FITT FORUM

Newsletter of Foundation for Innovation and Technology Transfer, Indian Institute of Technology, Delhi

Picking up the stride!

In the course of working for the organizational goals there is always that feeling and desire of besting earlier milestones! The year ending March'09 has been particularly gratifying for us at FITT. Whether it is the usual numbers or even the new program initiatives, we have fortunately been better off amidst the slowdown around us. In a way, it reflects growing confidence in the Institute expertise in research and development. That is not to feel complacent in any manner but, to prepare self to brave the real world challenges ahead even while hoping for an economic resurgence. Apart from achieving the highest contracted value of programs at FITT, we have embarked on consolidating some previously adopted technology transfer programs. And, that includes efforts to nurture and promote knowledge / technology based innovative ventures through financial / mentorship support under the laudable schemes of Dept. of Information Technology and Ministry of Micro, Small and Medium Enterprises. We have also been selected by TIFAC as the agency to facilitate commercialization of innovative technologies / products and processes under their TREMAP program. These programs alongside our active techno-entrepreneur (TePP) and technology business incubation (TBIU) programs enrich and enliven the innovation and entrepreneurship ecosystem at IIT Delhi where such activity has found a passing mention in a Wall Street Journal article. This is both pleasing and a reminder about the need to continuously improve and grow.

The period saw graduation of OnYoMo an – internet based local-search start-up at TBIU. Notably, information and communication technology has been a major area of strength at IIT Delhi and we capture some of that flavour in the few articles of the present issue. For the scientists it would be interesting to seek new technology frontiers what with newer dimensions be it in Augmented Realty, Cloud Computing, Wireless Communication etc acquiring the buzz. The research here would continue to bring out exciting innovations and we shall continuously strive to strengthen the interface with business.

Anil Wali

National Technology Day

IIT Delhi celebrated the "National Technology Day" on May 11th, 2009 in the Senate Hall of the Institute. A panel discussion on the topic "Meeting Environmental Challenges: The Role of Technology" was organized. The Panelists were Dr. Ajay Mathur, Director General, Bureau of Energy Efficiency, Govt. of India, Ms. Anumita Roy Chowdhury, Director, Research and Advocacy, Centre for Science and Environment, New Delhi & Dr. Jaswinder Kaur, Managing Director-India, Cleantech Group LLC. The moderator of this Panel

Discussion was Dr. A. Sagar, Deptt of Humanities & Social Science, IIT Delhi. Prof. S. Prasad, Director, IIT Delhi chaired the meet and Dr. Anil Wali, MD, FITT, proposed the vote of thanks. It was an Interactive session, with lots of questions were raised during the discussion. This function was organized under the aegis of FITT and was attended by over seventy academics.

We extend following supports under approved Govt. Schemes:

Innovation Support- under TePP (DSIR) To enable innovators to become technology entrepreneurs through financial support/mentoring- upto Rs 15/ 45 lakh (www.dsir.org)

Entrepreneurial & Managerial Development (MSME)- To nurture/ promote/ technology/knowledge- based innovative ventures through financial/ incubation support (www.msme.gov.in)

Commercialization Support under TREMAP (TIFAC) to facilitate commercialization of innovative technologies/products/processes through refinement, patenting, packaging and marketing (www.tifac.org.in)

Contents

The Anti-social Aspect of Social Networks

Social networking sites are becoming more popular day by day. Millions of people use services such as Orkut, Facebook, LinkedIn, Twitter and Myspace every day. Some of them are used for professional contacts, e.g. LinkedIn, while others are primarily used for entertainment. But common to all these sites is that they form a powerful and wide ranging platform for the dissemination of information. The success of Myspace in kickstarting music careers is well documented (see e.g. [4]). An important political dimension of these services was demonstrated during the protests in Moldova [6] and the recent anti-government protests in Iran [5].

While the rapid spread of information through these platforms has irrefutable advantages, there is also reason to be cautious. Social networking sites have certain intrinsic properties that make them ideal for malicious exploitation. They have huge and distributed user-bases, clusters of users sharing the same interests, developing trust in each other, and seeking access to the same resources, and platform openness for deploying malicious applications. During times of crisis, natural or manmade, the use of social networking to spread information can have the harmful effect of allowing rumours to proliferate even faster and wider than they do now. Another disadvantage is that spammers and hackers can utilise these networks to spread harmful content. In an era where email spam is easily detected by most users (would you send your bank account number to the widow of an assasinated African general?), mainly because it comes from people we do not know, it is possible for malicious users to leverage the trust we repose in our "friends" or "connections" on social networking sites in order to spread harmful content. In fact, as of now, all popular social networking sites have experienced some level of malicious use (see e.g. [7]).

The structure and evaluation of social networks has been extensively studied, but little work has been done to investigate the "antisocial" aspects of social network. In [1], present how a social network can be turn into a botnet that can be used to carry out a number of attacks. Jagatic et al. [2] study how phishing attacks can be made more powerful by extracting information from social network.

In view of this it is crucial to evaluate these social networks for resilience towards malicious use. Our research focuses on this understudied aspect of this widely used services. We aim to answer the following questions: (a) Can malicious content starting from a few compromised or malignant sources spread through the network with ease? (b) How can the spread of rumours be contained on a social network? (c) Does the varying trust people place in their different connections help limit rumours or does it help them to spread faster? These questions are descriptive in nature in that they aim to characterize the amenability of social networks to the spread of malicious information. But from the answers to these questions, we aim

to reach forward and devise simple, effective strategies for making social networking more rumour and spam proof.

The Simulation Framework

In order to study the robustness of social networks to the spread of malicious content we proceed by simulating the diffusion of such content through these networks. We begin by choosing the appropriate network model and then describing the diffusion models that we study. Finally we comment on some of our initial findings from this study.

Social networks have been widely studied and characterized mathematically. The consensus on the structure of social networks is that the connections they display are of two kinds, deterministic local connections and randomly selected non-local. To explain this in simple terms, if we consider people as nodes in the social network and acquaintance as a model for connection, then most people will be acquainted with all their neighbours (deterministic local connections) as well as some people from the large set of people all over the city who cannot be called their neighbours (random non-local connections). Such models are known as *small-world graphs.* One of the earliest proposals for small-world graphs was given by Watts and Strogatz [3]. The model consists of two parts corresponding to the two notions of acquaintance explained about. The first type of component is a clique or a cliquish sub-network, wherein there exists a relation between each pair of nodes. The second type of components are bridges, which connect two such sub-networks. Each node starts with k symmetric relationships for some fixed value k. The balance between deterministic local connections and random non-local connections is parametrized by a number ß lying between 0 and 1, which represents the probability of rewriting a link between two nodes in a cliquish sub-network to a randomly selected node from the entire network i.e. a node can break a relationship and reform it with another randomly selected node. This value, ß, can be thought to be the average ratio of non-local links to local links. Only one of the nodes (the one with the smaller id value) is allowed to rewrite the link. Note that at the end of this process the network formed has nodes with verying number of relationships.

We proceed by choosing an initial set of nodes we refer to as *compromised.* Each compromised node has a status field set to 1, while uncompromised nodes have status 0. We then start a diffusion process by which an uncompromised node can become compromised depending on its immediate neighbourhood. We assume that a node once compromised will remain compromised. We study two kinds of diffusion models. The first we call the *Majority model.* In this model an uncompromised node becomes compromised at time t if its compromised connections outnumber its uncompromised connections at time t-1. In the second model, which we call the *Degree trust model*, each node has a *trust* value associated with it. We set this trust value to be equal to the number of

connections the node has, also known as the degree of the node. In this model an uncompromised node becomes compromised at time t if the sum of trust values of compromised nodes is more than the sum of trust values of uncompromised nodes at time t-1.

