INNOVATION TECHNOLOGY BUSINESS

FITT FORUM

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

ISSN-0972-2548 Vol. 19 No. 2 July 2012

High Noon Spring School, IIT Delhi

IITD's TRYST 2012

Chemical Industry Academia Meet, IIT Delhi

Content

Cut-off frenzy & beyond...

Yes, there were no 100% cut-offs during undergraduate admissions to Delhi University colleges this year. But, still there were mind blowing cut-off %ages making one wonder whether this is an era of super-achievers or geniuses or symptomatic of some deep deficiency. Or, are these great 'exam scores' actually an outcome of our new found intellectual strength? Then the debates on admission mechanisms to various professional colleges (IITs included). The organized 'coaching' industry is thriving much to the dismay of many. Every stakeholder thinks his raison d'etre on such subjects is more sound than other's. Where else do we get this amazing spectacle? Whether this is helping the country or not, we still languish on the global innovation index (demographic dividend notwithstanding!). Why are we, along with our thousands of super-achievers (in IITs, IIMs, top Universities and others), not able to help the country rise above such mediocre levels? In this context thus, it seems fine not carry the tag - '3rd largest scientific manpower in the world' on us. Well, there are several such issues of wide ramifications which, can be addressed by collective wisdom, sound logic and pragmatic work plan.

In India, the demand for quality institutions far out-strips the limited supply. There is a crying need to upgrade the low-tier institutions to higher levels and thus lessen the 'frenzied' admission pressure on existing 'famous' institutions whether they are sufficiently relevant or not in the career aspirations of the students. Is it not reasonable to expect the country to simply offer a fair opportunity to all - based on their intrinsic strengths, proclivity and interest in an institution of choice. While the career avenues today are in plenty, it is not uncommon for students to compromise on their dreams and interests given the social pressures. It is also not uncommon to see brilliant technical graduates take up unrelated (and sometimes non-technical) career choices. The liberal arts / flexible course approach in undergraduate education is one useful step and it's heartening to see several institutions moving in that direction. Thus, young people may get opportunities to study specific subjects in unique combinations where they can suitably contribute and thus become productive and valuable assets for the country. Social inclusion apart, our academia ought to fast track their journey to become a Cambridge or a Harvard University - type institution and nucleate a large academic ecosystem of excellence!

We salute India's success stories in science, technology, literature, arts and other areas. Interestingly, numerous outstanding achievers in the world are not known by their high school grades / college education – Rabindranath Tagore, Walt Disney, Dhirubhai Ambani, Marie Curie, Albert Einstein, Bill Gates, Steve Jobs, Thomas Edison, Steven Spielberg, Alessandro Volta – to name just a few!

Anil Wali

Dr. Vijay Bhatkar, a distinguish computer scientist, has been appointed as the Chairman, Board of Governors of IIT Delhi.

Invited Articles

Emerging Opportunities in Computational Imaging

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Imaging systems form an integral part of our lives today. Research and development efforts in diverse areas of Science and Technology have resulted in numerous practical imaging systems that are relevant to areas such as healthcare, security, education, agriculture, energy and to several day-to-day consumer products. Further, in current Science and Technological researches ranging from sub-nano to astronomical length scales, imaging systems are playing a key role as tools that allow us to visualize natural phenomena or objects of interest, thereby, directly influencing new discoveries. Imaging is therefore an active interdisciplinary research area that is relevant to a wide range of fundamental and applied problems as illustrated in the chart in Fig. 1. It may not be considered an exaggeration if I were to suggest that every technology graduate today will be exposed to one or more of the topics in this chart in his / her future career.

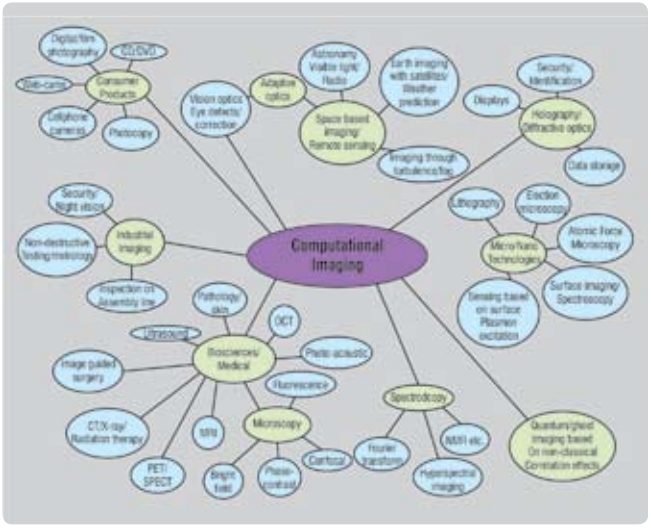

Figure 1: Scope of imaging research

As seen in Fig. 1, modern imaging systems have a wide range of variety in terms of the physical mechanisms used. They may however be described in a unified manner from a conceptual point of view as shown schematically in Fig. 2. A source of radiation illuminates an object of interest. The scattered waves from the object can encode information about the object in the form of space and time variations of intensity, phase, spectrum, polarization, degree of coherence and other forms of correlations depending on the particulars of the imaging phenomena. The central goal of an imaging system is to derive the maximum possible information that is encoded in the scattered waves so that; a human observer may be able to visualize / interpret this information in the form of an image of the object or its characteristics. Towards this goal, the imaging hardware (e.g. in case of an optical imaging system, this may consist of an assembly of lenses, gratings, phase masks, etc.) applies an appropriate transformation to the scattered waves before they are detected at the imaging sensor (typically an area detector in the form of a pixel array). Traditional research in imaging systems involved efforts for improving the imaging hardware (e.g. lens design) so as to obtain the best possible visual image at the sensor.

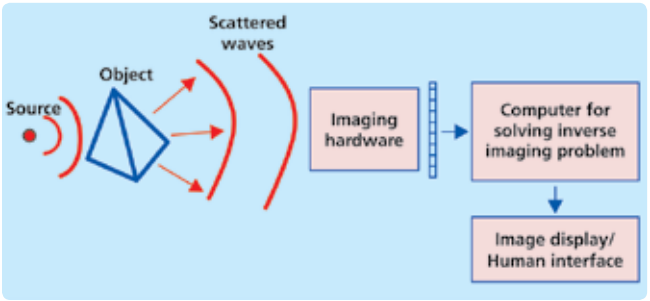

Figure 2: Schematic diagram of a modern computational imaging system

With the availability of computer processing power over the last couple of decades, imaging systems have increasingly become computational in nature. In this new paradigm, the pattern recorded on the sensor may not have any visual similarity to the spatial details of the object of interest. The imaging hardware is however designed such that, starting with the digitally recorded data at the imaging sensor, it is possible to solve an inverse or image reconstruction problem and to form an image of the object that is suitable for human interpretation. Research in computational imaging involves two complementary efforts:

- Design and implementation of imaging hardware that can apply suitable transformation to the information encoding scattered waves (see Fig. 2) before their detection at the imaging sensor, and
- Investigation of efficient mathematical methods for solving the corresponding inverse imaging problems, to meet a specific purpose.

