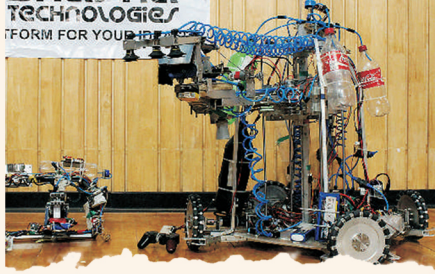
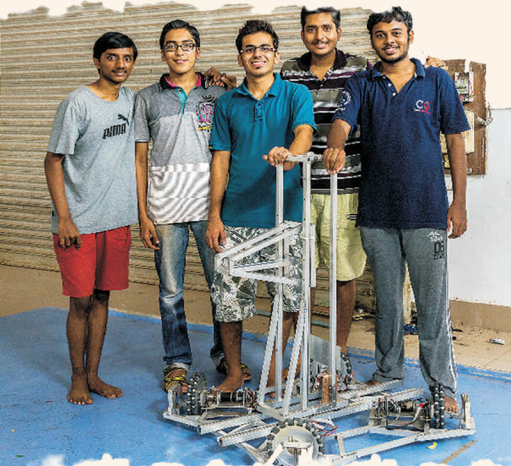
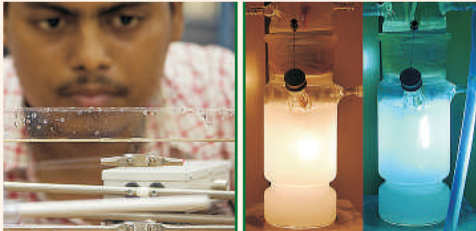




IIT MADRAS IN THE NEWS

April 2016 - March 2017



Date: 5th April 2016

IIT Madras ranked #1 in India Rankings 2016 in Engineering



4th April 2016 / New Delhi: In the first set of **India Rankings 2016** released today by the Hon'ble Minister for Human Resource Development today (April 4th, 2016) in New Delhi, **IIT Madras ranked no. 1 amongst Research and Teaching Institutions in Engineering** amongst several other similar institutions in India that participated in the ranking exercise.

The National Institutional Ranking Framework (www.nirfindia.org), created by the Ministry of Human Resources Development, Govt. of India in 2015, outlines a methodology to rank institutions across the country. The parameters used for ranking broadly cover "Teaching, Learning and Resources," "Research and Professional Practices," "Graduation Outcomes," "Outreach and Inclusivity," and "Perception".

"The top rank is a reflection of the commitment of the faculty, staff and students of IIT Madras towards fulfilling the objectives of the Strategic Plan 2020 that we have set for ourselves", said Prof. Bhaskar Ramamurthi, Director, IIT Madras. The IIT Madras Strategic Plan (www.iitm.ac.in/content/strategic-plan) spells out quantified targets for all key pillars of the Institute. These include a flexible curriculum suited to the aspirations of today's youth, high quality faculty, a thriving research programme with a critical mass of research scholars and laboratories with the latest equipment, India's strongest industry-academia collaboration epitomized by the country's first university-based Research Park, an effervescent start-up ecosystem with nearly a hundred companies being currently incubated, a rapidly expanding programme of collaborations and student exchanges with leading global universities, and an enviable Placement record.

In addition, the Institute prides itself in its outreach to the community at large. The Institute takes up a large number of projects and activities in the country where it brings to bear its core strengths in order to address various technical challenges. It has developed key technologies to address grand challenges faced by the country in water, energy, healthcare, housing, and the like. The Institute's alumni play an active role in helping the Institute grow, as well as in its outreach to the community. Alumni and well-wishers are making record contributions to the Institute to help it retain its position as a top educational and research institution and enhance its global standing.

For more information on the India Ranking 2016, please look up the Ranking Report: <https://www.nirfindia.org/index.html>

Date: 6th April 2016

ABB partners IIT-Madras for microgrids, joint R&D

ABB India on Tuesday entered into a technical cooperation agreement with Indian Institute of Technology Madras (IITM) to build microgrids as well as joint R&D in the field of rural electrification, utilisation of natural non-fossil resources. The cooperation also extends to the area of battery energy storage and their connection to loads and main grid, the company said in a statement. The agreement also includes internship opportunities to post-graduate students of IITM for the next three years. Under the agreement, ABB and IITM will jointly work to design, build and supply equipment for up to two such microgrids in rural areas.

BusinessLine

Date: 16th April 2016

IIT-Madras ties up with UK varsity to promote social entrepreneurship

UKISEEN to aid sharing of best practices, research for entrepreneurial ventures

OUR BUREAU

Chennai, April 15

IIT-Madras has partnered with the UK's University of Southampton to promote social entrepreneurship.

The two have launched a networking platform for knowledge sharing.

The platform, UK-India Conference on Social Entrepreneurship Education Network (UKISEEN), has been established by the Centre for Social Innovation and Entrepreneurship (CSIE), IIT-Madras, and the Social Impact Lab of the University of Southampton.

This will help the institutions to share best practices, teaching curriculum and research material for entrepreneurship ventures.

The programme will encourage student and faculty exchange programmes as

well and is accessible to other colleges and universities.

Social entrepreneurship aims to provide business solutions for social, cultural and environmental problems that benefit the community rather than individuals.

Speaking to *BusinessLine* on the sidelines of the launch of UKISEEN, Pathik Pathak, Faculty Director of Social Enterprise, University of Southampton, said the UK, with its robust entrepreneurship ecosystem, and India's strong technical background will benefit both the countries in nurturing social entrepreneurship.

Though social entrepreneurship has been in vogue for a long time in India, it is only in the recent times it gained momentum.



"The interest has its roots in the shift in consumers' attitude. They value ethical supply chains and are willing to pay more for it."

PATHIK PATHAK
Faculty Director of Social Enterprise, University of Southampton

Said Pathak: "The interest has its roots in the shift in consumers' attitude. They value ethical supply chains and are willing to pay more for it. Also, the Indian government is now encouraging such ventures, which is

bringing more investors."

Richard Everitt, Director Education and Society, British Council, told *BusinessLine* that the council is helping with the policy infrastructure for such ventures to thrive in the country.

"We are in discussion with policy-makers at the national and state level for removing policy impediments using our experience," he said.

Nascent trend

The UK has close to 70,000 registered social entrepreneurship ventures, generates revenue close to £24 billion and employs close to one million small and medium entrepreneurs, he added.

Joseph Thomas, Project Consultant, CSIE, said having the UK as a partner for social entrepreneurship will benefit Indian universities, especially now when the idea of social entrepreneurship is still rather nascent.

Date: 14th April 2016

Alumnus pledges \$1,00,000 life insurance policy to IIT

Chennai: In a novel way of giving back to his alma mater, R Muralidharan, an alumnus of IIT Madras, has assigned his and his wife's life insurance policy valued at \$ 1,00,000 to the institution. As per the wish of Muralidharan and his wife, Girija, the funds vested will be used to support an institute chair professorship through an endowment. Muralidharan, who is eternally grateful that his education was subsidised to a large extent, said that he got a scholarship because somebody had the goodwill to finance it.

"I wanted to pledge my insurance policy in the form of an endowment that remains with IIT forever. Also, some scholarships, in the memory of my father, are coming up for students in certain semesters." He also added that in the US, it happens that people pledge insurance policies to other people, and also that he wishes if the idea of donating to the institute strikes many people.

Date: 28th April 2016

Kris names chair at IIT Madras

» IIT Madras alumnus Kris Gopalakrishnan has named the third Distinguished Chair in Computational Brain Research after retired Professor from the Department of Computer Science and Engineering, Prof C R Muthukrishnan. He had earlier set up three Chairs in computational brain research at IIT Madras, with an endowment of Rs 10 crore each.

Date: 19th June 2016



IIT-M finds fix for rocket engines

Chennai: A group of Indian Institute of Technology (IIT) Madras engineers has found a way out of thermoacoustic (heat and sound) instability that gas turbine and aerospace industry has been grappling with for decades and incurring losses of \$1 billion a year. The team has developed a host of precursors believed to be the world's first early warning system for gas turbine power plants and jet engines. The technology has enthused some of the major players across the world.

Full Report, Page 6

THE HINDU BusinessLine

Date: 3rd May 2016

IIT-Madras all set to score a centum

The premier institute is quietly marching towards incubating 100 start-ups

N RAMAKRISHNAN

It has been a steady progress towards a landmark, not a case of nervous nineties. And, it is just one short of a quiet, no-frills century.

Wonder what this is all about? Well, IIT-Madras is all set to cross the landmark of incubating 100 start-ups in the three incubators it has - IIT-M Incubation Cell, Rural Technology and Business Incubator (RTBI) and Bio-incubator. It will soon add a fourth incubator, one focussed on medical technology.

It is a matter of time before the 100th venture is admitted for incubation; the screening committee cleared the 99th just last week. In a month, the IIT gets anywhere between five and 15 applications for incubation, not all of which are sent to the committee consisting of faculty, alumni and those with domain expertise, for approval, according to Jamaswati Ghosh, CEO, IITM Incubation Cell.

Ghosh, a doctorate in bio-physics from Imperial College, London, worked with start-ups in Kenya for a while, before shifting base to Chennai and joining the IIT-M Incubation Cell as its head, when it started in 2013.

IIT Madras incubates ventures from across the board, with all of them being technology start-ups. Many of them are in core engineering sectors, quite a few in manufacturing and others that are building products. It also has start-ups in the medical devices space, education, agriculture, so-

cial media and cloud computing, according to her.

The IIT-M Incubation Cell, structured as a not-for-profit company, is an umbrella body as far as the start-up ecosystem at IIT-Madras is concerned; it coordinates various activities involving faculty, alumni-turned-mentors, industry, alumni who want to become entrepreneurs and student-entrepreneurs. It also ensures that policies are uniform across incubators, takes care of all legal formalities and the common support services provided by the incubation cell.

Open for all

The incubation system is open not just for students and alumni of IIT-Madras, others too can apply, but "we do insist on identifying the value add that you would get from the ecosystem," says Ghosh. This means a faculty member will be associated with the venture right from the start in some kind of advisory role or the venture needs to use IIT-M's resources for its initial product development. That link up with IIT-M has to be established right at

the beginning, she adds. The Incubation Cell gets funding from among others, the Department of Science and Technology and, now from companies, which are allowed to fund incubators located within academic institutions as part of their corporate social re-

spons used to from 3 ups, de are in, ventur pus ci availa

Who happens the Incubation Cell develops, says, there been a spin-off from t ous re labora in IITM businc tures, may t that t dents worki while their c

with supervision of the faculty. This includes companies such as Ather Energy and Planys Technologies.

"This is a huge change in the last three years, that research is getting translated into commercial need.

The ecosystem is pretty well linked up now compared to what it was before; that is one of the roles the Incubation Cell has played, linking the various bodies, says Ghosh. There is greater industry participation, in nurturing the ecosystem. For

Companies, says Ghosh, want to be more engaged with the ecosystem. They want to participate and mentor start-ups. "We are talking with various groups on holding hackathons, workshops, take-up problem statements from the industry and throw them to the student population.

ch focus

had a strong re quite some time, t few years, thanks es getting started anticipation, there ore instances of y to go-to-market. cepting, commercieir research work. ave worked in in y years are coming stitute to start off eir own, renewing their alma mater. all these developaz on campus has ed. Instead of the o which US univeriduates were headch large company e joining, it is now lon which start-up e joining or which e they are starting mselves. "We have am of IIT thinking at direction. The e mindset has ged so quickly and bly," says Ghosh. this kind of a mium, it is not just a ntury, even a doub e or even a triple century seems certain.