We took small-world graphs consisting of 1000 nodes and 10 edges per node on average, with four different values of ß, ß=1.0, ß=0.75, ß=0.50, ß=0. The initially compromised nodes were chosen in two different ways, randomly and according to the maximum degree, and we try to analyze how these different ways of taking the initial compromise agents affect the diffusion process. The results for the majority model are shown in Figure-1 for graphs with different ß values, where the initially compromised hosts are chosen randomly. In this experiment, for each set of initial compromise host, each agent allows to
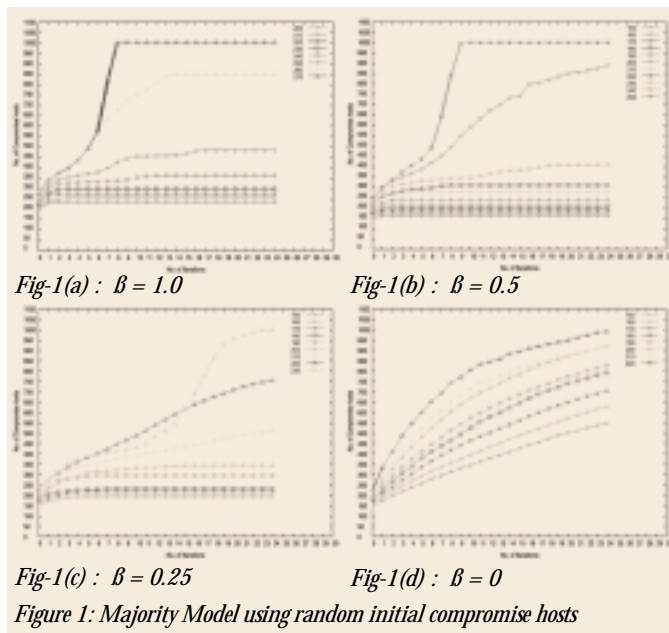

Fig-1(a) : ß = 1.0   *Fig-1(b) : ß = 0.5*

Fig-1(c) : ß = 0.25   *Fig-1(d) : ß = 0*

Figure 1: Majority Model using random initial compromise hosts

update his status for 25 times, the average outcomes for 20 iterations of the algorithm are shown in the plots.

As we can see, the rate of diffusion in the graph having more cliques Figure-1(d) is more than the graph having large number of random links as shown in Figure-1(a), Figure-1(b), Figure-1(c). We also note that for non-zero values of ß, the system has a sharp behaviour i.e. above a certain number of initial compromised hosts the malicious content spreads through the entire system, below that number the spread is contained to a portion of the network. We plotted the value at which the behaviour changes for graphs on different numbers of nodes. We note that the minimum number of initial compromised hosts required for the malicious content to spread through the network follows a linear law.

This observation is quite significant since it implies that the number of compromised nodes need to spread malicious content through the network scales linearly with the size of the network. Seen another way, it leads us to conclude that social networks

are quite robust because capturing a small fraction of the nodes is insufficient to spread malicious content network-wide.

In the second case, the initial number of compromised nodes were chosen according to maximum degree. The results are shown in Figure 3.
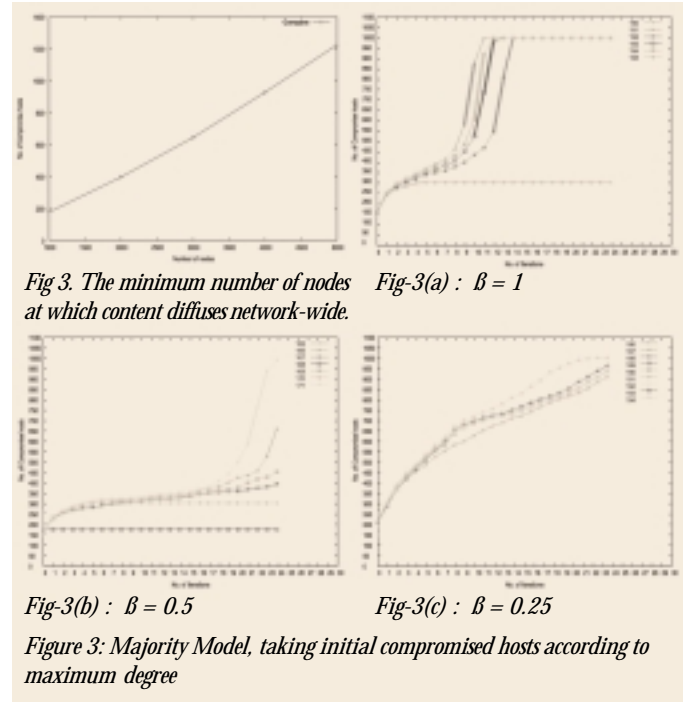

Fig 3. The minimum number of nodes   *Fig-3(a) : ß = 1*
at which content diffuses network-wide.

Fig-3(b) : ß = 0.5   *Fig-3(c) : ß = 0.25*

Figure 3: Majority Model, taking initial compromised hosts according to maximum degree

In Figure-3(a), we can see that rate of diffusion is greater than that of Figure 3(b) and Figure 3(c). This is because, when ß = 1, the graph become a random graph, hence there may exist node with much higher degree than the other nodes, while as the values of ß increases the degree of the nodes become more uniform. The graph having ß=0 is considered, because if ß=0 then all the nodes have the same degree.

Fig-4(a) : ß = 1   *Fig-4(b) : ß = 0.5*
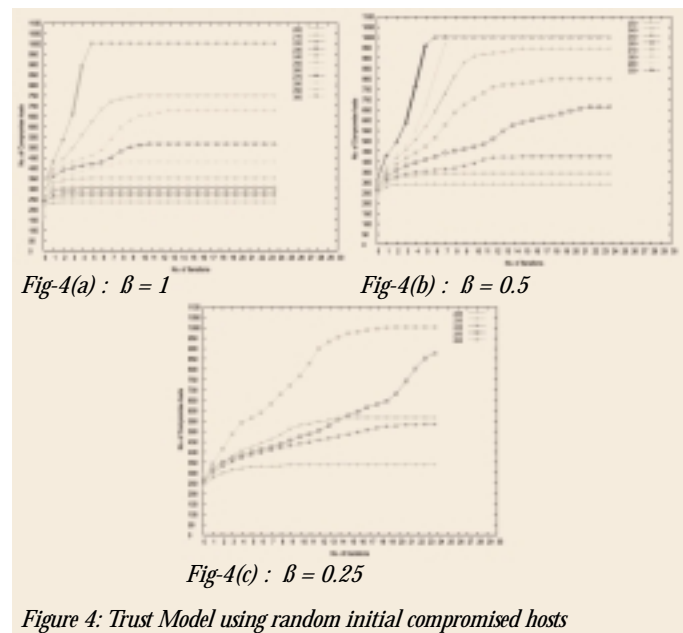
Fig-4(c) : ß = 0.25

Figure 4: Trust Model using random initial compromised hosts

In the degree trust model, the same ways of choosing the initial compromise hosts are considered i.e, randomly or according to the maximum degree. The graph for ß=0 is considered here, because when ß=0 the degree of all vertices are same, which gives us a network in which all nodes are trusted equally. The results can be seen in Figure 4.

Comparing Figure 4(b) to Figure 1(b) we see that our notion of trust, crude as it is, makes the network more robust to malicious content diffusion in the sense that it requires a larger number of initially compromised nodes for the malicious content to spread through the network.

When we chose the initially compromised hosts according to the maximum degree, we observed that the diffusion rate is higher in the graph containing more cliques than the graph containing more number random links. We omit those plots here.