As imaging systems increasingly become important to scientific investigations and in our daily lives, one would always like to have systems with better resolution, faster imaging time, lesser sensitivity to noise, ability to capture multidimensional information (e.g. intensity and spectrum at each pixel) etc. Simple brute force scaling of traditional imagers for this purpose may however prove infeasible from technical as well as economic points of view. Computational imaging model has a significant role to play in this context in the future. Computational imaging systems are hybrid in nature as they place equal emphasis on the imaging hardware part and the computational part. This opens up new possibilities for obtaining unprecedented imaging performance for years to come.

How many measurements are needed to generate an N-pixel image?

The question of how many measurements or data points are needed to generate an appropriate image in a given problem / application is fundamental to imaging system design. The generic ideas based on Shannon-Nyquist sampling typically suggest N measurements for N unknowns without regard to any possible redundancy in image representation. The development of image compression standards over the last two decades has shown that natural images are highly redundant in the usual pixel basis and tend to have sparse representations in scale based transforms such as wavelets. The recently developed Compressive Sensing (CS) theory [1] utilizes this transform domain sparsity to suggest significant reduction in the formal requirements on the number of measurements needed for signal / image recovery. The new mathematical ideas in CS theory have important implications for imaging research as we shall see below in an illustration from my own recent work related to medical imaging systems.

The medical imaging systems such as Magnetic Resonance Imaging (MRI), X-ray Computed Tomography have made significant difference to diagnostic healthcare in the last few decades. These systems are inherently computational in that the measured data are either a Fourier or X-ray projection transform of the object (approximately), which have no visual similarity to the 3D organ image to be reconstructed. The reduced or sub-Nyquist sampled data in this case would traditionally be considered "incomplete" for the purpose of image reconstruction. As illustrated here, Fig. 3(a) shows the maximum intensity projection (MIP) of brain vasculature recorded using the 3D phase contrast pulse sequence on a GE750-3T MRI scanner when fully sampled data are used. Images reconstructed with randomly under-sampled 4X less data using the conventional and the CS methods are shown in Figs. 3(b) and 3(c) respectively. The conventional direct image reconstruction (Fig. 3(b)) with this "incomplete" data loses most of the important vasculature details while the CS reconstruction shows minimal degradation of diagnostic image quality even for 4X less data [2].The possibility of such image recovery potentially reduces scan time of an MRI examination in this particular example; but more importantly, questions the fundamental data requirement considerations in designing imaging systems in general. The "incomplete data" image recovery as in Fig. 3(c) demands much more sophisticated mathematical treatment; however, it is to be noted that implementing a more complex computational algorithm may cost much less compared to building equivalent higher-performance MRI hardware. I would like to emphasize that the mathematical ideas used in this illustration are very general in nature and apply to a wide range of imaging research topics as described in Fig. 1.

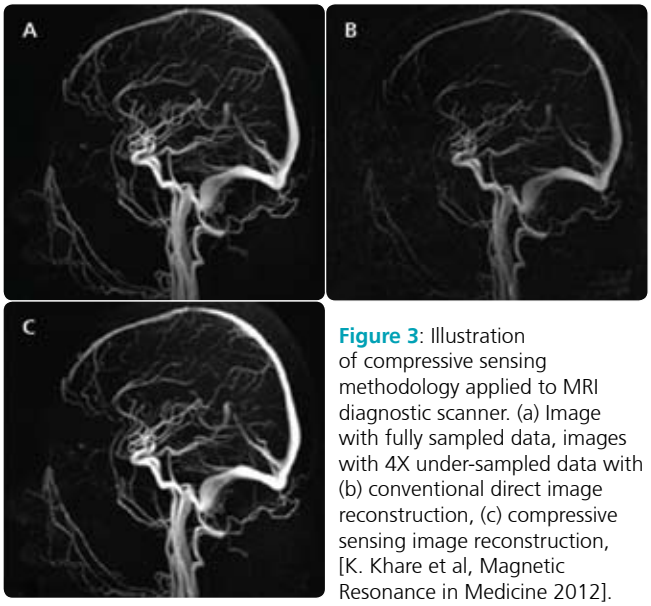

Figure 3: Illustration of compressive sensing methodology applied to MRI diagnostic scanner. (a) Image with fully sampled data, images with 4X under-sampled data with (b) conventional direct image reconstruction, (c) compressive sensing image reconstruction, [K. Khare et al, Magnetic Resonance in Medicine 2012].

The possibility of solving such "incomplete data" inverse problems has important implications for how imaging systems of tomorrow may be designed. The sparsity-based mathematical ideas are likely to guide future work in computational imaging research with regard to the following classes of problems:

Imaging systems beating conventionally perceived limits: We may be able to re-examine our notions about imaging system quality metrics such as resolution, speed, sensitivity to noise, etc. and evolve novel imaging concepts that may outperform traditional imagers. Such improved performance will allow researchers to observe objects of interest at newer scales (space / time / multi-dimensional information) leading to future discoveries in basic sciences as well as the development of important new applications relevant to our daily lives.

Low cost smart imaging systems: With less data requirements, one may think of simplifying the imaging

system design as a whole while achieving imaging performance almost equivalent to that of the so-called "premium" imaging technologies, e.g. in the area of healthcare, security, education, etc. Such newly developed low cost smart imaging systems can enable "premium" technology access to a large number of people who cannot afford it today, leading to significant social impact.

Premier technology institutes like IIT Delhi with diverse multi-disciplinary expertise are well placed to conduct research in both the directions above that are equally important for the society as a whole.

Concluding remarks:

New developments in imaging technologies will have significant technical, commercial and social impact worldwide, influencing both basic science research as well as the development of many applications relevant to day-to-day life. Imaging research involves expertise in multiple disciplines – Physics, Mathematics, Electrical Engineering, Computational Sciences, etc. – and its applications cover a wide range of topics (e.g. bio-sciences, material-sciences, healthcare, security, education, agriculture, energy, etc.). Imaging is therefore an ideal candidate for promoting interdisciplinary research / education culture and also for fostering collaborations between academia and industry. Involving younger generation of students in imaging research will be beneficial in creating human resources in India that will be ready to tackle future challenges in this area of high relevance to science, technology and society.

