural obstacles such as a river or a lake may exist within or along the border. The factors that affect probability of detecting a target are sensors-environment and target-related: target-to-sensor distance, propagation characteristics, the amount of energy emitted, the size and the motion pattern of the target, etc.

Scope:

This study concentrates on:-

- " Basics of wireless sensor networking technique.
- " Surveillance wireless sensor networks.
- " Military implications and methods.

Methods of Data Collection :

Bibliography of the sources of data is appended at the end. Much of the data has however been downloaded from Internet. Various white papers and few books, written by the scholars and researches in the same field, form the core material of the paper.

WSN: A link between the sensory world and the digital world:

In 1994 DARPA funded research on 'Low Power Wireless Integrated Micro sensor'. In 2003, Technology Review from MIT, listed WSN on the top, among technologies that would impact our future. WIRELESS SENSOR NETWORKS (WSN) is a new class of distributed system that are an integral part of the physical space they inhabit. WSN comprises small low-cost sensors with limited computational and communication power. The objective is to sense the environment and communicate the information to a data collection center. Many areas of employment are envisaged for WSNs ranging from the monitoring of endangered animals populations to military surveillance.

Unlike most computers, which work primarily with data created by humans, sensor networks reason about the state of world that embodies them. This bridge to the physical world has captured the attention & imagination of many researchers, encompassing a broad spectrum of ideas, from environmental protection to military applications. E.g. detection of earthquake. (auto detection, prevention & recovery)

Sensor detect the world's physical nature e.g. light intensity, temperature, sound, proximity to objects, chemical composition etc. Similarly, actuators affect the world in some way, such as toggling of a switch, making a noise, or exerting a force. Such a close relationship with physical world is in dramatic contrast to much of traditional computing. Databank is natural rather than invented by human.

Sensor networks are large collections of nodes. Individually, each node is autonomous & has short range. Collectively, they are cooperative & effective over a large area. Ex: Satellite can easily detect sky conditions as they can be seen from far away & a strategically placed sensor has an unobstructed view of a large area. Same satellite is not very good at detecting objects in a building, individual animals in a forest or chemicals in the soil. A distributed collection of shorter-range sensors & increasing no. of vantage points can improve performance manifolds. Phenomenon like temperature & humidity are much localized & cannot be effectively sensed from long distance.

Advantages over Existing Models:

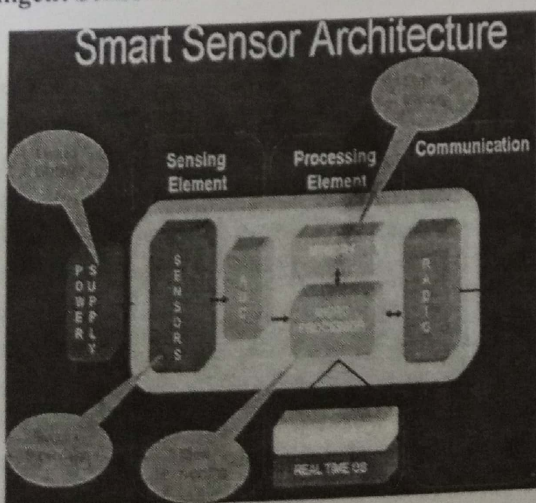
WSNs can address the issue of observing the environment :

- " At close range.
- " Densely in space.
- " Frequently in time.

Distributed sensing has following advantages:

- " Improved signal-to-noise ratio.
- " Allows greater fidelity.
- " In extreme, can reveal phenomena invisible from far.

Intelligent Sensors:



The architecture of a sensor node

The functions of an intelligent sensor system can be described in terms of compensation, information processing, communications and integration. The combination of these respective elements allow for the development of intelligent sensors that can operate in a multi-modal fashion as well conducting active autonomous sensing.

Compensation is the ability of the system to detect and respond to changes in the network environment through self-diagnostic routines, self-calibration and adaptation. An intelligent sensor must be able to evaluate the validity of collected data, compare it with that obtained by other sensors and confirm the accuracy of any following data variation. This process essentially encompasses the sensor configuration stage.

Information processing encompasses the data related processing that aims to enhance and interpret the collected data and maximize the efficiency of the system, through signal conditioning, data reduction, event detection and decision making. This may involve a collection of filtering and other data manipulation techniques together with advanced learning techniques for feature extraction and classification in order to provide the most relevant data in an efficient representation to the communications interface. Communications component of intelligent sensor systems incorporates the standardized network protocol which serves to links the distributed sensors in a coherent manner, enabling efficient communications and fault tolerance. Traditional task specific sensor systems often contain a number of limitations in terms of complexity, cost and flexibility. Intelligent sensors aim to overcome these limitations through the utilization of standardized transducer interfaces and communications protocols, resulting in autonomous, distributed, re-configurable sensors.

Integration in intelligent sensors involves the coupling of sensing and computation at the chip level. This can be implemented using micro electro-mechanical systems (MEMS), nano-technology and bio-technology.

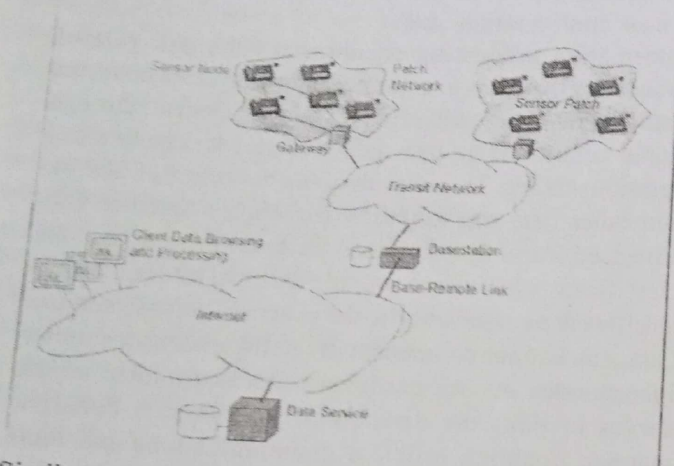
Network model:

A wireless sensor network consists of hundreds or thousands of low cost nodes which could either have a fixed location or randomly deployed to monitor the environment. Sensors usually communicate with each other using a multi hop approach. The flowing of data ends at special nodes called base stations (sometimes they are also referred to as sinks).

A base station links the sensor network to another network (like a gateway) to disseminate the data sensed for further processing. Base stations have enhanced capabilities over simple sensor nodes since they must do complex data

processing; this justifies the fact that base stations have workstation/laptop class processors, and of course enough memory, energy, storage and computational power to perform their tasks well. Usually, the communication between base stations is initiated over high bandwidth links.

One of the biggest problems of sensor networks is power consumption, which is greatly affected by the communication between nodes. To solve this issue, aggregation points are introduced to the network. This reduces the total number of messages exchanged between nodes and saves some energy. Usually, aggregation points are regular nodes that receive data from neighboring nodes, perform some kind of processing, and then forward the filtered data to the next hop.



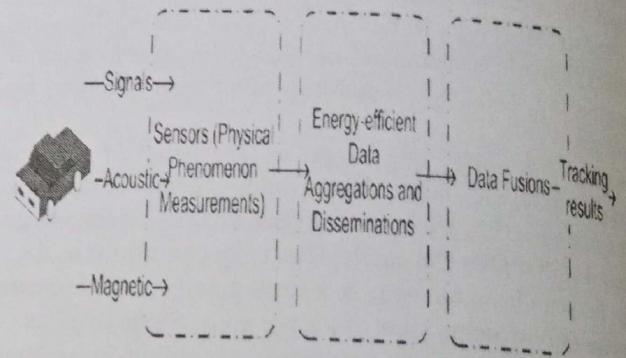
Similar to aggregation points is clustering. Sensor nodes are organized into clusters, each cluster having a "cluster head" as the leader. The communication within a cluster must travel through the cluster head, which then is forwarded to a neighboring cluster head until it reaches its destination, the base station. Another method for saving energy is setting the nodes to go idle (into sleep mode) if they are not needed and wake up when required.