In this article we have tried to give a small flavour of the nature of the work we are doing in the domain of social networks. This work is currently moving in several directions. Firstly we want to model our diffusion in a more realistic way by (a) incorporating better and more dynamic notions of trust, (b) allowing nodes which have become compromised to become uncompromised again and (c) launching geographically coordinated attacks i.e. create cartels of initially compromised nodes which are proximate to each other in the network. The second direction is to bring rigour to the work by analyzing the underlying models mathematically. The third direction is to study ways of stopping or retarding or limiting the spread of malicious content proactively and reactively.

This is joint work with Dr Sameep Mehta, Research Staff Member, IBM India Research Lab. Rudra Mohan Tripathy is a Research Scholar in the Dept of Computer Science and Engg.

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Optimization – The Unending Quest ?

Optimization is ubiquitous – there is hardly an avenue of human effort where it does not arise in some form or other. In its simplest form, the goal is to find a reasonably good solution that meets a set of constraints. In most situations, multiple solutions are possible, and the goal is to find the best one. Global Optimization involves finding the optimal or best possible configuration from a large space of possible configurations. It is among the most fundamental of computational tasks, and has numerous applications in science, engineering and industry, ranging from gene sequencing and VLSI design automation to airline scheduling and package design. In spite of its elemental character, it has remained a perennial topic for research. Advances in computing power have only brought harder and larger scale problems to within our sphere of awareness and interest. If the search space in a global optimization task is so small that every state can be evaluated, then obtaining the global optimal is trivial; otherwise some special structure of the problem needs to be exploited. Classical methods of mathematical optimization that are based on calculus, and its modern generalizations for non-smooth functions, unfortunately lead to global optima only in very special cases.

Difficulties arise when the function to be optimized neither has any such special structure nor possesses properties like continuity and differentiability, or has numerous local optima that obstruct the search for global optimum. In fact, most engineering instances pose all of the above difficulties and for some of them the objective function and often the constraints as well, cannot even be expressed as closed-form analytical expressions. Functions with a large number of shallow local minima arise in many applications, including data mining, location problems, bio-informatics, and computational chemistry. For instance, the protein folding problem can be reduced to the global minimization of a potential energy function, and in the simplest case depends on about 24 variables and involves searching for the best among approximately 10^{11} local minima.

For general global optimization problems, the broad class of general-purpose algorithms is the class of local search algorithms. Global optimizers typically depend on local search algorithms that search multiple states in the neighbourhood of a given state or configuration. Such methods find a local optimum, which depends on the starting state. A local search method generally does not yield the global optimum. The local search algorithm is usually coupled to a hill-climbing strategy, which allows the algorithm to escape from local optima. Simulated annealing (SA), first introduced by

Kirkpatrick et al. in 1983, is based on the analogy of the slow cooling of a metal. In SA, the escape mechanism is associated with a temperature parameter that is gradually reduced according to a cooling schedule.

Local search strategies suffer from entrapment in local optima, but can be very fast. The time required to run an iteration of simulated annealing is sufficient for many iterations of, say, gradient descent. Therefore, instead of escaping from the local optima, another approach is the use of multi-restart local search approaches. These begin exploration from a new initial state once an earlier local search step has terminated in a local optimum. Multistart approaches have produced excellent solutions in practical computer vision tasks, as Beveridge and others showed many years ago in 1996. They have also outperformed simulated annealing on the Travelling Salesperson Problem, and beaten Genetic Algorithms on several large-scale test beds.

Nature has typically been a source of inspiration for Global Optimization techniques. As mentioned, simulated annealing was motivated by the transition of disordered systems of atoms when in a molten state, to an ordered, low energy lattice. Genetic Algorithms, which owe their origin to Goldberg, are motivated by the biological evolutionary operations of selection, mutation and crossover. In evolution, the fittest individuals tend to survive, reproduce and hopefully improve over generations. Based on this logic, chromosomes that yield better optima are considered to be fitter individuals, and are used for creating the next generation of chromosomes, that are expected to lead us to even better optima. The population of chromosomes is updated till convergence or specified number of updates is achieved.

Particle Swarm Optimization (PSO) is inspired by the flocking behaviour of birds, and was developed by Kennedy and Eberhart in 1995. In PSO, a specified number of particles start search in different regions of the search space, and every particle is made aware of the current global best solution, and the best solution found by its neighbours. Each particle then updates its path and velocity according to these two optima. The algorithm converges when a particle finds a highly desirable path to proceed on and the other particles effectively follow its lead.

Ant Colony Optimization, proposed by Dorigo and others, mimics the behaviour of a group of ants following the shortest path to the food source. Ants (agents) exchange information indirectly, called stigmergy, by leaving a trail of pheromone. Analogously this refers to information left on the path itself that can be picked up and used by other agents for searching better. Distributed search strategies such as PSO and ACO are appealing for another reason: in many applications today, the application may require a distributed implementation. Communication between search agents may be prohibitively expensive, or just not feasible.

While the motivating source in nature may be quite fascinating, it is often not obvious if the algorithms will be efficient, or will indeed converge to the optimal solution, given enough time. Our work in this area (with Prof. Suresh Chandra, Dr. Ravi Kothari, and research scholar Sameena Shah), has focussed on finding efficient ways for large scale optimization, and examining performance guarantees. A surprising result is that Ant Colony Optimization can be fooled by sufficient initial bias or pheromone on the paths. In fact, a theoretical result, one of the first in the literature on ACO, is that if there is a specified minimum amount of initial pheromone on a longer path, a shorter path, even if discovered, will not be chosen.

This does not of course mean that ants cannot find shortest paths – merely, that some algorithms for global optimization need not converge to the global optimum. It also paves the way for improvements that can provide suitable guarantees.

As mentioned before, the performance of any local search procedure depends on the starting state, and multi-restart algorithms usually start from a random state. The knowledge of space that has been explored so far is not incorporated in guiding further search. A question that comes to mind is whether, based on some knowledge collected about the function, is it possible to generate a start state that is better than a random one, and to find successively better starting states. Some of the other work in our group focusses on the use of machine learning techniques in conjunction with local search approaches to learn how to optimize. One optimization tool developed during the course of our efforts is termed GOSAM, and is 3-4 orders faster than methods such as annealing, PSO, and Genetic Algorithms, on large benchmarks. One advantage of using machine learning approaches is that they can help us understand the structure of interesting optimization problems. GOSAM can be used in conjunction with a black box simulator, or an experiment, i.e. in scenarios where the function to be optimized is not known explicitly. As an example, a GOSAM based tool that links to a commercial circuit simulator can size components of a circuit. GOSAM is also available for use over a web link; this helps protect proprietary information, and offers optimization as a service.

The quest for faster and more reliable optimization tools will probably never end. The need for large scale optimization will grow, and the scale of application will probably double every couple of years as well. It is expected that systems sciences and nanotechnology will increasingly require advances in such tools. What would be an optimal arrangement of chosen molecules that would lock to a specified protein ? Potential uses of such tools in predicting protein structure, synthetic drug design, and nanoscale system design are obvious – but the need for an optimizer that can deliver will be increasingly felt. The answers may require engineers from multiple discplines to work together, while seeking inspiration in the very world around us that presents these problems in the first place.

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3D Geometry Processing: From Acquisition to Shape Analysis

We are all familiar with cameras and photographs, which have become ubiquitous in today's digital world. This has revolutionized how we remember, share, and transmit our impression of the surrounding world. However, the captured images being 2D projections of the real world allow us to only capture part of the world around. Recent advances in 3D technology have enabled easy acquisition of real objects, faithfully capturing intricate details and subtle variations, without incurring any loss or distortion due to projection. Figure 1 shows a 3D scan of a real world building. Acquiring such data allows us to digitally plan, measure, simulate, and design models before realizing such designs in practice. Such a workflow results in significant cost saving by preventing costly experiments with real replica. 3D geometry processing finds regular application in state-of-the-art design flow in a range of application like surgical planning, city layout, digital heritage, analysis of natural growth laws, car manufacturing, architectural design, to name a few.