"We are talking with various groups on holding hackathons, workshops, take up problem statements from the industry and throw them to the start-ups and the student population."

JAMASWATI GHOSH, CEO, IITM Incubation Cell

Date: 6th June 2016

IIT Madras researchers dissolve silver using glucose water

R. PRASAD

In a finding that may have many implications, IIT Madras researchers have found that silver can slowly dissolve in water if heated to about 70 degree C in the presence of glucose. As much as 0.5 weight per cent of a silver plate can get dissolved in glucose water within a week. The results of a study were published recently in the journal *Angewandte Chemie*.

Like gold, silver is a noble metal and is therefore supposed to be inert (resistant to chemical corrosion, especially to chemical reagents used in daily life). However, Prof. T. Pradeep from the Department of Chemistry, IIT Madras and his team found that silver atoms gets released from a plate in a simple, two-step mechanism — silver ions are first formed at the metal surface, which later form specific metal complexes with sugar.

"Atoms are highly reactive on the surface of the metal as they less connected and less bound and this allows the atoms to be released," said Prof. Pradeep.

Metal dissolution leads to corrosion of the plate and nanoscale pits get formed on the plate. Further dissolution occurs at the pits and as a result the pits get bigger, making a polished silvery metal appear black. Under favourable conditions, up to 10 per cent of the metal can get dissolved in 90 days.

"We have been studying the effect of metals in food and how toxic metals get into our food chain



Dissolution of silver by glucose is enhanced by the presence of carbonates and phosphates. Photo: Special Arrangement.

from soil, water and fertilizers," he said. Silver foils are used to decorate sweets and often such foils are eaten along with the sweets. In the past, silver vessels were used for cooking and even today silver plates are used. "So we were curious to know the interaction of silver with foods especially sweets. So this prompted us to study the interaction of sugars with silver," Prof. Pradeep said.

Dissolution of silver by glucose directly from the metallic state gets enhanced in the presence of ions such as carbonate and phosphates. The study found that enhancement of silver dissolution in glucose was about 10 and 7 times in the presence of 50 ppm of phosphate and carbonate respectively. But in the absence of glucose,

phosphate and carbonate were found to have no significant effect on silver dissolution.

"We store water in vessels made of different metals. We don't know what happens to the water. When we cook food, especially using lots of spices that are reactive, we may be consuming some metal too. We are damaging the health of our population by using poor chemistry vessels," he warned.

"Chemistry of sugars at metal surfaces can have tremendous impact on our population if ingredients of steel, copper and brass can dissolve in water and get accumulated in our food. The extent to which dissolution occurs is much larger than the permissible limits of many metals in water," he stressed. While the presence of

certain metals at specific concentrations might be beneficial, it can be extremely toxic in the case of others.

An offshoot of the study is that the method can be used for developing novel and green extraction processes for noble metals. In general, toxic chemicals such as cyanide are used for extracting silver.

"The newly developed method can extract silver effectively by a simple and green method. It does not require any harmful chemicals or high temperature or expensive set-up," Prof. Pradeep said.

The study was performed by Ananya Baksi, a Postdoctoral Fellow under the direction of Prof. Pradeep.



THE TIMES OF INDIA

Date: 7th June 2016

IIT-M makes bio-friendly bone implant

Magnesium & Calcium Phosphate Up Durability

U.Tejonmayam@timesgroup.com

Chennai: Researchers at IIT-M have developed a bio-compatible bone implant that is more durable and less likely to have adverse health effects than conventional metal implants. Orthopaedic metal implants have come under scrutiny for their lack of safety and durability, and experts have for long been in pursuit of better materials that do not cause users side effects.

The wonder material that the IIT-M researchers have come up with is a combination of magnesium and calcium phosphate. They chose this

STRONG TO THE CORE

The new implants are bio-compatible and more durable than conventional metal implants used for replacing bone

CONVENTIONAL IMPLANTS

- Made of stainless steel or titanium alloy
- Metals release toxic metal ions and are not durable
- These implants may cause metal poisoning called metallosis, which results in extreme pain and inflammation



MATERIAL DEVELOPED AT IITM

- The core of the implant is made of magnesium, which has density that matches natural bone
- Coating of calcium phosphate over the magnesium implant prevents corrosion
- Tests have shown the implant is non-toxic and durable

combination because their physical properties are far closer to those of human bones than anything scientists have experimented with earlier. The element magnesium and the mineral calcium phosphate are also vital to the functioning of the human body.

This is not the first time that researchers have used magnesium for implants, but

make it durable," he said. "We used hydroxyapatite, a calcium phosphate mineral, for this because it is a primary mineral the body uses to build and strengthen bones."

To make customized implants, researchers developed specialised laser-guided equipment that uses a regular 3D printing method. A hot air gun controlled by a robotic arm deposits layers of powdered hydroxyapatite mixed with a polymer to help it bind to the magnesium.

The researchers conducted a wide variety of tests with the implants including its load-bearing ability, elasticity, compressive strength and toxicity. Prof. Soundarapandian said the tests revealed that the implant also promotes bone growth. "The implants have elements necessary for the body," he said. "This implant has a 50% greater life span than metal implants."

Prof. Soundarapandian

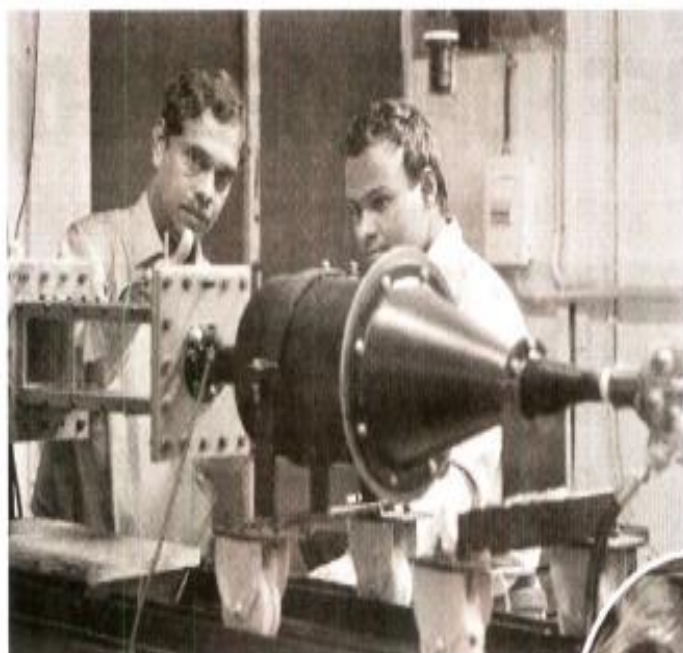
and his team are now waiting for ethical committee approval to run trials on animals. The team is simultaneously working to build implants with fibrin, a protein extracted from blood.

Orthopaedic Dr George Thomas said there have been cases of allergic reactions from metal implants although they've been very rare. The currently available implants are alloys of stainless steel or titanium.

"Implants currently available have done an excellent job. But they have problems like wear and scientists have been looking for solutions and alternatives for some time," he said.

"Researchers have in the past attempted to use other metals like shape-memory alloy (an alloy that 'remembers' its original shape and, when deformed and then heated, returns to that shape) and nickel but were not successful, Dr Thomas said.

Date: 3rd July 2016



Prof R J Sujith and his student Vishnu working on a turbulent combustor at the IIT Madras laboratory | EXPRESS

IIT-M develops warning system for gas turbines

Technology will prevent thermoacoustic instability, which triggers automatic shutdown in power plants

S V KRISHNA CHAITANYA
@Chennai

A group of engineers at the Indian Institute of Technology Madras (IIT-M) has cracked the elusive secret code of thermoacoustic instability, a problem that gas turbine and aerospace industry has been grappling with for decades, incurring losses to the tune of \$1 billion annually. The team has developed a host of precursors, dubbed as the world's first early warning system for gas turbine power plants and jet engines.

The technology has found interest among some of the major players in the sector, including the National Aeronautics and Space Administration

(NASA) and our own Indian Space Research Organisation (ISRO).

"We are exploring the process of working together with the ISRO. However, before we test the technology in aerospace sector, it will be tried first with ground-based engines like gas turbine power plants. We are now in talks with major gas turbine companies such as Ansaldo Energia, General Electric and Siemens to test the technology with real data. It needs lots of testing to root out any lacuna such as triggering of false alarms," Prof R J Sujith of the Department of Aerospace Engineering in IIT-M told *Express*. A key person behind the project, he recently visited NASA in this regard.

Prof Sujith said no technology is

available at present to help predict an impending instability in turbines.

The companies use pressure transducers to measure pressure fluctuations. After reaching the threshold point, the automatic controllers kick in and shut down the engines. Once the turbines are shut, it takes at least an hour to restart - a situation that is cumbersome and costly.

Contracts between the turbine manufacturers and power companies often require the manufacturers to bear the cost of such shutdowns and penalties incurred.

The situation is more critical when such instabilities arise in the engine of an aircraft or rocket, where the option to shut down the engine mid-air does not exist and severe vibrations or breakage of the engine can prove to be fatal. For such engines, extensive tests have to be run on-ground. However, a substantial number of these engines, especially for rockets, are destroyed while testing. "This is where our technology brings the radical change that industry has been craving for years. We can give several minutes of warning time, may be up to 20 minutes, for a power plant to take evasive action. For liquid rocket engines, it would probably be a few seconds, enough to stabilise the engine," he said.

However, Prof Sujith said it would take at least two to three years for the technology to develop into a full-fledged early warning system and for industrial consumption. The technology's robustness and protocols have to be established in the real scenario, which will take some time. "The companies will first provide historical data of thermoacoustic instabilities. Using the technology, we will try and predict the impending instabilities. This will give a tight understanding of the warning time and threshold limits," he said.

"We can also customise the system, according to the industry specifications. But we have not reached that stage yet," he said.



A WEEKLY UPDATE FROM INDIA'S FINEST RESEARCH INSTITUTES

Fuelling the future

PROF MUKESH DOBLE & TEAM
DEPARTMENT OF BIOTECHNOLOGY,
IIT MADRAS

DIESEL AUTOMOBILE engines have a problem of ignition during winters. It is a very common problem especially in the colder countries. Due to temperature drop, the diesel thickens and its flow, therefore, is reduced. As a result, the engines do not start. This problem occurs in automobiles mostly in North India during winter months.

This problem is commonly measured in terms of the fuel's 'pour point' and 'cloud point'. At lower temperatures, the ability to flow normally reduces.

Engineers have got around this problem by using certain chemical additives that ensure that the main fuel, diesel, does not thicken and its normal flow is maintained. These additives reduce the 'pour point' and 'cloud point'. These chemicals are regularly used with the fuel in colder countries. However, chemical additives have own problems in terms of their environmental impact.

India imports most of its automobile fuel, including diesel, from other countries. In its quest to reduce its import dependence, the government has been promoting the use of bio-diesel. At some places, Jatropha bio-diesel is already being mixed with diesel. There are plans to have a mandatory 5 per cent mix of Jatropha bio-diesel in all diesel sold in the country by the year 2020.