References:

1. E Candes, J Romberg, T Tao, "Robust uncertainty principles: exact signal reconstruction from highly incomplete frequency information", IEEE Trans Information Theory 52:489–509 (2006).
2. K Khare, C J Hardy, K F King, P Turski, and L Marinelli, "Accelerated MR imaging using compressive sensing with no free parameters", Magnetic Resonance in Medicine (2012). Early view available online at: http://onlinelibrary.wiley.com/doi/10.1002/mrm.24143/abstract.

A Dream for that Elusive Molecule

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Much of life can be understood in rational terms if expressed in the language of chemistry. It is an international language, a language without dialects, a language for all of time, and a language that explains where we came from, what we are, and where the physical world will allow us to go.

- Arthur Kornberg, Nobel Laureate1959

Chemists focus on molecules, for example, a steroid, antibiotic, protein, or DNA. They like the challenge of synthesizing them in the most innovative way. As they study molecules, they discover unexpected properties, manipulate them, and give birth to new knowledge and even new branches of science and technology. Chemistry, the international language, is very complex as its grammar is increasingly sophisticated and even supercomputers are unable to crack it. This language is sometimes guided by intuition, experience, and / or knowledge. The multifaceted dimensions and shear precision of chemistry attracted some and repelled many. This complexity is the underlying theme of our life. Beneath it, there lies a very simple order that is esthetically beautiful, which we are still trying to understand.

In recent years, chemistry has taken a big stride into biology. Particularly appealing are cell-penetrating molecules and molecules that interfere with cell cycles. One of the driving forces for such research is our desire for longevity. Ramayana provides a good example, where Hanuman, unable to find the wonder herb *sanjeevani*, brings the entire mountain to cure Lakshmana. The herb is believed to give life to the dead. Chemistry and the molecules were there even at that time! More interestingly, the origin of life theories based on chemical experiments support an evolutionary approach as opposed to a creationist view. The synthesis of artificial self-replicating molecules and the demonstration of Darwinian evolution at a molecular level demonstrate the power of organic synthesis in addressing anything and everything.

When life started on Earth, scientific discoveries were aimed at improving the quality of life. Following these developments were various ailments that threatened our existence. Presently, diseases like cancer, HIV, Alzheimer's, and other neurodegenerative diseases are giving scientists and medical practitioners a tough time. The final savior is the molecule, that elusive molecule. Looking for an extraordinary molecule with extraordinary functions has always been a chemist's dream. Interestingly, this has driven chemistry to newer and newer heights.

The molecules that play pivotal roles in biology are protein and DNA. Proteins are particularly complex and important due to their hierarchical structure and their interactions that control all of life's activities. It turns out that orchestrating these interactions is a method by which one can rectify or control many defects in our body. Many scientists have contributed immensely to the understanding of these biological molecules, for example, the double helical structure of DNA, protein structure, and their respective functions, to cite a few. Their breakthroughs are considered equivalent to the moon landing. The knowledge gleaned through their studies has led to many new questions of various natures: chemical, biological, mathematical, physical, and philosophical. Remarkably, many of these developments in the area of chemistry and biology have given excellent feedback to various disciplines and opened many avenues for science and technology.

The fundamental aspect of molecular behavior is traced back to its chemical structure. The structure guides the interaction between themselves and other molecules. These interactions are generally very weak and play a significant role in governing the properties. Proteins make interactions with other protein molecules, and these networks of interactions are highly complex.

The interactions between proteins are the central part of signal transduction. *Signal-transduction cascades* are molecular circuits that detect, integrate, and amplify diverse external signals to generate responses, such as changes in enzyme function, gene expression, ion-channel activity, cell division, etc. Cells communicate using variety of different'signal transduction' mechanisms, and is analogous to human communication via speech, sight, writing, phone, email, fax, etc. Defects in signaling pathways lead to various aberrations, predominantly cancer. All the signal transduction pathways are essential for the sustenance of the cell and its working. *Ras* pathway is one of the signaling pathways (Fig. 1), where mutation of one of the residues leads to a signal transduction defect that leads to cancer. The guanosine triphosphate (GTP) bound form represents the active, switched-ON state; the guanosine diphosphate (GDP) bound form is the inactive, OFF state. The transition between ON and OFF forms occurs in a unidirectional cycle (Figure 2). To turn it "ON", the GDP is swapped for GTP. GEF proteins (guanine nucleotide exchange factors) turn the Ras switch ON. Then, after the signal is delivered, the GTP is cleaved to GDP and phosphate, turning the protein firmly OFF. The lifetime of active GTP-bound state is reduced by regulatory proteins, namely GTPase activating proteins (GAP). The oncogenic *Ras* protein spends about 105-fold longer period in the activated state than the wild type *Ras* protein and can transmit signal in the direction of cell proliferation.