Our research focuses on various aspects of 3D geometry processing, from acquisition to shape analysis. In the acquisition phase, we have developed various algorithms to make shape acquisition easier for the novice users. Captured sections of models, or scans as they are popularly called, are aligned, both globally and locally, to generate one consistent model. This phase is similar in spirit to generating a panoma image by stitching together many photographs in the 2D image processing domain. Subsequently, we have proposed algorithms that exploit redundancy in data for model cleaning, filling in regions of missing or low quality data, and also for efficient data storage. Theoretically, this relates to shape analysis, or finding repetitions or symmetries in object. Such high level operations are trivial for humans, but can be notoriously hard for a computer working simply on the geometric data.

Architectural and engineering designs, as well as many natural objects, commonly exhibit significant symmetries or contain repetitive patterns. These types of structural regularity are not accidental, but often the result of economical, manufacturing, functional, or aesthetic considerations. Whether by evolution or design, symmetry implies certain economies and efficiencies of structure that make it universally appealing. Symmetry also
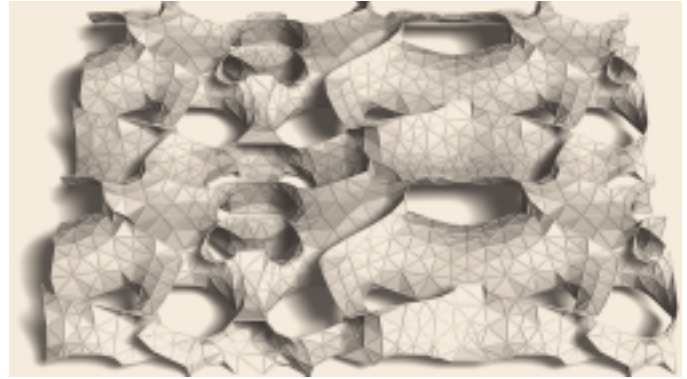
Figure 2: Symmetrization illustrated on an architectural design study. Our algorithm minimally deforms the six-fold approximate symmetries of the original model, resulting in a model perfect both in terms of geometry and meshing. This simplifies the manufacting process, enabling reuse of parts, and thus allows significant cost savig without compromising the design intent of the architect.

plays an important role in human visual perception and aesthetics. Arguably much of the understanding of the world around us is based on the perception and recognition of shared or repeated structures, and so is our sense of beauty. Symmetry is also fundamental in the laws of physics; hence optimality conditions in terms of statics often lead to symmetric configurations. In addition, structural regularity in architectural models allows pre-fabrication and mass-production of repetitive elements and can thus lead to significantly reduced production costs.

Over the past years, we have developed various algorithms to efficiently detect partial and approcimate symmetries in 3D objects, process the data to enhance their approximate symmetries, as well as help detect regularity or structures in objects. Such shape analysis tools allow us to easily perform a range of operations like smart geometric edits, data completion, model synthesis, reverse procedural modeling.

The area of 3D geometry processing is an exciting and challenging area to work in, specially given the rapid adaption of such tools in many design and manufacturing work flows. The area encourages close collaboration between academic and industry partners, opening possibilities for conceiving, planning, designing, and manufacturing ambitous engineering projects, both efficiently and effectively.

Further details about our work can be found at http://www.cse.iitd.ernet.in/~niloy. Any questions or queries can be directly send to niloy@cse.iitd.ernet.in.

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Figure 1: Given two building facades in arbitrary starting poses, we have designed algorithms that successfully align the scans. This is a challenging case for automatic registration since the scans comprise of noisy data with large flat featureless regions. This example has very few distinct features that can be reliably detected using any local descriptors.

The Internet Industry is On a Cloud

Ever since Google Inc. Chief Executive Eric Schmidt publicly uttered the term "cloud computing" in 2006, a storm has been gathering over Silicon Valley. Companies across the technology industry are jockeying to associate themselves with the clouds. Amazon.com Inc., better known for peddling books online, began selling an Elastic Compute Cloud service in 2006 for programmers to rent Amazon's giant computers. Juniper Networks Inc., which makes gear for transmitting data, dubbed, dubbed its latest project Stratus. Yahoo Inc., Intel Corp. and a handful of others recently launched a research program called OpenCirrus. While almost everybody in the tech industry seems to have a cloud-themed project, few agree on the term's definition. In its broadest sense, cloud computing describes something apparent to anybody who uses the Internet: Information is stored and processed on computers somewhere else-"in the clouds"- and brought back to your screen.

(Source: Mint, March 27, 2009)

SMEs not Making Optimum Use of Technology: Study

Indian small and medium sized business (SMBs) units are aware of the need to invest in technology for essential processes like product life cycles, data security, improving transparency, and adopting scalable and flexible solutions, but are held back by budget constraints, according to the findings of a recent study carried out by Symantec Corporation, called the Symantec 2009 SMB Security & Storage survey. The study reveals that some 3 million SMBs in India are investing in technology; 84 per cent of Indian SMBs are aware of the need to protect information;81 per cent are aware of the need to protect servers; and 61 per cent were unaware of the different types of present-day IT security threats. The data shows that awareness is not an issue; but the awareness has not translated into users deploying solutions that effectively protect their corporate data.

(Source: Business Standard,16-06-2009)

Building Up Manufacturing

Manufacturing in India has truly come of age in recent times. It appeared as if it might contribute 5-6% more to the gross domestic product (GDP), until the economic crisis. A recent survey of 700 manufacturing firms across the country for the National Manufacturing Competitiveness Council shows that the leaders of this revolution were mid-size firms that had the right mix of product variety and volume to serve domestic and global markets. The large majority of firms in the country, however, are small, and these firms need to play a new cutting edge, long-term role in the economy.

(Source: MINT, 20-04-2009)

Who Says We Have not Innovated

Some writers and "studies" seek to create the impression that India scores poorly on innovation. The term "innovation" is erroneously used in this country to mean only technological innovation, when there are many forms of innovation-organisational, managerial, financial, and others. There are cases like the Nano of Tata Motors and the Xylo of Mahindras, both examples of superb multi-dimensional innovation and preceded by a string of earlier innovations-Indica, Indigo, 407 LCV, ACE and HCVs of Tata Motors, including turbo-charged ones for the army, and the Scorpio of Mahindras and the tractors of Punjab Tractors (now bought by Mahindras). There are numerous other examples in pharmaceuticals, agro-chemicals, and fine and heavy chemicals. In electronics too, there are several examples: the 45 million lines of digital electronic exchanges based on C-Dot technologies worth more than Rs.40,000 crore, the computerised Railway Passenger System (RPRS0 and the monstrous Railway Computerised Freight Operations Information Systems (RFOIS), done jointly by the railways and the CMC.