While it does reduce the import burden, bio-diesel leads to another problem. Bio-diesels typically have a higher 'pour point' and 'cloud point'. It means that if the flow of normal diesel gets hindered when the temperature drops to, say, 5 degrees Celsius, the flow of diesel having 5 per cent of Jatropha bio-diesel can experience the same problem at 20 degrees.

So as we go in for more and more bio-diesel mix, this problem of increasing 'pour point' and 'cloud point' will become

more widespread in India.

We at the Department of Biotechnology at IIT Madras have been working on, what are known as, surfactants for several years. They are compounds that reduce the surface tension of the liquid in which they are dissolved, thereby easing their flow through the material they are encased in. In particular, we have been working on biological surfactants as against the chemical ones that are currently being used.

After working with several possible candidates, we zeroed down to three or four possible bio-surfactants that we tested with commercial diesel and bio-diesel. One particular one almost completely neutralised the effects of low temperatures on bio-diesels. This particular

surfactant is extracted from a yeast called *Pseudzyma antarctica*. This yeast was originally isolated in the Antarctica region but is now found to be common elsewhere as well. Less than 1 per cent mix of this bio-surfactant in the bio-

diesel is seen to completely reverse the effect of addition of Jatropha bio-diesel on the 'pour point' and 'cloud point'. This bio-surfactant prevents the crystallisation of fatty acid esters in the fuel, thereby maintaining its normal flow. In addition, it is completely environment-friendly.

While this is an important breakthrough, we are still to test the impact of this bio-surfactant on the efficiency of the engine. It will never be accepted if it reduces the fuel efficiency by any significant amount. Since we are mixing it in very small proportions in the fuel, we do not expect any major impact on the efficiency but those tests are still to be done. We will be doing these tests in collaboration with the combustion engine lab at IIT to see how this bio-surfactant scores on that account.

For your research to be considered for this column, please write to Senior Editor Amitabh Sinha at amitabh.sinha@expressindia.com

THE RESEARCH

Testing biological compounds to neutralise the effects of low temperatures on bio-diesels

Date: 13th July 2016

IIT-M student's underwater robot 'Duli' catches attention of DRDO

SV KRISHNA CHAITANYA @Chennai

WITH robotics emerging as a major area of focus for military applications, especially the bio-inspired ones, countries across the globe are investing heavily in this domain. But, not many have tasted success so far.

However, Santhosh Ravichandran, an MS student specialising in machine design in the Department of Mechanical Engineering at IIT Madras, has developed a first-of-its-kind turtle-shaped Robotic Underwater Vehicle (ROV) with bio-inspired propeller similar to a dolphin fin in just three months.

Called 'Duli', a Sanskrit name for a turtle, it had immediately caught the attention of Defence Research Organisation (DRDO). The robot has unique hydrodynamics with exceptional energy efficiency and camouflage abilities suited for carrying out of underwater SEAL operations. It can do visual

inspection withstanding the undercurrent of the ocean, it is claimed.

Project supervisor and associate professor at IIT-M Prabhu Rajagopal said a DRDO lab was in talks. "They wanted us to install their own sensors and do certain modifications to suit military requirements," he said.

Santhosh said the currently available underwater robots are predominantly operated with mechanical thrusters, which gives only 30% energy efficiency (read output to input), while Duli with bio-inspired flap movement will give 70% efficiency similar to biological organisms like dolphins.



Currently available underwater robots are predominantly operated with mechanical thrusters, which gives only 30% energy efficiency, while Duli with bio-inspired flap movement will give 70% efficiency

Santhosh Ravichandran, MS student at IIT Madras

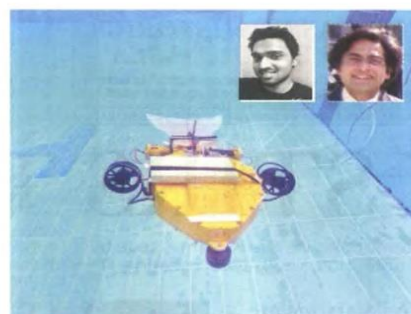


"We have exhibited the prototype at Underwater Interventions expo in United States in February this year. US navy, which is a participant, was all praise for our product and actually am in touch with them for any technical assistance. They also now plan to start a bio-inspired robotics programme," Santhosh said.

Rajagopal, who is also the director of Plan's Technologies, a spin-off start-up providing robotic services to port and shipping industry, said the product was still at preliminary stage and needed a lot of on-field testing to address several practical problems that might arise, but all the basics are covered. An autonomous version would be ready in a few months.

The novelty of the Duli is bio-inspired tail that could be used for rapid long motion which is eco-friendly. It will do sensitive jobs like surveying coral reefs without causing any disturbance to marine life. The mechanical pectoral thrusters are used only for manoeuvring. Usually bio-inspired designs suffer from complexities in control systems such as under-actuation, lower manoeuvrability.

Rajagopal said optimal shape of the caudal fin and its driving mechanism is currently being researched using computational fluid dynamics (CFD) simulations validated by experiments. Efforts are on to improve the hydrodynamic and mechanical dynamic performance of the vehicle with an improved hull design for robustness in a wide variety of applications.



Duli, the turtle-shaped Robotic Underwater Vehicle (ROV); (inset left) Santhosh Ravichandran, who developed the ROV, and his project supervisor Prabhu Rajagopal

Novel features

- It's India's first bio-inspired underwater robot with caudal fin
- Raspberry Pi, a credit-card size computer, forms the core to reduce cost of the unit. Raspberry Pi costs ₹5,000, while conventional mother board costs ₹6-7 lakh
- Automated version of Duli to be out in two months

Application areas

- Ports, shipping, oil and gas, pipelines, dams, bridges
- This hybrid design could potentially find applications in scientific exploration in biologically sensitive habitats, military missions, aquaculture and subsea oil and gas inspection tanks



Date: 8th August 2016

IIT Madras researchers develop instrumentation for cancer treatment

SHUBASHREE DESIKAN

One of the treatment modalities for cancer is hyperthermia. This is a method by which the temperature of a region containing tumour cells is raised above normal levels. Exposing cells to elevated temperature leads to cytotoxicity.

Hyperthermia can be used in several ways. According to the U.S. National Cancer Institute's website, it can be used for achieving hyperthermia locally by using an external applicator or by placing probes inside cavities to treat small areas; regionally, for large areas; or whole body, to treat metastatic cancer.

Some of the modalities are being used, such as in the treatment of peritoneal cavity (space inside the abdomen which contains intestines, stomach and liver) when the doctor uses an infusion of the area, during surgery, with heated anticancer drug.

Others such as using applicators regionally are in the process of being developed, as fabricating the antennae, or array of antennae, that can achieve this can present challenges in instrumentation.

Dr S. Krishnan, radiation on-

cologist at Apollo Hospitals, Chennai, says, "It [hyperthermia therapy] may not be very effective as a stand alone method but is good when used along with radiation therapy and chemotherapy."

A team from IIT Madras, led by Dr Kavitha Arunachalam, which has been working on developing instrumentation has made progress in designing and testing a prototype applicator.

According to Dr Arunachalam, when there is an array of antennae, the heat may be focussed into a greater depth than is possible with a single antenna. A "water bag" attached to the surface of the applicator cools down the skin from outside. Therefore, the resultant temperature profile shows a peaking at a certain depth which can be adjusted by the cooling process. "Hyperthermia is scarcely practised in India and has little influence on oncology practice and awareness regarding this treatment modality is low. One of the primary reasons is the lack of industry participation in device development," says Dr Arunachalam.

As Dr Krishnan says, "It [hyperthermia therapy] is also time-consuming. When a patient can undergo radiation treatment for just 15-20 minutes and get results,



The applicator being tested on the hands and neck of volunteers.

PHOTO: SPECIAL ARRANGEMENT

why should they go for a treatment that takes much longer and which is not proved also? However, if better antennae that can deliver heat efficiently are developed, it is welcome."

Dr Arunachalam's team is working on developing an array of body-contacting antennae which can deposit energy at a depth using microwave radiation. Microwaves have a larger wavelength in the tissue as compared to high-frequency acoustic waves and so can be used to target larger tumours which can range in size from few centimetres to several centimetres. Their achievement is in reducing the size of the antenna to suit the required frequency of operation at 434 Mega-

hertz. From the available large 10x10 cm square antenna, they have made progress to a circular one with radius 2 cm.

The team has conducted a pre-clinical pilot study of the energy coupling efficiency of the device on cancer patients and healthy volunteers, in collaboration with Dr K. Thayalan, Department of Radiation Oncology, Kamakshi Memorial Hospital, Chennai. When 1 milliwatt power was used, 85 per cent of it was used in heating the tissue in the head and neck region; it was 95 per cent in the case of breast tissue. Studies to evaluate safety and efficacy need to be carried out. The modalities for this are under way, according to Dr Arunachalam.

Date: 8th August 2016

Free online course from IIT Madras will teach you how to create mobile 'apps'

From booking a cab to buying groceries from the comfort of your home, mobile applications, popularly known as 'apps', have become an integral part of our everyday lives. In fact, sky is the limit when it comes to what all one can do with apps. Now, the Indian Institute of Technology Madras (IIT Madras) is offering an opportunity to all those with basic programming skills to learn app development in just five weeks. IIT Madras will start a free online course on Introduction to Modern Application Development (IMAD), from September, 5, 2016, which will be open to all. Short 20-minute course videos will be available online on YouTube and can be watched anytime. The course will have graded assignments, and a final test to help one remain focused through the course. Registration for the course has begun and can be done by visiting www.imad.tech.

Date: 15th August 2016

IIT Madras develops optical system to detect and monitor algal bloom

R. PRASAD

An integrated optical system capable of detecting and monitoring algal (or phytoplankton) blooms both spatially and temporally in coastal and open ocean waters has been developed by a team of researchers at the Indian Institute of Technology (IIT), Madras. Very soon, the Hyderabad-based Indian National Centre for Ocean Information Services (INCOIS) will begin using the optical system for detecting and monitoring algal blooms in ocean waters surrounding India. INCOIS is currently in the process of making the system operational.

Phytoplankton are the base of the aquatic food web, providing food and shelter for different organisms including fish. Along with other parameters, phytoplankton biomass (algal blooms) tends to behave as potential zones of fish aggregation. So identifying such algal blooms in real time using satellite data will greatly benefit the fishing community to zero in on fertile fishing locations.

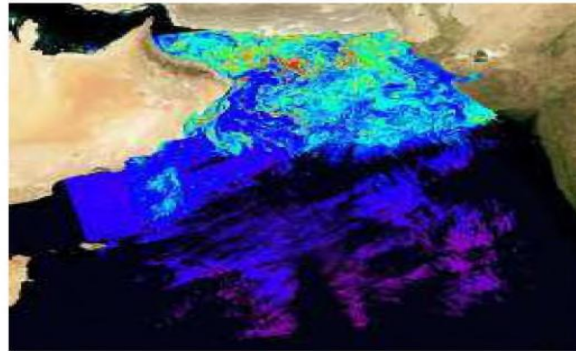
The optical system provides an array of optical parameters and spatial information regarding algal bloom density (chlorophyll) and their causative algal species that are commonly seen in coastal and oceanic waters around India, particularly in the Arabian Sea. Results of the study were published recently in the *Journal*

of *Geophysical Research: Oceans*.