Hybrid Sensor Network:

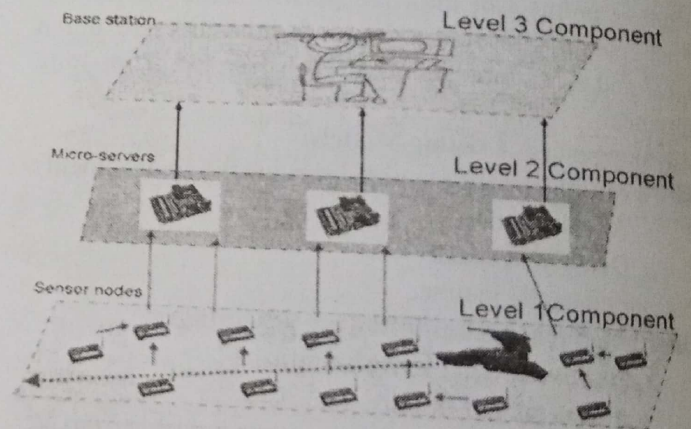
The goal of a HSN is to design and implement a hybrid sensor network system, which consists of several tiny inexpensive sensors and a limited number of powerful micro-servers & estimate and track the target based on the spatial differences of the target object signal strength detected by the sensors at different locations. The sensor nodes, which are deployed over a wide area use acoustic and magnetic sensors for detecting the presence of the moving objects, while the resource-intensive tasks, such as the data fusion algorithms are offloaded to the micro-servers.

The first component consists of inexpensive off-the-shelf wireless sensor devices, such as MicaZ motes, which are capable of measuring acoustic and magnetic signals

generated by different target objects (e.g., vehicles). The second component is responsible for the data aggregation and dissemination algorithms. It includes local micro-servers, where the measurements are transferred. The system tracks the target based on the spatial differences of signal strength measurements produced by the target object and collected from sensors at different locations. Therefore, the third component of the system is responsible for data fusion algorithms. This component will also be capable of handling noise introduced by the environment as well as by the sensors themselves.



Hybrid Sensor Network

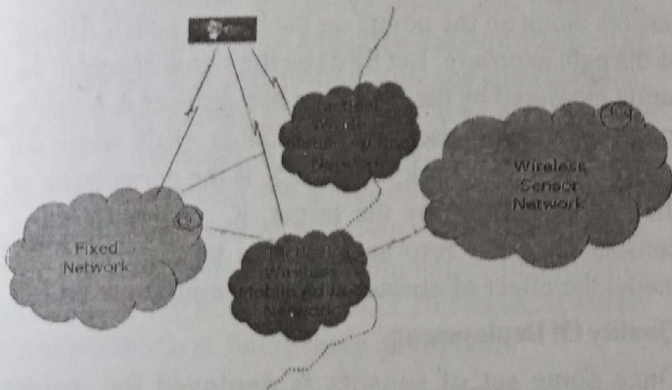


Different Layers And Components

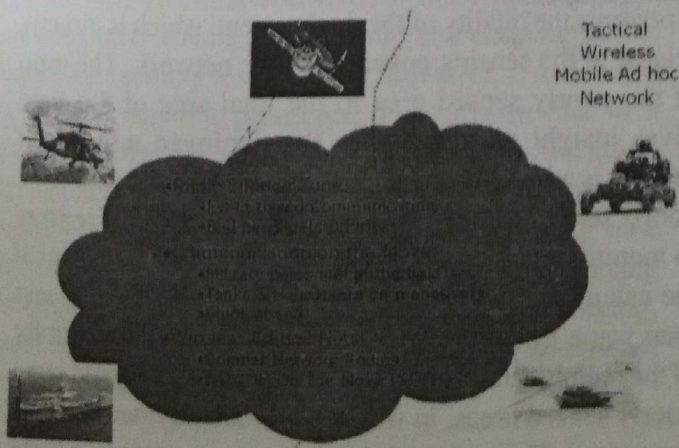
History: Military Networks of Sensors:

Since the early 1950s, a system of long-range acoustic sensors (hydrophones), called the Sound Surveillance System (SOSUS), has been deployed in the deep basins of the Atlantic and Pacific oceans for submarine surveillance. Beams from multiple hydrophone arrays are used to detect and locate underwater threats. Recently, SOSUS has been replaced by the more sophisticated Integrated Undersea Surveillance System. Networks of air defence radars can be regarded as an example of networked large scale sensors. Both ground-based radar systems and Airborne Warning and Control System (AWACS) planes are integrated into such

networks to provide all-weather surveillance, command, control, and communications. The radar dome on AWACS planes is 30 feet in diameter and six feet thick. It can detect ying targets in a range of more than 200 miles. In the 1980s and 1990s, the Cooperative Engagement Capability (CEC) was developed as a military sensor network, in which information gathered by multiple radars was shared across the entire system, to provide a consistent view of the battle field. Another early example of sensing with wireless devices is the Air Delivered Seismic Intrusion Detector (ADSID) system, used by US Air Force in the Vietnam war. Each ADSID node was about 48 inches in length, nine inches in diameter, and weighted 38 pounds. Equipped with a sensitive seismometer, these ADSID nodes were planted along the Ho Chi Minh Trail to detect vibrations from moving personnel and vehicles. The sensed data were transmitted from each node directly to an airplane, over a channel with unique frequency. Although the ADSID nodes were large, and the high energy cost of direct communication limited the lifetime of nodes to only a few weeks, they successfully demonstrated the concept of wirelessly networked sensors. With the success of digital packet radios for wireless networking by the ALOHA net Project at Hawaii and DARPA's Packet Radio Project in 1970s, wireless communication within the same frequency band using MAC techniques and packet-based multi hop communication became possible.



Layout Of Suggested Networks At The Border



Various Equipment Deployed At The Border

Surveillance WSN (Border Surveillance):

A wireless sensor network (WSN) comprises small low-cost sensors with limited computational and communication power. The objective is to sense the environment and communicate the information to a data collection center. Many areas of employment are envisaged for WSNs ranging from the monitoring of endangered animals populations to military surveillance. Surveillance wireless sensor networks (SWSNs) are used in intrusion detection in applications such as border surveillance against penetration by hostile elements or perimeter protection. Sensors are deployed to a region; they wake up, organize themselves as a network, and start sensing the area for intrusion. When a sensor detects an intrusion, the event is communicated to the sink node so that an appropriate action is taken. The SWSNs are designed such that the intrusion detection probability is maximized while maintaining a long network lifetime. It is imperative to define a metric that is dependent on :

- " The type and variety of the sensors
- " The number of sensors deployed
- " The deployment scheme
- " The characteristics of the target and the environment.

For example, the detect ability in a geography that is harsh and non uniform in shape will be lower than that in a plain for fixed number of sensors.

The detection performance of the SWSN can be further improved by using data/decision fusion techniques. The SWSN must be able to adapt to the changing network and environment conditions. Because intrusions are usually detected by several sensors, highly-reliable intrusion information can be derived by means of cooperation among the sensor nodes. This necessitates time-synchronization in order to meet the required accuracy in the network by increasing the probability of intrusion detection while keeping the false alarm rate at a reasonable level. Network failure, partial or wholly, may not only be due to the power exhaustion of the sensor nodes.