(Source: Business Standard, 18-03-2009)

Distinguished Faculty of IIT Delhi

Prof. Sneh Anand is currently completing her second term as the Head of the Centre for Biomedical Engineering, which is a joint venture of Indian Institute of Technology Delhi and All India Institute of Medical Sciences, Delhi. Having drawn inspiration from Prof. V.B. Anand, her father whose brief stint at IISc, Bangalore was appreciated by Honorable Nobel laureate Prof. C.V. Raman. Professionally she was mentored by renowned Biomedical engineer Prof. S. K. Guha, her dissertation supervisor and a colleague at IIT Delhi. She has been deeply involved in applied research for the benefit of masses and has put in more than thirty years of service at IIT Delhi. Prof. Sneh Anand did her graduation in Electrical Engineering from Punjabi University, Patiala (1970), followed by post-graduation (1972) in the field of Controls and Instrumentation and Ph.D in Biomedical Engineering (1976) from IIT Delhi. She is a Fellow of INAE, IETE and IMPA. She is currently Vice President, Indian Society of Biomechanics and also a Life member of Biomedical Engineering Society of India. In addition, she is a member of several technical and scientific advisory groups. Besides handling teaching assignments for BTech / MTech students, she has successfully supervised twenty (20) PhDs while another fifteen (15) are in progress. Over sixty (60) Bachelor's and Master's students have undertaken their final year projects with her including three (3) from abroad [France (2) and Netherlands (1)].

In the capacity of Principal Investigator, she has executed fifteen (15) Technology Development Projects funded by various government agencies like Department of Science and Technology, Department of Biotechnology, Department of Information Technology, Indian Council of Medical Research, Ministry of Human Resource Development, Life Sciences Research Board, Ministry of Social Welfare and Empowerment, Ministry of Health and Family Welfare and has acted as Co-Investigators in several other projects. She has four (4) patents to her credit [Micrometer for the blind (163392), Weighing machines for infants and adults (162089), Emergency care vehicle (160573) and Stretcher design (160528)] and four (4) more patent applications are in the pipeline. She is also involved with members of international projects from Massachusetts Institute of Technology, Stanford University and John Hopkins University, USA.

As a Biomedical engineer, Prof. Sneh Anand has made pioneering contributions in the fields of mass healthcare, rehabilitation, diagnostics and therapeutics. It is pertinent to mention that throughout her career, her endeavor has been to offer innovative solutions for India-centric real life health problems. Her contribution to indigenous product development that is widely available and affordable is well established.

In India where integration of handicapped people into the mainstream has always been a big challenge, her contribution in the field of rehabilitation engineering deserves a special mention which has led to a paradigm shift in the quality of life of the handicapped people (mentally / visually and physically challenged). The "Universal Communication System for Blind" developed by her enables the visually challenged to utilize a computer to read text as well as diagrams from the computer screen, in the process opening up various opportunities to them. Prof. Sneh Anand was involved in the development of an indigenous Braille duplication machine. Not only was this technology transferred to the industry, the Bureau of Indian Standards formulated the standards based on the specifications of this machine [BIS No.IS13837:1993]. Also, her contribution in the development of low cost attachments enabling the visually challenged to use the industrial machines in a conventional manner has increased the chances of their employability. This has been adapted by the National Association for the Blind in their workshops across the country. One blind mechanic has completed his 25 years of service in a workshop of the Centre at IIT Delhi. Communication devices like imagery based Brain-Computer Interface for the paraplegics, autistic, spastics and spinal injury patients using their residual functional abilities, have been well accepted as assistive devices in the community. Presently these activities are extended to develop adaptive intelligent prosthetic devices, understand mechanics of spine in school children with bags, develop a thought controlled wheel chair, determine neural correlates and cognition in blindness; maternal stress and understand benefits of yoga using state of art signal processing and electromechanical tools.

In the field of diagnostics, development of an optical sensor for estimation of Glycated Hb by exploiting its property of auto-fluorescence, a sol-gel based Myoglobin sensor for early detection of Acute Myocardial Infarction(AMI), technique for non-invasive measurement of Depth-of-Anaesthesia(DOA) index from electro-encephalogram(EEG) and technique for non-invasive diagnosis of knee osteoarthritis using electrical impedance plethysmographs(EIP) / electro-myograms (EMG) are some of the novel ideas conceptualized and clinically evaluated. Transdermal drug delivery using iontophoresis (Patented) is a significant development in the field of therapeutics, expected to make insulin and methotrexate delivery painless for diabetics and cancer patients whose count in India is rising at an alarming rate. Techniques have been developed by her for non-invasive measurement of intra-cranial pressure (ICP) in neonates using a special transducer, and for quantitative assessment of ability of Amytrophic Lateral Sclerosis (ALS) patients to plan a task need a special mention.

The stress being on affordable healthcare, Prof. Anand was instrumental in the development of portable cost effective anorectal and esophageal manometry machines. Anorectal system developed is being marketed in India and being routinely used at AIIMS as well as at other GI Surgery clinics. Clinical acceptance has been extremely encouraging.

The initiatives taken by her at the national level in scientifically validating the traditional medical systems in order to integrate them with the modern medical systems are a major step towards to integrated healthcare. The imperative aim is to empower the present day physicians of modern medicine to make the most of the ancient knowledge. Innovative devices developed include wireless instant ECG monitor combined with cardiac hemodynamic assessment using electronic pulse detection by pressure, IR and impedance sensor; cognitive index marker; detection of respiratory sinus arrhythmia. Within this program, an attempt has been made by her group to correlate bio-electromagnetic signatures of human body with the physiological state of the body and the results have been encouraging.

For these scientific endeavors, Prof. Sneh Anand has received numerous accolades like the "Topmost Invention Republic day Award" (1989) from the National Research & Development Corporation (NRDC), World Intellectual Property Organization

(United Nations) Silver Medal for work leading to blind working on machines in 1989; "Technology Invention Award" for the years 1988, 1989, 1992 and 1993 in the Rehabilitation Engineering by the Ministry of Welfare. ICMR conferred "Kshanika Oration & Citation Award" to her for research in healthcare technology in 1993. IETE conferred upon her the "Toshniwal" and "Gauri Memorial" award in 1997 and 2002 respectively. In the year 2004, IEEE presented her the "Lifetime achievement award in Medical Electronics", "Shiksha Ratan" in 2007.

Prof. Anand's vision as well as passion for research in this interdisciplinary field and the desire to disseminate scientific information makes her easily approachable, not only to students within or outside the Institute but also to people interested in the field of Biomedical engineering, irrespective of how big or small their contribution to the field may be.

All this has been possible because of the whole hearted support of her family, colleagues, students and friends. Disciplined guidance and blessing of her parents have only made her achieve this professional stature.

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Distinguished Faculty of IIT Delhi

Dr. Bhim Singh is Professor at Department of Electrical Engineering, Indian Institute of Technology Delhi, New Delhi, India. He received his B.Tech (Electrical) degree from the University of Roorkee, Roorkee, India, in 1977, M.Tech. (Power Apparatus and Systems) and Ph.D. degrees from the Indian Institute of Technology (IIT) Delhi, India, in 1979 and 1983, respectively. In 1983, he joined the Department of Electrical Engineering, University of Roorkee, as a Lecturer and became a Reader there in 1988. In December 1990, he joined the Department of Electrical Engineering, IIT Delhi, New Delhi, India, as an Assistant Professor, where he has became an Associate Professor in 1994 and a Professor in 1997. He has received the "Khosla Research Prize" of University of Roorkee in 1991. He is recipient of JC Bose and Bimal K Bose awards of The Institution of Electronics and Telecommunication Engineers (IETE) for his contribution in the field of Power Electronics. Prof. Singh also a recipient of Maharashtra State National Award of Indian Society for Technical Education (ISTE) in recognition of his outstanding research work in the area of Power Quality. He has received PES Delhi Chapter Outstanding Engineer Award for the year 2006, and has been the General Chair of the IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES'2006) held in New Delhi.

Prof. Singh has developed and implemented first time new control algorithms based on neural network technique and power balance theory for active power filters (APF) with reduced sensors using indirect current control scheme for power quality improvements in three-phase three-wire and four-wire ac distribution systems. The first time implemented neural network based control scheme for APF has provided effective reactive power compensation, load balancing and neutral current elimination in ac distribution systems. He has designed and developed a number of configurations of shunt, series and hybrid power filters to improve power quality in number of applications in industries and utilities.