"A few field-based techniques are available for studying algal blooms. But those techniques are limited in time and space besides being labour intensive, time-consuming and expensive, and hence they cannot be used for monitoring large water bodies. ISRO's Oceansat-2 satellite launched in 2009 can cover larger areas and provide global ocean colour observations," says Prof. Palanisamy Shanmugam, the senior author of the paper from the Department of Ocean Engineering, IIT Madras.

The optical-detection system developed by Prof. Shanmugam and his team uses the ocean colour satellite data, in situ measurements and underwater light field data collected from the field to provide algal species-specific information required for their monitoring and assessment.

Unlike the blooms that are found on the surface of water bodies, observing and monitoring subsurface blooms is particularly challenging. Conventional techniques fail when it comes to monitoring subsurface algal blooms. Though the optical-detection system was tested only to detect blooms from near surface waters, Prof. Shanmugam is confident that the optical system is capable of detecting and classifying blooms present under water. "We have not tested to what depth the optical system can be used. We are planning to carry out this study soon," he



DETECTING ALGAL BLOOM | NASA's MODIS-Aqua satellite captured on 18 February 2010 processed using a global algorithm developed by Prof. Shanmugam. Red, green and blue colour gradients depict very high algal bloom density, intermediate bloom density and very low bloom density

says. "We have tested and validated the results of this optical system with in situ measurements of the three algal blooms collected from the ocean waters. The average accuracy of our optical system which was developed in 2015 is over 85 per cent," he says. The uncertainty in accurately identifying the blooms was primarily due to lack of distinctive water colour, and absence of unique spectral features (in the backscattering coefficients caused by cases of less photosynthetic organisms), fluorescence and chlorophyll signatures associated with the bloom species.

The water colour is determined by particulate matter and dissolved substances in water, while fluorescence is to do with the light energy that gets absorbed by algae and re-emitted as fluorescence at a longer wavelength than the absorbed light.

Chlorophyll is used as a proxy for measuring the phytoplankton biomass. The increase in biomass of phytoplankton due to their increased growth or physical aggregation leads to algal blooms. Typically one dominant or a few phytoplankton species are involved in bloom formation.

Chlorophyll is used as a proxy for measuring the phytoplankton biomass

Some algal blooms including "red tides" and "blue-green blooms" are a serious concern because they can pose significant threats to water quality and risks to human and animal health.

All the major algal blooms are predominantly found to be associated with the cooler water masses off the western coast in the northern Arabian Sea. These blooms then spread into the central Arabian Sea along with a whirling motion of waters and currents. The blooms reach its peak spatial distribution between November and February and minimum in June to September. Strong upwelling along the Arabian Sea coast triggers initiation and growth of algal blooms, while enhanced cooling, vertical mixing, favourable winds, and atmospheric deposition of the mineral aerosols from surrounding deserts further aid its growth. The Bay of Bengal is relatively free of algal blooms except off the Ganges-Brahmaputra Estuarine Frontal system and estuarine and coastal regions where nutrients are abundant supply.

THE HINDU BusinessLine

Date: 17th March 2016

Tata Steel, IIT-Madras ink MoU for research in green energy

OUR BUREAU
Chennai, August 16

Tata Steel has signed a memorandum of understanding with IIT Madras to set up Tata Steel Advanced Materials Research Center, with initial focus on developing green energy and light weight technologies using carbon-based materials.

Anand Sen, President (Total Quality Management and Steel Business), Tata Steel, said the company has a similar MoU with IIT Bombay but for a different focus area, he told *BusinessLine* after signing the MoU with IIT Madras Director Bhaskar Ramamurthi.

Tata Steel has been collaborating with IIT Madras for many years on areas such as materials characterisation, heat transfer and process research, Sen said.

The centre will draw on ex-

pertise and knowledge within Tata Group for developing applications beyond steel. It will become the nucleus of advanced material research and technology development in India, he was quoted in a joint press release.

Materials discovered

Over the years, new materials have been engineered by research labs globally. These materials, called 'advanced' materials, provide unique combination of physical and chemical properties that were either absent or difficult to obtain using conventional materials, the release said.

According to IIT Madras Director Ramamurthi, the institute has faculty, students and equipment to provide next breakthrough in creating applications with new materials.



Anand Sen (left), President (TQM and Steel Business), Tata Steel, with Bhaskar Ramamurthi, Director, IIT-Madras, during the signing of the MoU, in Chennai on Tuesday BIJOY GHOSH

Date: 2nd September, 2016

The reinvention of IIT-Madras

How IIT-M rose up to #1 in India's first ever institutional ranking, and why, amidst many global round-the-year exercises, national ranking matters

SEEMA SINGH

02/09/16



For a middle class home, it may seem a shot from afar.

"You can run two bulbs, one fan, one tubelight, one television, and one cell phone charger. You can't run your grinder, cooler or refrigerator yet but we are getting there," says Ashok Jhunjhunwala professorially, adjusting his trousers over worn, open-toe sandals. Inside a model home at the Research Park, he gives a demo.

In his small audience is Tarun Mehta, founder of the two-year-old electric two-wheeler company Ather Energy, who, until recently, was building his e-scooter in the incubation cell a few floors up. The two exchange murmurs about a new battery engineering centre which is a hushed affair until the minister for power, Piyush Goyal, visits later in July.

The 125-watt solar panel outside and the energy load of appliances hooked-up to the micro-grid inside the model home don't add up. But that's where the ingenuity sits – in the Inverterless. Cleverly branded as Inverterless, it is a solar unit where the power generation, storage and distribution happen in direct current (DC), without any conversion to alternating current (AC) on which the world's grids run.

Most electronics devices today are DC but since the grid operates on AC, DC to AC conversion is the norm, as is the gross energy loss, sometimes as much as 50%.



THE TIMES OF INDIA

Date: 8th September, 2016

2 IIT-M alumni pay back their alma mater with \$1m donation

Manash.Gohain
@timesgroup.com

New Delhi: Two Silicon Valley-based alumni of IIT-Madras have donated \$1 million to fund guest faculty in Computer Science and Engineering to lead research projects.

The contribution by Anand Rajaraman and Venky Harinarayanan was announced at the 42nd International Conference on Very Large Data Bases in New Delhi on Wednesday.

The idea is to enhance teaching and research efforts in this area and help attract outstanding young faculty, students, research scholars and postdocs to the CSE Department at Indian Institutes of Technology, Madras.



Anand Rajaraman (L) and Venky Harinarayanan's contribution will be used to enhance teaching and research in IIT-M's CSE dept

Those chosen for the 'Venky Harinarayanan and Anand Rajaraman Visiting Chair Program' will have demonstrated thought leadership in his/ her chosen field, and are expected to have significant impact at IIT Madras on research thrusts in allied areas.

In order to ensure that the guest faculty are of high quality, an advisory commit-

tee consisting of Rajaraman, professor Jeff Ullman from Stanford and professor Randy Katz from UC-Berkeley has been constituted to help the CSE Department in screening and selection of the Chair Professor, as well as in the ongoing review and assessment process.

Rajaraman announced the initiative in his keynote address at the conference where he and Harinarayanan said, "Data-driven approaches are transforming the world we live in. The impact of data and algorithms is being felt in every field of human endeavor — industry, sciences, humanities, and government."

► Honoured to give back, P 4

IIT-M gets \$1m from alumni to fund research

Manash.Gohain
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New Delhi: Silicon Valley-based alumni of IIT Madras, Anand Rajaraman and Venky Harinarayanan, have donated \$1 million to create a corpus that will fund visiting chairs in computer science and engineering to lead research on data-driven approaches to solve important problems.

The idea is to help attract outstanding young faculty, students, research scholars and postdocs to the CSE department at IIT Madras.



THE TIMES OF INDIA

Date: 19th September, 2016

IIT-M beats peers in consultancy earnings

RAKING IN MOOLAH

Consultancy project details | Figures for IITs with over ₹5cr in consultancy projects in three years, as per NIRF 2016

Institute	2012-13	2013-14	2014-15	Total (In ₹Crore)	NIRF rank
IIT Madras	48.7	58.6	66.3	173.6	1
IIT Roorkee	35.8	40.5	42.9	119.2	6
IIT Delhi	23.9	41.7	38.1	103.7	4
IIT Bombay	29.8	31.6	30.6	92.0	2
IIT Kharagpur	14.5	12.9	15.5	42.9	3
IIT Kanpur	12.2	11.9	11.6	35.7	5
IIT Varanasi	3.9	4.7	3.8	12.3	14
IIT Guwahati	2.1	2.2	3.1	7.3	11

* NIRF: National Institutional Ranking Framework

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New Delhi: Indian Institute of Technology-Madras (IIT-M) bagged consultancy projects worth Rs 173.56 crore over the last three years, way ahead of other Indian engineering institutes.

According to the Union HRD ministry's National Institutional Ranking Framework (NIRF) report for 2016, Roorkee and Delhi are ranked second and third among the IITs vis-à-vis the worth of consultancy projects received. Together, the three IITs earned over Rs 396 crore through such projects.

In all, eight branches of the premier institute earned more than Rs 5 crore individually in consultancy projects over the past three years.

The fact that it was the first IIT to set up an 'Industrial Consultancy Centre', way back in 1973, is perhaps the reason why IIT-M has emerged as the preferred choice for industry and government organisations for consultancy projects. "Our Industrial Consultancy Centre was set up way back in the 70s, when it primarily dealt in civil, ports and automobile engineering. Gradually, it diversified to other areas, including pharmaceuticals,"

professor Bhaskar Ramamurthy, IIT-M director, told TOI.

According to the NIRF 2016 rankings, the institute is also the top-ranked engineering institution in India.

At IIT-M, over 45% of the faculty are engaged in industrial consultancy and "in the next four to five years, we aim to take this to 60%", Ramamurthy said.

In all, 92 projects have so far been accepted by the government under the Uchhatar Avishkar Yojana (UAY), rolled out with an aim to boost research while giving students of premier institutes a more market-oriented mindset, at an expense of Rs 282 crore.

Date: 24th September 2016

SPACE JAM

As satellites built by students begin to dot the skies at seamless intervals, India's dreams of exploring the final frontier are now cradled in colleges, write Nikita Puri and T E Narasimhan



(Clockwise from top left) The SRMSat launched by students of SRM University in Chennai; PISAT, developed by students of PES University, before its final touches; a graphic representation of PISAT; the team working on PISAT at CoRI in PES University; students at IIT-Madras who developed a nanosatellite that will be launched by the end of this year

For the past few months, Bengaluru-based research associate Kavya Shree has been consistently tracking two of Indian Space Research Organisation's (Isro) satellites, the Oceansat-2 and Cartosat-2. "It's for practice," she says.

At 9:42 am on September 26, if all goes as planned, Isro will use its reliable Polar Satellite Launch Vehicle, PSLV-C35, to fire a 377-kg satellite called SCATSAT-1 for ocean and weather-related studies from the Satish Dhawan Space Centre SHAR, Sriharikota. While SCATSAT-1 will have five foreign co-passengers from Algeria, Canada and the US, piggybacking along on the PSLV will be two student satellites: Pratham from the Indian Institute of Technology Bombay and PISAT from PES University in Bengaluru.

When PISAT first comes over Karnataka's airspace somewhere between 9 pm and 10 pm on the night of September 26, it will be up to Shree and a team of other students from PES to make contact with the satellite and track it as it hovers 680 km to 720 km over the earth.