A group of sensors may be intentionally destroyed, leading to area failures in a SWSN which must be studied along with the failure distribution of power-deprived sensors. An example of area failure is the effective elimination of sensor nodes through the presence of strong jamming. Since sensor failures are common, fault tolerance of the network should be investigated, because loss of individual sensors or a group of sensors should not hamper the task accomplishment of the network.

Surveillance Scenarios:

Suppose that a section of a border or perimeter is to be

monitored against unauthorized intrusion and the terrain is rough. Surveillance tasks may involve risks for humans in which case unmanned mission accomplishment is more desirable. Deploying a wired network infrastructure on the field is usually difficult. The WSN paradigm offers an easy and rapid alternative for building a network. Dense deployment is preferred to ensure robustness. For example, the sensors can be dropped on some region of interest by an aircraft. Nodes organize themselves to build up a network, medium access and network layers are configured dynamically on the run, and the network becomes operational. A sleep schedule may be established adaptively to decrease the power consumption.

A SWSN may be employed in a wide range of places such as country borders, wildlife parks, embassies, factories. The particular application will dictate a certain cost of a false alarm. For example, when a house or a factory is to be monitored for intrusion detection, the cost of a false alarm is relatively low. On the other hand, when the perimeter security of some mission-critical location such as an embassy or a nuclear reactor is to be ensured, a false alarm might trigger the transportation of special forces and/or personnel of related government agencies to the secured area, as well as the evacuation of residents in the surrounding neighborhoods, driving up the financial and personnel costs to confidence-shaking levels.

The detection of intrusions through a country's borders is a significant military application where interesting challenges related to WSN design may exist. The border to be monitored may be a huge area where the width is smaller than the length. The area need not be a straight line either, and there may be curling regions, the altitude may vary significantly, as is the case with our country. Moreover, some natural obstacles such as a river or a lake may exist within or along the border. Depending on the sensing range, the number of sensors and deployment scheme, the sensing coverage of the SWSN may have gaps. In case of a country border which might be hundreds of kilometers long, the surveillance area may be segmented to deal with complexity before deploying the sensors to the field. Furthermore, for emergency situations each segment may be monitored by a different control center. Segmentation can be carried out according to the geographical properties of the border such as topology and altitude.

Sensor Models:

Different types of sensors may have to be utilized in a WSN to address the problem at hand. For outdoor intrusion detection systems such as country border surveillance, microwave, ultrasonic, infrared and/or radar sensors are typical. Because the working principle of these

sensors differs, one needs a common measure such as the probability of detecting a target, p_d , to compare the performance of the sensor technologies. The factors that affect p_d are sensor-, environment and target-related: target-to-sensor distance, propagation characteristics, amount of energy emitted, the size and the motion pattern of the target, etc. Moreover, the false alarm rate constraint on each sensor (as well as on the SWSN itself if data/decision fusion is allowed), which limits the percentage of intrusion decisions when no target or an object that is not regarded as a target exists, also bounds the detection performance of the network.

Probabilistic Sensor Models:

A common approach in WSN research is to use the simple binary detection model. Here, the sensor detects a target with probability one only if the target-to-sensor distance d is below a threshold distance d_t . Such a simplification where d alone determines the outcome may be acceptable for indoor deployment, especially when line-of-sight is ensured.

Exposure Based Sensor Models:

As an alternative to using detection probability as a performance measure, the received energy level also gives an intuition about observability. The expected observability of a target in a field is referred to as exposure. For example, the total amount of energy received by the sensors along all the points on the breach path is defined as the path exposure. Let $S_i(d)$ be the signal energy of the target measured by the i th sensor at a distance d . A simple exposure based sensor model is $S_i(d) = Kd^k$ where the nonnegative constant k ; $2 < k < 5$, is the decay factor of the energy emitted by the target, K . A multiplicative constant between zero and one can be incorporated to model the effect of obstacles on the emitted energy.

Quality Of Deployment:

Once some set of sensors is deployed for border surveillance, to be sure that the deployment provides the necessary security level, one needs a measure that represents the quality of the deployment, which is directly related to the sensing coverage of the network. The ratio of the poorly sensed area to the total area of the field gives insight as to whether the deployed number of sensors is adequate or not. A point in the area is said to be poorly sensed or weakly covered if the number of sensors to monitor that point is less than a predefined value, or if the calculated detection probability for that point is less than some threshold. Depending on the non-uniformity of the region, random deployment schemes may yield large poorly sensed areas, in which case redeployment may be necessary. The ratio of the largest connected, poorly sensed area to the area of the field hints whether

redeployment is required or not. When setting up barrier coverage, random deployment may result in a well-secured region, in which a tiny breach hole may exist. To reveal such situations, one has to check if there is a path passing through the field where each point on this path is poorly sensed.

Military applications:

- " Wireless Video Sensor Network
- " Imouse Integrated Mobile Surveillance And Wireless Sensor System
- " Collaborative UAV
- " Smart Dust
- " Wild Net - Wireless Sensor Network for Wildlife Behavior Monitoring, Disease Tracking and Control

Conclusion:

Micro sensor network technology will have a significant impact on our lives in the 21st century. Micro sensor devices, ranging in size from cubic inches to cubic millimeters, will each have multiple on board miniaturized sensors (such as for light, temperature, humidity, acoustics, imaging, etc.), with considerable processing power, in each geographic position ability through global positioning systems (GPSs) or local positioning methods, and short range radio or optical communication links. These devices, which will be cheap and smart, can be deployed in small or very large numbers to instrument homes and highways, buildings and bodies, cities and infrastructures, as well as for monitoring and controlling defence applications. Particularly, in border surveillance, where the job is mundane & routine, SWSNs will raise an alarm automatically, reducing the strain on troops and giving exact location and type of intrusion. Thus, surveillance through WSNs adds a new dimension to existing equipments like TIIOEs, HHTIs, UGS, BFSRs etc. It will be apt to term SWSNs as future force multipliers.

The technology evolution and convergence of micro electromechanical sensors (MEMS) processing and communication will march toward hardware miniaturization and integrated sensing, computing, and communication chips. The daunting research task, however, is to develop algorithms, network protocols, and software that will enable the design of useful, long-lasting, reliable, survivable, and programmable systems out of such micro sensor network devices. This requires creating new frameworks that bring together in innovative ways many disciplines, including distributed computing, networking, signal and information processing, reliability, and robust system design.

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Despite the challenges, WSNs are becoming an integral part of modern society. WSNs will provide the communication backbone for industrial systems and home automation. These systems will be introduced to both the residential and commercial markets and may include thousands of devices. The advantages of these systems are persuasive for many industries.

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Impact of Emerging Mobile Technologies on Management Practices

Er P.Kothari, Er Ravinder Chanana, Dr H.M.Rai and Prof. Jitender khurana

Abstract -

To understand management functions in corporate and institutions, E-Learning and value added services are the need of the present day management practices. The demand to implement mobile technologies in various domains and in day to day life is growing. The amalgamation of such concepts require the understanding of management and technology. Drawing on indepth interviews with the various management staff members at different levels of management policy makers and insights from the present day mobile technologies, the key areas identified are corporate trainings, corporate meetings, planning and scheduling various functions. The combination of these key dimensions give rise to several new possibilities. Consequently high cost cutting can be achieved. It is concluded to discuss the policy implications of the most critical and controversial dimensions.

Keywords - Management technology, mobile technology, E-Learning, M-Learning and corporate training.

I. INTRODUCTION

Recently the market place has become considerably competitive. Corporate are continually seeking to redefine their competitive advantage by honing their distinctive and distinguishing capabilities, or the competencies that the competitors find difficult to replicate. A natural corollary to sustain this advantage is learning to do things differently and better. Therefore, the need to learn and constantly build the skill inventory is intrinsic to business driven by hyper competition professionals. Not surprisingly, therefore, the sheer lack of time on the part of learners, not withstanding the motivation to learn or organizational appreciation of the desirability of learning programs, is often the stumbling block in the making organizational learning happen.