Prof. Singh has been one of the first investigator to design and develop a large number of configurations of three-phase multipulse ac-dc converters in nonisolated and isolated, uncontrolled and controlled, full-wave and bridge topologies using phase staggering, multiphase and ripple injection techniques in varying winding connections such as T-connection, zigzag, fork, extended delta, hexagon, polygon with reduced magnetics through use of autotransformers. These ac-dc converters in 12, 18, 20, 22, 24, 28, 30, 36, 40, 44, 48, 56 and 88 pulse configurations have given remarkable power quality

improvements in front end ac-dc converters of variable frequency, ac motor drives in air conditioning, waste water treatment plants etc., electro-chemical processes such as electroplating, telecommunication power supplies, uninterruptible power supplies (UPS), high-power induction heating equipments and converters for renewable energy conversion systems.

The pioneering work of Prof. Singh as one of the first researchers on the design and development of voltage and frequency controllers for self-excited induction generators (SEIGs), using static compensator (STATCOM), saturable core reactors, have provided effective control of terminal voltage of SEIGs feeding static and dynamic loads in isolated and remotely located power generating systems. The design and development of a number of electronic load controllers (ELCs) for self-excited induction generators driven by pico hydro uncontrolled turbines and wind turbines have provided a novel method of voltage and frequency control of SEIGs in isolated hilly regions in India. The developed ELC-SEIG (electronic load controller - self-excited induction generator) system has eliminated the need for governor control of pico-hydro turbines, thus resulting in a reduction in the overall cost of the standalone generating system. At present, these schemes have been working successfully in several sites for few years, electrifying remote consumers who have been denied electricity due to their inaccessible location.

Prof. Singh was one of the first investigators (in the early 1990's) to develop the optimum designs of energy efficient squirrel cage induction motors for irrigation pumps operating under realistic conditions of voltage fluctuations and load variations because of change of water level in rural sector with high efficiency and high power factor resulting in substantial energy savings.

Prof. Singh has been one of the first inventors to design and develop of a solar PV (Photo-Voltaic) array fed low cost sensorless voltage source inverter fed permanent magnet brushless DC (PMBLDC) motor drive for water pumping. A novel design of pumping system without any energy storage system based on most efficient PMBLDC motor without current, position and speed sensor has provided a reduction in size of solar PV panels. This development has resulted in low cost and efficient water pumping systems for isolated rural areas all over the Indian subcontinent.

Prof. Singh has demonstrated a high level of leadership for more than 30 years in research, consulting and innovative teaching. He has more than 600 hundred research publications (284 in Journals and 338 in Conferences), granted one US patent and filed six Indian patents. He has executed more than sixty sponsored and consultancy projects and has supervised 30 doctorate level and 99 master level students, six patents and executed more than sixty sponsored and consultancy projects. Many of his supervised Ph.D. thesis and master dissertations have got various awards such as INAE award, FITT award, ISTE award, VMM award for the high quality research work. Prof.

Singh has organized more than forty short term courses and workshops, delivered more than fifty invited specialized lectures including several memorial lectures, and has chaired many sessions in international and national conferences / seminars and has delivered many special and state-of-art seminars.

His fields of interest include power quality, renewable energy systems, power electronics, electric drives and its digital control, permanent magnet motors, switched reluctance motors, vector control of cage motors, CAD of electrical machines, efficient utilization of electrical energy, optimization, modeling and simulation, generators for small scale power generation, self excited induction generators, brushless alternators and active power filtering and harmonic compensation, electrical machines, FACTS (flexible ac transmission systems), HVDC (High voltage direct current) transmission systems.

Prof. Singh has been very active in the Institute administration as he has been Chairman GATE (Graduate Aptitude Test in Engineering) and Organizing Chairman, JAM (Joint Admission Test for M.Sc.). Prof. Singh has been expert member of RDC (Research Doctoral Committee) of Electrical Engineering of Rajiv Gandhi Technical University (MP) and Uttar Pradesh Technical University (UP).

Prof. Singh has visited several countries such as United Kingdom on exchange program for the research in the field of switched reluctance motors, step motors, permanent magnet motors drives for six months in 1992, Canada for the research work on power quality in 1995-1996 for 9 months, Thailand on a sabbatical leave for 10 months in 2000 for research work on power electronics and drives. He has also visited USA, Australia, Singapore, China and Malaysia for several international conferences.

Prof. Singh has been very active in professional societies such as Institute of Electrical and Electronics Engineers (IEEE). He has been the Chairman of IEEE PES-IAS Delhi Joint Chapter for the last four years. During mustiness this chapter won twice the Outstanding Chapter Award, High Performance Chapter Award every year and one of Best Performing Chapter Award of last decade. He has been the founder Chairman of IEEE PELS-IES Delhi Joint Chapter and its Chairman since 2006. He is a Distinguished Lecturer (DL) of IEEE Power and Energy Society under Distinguished Lecture of Program (DLP) of IEEE since year 2002.

Prof. Singh is a Fellow of the Indian National Academy of Engineering (FNAE), The National Academy of Science, India (FNASc), Institution of Engineers (India) (FIE), and Institution of Electronics and Telecommunication Engineers (FIETE) and a Life Member of the Indian Society for Technical Education (ISTE), System Society of India (SSI), and National Institution of Quality and Reliability (NIQR) and Senior Member of Institute of Electrical and Electronics Engineers (IEEE).

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UK-India Sign Research Agreement on Solar Energy

A workshop on on 'India-UK Cooperation in Solar Energy Research ' was held at IIT Delhi on April, 26, 2009. The main aim of the workshop was to discuss the priorities for a multimillion dollar joint initiative for collaborative research project in solar energy-an agreement for which has been signed. The workshop at IIT-D was hosted by DST and the Engineering and Physical Science Research Council (EPSRC). EPSRC is one of seven research councils that are part of Research Councils UK (RCUK). With an annual budget of over three billion pounds, RCUK is the single largest research funding body in the UK. A co-operation agreement was signed during the workshop.

(Source: Education Times, 27-04- 2009)

IIT's Pilot Projects for Better Food, Better Air

The Department of Biochemical Engineering and biotechnology at IIT Delhi has been working on two inspiring projects. Both projects, led by Professor Vikram Sahai-the chief Scientific Officer of the Department along with Prof. V.S. Bisaria & Prof. Srikrishna of the department of DBEB, IIT Delhi. One of his projects pertains to food security and other to reducing global warming. Over the last two years, Sahai and his associates have been working on multiplying a certain bacteria that is capable of increasing the fertility of crops by reintroducing valuable nutrients into the soil. The food security project was started as an initiative of the Government of Switzerland and Government of India six years ago to develop biofertilizers that will reverse the loss of nutrients in the soil, according to Prof. Sahai.

(Source: The Sunday Express, 07-06-2009)

Finally, a Patent-Teacher Meeting at IIT

The word 'innovation' has acquired a new dimension at IIT-Delhi. Traditionally less inclined to seek protection for its pioneering technology and ideas, the premier institute has finally latched on to the importance of Intellectual Property Rights (IPR). In 2008-09, IIT-Delhi approved 35 of its innovations for patent filing, which is the highest ever for this institute. "This has resulted from a change in mindset. Earlier, our faculty were more keen on having their work published quickly. Getting patent rights for the same was never a priority," said Professor Surendra Prasad, Director, IIT-Delhi. "Now, things are changing around here." Till date, IIT-Delhi has filed 180 patent applications and has 60 under its belt. It's only in the last decade or so that the institute has turned more aggressive so far as seeking protection is concerned. The number of innovative ideas and designs approved for filing of IPR has been steadily increasing since 2004-05, when the figures for innovations approved for filing stood at 24. "On an average, we file about 20 to 25 patents every year. But it's only in the last couple of years that the maximum applications have been filed," said Anil Wali, Managing Director, Foundation for Innovation and Technology Transfer (FITT), which is actively engaged in transfer of IIT-Delhi's technologies for commercialisation and also seeking protection for them.