There are graphs and beeping machines everywhere at Shree's workspace on the eighth floor of the Panini block at PES. Her workspace is the ground control station, or the PISAT Satellite Control Facility. On the roof of this floor, a parabolic dish with a diameter of 3.7 m steadily makes its rotations. "That'll help us get in touch with PISAT," says V Sarnasiva Rao, a professor at PES University who has been instrumental in building this ground control system. Rao was with Isro for 37 years before he took up teaching.

In the basement of the building lies CoRI, or the Centre of Research & Innovation, the lab where PISAT was conceptualised. Within this lab, there's another, more secluded workspace. Four students in crystal blue lab coats zealously work on circuit systems and different monitors here. As we enter, two of these students hurriedly approach and hand us fresh anti-static coats. As students personally vested in building spacecraft, their concern is that human bodies, which carry a lot of charge, could harm the sensitive components in the room.

Even as they formulate plans for the next satellite, an updated version of PISAT, the students are busy checking if everything is on track with the cube satellite that was moved to Sriharikota over two weeks ago to be integrated with the PSLV-C35. Their 5-kg nanosatellite carries an imaging camera to capture an imagery of 185 km x 135 km area with about 80m/pixel resolution. Simply put, this satellite will take pictures of Earth that can be downloaded at scheduled times at CoRI.

After PISAT was tested at Isro, six students accompanied the satellite to Sriharikota and spent a week there, working alongside

scientists on the launch.

"Since they have jammers at the space centre, these students had absolutely no signals to make calls or update their Facebook profiles about being at the launch centre. It was the most restricted area they had ever seen," says Divya Rao, associate professor at the college and a core member of Team PISAT. At this, the students quickly overcome their diffidence and pitch in.

"We couldn't click any photos since the area was restricted, but we've come back with a lot of stories," says Gaurav Agarwal, a student who was at Sriharikota, adding that he's lost count of the number of times he's repeated the stories. "I stay in the boys' hostel, so we've been up every night talking about our experiences there."

The best part of being at Sriharikota, says Agarwal, was interacting with scientists during the test cycles that can take up to 36 hours. "They told us about their ongoing researches and asked us about ours," he says. "We learnt that there's no reason we should ever back down because there's a solution to every problem."

PISAT's journey began in 2011 with the establishment of CoRI. Over these years, about 250 students have been involved in the satellite's development. "The biggest challenge for us as a private university was funding the project," says Vinod Agnawal, CoRI director who was with Isro for over 46 years. Four other colleges pitched in with funds for PISAT, and in

exchange, their students were also involved in its making. While the satellite cost about ₹35 lakh, setting up the support system to build it cost about ₹1.25 crore.

The idea behind student satellites, explains Isro spokesperson Deviprasad Karnik, "is to encourage educational institutions and the student community to have a hands-on experience when it comes to building spacecraft." Isro provides students with expert guidance once their proposals have been accepted. It also gives them access to testing procedures.

Since April 2009, Isro has launched six student satellites: PISAT and IIT-Bombay's Pratham will boost this count on Monday.

Pratham's story began eight years ago when aerospace engineering students Saptarshi Bandyopadhyay and Shashank Tamaskar approached the institute with the idea of building a satellite. They started by partially setting up a ground station and zeroing in on a payload (core functionality), before convincing Isro to back the idea. Financed by IIT Bombay and Isro, it cost about ₹1.5 crore to build Pratham.

A small cube, Pratham's payload is to measure the total electron content (TEC) of the ionosphere and create a tomographic map of TEC over India. Radio waves are affected by the presence of electrons. TEC maps can also be used to estimate the GPS signal delay. Pratham is expected to survive the forces of space for at least four months.

The lab on the ground floor of the aerospace engineering department has become home to various groups of students who've been a part of Pratham's making. "There are no fixed hours, but team members spend an average of two to three hours daily on the project," says Ratnesh Mishra, the current project manager. "Sometimes, they pull all-nighters, working until 3 am and going straight to class in the morning after a nap."

Most of the 30-member team gathers here on Tuesdays and Fridays to fine-tune the design. Students are encouraged to arrive at a solution themselves before approaching the faculty. Much like PISAT, Pratham is an interdisciplinary team comprising students from electrical, mechanical, chemical, civil engineering, physics and aerospace departments. The boundaries between work and pleasure

are blurred here: a basketball, a cricket bat and a large weathered couch are part of the décor. A speaker is reserved solely for music. A poster next to the whiteboard used for chalking out plans reads: "There is no free lunch." On their Facebook page, posts announcing dates and results of recruitment tests are spruced up to include media coverage on Pratham.

Michael Griffin, American physicist and former administrator of NASA, has acknowledged the project in an e-mail to the institute: "When I was in college, I was building radios — not satellites! My two visits to India have left me more than a little impressed with Indian aerospace engineers."

Pratham was to be launched by 2010, then it got pushed to 2012. Manpower issues, administrative affairs and technical glitches were some of the reasons for delay. What also hurt was that after seniors graduated, the project was left in the hands of an inexperienced team that had to tackle academics and catch up on the satellite's development. In 2012, the students reportedly considered closing the programme but decided against it because too much work had already gone into it.

After its launch, data from the satellite will be analysed at the institute and will later be made available as an open-source material, says Mishra. The satellite-making project has benefited students in many ways. "On the technical side, you understand not just how one sub-section of the satellite works but also how it interacts with other sub-sections. You see the bigger picture," adds Mishra.

Another satellite scheduled to be launched later this year is from IIT-Madras. This project started six years ago when three students approached the institute, but it took some time for the faculty to come on board. The main challenge, says R David Kolipillai, dean (planning), was to ensure that the project didn't gradually die out when the students graduated. While the current team for the project is of 30 students, 300-odd students have been a part of it.

Akshay Gulati, who joined IIT-Madras in 2007, was one of the three who had first pitched the idea; he had assured he'd stay back till the project's completion. And he did, turning down job offers from agencies, including Infosys. If the testing goes as planned, IIT-Madras will be sending out a nanosatellite by the end of this year. Set to be placed at a height of 600 km to 800 km, the satellite's goal is to study the energy spectrum of charged particles in the upper ionosphere and understand the effects of solar and lightning storms, besides seismic activity.

While the seed fund came from the college, IIT alumni stepped in to pay for the satellite's cost, of which is estimated to be around ₹3 crore. Reportedly, a few gave in as much as ₹50 lakh. "We owed it to the institution and the alumni (which) infused so much of money) to finish what we started," says Gulati.

Around the same time as IIT-Madras, students at Sathyabama University, Chennai, had also started work on a satellite. Costing about ₹1.5 crore, this satellite was launched in June to monitor the concentration of greenhouse gases. The next step for these students is to establish a centre to share their learnings.

The opportunity to take on a new challenge, feels Kuldeep Barah, draws many students to space research. Barah, who comes from a family of farmers, is the first in his family to



KAVYASHREE'S (ABOVE) WORKSPACE AT PES IS THE GROUND CONTROL STATION FOR THE SATELLITE

pursue engineering and is currently enrolled at SRM University, Chennai. His college had sent out a satellite in 2011 to study global warming and pollution. The 21-year-old is now part of SRM's team that is working

towards sending a satellite to the Moon. On the orientation day, when Barah heard about the success of SRM's satellite, he realised that's what he wanted to do. Space research, he emphasises, has become the focus of his life. The student labs where the satellites were designed have become a strange mix of information in binary data and dreams of conquering the final frontier. For many, their seniors may have started these projects, but spending their nights and vacations building a satellite of their own is a legacy these young minds are proud to be a part of.

"They've had to closely study and rework designs; they've had to look at the practical implementations of everything and think outside the box," says Agarwal, the head of CoRI. "These students are better prepared to take on whatever life throws at them. They have become problem-solvers."

Ranjita Ganesan contributed to this article



This dish on the roof of PES University will establish contact with PISAT

AUTOMOTIVE RESEARCH CENTRE AT IIT-MADRAS TO WORK WITH GERMAN BODY

CHENNAI: The Indian Institute of Technology (IIT)-Madras will set up an Applied Centre for Advanced Automotive Research Centre in partnership with Fraunhofer Gesellschaft of Germany on its campus here, the premier institute has said.

"The centre will focus on solutions to the automotive industries with our talent and delivery mechanism of Fraunhofer," said the institute in a statement here.

An agreement was signed here by IIT-Madras Director Bhaskar Ramamurthi and Fraunhofer Institute for Machine Tools and Forming Technology Head Dirk Landgrebe for establishing the research centre. The centre will conduct research on new frontiers such as light-weighting, advanced manufacturing, emission, engineering design, novel materials, noise, vibration and harshness (NVH), which are of interest to the automotive sector.

The centre will be developed in collaboration with the Department of Heavy Industries and industry partners, including manufacturers and automobile associations.

"The centre of excellence will deliver solutions to the industry in a time-bound manner. We will also reach to the industry to understand its requirements and find solutions to its problems," said IIT Dean K. Balasubramanian on the occasion. Fraunhofer has been in India since seven years, collaborating with the Indian industry and the government to strengthen its engagements in the country.

"Our institute has been at the forefront of developing cutting-edge applied research in the range of production technologies," said Landgrebe in the statement. **IAN S**

IIT-M makes life easy for cardiovascular patients

VAISHNAVI GIRISH

Hyderabad: Indian Institute of Technology, Madras (IIT-M) signed a memorandum of understanding (MoU) with M/s Synkro Max Biotech Pvt Ltd (SMBPL) on Wednesday for Technology Transfer to develop organic surgical patches. The MoU was signed by Prof Krishnan Balasubramanian, Dean, ICSR, IIT-Madras and C V Seshadri, MD, SMBPL.

The main aim of MoU is to

tice for its inherent properties. It is the first of its kind in India and whole of Asia," said, Venkatesh Balasubramanian, Professor, Department of Engineering Design at IIT-M.

"It is always a desire that the philosophical work done as a Doctoral thesis is inventive and innovative. Having a cardiac surgeon of long standing, choosing to take a change in career to research is even better. The bedrock of the dissertation work was to work on a product not as

SMBPL are taking this technology to offer SynkroScaff, a product conceived, researched, designed, developed and made in India for the world," he added.

Sharing her views on the technology transfer, Dr. Soma Guhathakurta, Adjunct Professor of IIT Madras and Director of Bio-engineering Division of SMBPL, said, "India's import dependency on medical devices is over 80 per cent. At Bio-engineering Division of SMBPL, our main scientific objective is to indigenously develop versatile biological devices and reduce import dependency. We adapt the principles of regenerative medicine, materials science and engineering to develop biological substitutes that can restore and maintain physiological function. The growing need of the cardiac patches in our country made us develop SynkroScaff—a Tissue-Engineered Bovine Pericardial Patch using indigenous technology originally sprouted out of my doctoral research in IIT-Madras under the guidance of Prof Venkatesh Balasubramanian. SynkroScaff is the first of its kind in Asia and will be manufactured in a facility complying with cGMP standards."

"Synkro Scaff has got versatile use to achieve anatomical correction of the heart and its blood vessels deformities and deficiencies. Its applications are immense in cardiovascular as well as in many other surgical practices. Experimental efforts are currently underway at Bio-engineering division, involving tissue-engineered products at different stages of development," he added.