II. INNOVATIONS IN MOBILE TECHNOLOGIES

Looking at present day mobile technology, it has touched every arena of modern life, from communications to entertainment, from controlling to coordinating and so other areas of day to day life. The rapid emergence of new

technologies out spaces the ability to learn communities, to apply the technological infrastructure in any systematic and sustainable fashion. E-Learning communities are still grappling with significant pedagogical, cultural and business issues. These are often under estimated by the technocrats. Thus, the use of innovations in mobile technology can be sought to play a key role in the present day management scenario. Exploitation of the mobile technology and utilizing it towards corporate functions can be an innovation of a system, that is characterized by a relatively low level and concentration of investment in high quality time bound management. An exploitation of scientific knowledge and research results into an economic activity.

There are many close links between E-Learning and M-Learning. It can be argued that they represent a continuum based on the deployment of ever sophisticated technologies. This paper presents to "tease out" the strategic assumptions behind the current thinking on the m-Learning paradigm; to explore the relationships with E-Learning developments; to describe the strengths and weaknesses of the existing mobile device technologies; to make some assessment of the state of play in current M-Learning initiatives.

III. LEARNING STRATEGY

The concept underlying is the idea, that individuals never stop to learn throughout their lifetime. Corporate seek from their employees, the ability to adapt, adopt and improve processes in a flexible way.

It has been found that time deprivation is a major challenge in realizing meaningful learning intervention. Whether at work or at home. The working professional has little time to spare. As a result the need to learn, inadvertently and unfortunately takes a back seat.

Example: A training program that requires the learner to take out 30 odd minutes may not necessarily fit in the schedule of the learner. This may be due to his time crunch, both in and out of office. Therefore, the training program, however, well intended, instructionally sound and critically required to plug a competency gap, will fail to yield the desired result.

Apart from the training needs that arise from the working professional's current role related competency gaps or the learning needs that are concomitant to career

progression, another latent challenge that faces time strapped people in the corporate environment is the pursuit of Personal Learning Agenda (PLA). It is distinct from organizational bias in the professional learning agenda of a person. The PLA of a person is typically related to the acquisition of the knowledge and skills residing outside the organizational domain.
Example: PLA of a person can range from learning to make pasta or a new language, to pick tips and tricks to become a smart investor.

IV. LIFE LONG LEARNING

Life long learning has emerged as a complement to institutional education. The assumption underlying the life long learning concept is that it is impossible to supply all the knowledge and skills, learners need throughout their life times at school or university. [1]

People need and desire to constantly enhance their knowledge and skills for the sake of their professional or personal development or to solve problems in both areas. Learning is a process of mental and social change of an entire life time.

In future, learners will not be bound to particular locations. New technologies offer the opportunity to learn and study at any time and any where in different ways - according to the preferences of the user. Life long learning is primarily collaborative, rather than competitive. It involves joint and cooperative learning as well as the exchange and critical discussion with others.

V. TIME POOR MONEY RICH

Information technology was developed to ease out our lives.

Paradoxically, it has created even more work and pressure on our society. It is characterized by a high correlation between time poor and money rich. [2]

Learning today during leisure time has become a trend in our knowledge society. Levels of education are rising. Still time has become one of our scarcest resources. Time rich segments are composed of retired people, children and youth and unemployed. Most professionals and parents with studying children can be considered to be having time poor. Consumer behavior of time poor persons has shown to be clearly goal oriented. [2]. The mobile and internet solutions show to be an efficient way to solve needs of time poor persons for enhanced vocational and leisure learning services.

It is proposed that mobile learning approaches within corporate companies should be targeted to those employees, who are consistent with the time rich money

poor persons. Executives with a high degree of discipline and self initiative persons should be encouraged for M-Learning. Earlier research studies have indicated that third generation distance learning systems which include interactive video, email, internet and audiographics technologies are especially suited to higher education and to adult learning, mainly as a result of the interactivity embedded in the system [Katz 2000]

VI. M-LEARNING

With mobile phone penetration more than 100% in many countries, the ergonomics continually redefines the form factor of hand held devices. The multimedia capable 3G mobile devices and interoperability of mobile phones across different networks and countries, the ubiquitous mobile phone offers immense potential for its use to deliver learning content.

M-Learning covers a complex array of possibilities. It is opened up by the convergence of new mobile technologies, wireless infrastructure and E-Learning developments. As with any emerging paradigm, there are many attempts to define its essence. It is worth quoting some of these definitions in order to capture the common threads inherent in M-Learning.

1. "M-Learning is the intersection of mobile computing and E-Learning. It has accessible resources wherever you are, strong search capabilities, rich interaction, powerful support for effective learning and performance based assessment. It is E-Learning independent of location, time or space." [3]
2. "A new M-Learning architecture will support creation, brokerage, delivery and tracking of learning and information contents, using ambient intelligence, location dependence, personalization, multi media, instant messaging (text, video) and distributed databases". [3]
3. "Three ways learning can be considered as M-Learning. It is mobile in terms of space. It is mobile in different areas of life. It is mobile with respect to time". [3]

The enormous growth of the Internet over the past decades has paved the way for the emergence of E-Learning as an educational concept. Web based Learning Management Systems (LMS) like Blackboard, E-Learning Suite or WebCT are fixed components of institutional and vocational education. The speed at which coverage of mobile phones developed after the year 2000 added the dimension of mobility to the learning offer. Mobile devices can help to combine work, study/education and leisure in

A meaningful way. M-Learning can be considered as a learning activity. It can take place in changing communities and mixed with everyday life skills. [1]
 M-Learning is an emerging form. It offers both trainers and learners an opportunity to interact and gain access to learning material by use of a wireless hand held device. It is independent of time and space. [4]
 Research in M-Learning for higher education is steadily progressing. In a survey of young adults in age group of 18-24 years, the use of mobile phones in U.K., almost half expressed an interest in use of their mobile phones to improve their reading, spelling, maths or language skills. Although only 5% currently use palmtops, 55% stated that they might use one under other conditions, especially lower prices. [LSDA 2003]. Whereas the diffusion of PDAs is still not frequent among younger users and private use in general. Most business executives use PDAs or Smartphones as part of their day to day work. Frequent mobile device for time poor persons. A comparison between the concepts of knowledge management, E-Learning and M-Learning shows that several aspects of M-Learning concept seem closer to the organizational knowledge management than to the E-Learning concept.

VII. STRENGTHS OF M-LEARNING

- " Multimedia communication device with SMS for text messaging and MMS for exchange of images, video and Internet access.
- " Ubiquitous with penetration of mobile technology beyond Internet.
- " Interoperability storage capabilities.
- " 3G networks with greater bandwidth for faster downloads.

VIII. CONCEPTUAL MODEL

Based on in depth interviews with the management personnel like administrative staff, HR Managers and other policy makers, the following dimensions are identified for the proposed model.

- " The selection of key management practices and procedures.
- " The participants and their selection criteria.
- " The type of research.
- " The availability and affordability of Skilled Management.
- " The approach towards the activities in the organization.

- " The geographical availability of mobile bandwidths.
- " Financial viability of the amalgamating technology with management

IX. EXPECTED OUT COME

Corporations striving to reconcile the issues of time derivation and enabling consequential learning can leverage the ubiquity of mobile phones to access learning ware during the periods of time during which their professionals are not gainfully engaged.