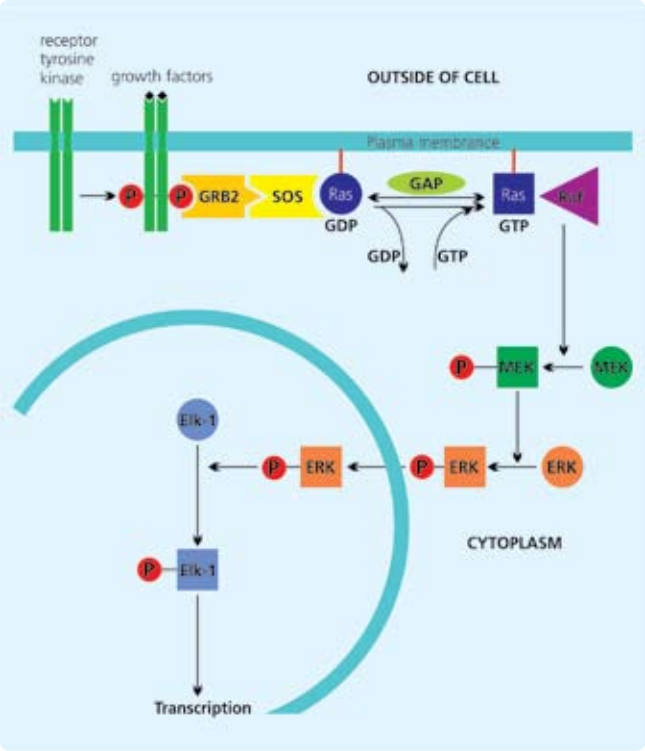


Figure 1: *Ras* signal transduction pathway

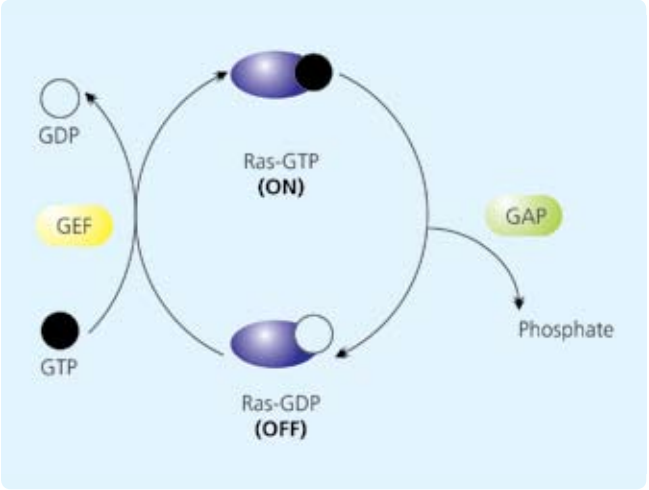


Figure 2: GTPase cycle and the *Ras* protein

Large numbers of molecules are designed to target these interactions in order to rectify signaling problems. Chemists are at work, thinking about an elusive molecule that may come from their laboratory. It is noteworthy that many of the signaling proteins are not available in reasonable quantities because they are post translationally modified proteins. The synthesis of a variety of *Ras* proteins and their mutants using combined chemical and biological methods is a challenging endeavor for chemists. Many proteins in the cell can only be prepared by a chemical method, and the search for a chemical method is still in its infancy.

Various approaches are currently underway to combat diseases related to signal transduction. The elusive molecules that can cure diseases may be hidden as a natural product; therefore, natural-product-guided drug discovery is one approach. A derivate of the natural product or a totally synthetic system based on chemists' intuition and imagination is the other approach for discovering the elusive molecules. The search of chemists continues and will continue forever. The hope is that each invention or discovery will give some tips and will guide us to further discoveries relatively quickly. Molecular chemistry is our hope and finding more unique molecules and their behavior are the need for the hour. Interestingly, each molecule is unique, but sometimes we are not aware of its unique properties. Hopefully, our creative design, fine tuned over years, will be as accurate as nature's design.

The challenge involved in organic synthesis, coupled with the imagination and the joy of creation of molecules, is the ultimate happiness for chemists. Their hope is that one day some of the molecules synthesized will give happiness to the whole world.

(Dr. V Haridas is an Associate Professor in the Department of Chemistry at the Indian Institute of Technology, New Delhi, India. His interest is in the area of organic chemistry with particular emphasis on peptides. His group is involved in the design and synthesis of dendrimers, and secondary structure mimetics. In addition to that the group is also working on the synthesis of antiviral and antibacterial compounds based on minimalistic approach)

Sensing Eye: An Energy Saving Device

Mr. Dharmender Jaitly,
Tech. Asst. Mechatronics Lab., ME Dept., IIT Delhi

Due to increase in the use of electric energy, there is huge deficit between the demand and supply. Thus, there is demand for energy saving products. This article describes one such device called "Sensing Eye" that has been developed in the Mechatronics Laboratory of IIT Delhi.

Our master sensor, as shown in Figs. 1 and 2, senses the motion / presence of a living being, and in response to the Radio Frequency (RF) link, controls the slave device to switch on / off any appliances. The developed system provides wireless switching (on / off) to the connected loads.

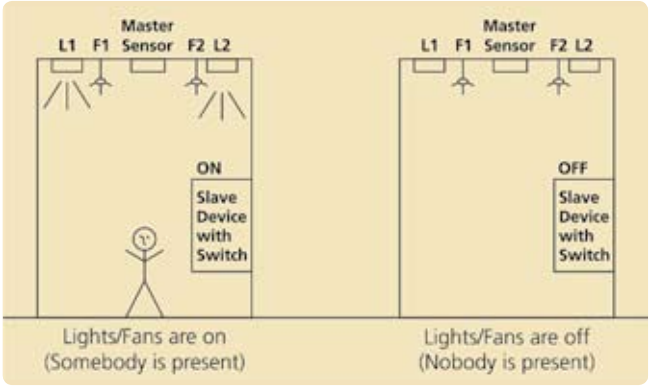


Figure 1: Schematic diagram of the situations

Schematic diagrams of the situations are shown in Fig. 1. The developed device will save energy in Laboratories, classrooms, corridors, washrooms, common places, hostels, and other places where people often leave the place without switching off the lights, fans and, more importantly, ACs. Master and Slave devices are shown in Fig. 2.

Master Sensor

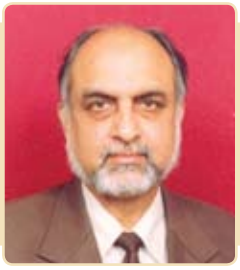
Slave Device

Figure 2: Photographs of Master Sensor and Slave Device

Anybody interested to experience the "Sensing Eye" can visit the Mechatronics Lab. (Block II, Room 420, Tel. 2659 6320).

This is the second article in a row (First one on "Occupancy Sensor" appeared in FITT Forum, Jan. 2012).

Faculty Profiles



Prof. Vikram Kumar
Dept. of Physics
Indian Institute of Technology
Delhi

Prof. Vikram Kumar is well known in the area of semiconductor materials characterization and device technology. He is a recipient of the prestigious SS Bhatnagar Award for physical sciences in 1992. The Material Research Society of India (MRSI) has named him the distinguished material Scientist of the Year 2012.

Vikram Kumar started his scientific research career at the Lehigh University, PA, USA in late sixties. His doctoral work was to study the interface states at the silicon - silicon dioxide interface in metal - silicon dioxide - silicon (MOS) structures with ultra-thin oxide layers. The MOS technology was just getting established at that time. His work on ultra thin oxide MOS structures is cited widely, and even in 2011 – nearly thirty five years after publication. It is worth noting that such ultra-thin oxide layers are now common in CMOS IC technology for high speed and high density integrated circuits.

Soon after completing his doctorate, Kumar returned to India and took up a faculty position (1977-92) at the Indian Institute of Science Bangalore. Kumar set up an advanced semiconductor processing and characterization laboratory. He used deep level characterization techniques to extensively study electronic defects in a variety of semiconductors including Si, GaAs, InP, GaSb and related ternary compounds. He has also studied the interface states and passivation of semiconductor surfaces and effect of hydrogenation on interface states and bulk defects. These studies resulted in several doctoral and master's theses.