L to R Prof Krishnan Balasubramanian, Dean, ICSR, IIT Madras, R Sundaram, CTO, ICSR, IIT Madras, Prof Venkatesh Balasubramanian, IIT Madras (sitting), C V Seshadri, MD, SMBPL, Dr Soma Guhathakurta

transfer organic surgical patches technology developed by the IIT-M students.

"Researchers at IIT-M had developed a tissue-engineered indigenous pericardial patch, which is superior in many aspects having the property of regeneration and integration in the body and ease of handling by surgeons. In a way, it is a lifesaving implant for critical cardiovascular patients with anatomical and structural deficiency in the system. In future, it may be applicable for many other areas of surgical prac-

an incremental improvement but a disruption that will stand longer after both of us were gone. In that pursuit, a methodology to process the core material that is used a patch in various surgical procedures was developed. This was possible by an innovative processing of xenogeneic tissue for human usage. While the doctoral work won the best thesis award from INSA in 2008, the true victory is when it is available as surgical patch for the world, Made in India. It is indeed a pleasure that Dr. Soma Guhathakurtha and

Date: 4th November 2016

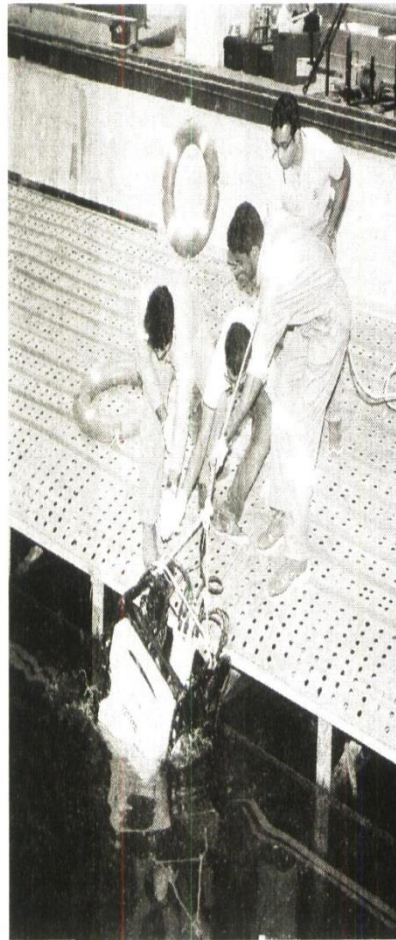
19th November 2016

International Day fest held in IIT Madras

Chennai: The office of International Relations in the IIT-Madras celebrated the fifth edition of the 'International Day' on Thursday with foreign students from Germany, Japan, China, Spain and so on. It included

various cultural activities and also foodstalls put up by respective countries. The foreign students also walked the ramp in their traditional attire and danced to Bollywood tunes. The multicultural

festival included games for campus community and students, German song, Chinese song, Bollywood dance, traditional Zimbabwe dance and so on. Yumi Abe and Noriko Ishibashi, both from Japan, were busy making a delicacy named 'udong'. **ENS**



A demonstration of the indigenously built cost-effective compact Remotely Operated Vehicle (ROV) for submersible inspection | EXPRESS

Indigenous underwater ROV launched at IIT-M

EXPRESS NEWS SERVICE
@ Chennai

COMMONLY found in the Arctic ocean, Beluga whales are unique for emitting high-frequency noises with which they communicate with one another. But thousands of miles away here in Chennai, a different 'Beluga' is ready to take off into the deep oceans.

Developed by Planys Technologies, Beluga is an indigenously built Remotely Operated Vehicle (ROV) that can provide submersible inspection and survey solutions. It was launched on Friday at IIT Madras, where the company had its roots in the institute's incubator cell. Coming after the launch of an earlier ROV, named Mike, the firm has become a pioneer in developing compact underwater ROVs capable of non-destructive testing.

According to Tanuj Jhunjhunwala, co-founder and CEO of Planys, Beluga offers submersible robotic inspection for offshore structures. With several features onboard, the ROV has been tout-

ed to be specifically designed for the oil/gas and shipping sector. It has a sonar system, which helps to construct 3D images of submerged structures. An ultrasonic measurement equipment has been installed to help the structure's health. High-definition cameras will help capture clear videos. "It is a powerful vehicle which can go to depths as low as 200 metres and can carry out accurate inspection," Tanuj said. It is best suited to check offshore oil rigs, ships and dams, to check structural strength, he added.

The earlier Mike, which only offers visual inspection capability, has been operated for more than 1000 hours and has been deployed in several ports of the country. The ROV has also been used at Sathanur dam.

"It took six months to design, manufacture and test 'Beluga', which is 4-5 times cheaper than the international market rate, which is currently upwards of ₹1 crore," said Pulkit Agarwal, Product Development Lead, an IIT Madras alumni.

BusinessLine

Date: 22nd November 2016

IIT-M report paints a healthy picture of start-up ecosystem

OUR BUREAU

Chennai, November 21

An IIT-Madras report on the entrepreneurial ecosystem in the country reaffirms that the start-up world is active and buzzing — there are more individuals turning angel investors, the amount the angels invest is going up, more start-ups are being founded and many more of these are getting funded. However, the percentage of ventures that attract subsequent rounds of funding has dropped significantly.

Titled 'India Venture Capital and Private Equity report: Inspiration and momentum for the gladiators; a study and analysis of the start-up industry', the report by the Department of Management Studies highlights two concerns. One, the development of the ecosystem has been restricted to a few States and within these States, only to the capitals. "The velocity of trickling down to other cities has been very slow," it points out. Two, "the growth in the number of investors and the amount of investment has been significantly high, which cannot be sustainable in the long run."

Such exuberance, the report says, can have undesir-

Raises concerns over ventures being restricted to a few States, and sustainable investments

able side effects. For instance, many naïve investors can get attracted by the euphoria of investing in start-ups, without fully being aware of the risks involved. From a situation a few years ago, when founders and members of the industry complained of the lack of seed and early-stage funding, the pendulum has swung the other way now, says the report.

Because of the "spray and pray" practice of some investors — that of making small investments but not showing the required commitment — these investors tend to move away from making such investments if they are disappointed by the outcome, resulting in dwindling investments in start-ups.

Analysing angel deals, the report reveals a continuous increase in the number of deals between 2008 and 2015 — from 103 deals in the 2008-10 period to 2,790 in 2013-15. "The fact that so many angels are making investments in



Analysing the trends in start-up funding from all sources, the report says investment picks up slowly in each sector, reaches a peak and tapers off SHUTTERSTOCK.COM

start-ups has been one of the biggest changes in the entrepreneurial ecosystem in recent years," it adds.

During this period, the amount invested by angels grew from ₹36.8 crore in 2008-10 to ₹4,321.7 crore in 2013-15, while the number of angel investors increased from six in 2008 to 978 in 2015. Another development as far as angel investors go is the forming of networks, such as the Indian Angel Network, Mumbai Angels, Chennai Angels and the Keiretsu Forum, which is a global net-

work of angel investors headquartered in the US and with chapters in different countries.

According to the report, the average investment in an angel round has increased nearly four times between 2009 and 2015, from ₹1.06 crore to ₹4.67 crore. The study also finds that the average age of the start-up at the time of receiving the angel funding has decreased markedly — from 4.77 years in 2008 to around half a year in 2015. As is to be expected, given the trend in the nature

of start-ups, ventures in the software and internet services account for the largest number of angel deals, followed by internet marketplace and e-commerce, whose share has shown an increasing trend of late.

Analysing the trends in start-up funding from all sources — angels, angel networks and venture funds — the report says investment picks up slowly in each sector (possibly a period of learning and understanding for both the entrepreneur and the investor) and re-

aches a peak and tapers. "It is clearly evident that entrepreneurs have a better chance of getting funded during the growth period of the sector," the report says, and adds: "The sector that has bucked the trend has been the software and internet services sector."

Start-up gap

Clearly, Bengaluru, Mumbai and the National Capital Region lead in terms of start-ups getting funded, and over the years, the gap between these three cities and the others — Chennai, Hyderabad and Jaipur — has considerably increased. To ensure that the gap does not widen further, the report suggests that policy makers should identify components of the entrepreneurial ecosystem in cities such as Bengaluru that make more start-ups get funded.

Dealing with follow-on rounds of funding, the report says only one in every 875 start-ups that get founded, or a mere 0.11 per cent, is able to raise four or more rounds of funding. Out of the total start-ups that get founded, about 6 per cent have been part of an accelerator or incubation programme.



THE TIMES OF INDIA

Date: 25th November 2016

IIT-M to help CERN unravel mysteries of universe

U.Tejonmayam@timesgroup.com

Chennai: In 2025, when scientists at CERN, the European Organisation for Nuclear Research, start looking for signs of a new charged particle from the massive 14,000-tonne CMS (Compact Muon Solenoid) detector installed in France, a silicon tracker detector built by Indian Institute of Technology Madras (IIT-M) will be among the key tools. Data from the main detector 100m below ground may help scientists understand the evolution of the universe better.

The silicon detector made by IIT-M will replace the existing detector when it dies out by 2025. IIT-M professor

INSTITUTE TO BUILD DETECTOR

► **CMS (Compact Muon Solenoid) is a particle physics experiment** that will help scientists understand how the universe evolved and more

► **Silicon tracker detector, which is built by IIT-M,** is one of the four sub-detectors to be installed in the CMS detector in France as part of CMS experiment at CERN, the European Organisation for Nuclear Research



► **The silicon detector will help scientists track new particles** along with other particles

► **It will be installed in the main CMS detector by 2025**

► **India will also manufacture 2,000 sensors** for the detector

Prafulla Kumar Behera, who is the co-convenor, B-physics subgroup in CMS, said the institute would build part of the silicon detector in col-

laboration with other Indian institutes. The silicon detector will be one of the four sub-detectors in the main CMS detector.

"IIT-M will fabricate high-precision mechanics made of aluminum carbon fibre and carbon fibre. They are lightweight material that support structure for the sensors in the detector," he said.

This is not the first time a detector for CERN is being built in India. A part of a detector for the Large Hadron Collider, which helped scientists discover Higgs Boson in 2012, was built in India.

A CMS detector is designed to see a wide range of particles produced during high-energy collision of protons. When this happens, scientists will essentially be recreating a very small model of the state of the universe when it was in the first tril-

lionth of a second after the Big Bang. The silicon detector, which will be installed near the collision point, will give the position of the particle when it travelled through the detector. The magnetic field in the CMS detector will help find the momentum of the particle. For physicists, this data is the key as it will help draw a picture of events at the heart of the collision.

IIT-M became the first IIT to be made a full member of the experiment at CERN in 2014 involved in validation of the high level trigger and silicon tracker calibration. The team comprises four faculty members and nine students.

► **Will be made in India, P 5**

Business Standard

Date: 25th November 2016

IIT Madras patent filings increase by 33%

TE NARASIMHAN

Chennai, 24 November

The patent filings by Indian Institute of Technology, Madras (IIT-M) has recorded an increase of 33% to 93 filings during 2015-16, against 70 last year.

The Electronic System & Design Manufacturing (ESDM) sector has the highest number of patent filings among the

industrial sectors in which these patents were filed, with 18 patent applications during the year. Institute has also topped among the IITs in the country, with the highest number of patent filings, with around 248 patent applications so far, out of which 13 has been approved. According to reports quoting Ministry of Human Resource Development, in September, IIT Bombay follows with a total of 205 patent

applications of which 10 were approved.