(Source: Hindustan Times, 07-01-2009)

Awards

Prof. K. Gadgil of the Centre for Energy Studies (C.E.S.), IIT Delhi received the Distinguished Scientist Award (Iraj Zandi Award)" during the 24th International Conference on Solid Waste Technology & Management at Philadelphia, PA, U.S.A. in March 2009.

Dr. Vibha Arora Department of Humanities and Social Sciences received the prestigious M.N. Srinivas Memorial Prize (2008).

Prof. Ranjan K. Mallik of Electrical Engineering Department awarded the IDRC Research Chair in Wireless Comunications.

Prof. Bishnu Pal Physics Department elected as 'Director At Large (2009 OSA Board of Directors) Optical Society of America (OSA)

Prof. J. Nanda Electrical Engineering Deptt. felicitated with Prof. S.N. Mitra memorial award of INAE.

Design Degree Show 2009

Design Degree Show 2009 of M.DES final year students of IIT Delhi, was opened from June 11 to June 20, 2009 at IIT Delhi. There were lot of original design displays created by the final year students of M.DES Design course. A few examples of the models displayed were "Vehicle Design for Elderly"; "Cargo Motor Cycle"; "Design of a Dish-washing appliances"; "Design of a crossover motor bikes"; "Green Gadget"; "Design of Walk through Metal Detector" etc.

People from all walk of life visited this show. There were representatives from Industries, Govt bodies, research organizations etc.

RUB Prospecting Entrepreneurship Programmes

The Royal University of Bhutan (RUB) is prospecting the introduction of entrepreneurship programmes at Sherubtse College and other institutions of higher learning in the country. RUB is currently in discussion with FITT to work together in the future to promote basic entrepreneurship development programmes in the country. The FITT General Manager, Shri K K Roy, is in the country to study the feasibility of a partnership between RUB and FITT, and recommend strategies to develop and promote entrepreneurship development programmes. Roy said: "Besides the interest and passion of the individuals, it is very important for the government to create a conductive environment for the development of entrepreneurs. Support and network is a must". Speaking to BHUTAN TODAY, he said : "Entrepreneurship development in Bhutan is only in bits and pieces. Certain frameworks of restructuring the existing system and steps to implement them have to be taken collectively by the university, industries and the financial institutions in the country for entrepreneurship development, which has to be done from the grassroot level upwards". Speaking about the possibility of a partnership between RUB and the FITT, he said that it is too early to comment at this moment. "Assessments and studies have to be carried out in the field."

(Source: BHUTAN TODAY April 15, 2009)

Centurion Project Delivered

On 31st March, 2009, Mechartes completes a unique century by delivering its 100th project in the domain of CFD for HVAC sector. The centurion project delivered is a car park ventilation CFD study of Al-Sadd Development Complex (Doha). During this century stand, a wide variety of projects were undertaken in the domain which include Comfort Simulation, Tunnel Ventilation CFD, Data Center Simulation, Smoke Simulation, Air Quality Simulation, Thermal Simulation and Car Park Ventilation simulation.

[Source: Mechartes Newsletter (08-09)]

150 Start-ups Dial Bharati Innovation Fund

As many as 150 start-ups have sought seed capital from the Rs.200-crore Bharti Airtel Innovation Fund. The telecom major will shortlist entities with interesting ideas and probably pick up equity stake in these ventures. Bharati Airtel told Business Line that the ideas received by the company include applications for mobile TV, M-commerce, wireless security, m-advertising, healthcare and social networking.

(Source: Business Line June 12, 2009)

Venture Capital Funds Available for Technology Start-ups

Venture Capital (VC) firms, as it happens, are still investing. While the pace of investments has slowed down on an industry-wide basis, firms that have recently raised capital see this as a great opportunity to make some serious long-term bets. The fact is that now is a much less distracting time than 12 months back-lesser noise, lesser competition, and lesser irrationality. This is especially true in areas where the customer demand is unaffected- for technology oriented business, this means more of consumer internet, mobile VAS, education and healthcare business. And perhaps less of software products and offshore services, even though specific industries there continue to do well. Needless to say, the bar for start-ups to raise capital has gone up. Capital is more selective today than it was few months back. Besides a stricter industry selection as mentioned above, the premium on capital efficiency of business has gone up as a selection criterion. The good news is that start-ups that deserve to get capital will still find it-if earlier the success rate was 5 per cent, now it might be 4 per cent; if earlier 95 out of 100 start-ups were not finding capital, now it might be 96-not a whole lot of difference in odds!

(Source: Business Standard 19-03-2009)

Patents Grant for Mere Change Under Scanner

The Mumbai patent office has initiated an inquiry into alleged violations in granting patents for modified forms of existing drugs, even as newly available documents related to these present evidence of negligence. The office has asked patent examiners, assistant controllers and other officials to state their reasons for not raising objections while granting certain patents.

(Source: Mint,30-01-2009)

IITs to Market Patents with Help From Investment Firms

Sitting on a pool of close to 900 patents, the Indian Institute of Technology (IITs) are, for the first time, planning to monetise these intellectual properties (IPs) by exploring tie-ups with firms that invest in "inventions". IIT Bombay, for instance joined hands with Intellectual Ventures to seek support in marketing and licensing patents the institute holds. IIT Delhi too has signed up with the venture fund and others like IIT Kharagpur, IIT Kanpur and IIT Guwahati are considering such offers. Other than the US-based Intelolectual Ventures, Imperial Innovation—an arm of UK's Imperial College—has approached a few IITs for the same purpose. " Most of our faculty does research and there's no inclination towards inventions. With this tie-up there's a clear incentive to invent,"said Devang Khakkar, director, IIT Bombay. IIT Delhi Director Surendra Prasad agrees:"Securing the intellectual property (IP) has never been a major ambition for a faculty-member. Since this tie-up, we have a regular series of patent filing which is picking up now. Besides, arrangements like these would help us protect the IP to an extent." On an average, IIT Delhi files 20-25 patents annually.

(Source: Business Standard 08-06-2009)

Technology Transfer

Three softwares developed at Indian Institute of Delhi have been licensed out to M/s. LeadInvent Technologies Pvt Ltd.-a start-up company incubating at TBIU, IIT Delhi.

The softwares, which have been licensed are: Sanjeevini-A Computer Aided Drug Design (CADD) methodology; Bhageerath-A Computational pathway towards predicting 3D structure of small globular proteins; ChemGenome-A three vector model for analyzing DNA sequences.

These softwares have been licensed on non-exclusive terms.

Dip in Patent Filings Likely

The number of patent filings in the coming years are expected to come down, as companies worldwide are likely to cut down their R&D spending, according to experts. According to experts of intellectual property rights, the number of patent and allied applications could witness a fall in long term globally mainly due to the ongoing global financial slowdown. Apart from patents, the allied field of intellectual property rights includes trademark, design, copyrights and geographical indications.

(Source: Economic Times 09-03-2009)

Intellectual Property Rights: An Overview

The last four years have seen a three fold increase in patent filing. The number of filings increased to 35,000 in 2007-08 from 13000 in 2003-04. The number of patents granted recorded a steep rise from 1911 in 2004-05 to 15,261 in 2007-08. This is a growth of almost 800 percent in in just 3 years. Trade mark registrations have gone up from 11,190 in 2002-03 to 1,01,300 in 2007-08. In fact, the number of trade marks registered during the last three years is more than the total number of trade marks registered in all the previous years.