Detailed investigations of defects in Si by Kumar's group have shown for the first time: the interaction of gold impurities in silicon with divacancies created by high energy electron irradiation; the existence of interface states at the c-Si / a-Si interface; the first unambiguous evidence of passivation of phosphorous donors in silicon by hydrogenation; a novel modification the DLTS technique using small filling pulses permitted direct measurement of the electron capture cross section of the Si-SiO2 interface states in MOS structures. His innovative experiments provided the first direct evidence of the negative U character of the technically important DX center widely observed in the AlGaAs. He has extensively investigated the EL2 trap in GaAs, which is responsible for the semi-insulating nature. Dr Kumar's extensive studies on GaSb established the conditions for high quality crystal growth, epitaxy and surface passivation; contact formation and deep level characterization and helped establish this material as technologically important for many optoelectronic applications. His extensive work towards the understanding of electronic defects and interface states in silicon, III–V and II–VI semiconductors lead to the prestigious Shanti Swarup Bhatnagar Award in 1992.

Dr Vikram Kumar joined as the Director of the Solid State Physics Laboratory (DRDO) in 1992. He has contributed towards the development of technology of materials and devices some of which have reached production stage. His team developed the technology of 0.7 µm gate ion implanted MESFET and 0.5 µm pseudomorphic HEMT using MBE grown strained layer AlGaAs / InGaAs / GaAs structures. He led the team for setting up GaAs Enabling Technology Centre (GAETEC) foundry for pilot production of monolithic microwave integrated circuits (MMIC) which is now supplying devices to various users including defence and space. It is to be noted that the recent RISAT satellite has about 5000 MMICs fabricated at GAETEC and functioning wonderfully. He has also developed and transferred the technology for growth of single crystals of CdZnTe and supplied device quality wafers. These wafers are currently being used to develop the FPA for night vision. He also contributed to the development HgCdTe based PV and PC infra-red detectors for night vision devices.

Under his directorship (2003-09), the National Physical Laboratory (NPL) underwent international peer review to fulfil the requirements of BIPM mutual recognition arrangement (MRA) achieving international equivalence of measurements. At NPL he initiated research programmes on silicon and organic solar cells as well as white light emitting diodes. Kumar is working personally in the area of polymer electronics; in particular, he has been modelling carrier transport in organic materials. He has co-authored a monograph titled 'Conducting Organic Materials and Devices' published by Academic Press as Vol. 81 of the Semiconductors and Semi-metals Series in 2007.

After completing his term as Director NPL, he has joined IIT Delhi where he is coordinating an interdisciplinary project on nanotechnology. He has continued his research on semiconductors and carbon nano-tubes.

Vikram Kumar has co-authored over 165 technical papers in peer reviewed journals and also co-authored a book. He has given numerous invited talks in India and abroad. He has guided fifteen PhD students and several M.Tech theses. He has been contributing to the development of science and technology in India as member of several nationally important committees for DST, DRDO, MNRE, UGC, CSIR etc. He played a key role in starting the National Programme on Smart Materials, and as chairman of the committee for development of devices, guided the development of MEMS technology in India. Currently, he is the chair for the DIT Working Group on Nanotechnology and DST Expert Group on Enabling R&D for Solar Energy. He is member of the PVR&D Panel of the MNRE. He is a fellow of the National Academy of Sciences, Indian National Academy of Engineers (INAE) and Institute of Electronic and Telecommunication Engineers (IETE) in addition to being a member of several professional societies.

Dr. Sidh Nath Singh
Department of Applied Mechanics
Indian Institute of Technology Delhi

Dr. Sidh Nath Singh obtained his B.Tech (1975) & M.Tech (1977) in Aeronautical Engineering from IIT Kanpur and received Ph.D (1985) in Fluid Engineering from IIT Delhi. Prof. Singh became a lecturer in the Department of Applied Mechanics at IIT Delhi during July 1980 and rose to become a full Professor in the same department in 1995.

Prof. S N Singh specializes in Fluid Mechanics and Solid Liquid Flow and his areas of research interest are Internal & External Flows; Turbo-Machines; Mixing of Jets; Computational Fluid Dynamics of Internal Flows; Flow Instrumentation; Open Channel Flow. During various engagements with British Council Research Assignment, he trained and worked with eminent scientists like Prof. J H Whitelaw & Prof. A D Gosman, Imperial College of Science, Technology and Medicine, London. He possess excellent expertise on handling of instruments like Hot Air Anemometer, Laser Doppler Velocimeter and in-depth computational technique skills on 'TECH-T' computer code, 2D & 3D code in non-orthogonal coordinates, 3D code in curvilinear orthogonal coordinates & commercial code on CFD, STAR-CD & CFDRC.

Prof. Singh's has an active research profile. He has guided 26 Ph.D and 86 M.S. / M.Tech students. Till date he has to his credit more 385 publications in numerous international and national journals and technical conferences. Prof. Singh is an inventor too and has a filed a few patents as well. Prof. Singh has had the distinction of having been honoured on several occasions with medals and recognition particularly, for technical publications. To enumerate a few: RINA's Medal of Distinction, Shri Sam Dotiwala Medal, The Hem Prabha - S N Gupta Medal, The Corps of Electrical and Mechanical Engineers Medal etc. Prof. Singh is a Life Member / Fellow of several professional societies like: Indian Society of Technical Education; Indian Society of Mechanical Engineers, National Society of Fluid Mechanics and Fluid Power; Institution of Engineers; Aeronautical Society of India; American Institute of Aeronautics and Astronautics (AIAA), USA.

Prof. S N Singh has been rated amongst the top consultants at the Indian Institute of Technology Delhi. He has delivered more than 74 consultancy and sponsored research projects both from public and private sectors. Prof. Singh likes to address challenging industry problems. Besides, he has spearheaded the laboratory development projects at REC Srinagar, MNREC, Allahabad, MACT, Bhopal and REC Silachar under Institutional Network Scheme.

Besides his academic attainments, Prof. Singh has been entrusted with numerous administrative responsibilities at IIT Delhi like: Head, Applied Mechanics Department (2011-12); Dy. Director (Operations, 2012 –); Chairman, GATE & JAM IIT Delhi (2007-08); Professor In-charge, Accounts and Audit (2006 – 08), Dean, IRD (2008-11) etc. Prof. S N Singh is a dynamic person who balances his academic and administrative responsibilities with elan. He is quite passionate about his responsibilities that best serve the Institute.