"The actual effort to preserve the Intellectual Property generated in IIT Madras was started at the end of 2012 or in the beginning of 2013. Till then, the faculties were focusing on publishing papers and after that, it has changed to first filing the patent and later publishing," said Krishnan Balasubramanian, dean of Industrial Consultancy & Sponsored Research.



THE TIMES OF INDIA

Date: 28th December 2016

'15% of IIT-M grads start own ventures'

TIMES NEWS NETWORK

Chennai: Nearly 15% of students graduating from IIT-Madras venture into entrepreneurship, with over 40% of faculty members of the institute being involved in entrepreneurship activities, the institute announced on Tuesday, during the Reunion Day celebrations. Over 500 alumni participated in the event.

Speaking on 'Entrepreneurship at IIT-M', Ashok Jhunjhunwala, the institute's chair professor and faculty-in-charge of IIT-M incubation cell, said the research park and the entrepreneurial ecosystem at IIT Madras had become a driving force in the startup ecosystem of the country. He shared the figures to show the rise in entrepreneurial leaning from both the institute's students and faculty members.

R Nagarajan, dean, International and Alumni Relations, IIT Madras, said the institute witnessed a tremendous upsurge in alumni relations in the last decade, both in number as well as nature of connections.

Bhaskar Ramamurthi, director, IIT Madras, said the strength of students pursuing post-graduation and doctoral studies at IIT Madras is more than those pursuing their under graduate courses. "Students nowadays have much more flexibility in the courses and electives they can opt for," said Ramamurthi.

THE NEW

INDIAN EXPRESS

Date: 1st January 2017

With IIT-M students' touch, plastic bottles transform into construction materials



A bench built using plastic bottles filled with sand at Taramani | MARTIN LOUIS

S V KRISHNA CHAITANYA@Chennai

IN a novel initiative, a group of students from Indian Institute of Technology (IIT) Madras have embarked on a social campaign that converts one problem into a solution for the other. They have transformed thousands of discarded plastic water bottles collected from city restaurants into durable construction material and are planning to build toilets in rural areas. The first such 'bottle' toilet is going to come up in Bandikavanoor in Sholavaram taluk in Thiruvallur district.

The idea was conceptualised as part of 18th edition of four-day Shastra-2017, which is one of

the Asia's largest student-managed technical festival that commenced on Saturday. As per WHO/UNICEF Joint Monitoring Programme, 2015, 44% of India's population is still defecating in open risking health, dignity and safety every day.

"We have two grave issues. One, defecating in open and other piling of plastic bottle waste. So among several social campaign ideas that were discussed under SYNK (realise, reuse, reform) as part of Shastra this year, we decided to take up these two issues and find solution," said Atul Chreyas, SYNK coordinator, to the Express.

The beauty of this technique

lies in its simplicity. Students have first filled the PET bottles with coarse sand (Savudu) and water. Later, they drained the water to ensure there is no gap between the sand crystals and filled with more sand to the brim. Now, 400 ml discarded plastic bottle weighs 800 grams and is a substitute for the bricks.

Another student, W Keerthana, said the basic compressibility tests show the bricks and these plastic bottles are equal in strength. "To prove our idea, we have built a bench in front of Taramani guest house inside the IIT Madras campus and will be carrying out a few tests before going ahead with the construction of toilets," she said. Students say the PET bottle can be built in just a couple of days for ₹18,000.

You can help

Students said the bottles required for these toilets will be collected through multiple collection boxes in various restaurants and through several collection drives. Already, 10 restaurants including Green Park in Vadapalani and The Westin in Velechery are collaborating with the students. Students are inviting more restaurants, lodges, companies and NGOs to participate and provide bottles that create a sink of these waste, which is harmful for the environment.

Focus on accessibility

IIT Madras Students Udith Krishna and Ramprashanth, who are the head organisers of the summit, said the aim of the summit was to identify the problems faced by people with disabilities and find solutions to make products, services and environments accessible

The summit is a competition where 35 students have been selected from a large pool of applicants

There are two tracks to the summit - the policy proposal track which tackles a real life problem for which the participants have to present a detailed solution and a social enterprise competition where any accessibility-related venture can take part.

The highlight of the summit is The first ever hackathon for the visually impaired. Students of IIT Madras have associated with professors from MIT and UC Berkely to train 20 visually impaired students to code in python for the past two months. Along with 20 beginners, there are intermediate and expert visually impaired coders from Stanford University and Bangalore who will also showcase their projects



Date: 2nd January 2017

MECHANICS OF THE WILD

NATURAL SELECTION: IIT-M DEVELOPS STEALTH SHIPS

Lessons From Dolphin, Fish Help Make Vessels Smarter

U.Tejonmayam@timesgroup.com

If only one could soar with the birds on a whim or dive into the deep blue sea with the fish. Man has always looked to nature for inspiration to do things distinctly unlike humans. So we've had the Icarus [late, of tragic legend] and the Wright brothers [of more recent and well documented success].

The Wright brothers were the first to learn everything they needed to know from birds, how to be able to fly and carry objects that are heavier than air — slats, wingtips, tailwings, empennage, horizontal and vertical stabilisers, updrafts and downdrafts and thermals. We've also reproduced vessels that can sail the high seas from the lessons that waterborne creatures have taught us.

Well, almost. Evolution, you see, has had a jump on us of a few thousand years during which people developed the skills and tools required. And imitating nature has on occasion had devastating consequences.

One of the theories regarding the sinking of British liner *Titanic* in 1912 was that its rudder was not efficient enough to prevent what was then the largest ship in the world from the striking the iceberg and claiming the lives of more than 1,500 people.

With a less conventional rudder, scientists at Indian Institute of Technology-Madras hope to develop fin-like blades, inspired by animals like penguins, turtles and fish, which can be super-efficient propellers and whip-lash-like rudders. These blades respond faster to commands and their dual functions mean they can turn on a dime and save on fuel consumption. The bio-inspired propulsion systems can be used in ships remotely, underwater and in aerial vehicles as well.

Just like aquatic animals that navigate without a ripple on the water's surface, these systems can steer a vessel underwater without creating a disturbance — making them hard to detect. Vehicles with these systems are stealthy — the current buzzword in military hardware.

IIT-M's department of ocean engineering P Krishnankutty says aquatic animals make use of a variety of propulsion systems but the IIT-M team focused particularly on penguins and fish, which have better hydrodynamics and cause less disturbance.

Research scholar M N Praveen Babu said the penguin-inspired system has two fins that use the pressure difference between the upper and the lower surface

REVERSE MECHANICS

UNDERWATER VEHICLE

- Two side (pectoral) fins near to the fore end along with a tail fin inspired by fishes
- It can stabilize, control and produce thrust
- While the side fins rotate and swing, the tail fin sways
- The tail produces more thrust than the side fin

PROPELLER SHIP

- Two flapping fin-like blades inspired by penguins and turtles
- It will also rotate and swing to move forward
- The fins work on the pressure difference created between the upper and the lower surface of the fins

PROPELLERS

MAN MADE VS DEEP-SEA AQUATIC

Efficiency	65%	80%
> Harms environment		> Ecologically friendly
> Conspicuous		> Less conspicuous
> Stopping ability		> Stopping ability

15L

(20L for large displacement vessels)

Instantaneous braking

APPLICATIONS

PROPELLERS | Bio-inspired propulsion systems can be used in aerial vehicles for surveillance, surveys, mining

> Bio-inspired underwater vehicles can be used for coastal surveillance, search and rescue, and mapping

of the fins to generate propulsion, rotating and swinging to move forward.

"The other system inspired by fish has two side fins near to the fore end (where the pectoral fins of a fish are) and a tail fin," Babu said. "Both the pectoral and tail fins help propel and manoeuvre but the tailfins give larger thrust."

The researchers tested propulsion and rudder systems on ship models in

two different sizes at varying speeds. "We tested several parameters including self-propulsion, thrust force, flapping amplitude, flapping frequency, forward speed, lift and drag," Babu said. "Certain devices, we found, had an efficiency of 80% when compared to an average of 65%."

Countries like the US, Japan and China are involved in research of bio-inspired propulsion systems.

Date: 2nd January 2017

Hundreds attend Alumni Reunion Day at IIT Madras



CHENNAI: Over 500 alumni of Indian Institute of Technology Madras (IIT Madras) and their family members came together to celebrate their batch reunions at the college premises. The day was marked by the 35th reunion of the 1981 batch, silver jubilee reunion of 1991

batch, 20th reunion of 1996 batch and decennial reunion of the class that graduated in the year 2016. Welcoming all alumni to their alma mater, Prof R Nagarajan, Dean, International and Alumni Relations, IIT Madras said, "We have witnessed a tremendous upsurge in our alumni relations in the last 10 years or so, both in number as well as nature of connections we have been able to make with our alumni. We look forward to their continued support in the growth and development of the Institute." Ravi Venkatraman, President, IIT Madras Alumni Association (IITMAAA), spoke about the various initiatives taken up by IITMAA to ensure better connectivity of the alumni, not just with the Institute but also with fellow alumni members. An IITM Alumni Card, which entitles ones to a host of privileges and offers across retailers and the revamped website of IITMAA were launched on the occasion.

BusinessLine

Date: 13th January 2017

IIT-M alumni launch innovation centre with \$5-million fund plan

OUR BUREAU

Chennai January 12

Alumni of IIT-Madras have joined hands to launch a centre for innovation & entrepreneurship at their alma mater.

The Gopalakrishnan-Deshpande Centre at IIT-M is the brainchild of Jaishree Deshpande and Gururaj Desh Deshpande and has been patterned after similar centres at universities across the US, Canada, and the Centre for Social Entrepreneurship in Hubballi, Karnataka. Former co-chairman of Infosys Kris Gopalakrishnan has joined them in the initiative.

Funding pattern

The centre will be co-funded by the Deshpandes and Gopalakrishnan to the tune of half a million dollars every

year over the next five years, for a total of \$5 million.

The centre will help launch the next generation of solutions, from the institute labs as well as from the fertile young student minds, to create significant economic and social impact at a national and, eventually, global scale.

"We need to feel that we are strong enough to innovate because the rest of world now looks up to India as a lot stronger place than Indians look at themselves. So, we would love to see a lot more of Indians gain confidence to innovate and collaborate," said Desh Deshpande, who is now President and Chairman of US-headquartered Sparta Group.

Echoing those views, Gopalakrishnan pointed out that his recent experience of

working with start-ups and young entrepreneurs revealed that quality of people in India was on par with the rest of the world and there was huge scope to come out with innovative ideas.

Tech start-ups

IIT-Madras, which is at the forefront of entrepreneurship ecosystem, incubates about 30 start-ups every year. It has so far incubated about 110 tech start-ups. Also, it has about 60 industry R & D collaborative initiatives.

"Gopalakrishnan-Deshpande Centre comes at the right time to give a big fillip to the entrepreneurial ecosystem at IIT-M. The centre will be betting on people who come with some fascinating ideas," said Bhaskar Ramamurthi, Director, IIT Madras.

Date: 26th January 2017

IIT initiative to educate underprivileged children

EXPRESS NEWS SERVICE
@ Chennai

FOR the past one year, about 700 children from underprivileged families, mostly Dalits, in Chennai and a remote village in Bihar are being imparted informal education by volunteers from the same community. The children, who were earlier averse to basic learning, are now showing incremental improvement and are able to read their regional language and English text-books.