Example: Home office commute or office client site commute time typically go underutilized, because there is no access to learning materials on the go. If the mobile access to learning resources can be enabled during such times, employees will be able to plug such "holes in time" with episodic learning. However, it implies that coursework developed for learning on mobile devices should be such designated that it enables multitasking, allowing the learners to go through learning modules, while performing routine, daily tasks like jogging and workouts. Infact mobile courseware designed for simultaneity between learning and performance of regular routine tasks. Working professionals will find the much needed time slot to pursue their professional and personal learning agendas without interfering with their daily schedules.

Besides enabling the learn as you go paradigm, mobile devices can contribute immensely to improve engagement of the learner. Effectiveness of learning ware will increase through peer to peer collaboration, active learning and contextual learning.

Example: The multimedia capabilities of mobile devices can be leveraged for deploying image or video based assessments during which a particular piece of media depicting a sales problem scenario can be flashed to learners with the objective of obtaining their strategies to resolve the problem and information sharing. In this process learning is facilitated. Such collaborative learning opportunities come particularly handy for workforce operating in the field. Because, th mobile is a communication device, it easily lends itself to collaborative learning initiatives. It leads to growth of communities of practice and creation or sharing.

Further, the mobile device with support for multiple communication protocols like, GPRS, WLAN and Bluetooth, facilitates transference of learning content on to mobile devices on "as and when needed" basis. It will lead to contextual learning. This enables deployment of learning to real life tasks and the interplay of content. Its application enriches the contextualization of learning. It is

apparent that mobile phones seamlessly connect with the requirements of corporate learning strategy with lightweight learning that fits the "holes in time" of the working professional, less learner time, tight coupling with real life tasks and design for multitasking.

X. CONCLUSION

Chairmen of corporations expect their employees to be well versed with the latest technology. M-Learning is one of the learning media. It is gaining importance with development of mobile technology. Mobile technology is a handy tool for money rich time poor cadre of employees in corporate sector. A compatible model will help the corporations to achieve the desired growth.

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Role of Motivator in Human Resources Development

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INTRODUCTION

There is no single wand (magic rod) available in this world, which can motivate all. Because it is always very easier said than done. Likewise, motivation is also not so easy because of different situation, different level and different nature of human being. Every individual has his own perception, the life style, priorities that too changes variably from time to time, situation to situation, level to level and one stage to another. So it is very difficult to say, to what extent, that the variation in a particular situation will vary the level of motivation, whether, it will be in proportion to the change of variation in situation or otherwise.

Normally it is seen that change in a particular situation will definitely have a change in level of motivation. The situation can be created by making / bringing the desired level of changes in the external and internal environment of the organization but the change itself do not always bring the motivational change. Situational changes sometimes, it works vice versa also, which become very difficult to manage, leading to the downfall of employee's motivation and job satisfaction.

Definition:

Len Nadler of George Washington University is supposed to have formulated the concept of Human Resources Development.¹

Nadler (1970) defined HRD as a series of organized activities, conducted within a specified period of time, and designed to produce behavioral change. Some of the common activities he identified within HRD are training, education and development. He identified training as those activities intended to improve performance on the job, education as those activities intended to develop competencies not specific to any one job, and development is preparation to help the employee move with the organization as it develops.

In a revised definition Nadler (1984) defined it as organized learning experiences in a definite time period to increase the possibility of job performance and growth.

A recent review of the definitions of HRD by McLean and McLean (2001) provides a lot of insights into the field. The following are some of the highlights of this article:

While there have been many efforts to define HRD, no

consensus seem to have emerged

The US definition of HRD seems to have influenced the definitions of many other countries

It appears that definitions of HRD may vary from one country to another, and the national differences are a crucial factor in determining the way HRD professionals work

There appears to be differences in the perception and practice of HRD in local companies as compared to Multinational companies

In several countries HRD is not distinguished from HR but is seen systematically as a part of HR.

McLean and McLean (2001) have offered the following global definition of HRD after reviewing various definitions across the world:

" Human Resource Development is any process or activity that, either initially or over the longer-term, has the potential to develop adults' work based knowledge, expertise, productivity, and satisfaction, whether for personal or group/team gain, or for the benefit of an organization, community, nation, or, ultimately the whole humanity" (p1067).

Strategic HRD puts... particular emphasis on the development of comprehensive, coordinated and dynamic approaches for major learning initiatives within and outside an organization in order to facilitate the achievement of all stake holder objectives in a competitive and turbulent environment.

Human Resource Development (HRD) is the framework for helping employees develop their personal and organizational skills, knowledge, and abilities. Human Resource Development includes such opportunities as employee training, employee career development, performance management and development, coaching, mentoring, succession planning, key employee identification, tuition assistance, and organization development.²

The focus of all aspects of Human Resource Development is on developing the most superior workforce so that the organization and individual employees can accomplish their work goals in service to customers.

Organizations have many opportunities for human resources or employee development, both within and outside of the workplace.



Human Resource Development can be formal such as in classroom training, a college course, or an organizational planned change effort. Or, Human Resource Development can be informal as in employee coaching by a manager. Healthy organizations believe in Human Resource Development and cover all of these bases.

HRD or Human Resource Development can best be described as a comprehensive learning system designed to enhance individual performance for the purpose of improving organizational efficiency. As such, HRD includes three types of learning activities: on the job, off the job, and through the job.

Motivation is the driving force which help causes us to achieve goals. Motivation is said to be intrinsic or extrinsic. The term is generally used

According to Scott, "Motivation is a process of stimulating people to action to accomplish desired goals."

The change and the motivational implementation by Strategic Human Resource Manager as a Change Agent:

Even measuring the level of motivation is not so easy specially in case of big organizations and the corporate houses because it is not always exhibitory instantly or at the initial stages, in exhibitory many a times. Sometimes when it is exhibitory, it is ignored due to the fact of Newton's law every action (changes) have equal and apposite reaction. In this case the time taken for the adaptation period is finally realized at a later stage that the time is lost, leading to the irreparable situation making it more difficult, the role of strategic Human Resource Manager, to implement the change.

In case of individual employee, monitoring the motivation at individual level is easier than in case of big organization or the corporate houses. Because the Newton's third law is easy to understand and reaction in individual employee case is more symptomatic and exhibitory in nature, that is why the span of control and the type of organization plays a crucial role to imply and implement the change as an effective measurer of a strategic human resource manager as a motivator. It is very important for the strategic human resource manager to check the pulse as well as the impulses of the individual, the organization and the environment simultaneously.

The group behaviors and the individual behaviors are having a lot of variations. The social scientist and the psychologists are of the opinion that there are various factors like attitudinal individual psychology, the heterogeneity or the homogeneity of the groups are

the various factors of the internal as well as the external environment etc, in general and the aim of the group in particular. If the intensity of the direction of the motivation is high enough and pilferage in the concentration of the group is lowest possible than the task of the strategic human resource motivation becomes easier, still the loss of concentration in the group than the individual cannot be ruled out is a matter of concern. That is why the venues of the meeting of the groups for the motivation are decided as far as possible in the pin drop silence zones and still the human brain is so dynamic, in fact, that the difference in the analyzing velocity of individual in the group leads to some what heterogeneity of the so called homogenous groups thereby leading to the difference of perception and the opinion of individual in the group, and making the task of motivation of strategic human resources manager a little more difficult.

The situation can be more complicated when dealing with the conflicting group rather than the harmonious groups. The main problem is related to the perception because the conflicting groups normally perceive the things in a different manner leading the groups to the diversions than the Solution.

The two-way communication plays an important role in this situation, if the barriers in the communication are removed and the umpiring strategic human resource manager is really neutral and at the same time the good listener, the task of motivation becomes easier, if SHRM understand well the pulses and impulses of the group. So the understanding of the pulses as well as the impulses of the group in cases of negotiation and conflict resolution becomes very important for the strategic human resource motivator.