Robotics Research at IIT Delhi

FITT / IIT Delhi Happenings

Celebration of National Technology Day

FITT, IIT Delhi celebrated the "National Technology Day" on May 11, 2012. Prof. R K Shevgaonkar, Director, IIT Delhi chaired the event and delivered key note address. The event had Mr. J Tyagi, Director (Works), DMRC as the chief guest. During the event, a national award winning documentary film on "The Dream Fulfilled – Memories of an Engineering Challenge" highlighting DMRC was shown. Several members of the Institute management, senior faculty, students and members of FITT were present. Besides, following technological innovations developed at the institute were presented by their inventor faculty members:

- **Fabric Feel Tester** – Indian Prospective by Dr. Apurba Das, Textile Technology, IIT Delhi
- **Sanitation Technology** by Dr. V M Chariar, CRDT, IIT Delhi

Chemical Industry Academia Meet

FITT organized a chemical industry academia meet at IIT Delhi on March 15, 2012. The meet aimed to provide a platform for exchange of ideas and views between faculty, research scholars and industry partners. Prof. M Balakrishna, Dy. Director (faculty) of IIT Delhi inaugurated the function followed by address from Prof. A N Bhaskarwar, Head, Dept. Chemical Engineering, IIT Delhi. There were presentations by various members of the faculty and the industry. Members from various Departments and Centres along with several industry representatives were present. L'Oreal, Fresenius, Jubilant Life Sciences, Pharma Instinct etc. were amongst the industrial units present. The meet generated extremely fruitful dialogue. Dr. Anil Wali of FITT summed up the discussion and exhorted the stakeholders to strengthen the engagement process.

MoU with ASQ

FITT has signed a Memorandum of Understanding with American Society for Quality (ASQ) India Pvt. Ltd. for advancement of new knowledge and practices for the benefit of IIT Delhi community in engineering and management sciences as well as to benefit executives working in the industries and Government through continuing education. The MoU was signed by Dr. A Wali MD on behalf of FITT and Dr. Amit Chaterjee MD on behalf of ASQ India on May 31, 2012.

A high level French delegation led by Dr. Joël Bertrand, CNRS Director General for Science visited FITT / TBIU on Jan 13, 2012.

A senior-level technical delegation from TMEIC, Japan visited FITT on Feb 27, 2012 for research collaboration.

Research & Views

1. Human-induced global ocean warming on multidecadal timescales, K.N. Achuta Rao (CAS, IITD) et. al., Nature Climate Change, June 2012

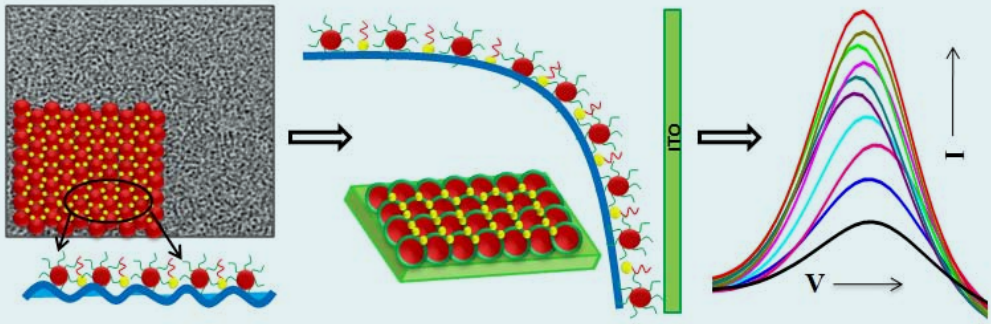
2. Some deleterious consequences of birth of new disciplines in science: the case of biology, M.N. Gupta (Chemistry Dept., IITD), Current Science, July 2012

3. Bipolar Charge - Plasma Transistor: A Novel Three Terminal Device M. Jagadesh Kumar et. al, Elect. Engg. Dept., IITD, IEEE Trans. Electron Devices, April 2012

4. Self Generated and Reproducible Dynamics in "Gene Years" Represent Life Aditya Mittal, KSBS, IITD, J. Biomolecular Structure & Dynamics, Feb. 2012

FITT - The BIG Partner

C-CAMP (Bangalore), IKP (Hyderabad) and FITT (N Delhi) have been selected by BIRAC (DBT) as the Biotechnology Ignition Grant (BIG) Partners to co-ordinate the BIG support scheme. The main aim of the BIG scheme is to help establish and validate proof of concept, and enable creation of spin-offs.



Nanopatterned Cadmium Selenide Langmuir-Blodgett Platform for Leukemia Detection
Sameer Sapra et al.,*
**Dept. Chemistry, IIT Delhi*

Innovations

Opportunities for IP Licensing

Sl. No	Title	PI
1	A MEMS based low cost temperature sensor on silicon substrate using trench formation, backfill and CMP for detection of methanol	Prof. S Chandra, CARE
2	Versatile perfusion module for supporting membranes	Dr. J Gomes, DBEB
3	Pure hydrogen and bamboo-shaped carbon nanotubes production from methane using Cu-Zn promoted Ni / Al_2O_3 catalyst	Prof. K K Pant, Chem. Engg.
4	A process for purification of recombinant human G-CSF using three phase extraction integrated with a multimodal chromatographic purification	Prof. A S Rathore, Chem. Engg.
5	Effective kinetic resolution of acyclic aliphatic sec. alcohols using cross-linked protein coated micro crystals of a lipase	Prof. M N Gupta, Cy
6	A novel version of cross-liked enzyme aggregates with improved stability towards high temperature and presence of organic solvents	Prof. M N Gupta, Cy
7	High performance supported metallic / mixed metallic catalyst for sulphuric acid decomposition in sulphur-iodine (SI) cycle for hydrogen production	Dr. S Upadhyahula, Chem. Engg. Prof. A N Bhaskarwar, Chem. Engg.
8	Water-based offset lithographic printing ink	Prof. A N Bhaskarwar, Chem. Engg.