(Source: Indian Express 26-02-2009)

IP-Based Biz Models to the Fore

It may sound crazy in a place notorious for copycats, but at least ten aspiring entrepreneurs in India see intellectual property (IP) as a viable business model. Out of the 254

finalists in ET's The Power of Ideas programme, 10 chose to submit "intellectual property-based business ideas" for their preferred area of entrepreneurship.

(Source: Economic Times 26-05-2009)

New Innovations/Opportunities for Technology Transfer

Sl. No.	Title of the Invention	PI/Deptt.
01	Shift-cum-Angle multiplexed mono-ocular holographic image-search engine	Dr. Joby Joseph, Physics
02	An apparatus & Method for Controlling Distribution and Dispersion of Nano- particles in Polymers	Prof. A. K. Ghosh, Polymer Science and Engineering Prof. Naresh Bhatnagar, Mechanical Engineering
03	Design of high load sustaining cavitation free journal bearing	Dr. R. K. Pandey, Industrial Tribology Machine Dynamics & Maintenance Engineering
04	Mechanical type automatic flushing system	Prof. S. N. Singh, Applied Mechanics
05	Controller for a Wind Energy Conservation System employing Squirrel Cage Induction Generator feeding local loads	Prof. Bhim Singh, Electrical Engineering
06	Controller for a Wind Energy Conservation System employing Doubly Fed Induction Generator feeding local loads	Prof. Bhim Singh, Electrical Engineering
07	Design of Light weight offset knee joint for above knee amputees	Prof. Naresh Bhatnagar, Mechanical Engineering
08	Design of Multi-functional knee joint of FRP composites for polio and cerebal palsy patients	Prof. Naresh Bhatnagar, Mechanical Engineering
09	A composition for a convenient methodology for the synthesis of nano-rods of Lanthanium Hexaboride (Lab$_6$)	Prof. A.K. Ganguly, Chemistry
10	Error correcting synthesis methodology for low power VLSI	Prof. Jayadeva, Electrical Engineering

Training Programmes

Forthcoming customized training programmes/workshops/conferences

		HRD Programmes		
Sl. No.	Title	Duration	Sponsored/Participation	Faculty/Co-ordinator
1.	Short course on "Advanced Sensing Technology for Civil Engineers"	July 17-19, 2009	Participation fees based	Dr. Suresh Bhalla Civil Engineering
2.	Training Programmes in Bioinformatics and Computational Biology	August 23, 2009 onwards	Participation fees based	Prof. B. Jayaram Chemistry
3.	Indo-Canada Workshop on Electrify Generation using Renewable Energy	October 12-13, 2009	GITA/CII & ISTP (Canada)	Prof. S. S. Murthy Electrical Engineering
4	Workshop on RadTech India 2009	November 1-4, 2009	Participation fees based	Prof. Veena Chaudhury Polymer Science & Engineering
5.	Short course on Soft Computing Technologies	December 7-11, 2009	Participation fees based	Prof. Madan Gopal Electrical Engineering
6.	Multiphase Reactor Engineering for the Process Industry	December 9-11, 2009	Participation fees based	Dr. Shantanu Roy Chemical Engineering
7.	12th International Conference on Rough Sets, Fuzzy Sets, Data Mining and Granular Computing (RSFDGrC 2009)	December 16-18, 2009	Participation fees based	Prof. Santanu Chaudhury Electrical Engineering
8.	3rd International Conference on Pattern Recognition and Machine Intelligence (PReM`09)	December 16-20, 2009	Participation fees based	Prof. Santanu Chaudhury Electrical Engineering
9	Short course on Next-Generation Networks	January 9-10, 2010	Participation fees based	Prof. Subrat Kar Electrical Engineering

Ultra Wideband Communication System

Ultra Wideband or UWB is a technique based on transmitting very-short-duration pulses, often of duration of only nanoseconds or less. This allows it to deliver data rates in excess of 100 Mbit/s wirelessly, while using a small amount of power. UWB technology offers opportunities for short-range wireless multimedia communications and networking. Unlike conventional wireless systems, which use narrowband modulated carrier waves to transmit information, UWB systems transmit over a wide band of radio spectrum, using a series of very narrow and low-power pulses. The combination of broader spectrum, lower power and pulsed data means that Ultra-Wideband causes significantly less interference than conventional narrowband radio solutions while safely coexisting with other wireless technologies in the market. The distinct advantages of UWB communication that make it a strong candidate for future communication systems (both military and civilian) are: exceptional multi-path immunity, potential for substantially less power consumption than conventional systems, inherently secure, highly resistant to interference and exceptionally high spatial capacity. UWB technology can also be used for precise positioning and ranging applications.

Based on the properties of UWB communications, we propose an apparatus and method for accessing computer data and surfing the Internet by a Display Unit. Today, an enormous amount of material is accessed through the computer. This information is either stored in the memory of the computer or accesses through the internet. However, the display monitor of any computer is attached to the CPU, forcing the user either to 'sit at the computer' or carry the whole thing around (as in a Laptop). The invention deals with accessing information from the computer's Central Processing Unit (CPU) using UWB communications, thereby making the process of accessing information from one's computer more convenient and user friendly. The objective is to disassociate the computer's display (i.e., the computer monitor) from the CPU. This also permits multiple users to utilize the same CPU simultaneously. An Indian Patent Application has been filed in the name of IIT Delhi related to this work.

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Technology Development Projects
January-June 2009

S.No.	Title	PI
1	Climate change impact on river basin in semi arid areas in India: Mitigation and adaptation measures to address current and future challenges	Prof A K Gosain
2	EU funded Consortium Project "Optimized fuel for transport in Europe (OPTFUEL)"	Prof L M Das
3	Evaluation of DPR of Biogas Project at Village Mohana Distt. Sonepat for Enrichment & Bottling	Dr V K Vijay
4	Optimization of Pigment Grinding in Ball Mills	Prof B Pitchumani
5	Concept Design of low cost painter friendly applicator for storage & use of guide coat powder	Dr Amitoj Singh
6	Analysis and design validation of mounting bracket assembly	Dr A K Darpe
7	Environment & Safety examination, evaluation and development of project cost for beautification of express way	Dr K N Jha
8	To develop efficient method for extraction of nylon from tyre waste	Prof. Jayashree Bijwe
9	Analysis of two-phase flow through fine channels of Porous Substrates (phase-III)	Dr. Shantanu Roy
10	Finite Element Modeling of Lateral Impact of Pneumatic Tires	Prof Anoop Chawla
11	Striver – Startegy and Methodology for Improved IWRM – An Integrated interdisciplinary assessment in four twinning river basins	Prof. A K Gosain
12	Development of Calix[4]Arene Crown Ether derivatives for use in Cesium separation from radioactive waste reg.	Prof H M Chawla
13	Design of STP / ETP for M.A. Medical College Agroha	Dr A K Mittal
14	Technical Design Guidance for personal and beauty care delivery and dispensing systems	Prof S R Kale
15	Development of processes for purification of antibodies from biological fluids including fermentation broths & kits related to the above	Prof M N Gupta
16	Analysis of Design of bush bearing/pins on backhoe loader 3DX	Dr R K Pandey
17	Comparative study of polyolefin – Processing and property evaluation	Prof Veena Choudhary
18	Studies and Analysis of thermal conductivity of friction materials	Prof J Bijwe
19	Thermoforming of PP Sheets for Industrial Applications	Prof A K Ghosh
20	Studies on Poly (Vinyl Acetate) prepared using varying reaction conditions	Prof Veena Choudhary