When the strategic human resources manager is working for motivating the conflicting group to reach to some amicable solution, he should be cautious enough that the motivation should not divert towards the instigation in any form at any level or at any stage in the future, in any of the conflicting group.

Strategic Human Resource Manager is expected to take as the mantle of a business partner along with the managers of other line functions, in driving the firms' strategies. To drive profitability the organization has to follow certain strategic human resource practices, which provides scope for the growth and development of the skills sets of the employees. With the help of good strategic human resource practices, the strategic human resource manager, will devise ways to make the organization, the best employer of the country seeing revenues soaring all the time, very high.

Relationship between the Change, Development, Motivation and job satisfaction: -

The motivation, change, job satisfaction and the development are the inter-related terms; they interact and influence one another almost in a proportionate manner. Because the development is not possible without, any change in some form or other at some level. Rightly said: - "Nothing is permanent in this world, except, the change."

Change can be in any of the two forms either structural change or the functional change, sometimes it is both structural as well as the functional change during the innovation and renovation. The force behind the implementation of this change, for ensuring the process going smoothly is the force of the motivation.

The revolutionary changes can be brought very smoothly if the pulses and the impulses of the masses can be tapped continuously sensibly and imbibing the moral values and ethics simultaneously as happened during the disintegration of the USSR in 1992-93 and the unification of Germany. So it is the motivation and job satisfaction which brings the required positive changes without any complication for the development, but at the same time if the change process is forced one, i.e. without motivation than instead of development it may lead to the decay as Lord Huntington rightly said, "The development and decay goes together".

Arnold Glasgow - "One of the tests of leadership is the ability to recognize a problem before it becomes an emergency."

Features of Motivation: -

- a) It results from the felt need.
- b) It is a driving state which channels behavior into a specific cause, that is fulfillment of a felt need.
- c) It persists until the need subsides / satisfied.
- d) Motivation is a continuous process.
- e) A person cannot be partly motivated, as he is a self contained and inseparable unit.
- f) If the men at work are not motivated properly then it will be drastic to the organization.
- g) As rightly said in the words of Allah, "Poorly motivated people can nullify the soundest organization."

Importance: -

- Productive use of resources;
- Increased efficiency and output;
- Achievement of Goals;

Development of Friendly Relationship;
Stability in the Workforce.

Determinants of Motivation: -

- The individual;
- The organization;
- The environment;

It has never been possible for a fetus to survive outside the uterus, because it provides the proper environment required for the development of a fetus to a newborn baby. The newborn baby will have the features and characteristics of its mother, which provided the environment to the fetus. Likewise, whatever happens in an organization it is the percussion of the internal and the external environmental forces as rightly said, "Nothing exists outside the environment". The morphological structure of product, the human being and the organization depend upon the environment, likewise the environment also directly influences the functional aspects.

The internal and external environment which includes various factors like culture, values, ethics, traditions, economics, social, political, scientific archeological aspects etc, influence on the products and the by products of the organization. They are in separable and influence each other continuously but same time in a fluctuating manner. Therefore, the environment plays very important role in the motivation of the employees and a strategic human resource manager can never ignore it.

Role of Motivation in Strategic Human Resources Management:

Motivation has played a very important role in all the aspects of human resource management in general and strategic human resource management in particular. To become a good strategic partner, HR practitioners need to comprehensively understand business strategy. Motivation works as a lifeline in the organization which circulates the organization values, the belongingness, at all the stages of human resource management. It works as the best tool to bail art the down fall trend in an organization.

The various companies, institutions and the corporate houses, which could not motivate their human resource during the time of recession, had to pay a big price for that ranging from huge financial losses to the disbandment of the company, institution or the organization in question.

Rightly said-A motivated force can win a war against a big enemy easily, if the force is motivated, but at the

same time the biggest army can loose the war in a drastic way, if demotivated, likewise the motivated employees of an organization can do wonders in all types of situations and in any type of organization.

Motivation at right time in the right direction:

The situational, contextual and the individual factors plays very important role in motivation, following are some examples of situational motivation:-

The morning prayers in the institutions

The preamble of the constitution of India

The final words by the General to its army, before going for the war.

The address by a president of a country, to the members / delegate of the expedition team.

The Speaker of the Lok Saba, House of Commons, The Senate, Diet etc. before seeking the voting on issue of national influence.

Address by the Head of Organization, like WHO, WB, ADB, ASEAN, SARC, SEATO, NATO, UNO before taking up the important issue.

Broadcasting of national songs, before a particular important national event.

Seeking blessing, from the parents, elders, VIPs, famous personalities before going for new avenues, competitions, venture, mission etc.

Political, social and business leaders addressing the masses of their domain at various levels to minimize the demotivation (devastation) during the time of loss in war, failure of a mission, natural calamities where huge loss of life is predicted.

To conclude, it may be said that role of motivation in human resource development may seem to be an intuitive concept that is easily understood, but the diversity of recent research on role of motivation in human resource development, still raises conceptual and methodological debates. Although this may highlight the topical interest of this issue, it also calls for further and more in-depth

research into role of motivation in human resource development. A common framework involving both role of motivation in human resource development, conceptual approaches and measurement methodologies would be a step forward in improving working conditions surveys.

Abbreviations used:-

ADB- Asian Development Bank

ASEAN- Association of South East Asian Nations

HRD- Human Resource Development

USSR- Unions of Soviet Socialist Republic

SARC- Association of South Asian Countries

SEATO- South East Asian Territory Organization

SHRM- Strategic Human Resource Management

NATO- North Atlantic Territory Organization

UNO - United Nations Organization

VIPs- Very Important Persons

WB- World Bank

WHO- World Health Organization

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PARASITIC COMPUTING

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ABSTRACT

PARASITE as the word suggests is an entity that resides on another entity exploiting the resources of the latter. The term PARASITIC COMPUTING refers to the technique of using the resources of one computer by another computer without the knowledge of the former. Distributed computing networks turn home users' computers into part of a virtual supercomputer that can perform time-intensive operations. This seminar provides an insight into the details of how parasitic computing uses the computation power of the computers connected to the internet in solving complex mathematical problems. This technique was developed by the scientist at the Notre Dame University, Indiana (USA). According to the scientists, the transmission control protocol (TCP), could be used to solve a piece of a mathematical problem whose answer could then be relayed back to the original user. The implementation is discussed with the NP-Complete problem. Unlike hackers who exploit flaws to gain direct access to machines, the Notre Dame scientists created a virtual computer by using the fundamental components of distributed computing.

Introduction

Parasitic computing is programming technique where a program in normal authorized interactions with another program manages to get the other program to perform computations of a complex nature. It is, in a sense, a security exploit in that the program implementing the parasitic computing has no authority to consume resources made available to the other program.

The example is, two computers communicating over the Internet, under disguise of a standard communications session. The first computer is attempting to solve a large and extremely difficult 3-SAT problem; it has decomposed the original 3-SAT problem in a considerable number of smaller problems. Each of these smaller problems is then encoded as a relation between a checksum and a packet such that whether the checksum is accurate or not is also the answer to that smaller problem. The packet/checksum is then sent to another computer. This computer will, as part of receiving the packet and deciding whether it is valid and well-formed, create a checksum of the packet and see whether it is identical to the provided checksum. If the checksum is invalid, it will then request a new packet

from the original computer. The original computer now knows the answer to that smaller problem based on the second computer's response, and can transmit a fresh packet embodying a different sub-problem. Eventually, all the sub-problems will be answered and the final answer easily calculated.

So in the end, the target computer(s) is unaware that it has performed computation for the benefit of the other computer, or even done anything besides have a normal TCP/IP session.