Technology Profiles

A System & Method for Obtaining Continuous Pattern Blending in Textile Strands

Prof. S M Ishtiaque, Textile Technology,
Prof. J K Chatterjee Electrical Engineering &
Mr. Vijay Kumar Yadav Textile Technology

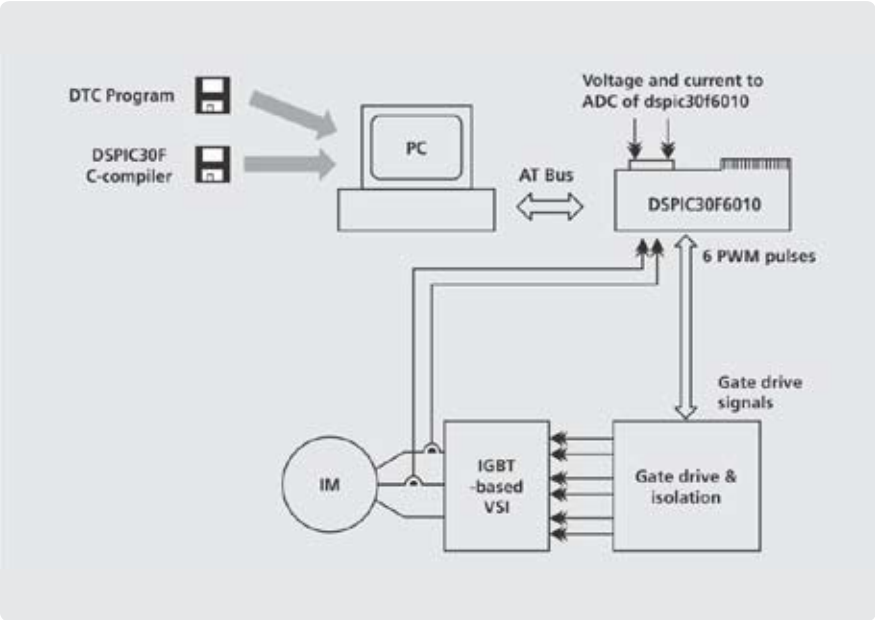
Multi-colour patterns in fabrics are very common for imparting aesthetics looks to the fabric. Such patterns in fabrics are usually in form of bands, strips and checks. Usually multi colour looms are employed and more than two colour yarns are used as weft and / or warp for regular strips and check effects where as for irregular and fancy effects in the fabrics more common routes are dying / printing and use of fancy yarns. The multi colour effects in the yarn at spinning stage are mostly achieved by mixing or blending different colour staple fibres in a controlled fashion. Blending of staple fibres having different type or colour is normally done at draw frame stage or the blow room.

The present invention is a system and method for obtaining continuous pattern blending textiles strands. It involves an apparatus that can be retrofitted on an existing commercial draw frame thereby, producing silver containing a blend of different colours or fibre materials, in the longitudinal directions of silver and in a controlled and reproducible manner. It address the pattern effects in yarns during spinning process, where the composition of the constituent fibres can be changed in real time along the length of strand, so as to produce a regular effect in the product according to the desired customized pattern.

It demonstrates a tailor made solution approach of imbibing a modern draw frame with capabilities of producing a constant linear density blended silver with varying proportion of constituent fibre colour / type along the silver length.

The following advantageous can be achieved by virtue of the proposed process change and system embodiment as shown here in;

1. Capability of blending silvers of different colours in a controlled and reproducible manner.
2. With a GUI platform, the blend variation of components can be conveniently set.
3. Can produce regular or random colour pattern in the output silver by changing the colour / fibre composition in real time.
4. Can produce different colour pattern in warp & weft yarn to produce desired fabric.
5. Can produce complicated colour patterns in fabrics.
6. Can produce shading effect in warp and weft direction in fabric.



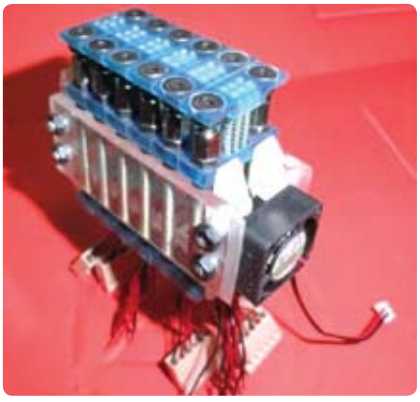
A System for Generating Refreshable Tactile Text and Graphics

Prof. P V M Rao, Mech. Engg.
Prof. M Balakrishnan, Comp. Science
Prof. K Gupta, Mech. Engg.
Pranay Jain, B.Tech. Student
Anshul Singhal, B. Tech. Student

The present invention relates to refreshable Braille display which allows blind users to read computerized text through touch. Each character is converted to a corresponding Braille character according to standards, and displayed on electronically Braille display by popping up pins which correspond to Braille dots. In other words it mimics Braille embossed on a paper, giving blind users a similar experience without the use of paper and expensive and bulky embossers.

The proposed device is modular and can be assembled to form single character to multiple-row Braille displays. When assembled, it takes input from any computer or equivalent device and will output text / graphics in the form of refreshable Braille display. Modular nature of this device allows to build displays not only for text but also for graphics in tactile form.

Compared to the traditional Piezo Braille Cells, the present technology uses novel smart material based actuation. This allows makes cost of each module to be significantly lower. Once assembled, the present development finds applications in electronic products such as computers, mobile phones, PDAs and calculators and those for public use like vending machines, ATMs and information kiosks. New products like navigation systems and portable readers too can use this technology for building text and graphics display.



R&D Projects...

Sl. No	Title	PI / Dept.
1	Studies on thermal conductivity of brake blocks	Prof. J Bijwe, ITMMEC
2	Water availability, demand and adaptation option assessment of the Ganges basin under climate change	Prof. A K Gosain,CE
3	Design and development of smart energy monitoring and control device	Dr. S Jha, DME
4	Collaborative research project with University of Southern Mississippi for exchange of students (Under NSF)	Prof. V Choudhary, CPSE
5	Fundamental studies on droplet coalescence and re-dispersion in liquid-liquid dispersions (Phase-IV)	Dr. S Roy, Chem. Engg.
6	Smartphone application acceptability and its impact on driving behavior of drivers in Delhi	Prof. D Mohan, TRIPP
7	Study of the environmental health and safety issues in Cadmium Telluride (CdTe) photovoltaic technology	Prof. V Dutta, CES
8	Built environment modeling for urban renewal	Prof. A Sawhney, CE
9	DLF for weakly meshed distribution system	Prof. P R Bijwe, DEE
10	Development of Polyvinyl Acetate based resin as a binder for combustible cartridge case (CCC)	Prof. V Choudhary, CPSE
11	Development of biodegradable nanocarrier system for delivery of anticancer peptides	Prof. H Singh, CBME
12	Development of a flexible refrigerator (Phase-I)	Prof. S Jain, DME
13	State Action Plan on Climate Change (SAPCC) and vulnerability assessment	Prof. A K Gosain, CE
14	Automated fault detection and diagnostics rules for HVAC systems (Phase-III)	Prof. S Jain, DME
15	Expert report on violation of Blackberry SDK terms and conditions	Prof. R K Mallik, DEE
16	Services for Silver Plant Specialist	Prof. R Chattopadhyay, DTT
17	Analytical characterization of biotech therapeutics	Dr. A S Rathore, Chem. Engg.
18	2-in-1, Self-orthodontic spring separator for predictable separation of teeth in orthodontic patients	Prof. A Kumar, Phy
19	Development of polyurethane and modified polyurethane with nano-materials coating for power plant applications	Prof. M Joshi, DTT
20	Development, implementation and performance comparison of estimation methods for Bearings Only Tracking	Prof. A Kumar, CARE
21	Expert opinion with regard to novelty and inventiveness of invention described in 489 / CHENP / 2009	Prof. H M Chawla, Cy
22	Development of practical oriented teaching manual and set of MIC devices	Prof. S K Koul, CARE
23	Impact of climate change on hydropower development: Water resources management for multiple uses in the Godavari river basin	Prof. A K Gosain, CE
24	Development of real time platform noise simulator software using time varying underwater channel	Prof. A Kumar, CARE
25	Design and finite element analysis of large scale fire simulation chamber	Prof. M R Ravi, DME
26	Development of friction composites to evaluation potential of some solid lubricants	Prof. J Bijwe, ITMMEC
27	Advice for development of long term monitoring techniques using underwater acoustic technology (Phase-III)	Prof. R Bahl, CARE