The proof-of-concept is obviously extremely inefficient as the amount of computation necessary to merely send the packets in the first place easily exceeds the computations leached from the other program; and the 3-SAT problem would be solved much more quickly if just analyzed locally. In addition, in practice packets would probably have to be retransmitted occasionally when real checksum errors and network problems occur. However, parasitic computing on the level of checksums is a demonstration of the concept. The authors suggest that as one move up the application stack, there might come a point where there is a net computational gain to the parasite - perhaps one could break down interesting problems into queries of complex cryptographic protocols using public keys. If there was a net gain, one could in theory use a number of control nodes for which many hosts on the Internet form a distributed computing network completely unawares.

What is parasitic computing?

The net is a fertile place where new ideas/products surface quite often. We have already come across many innovative ideas such as Peer-to-Peer file sharing, distributed computing etc. Parasitic computing is a new in this category. Reliable communication on the Internet is guaranteed by a standard set of protocols, used by all computers. The Notre Dame Computer scientist showed that these protocols could be exploited to compute with the communication infrastructure, transforming the Internet into a distributed computer in which servers unwittingly perform computation on behalf of a remote node.

In this model, known as "parasitic computing", one machine forces target computers to solve a piece of a complex computational problem merely by engaging them in standard communication. Consequently, the target



computers are unaware that they have performed computation for the benefit of a commanding node. As experimental evidence of the principle of parasitic computing, the scientists harnessed the power of several web servers across the globe, which-unknown to them-work together to solve an NP complete problem.

Sending a message through the Internet is a sophisticated process regulated by layers of complex protocols. For example, when a user selects a URL (uniform resource locator), requesting a web page, the browser opens a transmission control protocol (TCP) connection to a web server. It then issues a hyper-text transmission protocol (HTTP) request over the TCP connection. The TCP message is carried via the Internet protocol (IP), which might break the message into several packages, which navigate independently through

numerous routers between source and destination. When an HTTP request reaches its target web server, a response is returned via the same TCP connection to the user's browser. The original message is reconstructed through a series of consecutive steps, involving IP and TCP; it is finally interpreted at the HTTP level, eliciting the appropriate response (such as sending the requested web page). Thus, even a seemingly simple request for a web page involves a significant amount of computation in the network and at the computers at the end points.

In essence, a 'parasitic computer' is a realization of an abstract machine for a distributed computer that is built upon standard Internet communication protocols. We use a parasitic computer to solve the well known NP-complete satisfiability problem, by engaging various web servers physically located in North America, Europe, and Asia, each of which unknowingly participated in the experiment. Like the SETI@home project, parasitic computing decomposes a complex problem into computations that can be evaluated independently and solved by computers connected to the Internet; unlike the SETI project, however, it does so without the knowledge of the participating servers. Unlike 'cracking' (breaking into a computer) or computer viruses, however, parasitic computing does not compromise the security of the targeted servers, and accesses only those parts of the servers that have been made explicitly available for Internet communication.

The NP-Complete Problem

A problem is assigned to the NP (nondeterministic polynomial time) class if it is verifiable in polynomial time by a Nondeterministic Turing Machine (A nondeterministic Turing Machine is a "parallel" Turing Machine which can take many computational paths simultaneously, with the

restriction that the parallel Turing machines cannot communicate.). A problem is NP-hard if an algorithm for solving it can be translated into one for solving any other NP-problem. NP-hard therefore means "at least as hard as any NP-problem", although it might, in fact, be harder. A problem which is both NP and NP-hard is said to be an NP-Complete problem. Examples of NP-Complete problems are the traveling salesman problem and the satisfiability problem.

The 'satisfiability' (or SAT) problem involves finding a solution to a Boolean equation that satisfies a number of logical clauses. For example, $(x1 \text{ XOR } x2) \text{ AND } (x2 \text{ AND } x3)$ in principle has 23 potential solutions, but it is satisfied only by the solution $x1 = 1, x2 = 0, \text{ and } x3 = 1$. This is called a 2-SAT problem because each clause, shown in parentheses, involves two variables. The more difficult 3-SAT problem is known to be NP complete, which in practice means that there is no known polynomial-time algorithm which solves it. Indeed, the best known algorithm for an n-variable SAT problem scales exponentially with n. Here we follow a brute-force approach by instructing target computers to evaluate, in a distributed fashion, each of the 2^n potential solutions.

As technology has evolved, need for more and more computing power has also increased. As a result, we have witnessed some extraordinary and applaud able computing solutions such as distributed computing currently being performed by SETI via 'SETI@home' (Phillips, 1999). Parasitic computing invented by computer scientists of the University of Notre Dame and questions its practice ethically.

Working over internet

A reliable communication over internet via TCP/IP is a complex process and requires a significant amount of computation to validate the integrity of the datagram being sent and received between two nodes (Cerf & Kahn, 1974). The integrity of a data segment is maintained by validating the result of certain operations on the bytes of 16 bit Checksum field in its TCP packet (Braden, Borman, & Partridge, 1988). Figure 1 displays a TCP pseudo header with 16 bit checksum field starting at bit offset 224. In August 2001, four researchers at the University of Notre Dame - Albert László Barabási, Vincent W. Freeh, Hawoong Jeong and Jay B. Brockman invented a very sophisticated computing technique known as parasitic computing based upon this behavior of TCP/IP (Barabási, Freeh, Jeong, & Brockman, 2001).

Bit offset	0-3	4-7	8-15	16-31
0	Source address			
32	Destination address			
64	Zeros	Protocol	TCP length	
96	Source port		Destination port	
128	Sequence number			
160	Acknowledgement number			
192	Data offset	Reserved	Flags	Window
224	Checksum			Urgent pointer
256	Options (optional)			
256/288+	Data			

Figure 1 TCP pseudo header (IPv4)

How is TCP/IP Works

In order to fully understand the concept of parasitic computing, it is important to understand how communication over internet via TCP/IP works. To demonstrate this, consider a scenario where a user is trying to visit a website. When user informs a browser the website URL (uniform resource locator), the browser opens a transmission control protocol (TCP) connection and connects to the web server. After establishing this connection, browser issues a hyper text transmission protocol (HTTP) request via already opened TCP connection. This TCP message is then carried to the destination (web server) via internet protocol (IP).

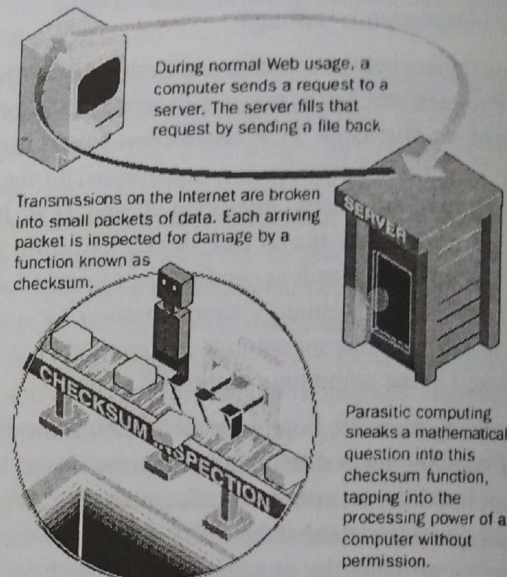
In this process of transmitting message from source (user) to destination, IP might break entire message into several pieces commonly addressed as TCP packets. These packets are then transmitted to the destination IP address via different routes. Once the destination receives all packets, a response is returned to the source via the same TCP channel. The original message is then reassembled via consecutive steps involving TCP and IP and is interpreted as HTTP request. After that, the web server sends a response (webpage HTML) back to the user (Peterson & Davie, 1999) (CISCO). Thus, even such a simple communication over internet requires significant amount of computation at all network stages and only cooperation and trust between all involved parties can guarantee a successful communication over internet.

In parasitic computing, this trust based relationship of machines connected to the network is exploited to make other machines perform a certain mathematical operations on certain data without an authorization. Albert László, Vincent, Hawoong and Jay used a parasitic computer to solve the well known NP complete satisfiability problem, by engaging various web servers physically located in North America, Europe, and Asia, each of which unknowingly participated in the experiment. Like SETI@home project, parasitic computing decomposes a problem into several small problems which are mutually

exclusive and can be solved independently via machines connected to the network. But unlike SETI@home project, the participating machines perform these calculations without knowing about them (Barabási, Freeh, Jeong, & Brockman, 2001). Parasitic computing can be a very effective technique when it comes to solve NPComplete problems such as Circuit SAT, 3 SAT, etc. These problems are currently considered as some of world's most complex and time consuming problems. These problems generally have a set of solutions which itself is a subset of a set of possible solutions (Garey & Johnson, 1979).

This behavior can be described as the following:

$$\text{Solution } X \subset \{s_1, s_3, s_2, \dots, s_n\}, n > 0$$



SOURCES: Nature, University of Notre Dame

Hassan Hodges/AP

Although any possible solution to such problems can be verified quickly, there is no known efficient way to identify a solution in the first place. In fact, the most notable characteristic for such problem is that there is no fast solution. The time required to solve such problem is exponentially proportional to the size of the problem. So, as the size of the problem grows, the time required to find all solutions of the problem grows exponentially (Garey & solve a moderately large NP Complete problem can easily reach billions if not trillions of years using any kind of modern computing technology we have available today. For this reason, even just determining whether there is a fast solution to such problems or not is one of the principal unsolved problems of computer science. Figure 2 describes how parasitic computing works. As described in figure 3.1, the parasitic computer starts the process by transmitting specially generated messages to number of targeted web servers consisting of arithmetic and logic unit (ALU) and a network interface (NIF). The packet

carrying one of possible solutions to the problem is inserted into the IP level bypassing the parasitic node's TCP. This can be seen in figure 3.2. The parasitic computer generates a message in such a way that if the solution is not valid, it will fail the TCP checksum on the destination machine and the packet will be dropped. But in the case when the solution is correct, it will be propagated to the HTTP layer via TCP. Since it is a behavior of a web server to respond to any requests coming to an HTTP layer regardless of whether it understands the request or not, the web server will send a response back to the parasitic computer that it has received an HTTP request (Barabási, Freeh, Jeong, & Brockman, 2001). Thus the parasitic computer sends out a message for each possible solution as described in figure 3.1 with black arrow, it only receives responses back from the server when the possible solution is a one of the actual solutions of the problem. This is displayed with a red arrow in the figure 3.1.

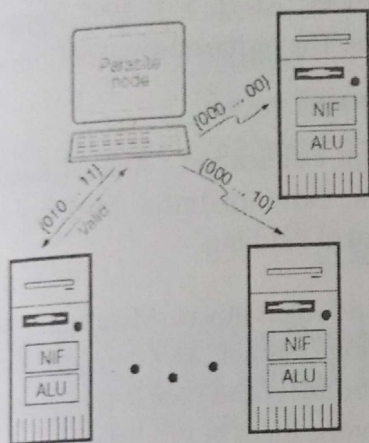
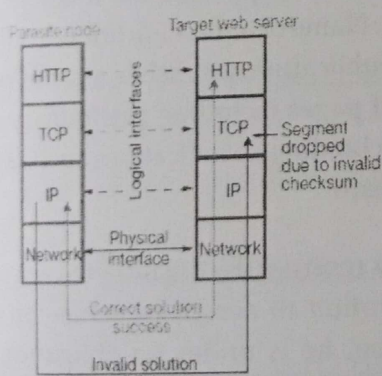


Figure 3.1



In biology, parasitism is a type of symbiotic relationship between organisms of different species where one organism, the parasite, benefits at the expense of the host (BBC). The concept of a parasitic computing is similar to the biological definition. According to the inventors of the parasitic computing:

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Parasitic computing is programming technique where a program in normal authorized interactions with another program manages to get the other program to perform computations of a complex nature. It is, in a sense, a security exploit in that the program implementing the parasitic computing has no authority to consume resources made available to the other program (Barabási, Freeh, Jeong, & Brockman, 2001).

Although as elegant and effective it proves to be, there are some major problems with this approach for computing. Since most of the computers connected to the network will be using TCP/IP, the resources available to the parasitic computer are virtually unlimited and almost all of the computer can be exploited. Furthermore, there is a very high possibility that servers can allocate their valuable CPU cycles to do the processing commanded by the parasitic node thus degrading overall performance of the applications running on the server and access efforts of the normal application user similar to that in the Denial of Service attack (DoS) (Ganti & Xiao, 2008).

Conclusion:

In order for this technique to be widely accepted, potential users need to answer some important ethical questions. Just like a famous proverb: speed thrills but kills, the speed at which this technique is capable of solving NP Complete problems is thrilling! But what about the possibility of a DoS (unintentional or intentional) attack as discussed above? Another ethical question raised by Vincent Freeh is, "when you're on the road, do you use a McDonald's restroom without buying a hamburger?" There are many related questions like what if terrorists gain their expertise on this technique? But the final question is: just like we patch security holes in our applications, is this possibly a time to rethink a better and more secured protocol for communication over the internet? Shouldn't the security of underlying internet protocols used by billions of users worldwide have equal priority for its updates and patches if not higher than any of normal applications?

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CONTENTS

TDMA For VoIP Applications over Wireless Lan Dr. Ela Kumar, Anuj Kumar	
Wind Turbines Design A Feasibility Study and Scope of Improvements Er. Hari Pal Dhariwal, Er. Dharampal Yadav, Er. Vivek Sharma	1
HTS Motors Milestone for Indian Industries Ashish Siwach, Sunil Kumar	6
Comparative Study of Web Personalization Techniques Dr. Ravinder Rathee, Devender Kumar	11
Employee Engagement - Need of Hour Rohit Bansal, Sandeep Tayal	14
Evaluation of Web Personalization Techniques Dr. Ravinder Rathee, Pardeep	18
Proper Utilization And Sizing Of Solar Energy : An Approach to Manage the Demand Of Electricity Dr. Barun Kumar Roy, Mrs. Monalisa Roy & Mr. Amit Kumar	24
Teacher Empowerment: Needs And Initiatives Dr. Sanjay Kumar, Sangeeta Rani	29
Wind Energy A Safe, Non-Polluting & Renewable Power Resource Er. Dharampal Yadav, Er. Hari Pal Dhariwal	35
Green Chemistry In Service Of Mankind Sharwan K Dewan, Vinay Batra	39
Nanotechnology and Its Applications Sharwan K Dewan, Vinay Batra	58
Experimentally Modified Protocols with Transmission Count Metric For Efficient Throughput In Ad-Hoc Networks Arun Kumar Singh, Jitender Kumar Khurana	62
Diligence-Specific Protocol Design In Wireless N/W Jitender Kumar Khurana, Arun Kumar Singh	64
Fuzzy Logic: Instrument For Intellectual Knowledge Management Er. Savita Bishnoi, Er. Seema Sharma, Kuldeep Singh Kanswan, Sankalp	70
WIRELESS SENSOR NETWORK FOR BORDER SURVEILLANCE MANOJ DUHAN, R S DUHAN, PRATEEK NARULA	77
Impact of Emerging Mobile Technologies on Management Practices Er P.Kothari, Er Ravinder Chanana , Dr H.M.Rai and Prof. Jitender khurana	84
Role of Motivator in Human Resources Development Dr. AJAY PAL KAUSHIK, ASSOCIATE PROFESSOR	90
PARASITIC COMPUTING Tarun Ahuja, Navdeep Virk	94
	98

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