Professional Development Programmes

Forthcoming HRD Programmes (Course / workshop / training / conference)

Sl. No.	Title	Date	Sponsored / Participation Fee (PF) based	Faculty / Dept.
1	PCR-I Semester 2012-12	July - Nov, 2012	PF	
2	Broadband Telecom Systems – Long Term Evolution (LTE)	July 30 - 31, 2012	PF	Dr. S Prakriya, DEE
3	Telecom Technology in Management	To be announced	PF	Dr. M Sagar, BSTTM Dr. B Lal, BSTTM
4	Developments in Biomass Derived Fuels – Bio-energy Based Bio-economy (Including Third Generation Bio-fuel – Algal Bio-fuels)	Aug 1 - 2, 2012	PF	Prof. D K Sharma, CES
5	Indo-Danish Workshop on "Future Materials for Wind Energy" *(New Computational methods, Processing and Materials Characterization Techniques)*	Oct 8 - 9, 2012	PF	Prof. P Mahajan, AM
6	Bioinformatics and Computational Biology	Aug 16 – Sep 27, 2012	PF	Prof. B Jayaram, KSBS
7	Tribology for ONGC Maintenance Engineers	Oct 17 - 19, 2012	ONGC, Vadodara	Dr. H Hirani, DME
8	Coal and Ash Handling at the Thermal Power Plants	Nov 19 - 21, 2012	PF	Prof. V K Aggarwal, ITMMEC

Professional Candidates Registration Programme

Applications are invited from qualified professionals working in industry and research organizations for a unique knowledge augmentation and skill enhancement programme at IIT Delhi. This involves a semester-long registration for a regular PG subject. Course fees ranges from Rs. 15,000/- to Rs. 20,000/- (industry professionals) and Rs. 6,000/- to Rs. 8,000 (academic / government personnel) for a 42 hour lecture course. In the case of a few select courses, on-site course delivery using the two way audio-video link can be considered.

All major disciplines of Science and Engineering, and also relevant courses from the Humanities, Social Science and Management streams which are being conducted at IIT Delhi are covered. The course detail can be downloaded from FITT website www.fitt-iitd.org.

Eligibility: Degree in Engineering or Masters Degree in Science, Management or any other Post Graduate Degree with relevant industry experience. The two semester sessions in the academic year start in the month of July and January, the exact dates being notified in advance.

Contact: uttamaswal@hotmail.com, kirityroy@yahoo.com

Miscellaneous

Corporate membership of FITT

FITT invites the industry / industry associations / R&D organizations and financial institutions to become corporate members of FITT at a nominal annual subscription.
A corporate client can participate in technology transfer and joint R&D programmes of the Institute on a priority basis with FITT providing the interface. Membership forms can be mailed on request or can be downloaded from www.fitt-iitd.org.

New Corporate Members (Jan – June 2012)

- Indian Grameen Services
- Bhartiya Samrudhi Investments Consulting Services Ltd.
- L'Oreal India Pvt. Ltd.
- Cube Software Pvt. Ltd.

Techno-Entrepreneurship Support

FITT extends following supports for innovation / entrepreneurship under approved Government Schemes:

Technological Incubation and Development of Entrepreneurs (TIDE), DIT: to financially support technology ventures (IT and IT & ES) at incubators during early stages of their development up to Rs. 25 lakhs. (www.mit.gov.in)

Seed-Support to Incubatees, TDB: for addressing the varied development needs of the start-ups at incubators up to Rs. 25 Lakhs. (www.dsir.gov.in)

Biotechnology Ignition Grant (BIG) scheme of BIRAC (DBT) to establish and validate proof of concept through financial support / mentoring to incubatees and new start-ups – up to Rs. 50 Lakh. (www.biracdbt.nic.in)

Entrepreneurial and Managerial Development of SMEs through Incubators, MSME: to nurture / promote technology / knowledge–based innovative ventures through financial / incubation support up to Rs. 6.25 Lakhs. (www.msme.gov.in)

News and Views

Solar storms present growing threat to high-tech civilization

(Source: The Hindu; Business Line, 1st May 2012)

IIT-D to go to Haryana, new campus in Sonipat

IIT-Delhi will soon set up its extension campus in Sonipat, just a few kilometres from the capital's border. Responding to a letter from the IIT-D director, Haryana chief minister Bhupinder Singh Hooda has announced that his government will provide 50 acres to the institute in Rajiv Gandhi Education City in Sonipat.....

(Source: 11th June 2012)

IIT-D to help set up Mauritius institute

Professors from IIT Delhi may soon be called to help set up a research centre in Mauritius. IIT Delhi has come up with a plan to help the government improve the technical education facilities in the island nation. So far a feasibility report, in which IIT Delhi has given its nod, has been filed.....

(Source: Hindustan Times, New Delhi, 3rd May 2012)

IIT Sensor to keep Jumbos Safe on tracks

(Source: Daily News & Analysis, 20th June 2012)

Pesticides and the technology tread mail

Farmers cannot deal with a pest attack on their own. They are dependent on scientists to create pest-resistant varieties, and on multinationals to develop ever more potent pesticides... Dr. Richa Kumar, Dept. Humanities & Social Science, IIT Delhi

(Source: Business Line, 27th June 2012)

Govt. steps up efforts on intellectual property

India's effort to have a comprehensive intellectual property rights (IPR) strategy seems to be getting off the ground, with the Department of Industrial Policy and Promotion (DIPP) circulating the first draft of this for an inter-ministerial consultation process...

(Source: Mint, 2nd August 2012)

Team

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