The Teaching Reading Project (TRP), a pilot initiative of the Indian Institute of Technology (IIT)-Madras, is changing the lives of these young minds.

Under the project, five Chennai city corporation schools at Mogappair, Cholambedu and Taramani and five government schools in Pindaruch village in North Bihar were selected. Nearly 200 children from Chennai and 500 from Bihar village were benefited by the gesture.

The three-year programme is

being financially supported by Tamil Nadu Newsprint and Papers Ltd (TNPL), which is pumping in ₹15 lakh per year under Corporate Social Responsibility (CSR).

The national co-ordinator Rajesh Kumar, Professor, Department of Humanities and Social Sciences, IIT-M, said the project had completed one year. The recent progress test showed that about 30 per cent students got about 10 on 10 for reading their Tamil/Hindi and English text books, and about 40 per cent students got about five or more on 10, which is satisfying.

The project team in Chennai is led by retired Professor K Elango from the Department of English, Anna University, and National Secretary of the English Language Teachers' Association of India (ELTAI).

Now, the governments of Jharkhand and Puducherry are also showing interest in this model of education for their underprivileged children, said Rajesh Kumar.



Date: 25th November 2016

'2,000 sensors will be made in India'

► From P 1

Earlier this week, India became an associate member of the organisation after being inducted as an observer in 2004. IIT-Madras is also likely to be one of the silicon sensor qualification centres. Two scientists from CERN recently visited the campus along with faculty from collaborating institutes. Behera said

India is the seventh largest country in the CMS collaboration which comprises 3,200 scientists

that India will also manufacture 2000 of the total 10,000 sensors in the silicon detector. A production centre will be set up for the purpose. It will be one of the five centres that will manufacture the sensors, the others will be in countries including Germany and the US. India is the seventh largest country in the CMS collaboration which comprises 3,200 scientists and engineers and 800 students from 190 institutions across 42 countries. Apart from IIT-M, Indian collaborators include TIFR, BARC, Delhi University, Punjab University, NISER, IISER in Pune, IISc and SINP.



Date: 22nd February 2017

IIT-M, Australian university tie up for research

SPECIAL CORRESPONDENT
CHENNAI

The Indian Institute of Technology – Madras and Queensland University of Technology (QUT), Australia, will take up joint applied research with a focus on information security, combustion and health

technology. The Institute signed an agreement with Queensland University for a joint doctorate degree programme last year.

The institutions began collaborating in information technology in 2006 in information security and

have since included other disciplines. The Vice Chancellor of QUT Peter Coaldrake and IIT-M director Bhaskar Ramamurthi signed the agreement which officials said would benefit both countries with cutting-edge innovation since it is industry-driven.



THE TIMES OF INDIA

Date: 25th February 2017

Generating electricity from e-waste: IIT-Madras innovation waits for takers

Vishwa.Mohan
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New Delhi: Scientists at IIT-Madras have come up with a novel technique where e-waste can be used as a resource not only to treat waste water but also simultaneously to generate electricity, making it an important innovation to neutralise the threat to the environment posed by the disposal of such hazardous waste.

Under this technique, scientists use e-waste component like "LED/LCD (liquid crystal coated polaroid) glass" as an electrode material in 'Microbial Fuel Cells' (MFCs) which is primarily a technology used for only waste water treatment. Use of e-waste as an electrode, however, helps it to generate electricity and recover metals for reuse.

"The basic concept that we use in this study is 'use of waste to treat waste'. The MFC is a pollution free process. It considerably reduces the organic waste treatment cost by producing electrical energy without combustion of fossil fuels", said a joint paper by scientists Praveena Gangadharan and Indumathi M Nambi.

Gangadharan has developed this technique under the guidance of Indumathi Nambi, associate professor in the department of civil engineering at IIT-Madras.

Technologies available in the country at present are generally meant for only recovering and recycling components like glass, plastic, printed circuit board, hard drives, batteries and valuable metals. But this new technology, the scientists claim, can use LED/LCD glass component of e-waste for the twin jobs - waste water treatment and electricity production.

The technique, developed through financial support of science & technology and HRD ministries, could not move from the lab to the market though the scientists had invented the technique two years ago and it was at the time awarded during an innovation festival at Rashtrapati Bhavan in March, 2015.

Unable to find any takers for its technology at this stage, IIT-Madras is now planning to approach the Technology Development Board (TDB) of the science & technology ministry. "We will approach the TDB which can help the innovation move out of the lab so that it can reach out to industries or start-ups for adaptation and wider application", said Nambi. She told **TOI** that the technique has successfully been demonstrated and it's now time to take this out of the lab. "Cheaper, economical and eco-friendly process of this kind can be utilised for large scale application with suitable process development", said the joint paper on this innovation.

The TDB was constituted in September 1996 as a statutory body to promote development and commercialisation of indigenous technology and adaptation of imported technology for wider application.

Date: 7th March 2017

App will help guide visitors along IIT-M heritage trails

TIMES NEWS NETWORK

Chennai: If you're a newbie to the IIT-Madras campus or just have some time on your hands to explore the campus, your tour guide to the campus' natural attractions or history spots could be right on your cell phone.

Students of the institute launched the IIT-Madras Heritage Trails app on the 11th anniversary celebrations of the IIT-M heritage centre on Monday.

The app is a guide to two trails — one that will take you through heritage spots like Gajendra Circle, Building Science Block and the Open Air Theatre — and the other through zones with natural attractions where you can hope to see black-buck and endangered species of animals and birds in a wooded area.

While the heritage trail has about 15 marked locations, the other has 10. The students are hoping to add more locations to the trails in the coming months.

The app also will display detailed descriptions of each heritage spot and, for new visitors, bus route and bus stop information will help guide them through the trails.

"The idea was first proposed by one of our profes-



India Pistons director and 1964 batch alumnus R Mahadevan unveils the model of the original Gajendra Circle

sors who said few people who visit the campus know much about the history of IIT. So we thought of developing this app for the heritage centre day celebrations," said Devunuri Sai Praneeth, one of a four-member team that developed the app over a period of three months.

The other three members are Omkar Patil, Sathwik C and Anurag S.

Apart from the app going live on the Google Play store on Monday, a model of Gajendra Circle (a popular landmark on the campus) in its original form, as built in the 1950s, was also unveiled by 1964 batch alumnus R Mahadevan, director of India Pistons.

While the idea of the Heritage Centre was mooted in

2000, it was formally inaugurated by Arcot Ramachandran, former director of IIT-Madras, on March 3, 2006. The Centre is located on the ground floor of the administration building and functions as a repository of material of heritage value and historical significance of various facets of the institute.

The exhibits include photographs, documents, publications, paintings, portraits, products developed at IIT-M and other articles.

Information regarding important events, laboratory development, visits of important dignitaries, Indo-German cooperative activities, and academic achievements of faculty and students are included in the repository.

Date: 9th March 2017

IIT-M solar inverter system wins award

OUR BUREAU

Chennai, March 8

Indian Institute of Technology-Madras has won the 2017 IEEE Spectrum Technology in the Service of Society Award for its solar-direct current (DC) inverter system.

The system, developed using micro grid technology, converts in-home power distribution from 230V Analog Current to 48V DC to directly power ap-

pliances and devices. The system is also equipped to tap rooftop solar power, making it the most energy efficient solution for homes and offices, according to a press release.

It was developed by Centre for Decentralised Power Systems at IIT-M. The system consists of DC solar generation, DC power-line, DC appliances and battery. Currently, the system has been deployed in 4,000 off-grid homes in Jodhpur and

Jaisalmer in Rajasthan and is being deployed in around 7,200 homes in Assam. The inverter system has been installed in villages in Karnataka, Tamil Nadu, Odisha, Andhra Pradesh and Telangana.

With energy efficiency becoming a mantra, many offices and homes are using DC to power devices and appliances using existing AC power-lines. This requires an AC to DC converter, which adds to the losses, cost and unreliability.

So solar-DC is a viable and cost-effective solution for powering homes in remote off-grid areas, due to its reliability, affordability and its operation without dependency on grid.

The IEEE Spectrum Technology in the Service of Society Award is presented to the company/institution voted by IEEE Spectrum editors as having developed the technology that has the potential to benefit mankind.



THE TIMES OF INDIA

Date: 10th March 2017

IIT, US join hands to push clean energy

TIMES NEWS NETWORK

Chennai: IIT-Madras and the US consulate are giving students and startups an opportunity to showcase innovations in the use of renewable energy in agriculture, urban housing, transportation, industrial process, and water and sewage treatment.

Successful entries (students can register at info@carbonzerochallenge.org) will be divided into teams that will undergo six months of training from US and Indian mentors.

Tamil Nadu Energy Development Agency chairman Jag-



US Consulate public affairs officer Ariel Pollock, TEDA chairman Jagmohan Singh Raju and IIT Madras director Bhaskar Ramamurthy during the Launch on Thursday

mohan Singh Raju launched the competition on the IIT-M campus on Thursday. Students and early-stage entrepreneurs must submit a video or a Power-Point presentation on their solutions and a two-page concept paper. Experts will evaluate the innovations and will divide those eligible into 25 teams of five members each. The teams, to be mentored by American and Indian experts, will develop prototypes with financial assistance from the organising committee. IIT-M will hold a demonstration in December, when the innovators will demonstrate solutions to experts and others.

QS **WOWNEWS**

Newsletter - November 2016-January 2017 edition

IIT Madras finalises US\$18 million investment plan with US Firm



InnoNano Team with functionaries of IIT Madras

India - InnoNano Research (INR), a clean water technology company incubated at Indian Institute of Technology Madras (IIT Madras), Chennai, is set to develop its global footprint. The company has recently finalised an agreement with NanoHoldings (NH), an energy and water investment specialist firm, to set up a global water technology company with an investment plan of US\$18 million. With an aim to make India an exporter of water technologies, and to support the "Make in India" efforts of the government, the company plans to establish a state-of-the-art manufacturing facility, a modern research laboratory and technology delivery offices across North America, Asia and Africa.

Nano Holdings, a US-based energy and water investment specialist firm, has supported global patenting activity for the team and IIT Madras for the past 4 years. "These technologies are destined to change the world in a significant way," said Justin Hall-Tipping, CEO of NH.

This is perhaps a first-of-its-kind global expansion programme for academia-born Indian material technologies in India. "IIT Madras is delighted that research at the cutting edge of materials science has led to applications at the very core of human well-being, namely, supply of safe drinking water," said Prof Bhaskar Ramamurthy, director of IIT Madras.

Prof T Pradeep, co-founder and advisor of INR, hoped that more will come out of such support and added: "Making our science challenging to academia and simultaneously delivering solutions to the common man is an enormous challenge, but we find a purpose there. Water is an area where India needs self-reliance and every technology and every effort matters in this noble objective. Water technologies have to be inclusive as water itself presents enormous diversity, both locally and

globally. This would not have happened without the sustained support of Department of Science and Technology, Government of India."

INR is an 8-year-old IIT Madras incubated start-up company, born out of the water technologies seeded at Professor Pradeep's laboratories. The company was started with Anshup, an IIT Madras graduate in chemical engineering, who did his undergraduate project with Prof Pradeep. Soon, Udhaya Shankar and Amrita Chaudhary joined. The team along with other research scholars and post-doctoral fellows developed a range of technologies to tackle diverse contaminants in drinking water, maintaining international quality standards. Inventors of the technology decided to take these technologies to the most affected parts of the country. With due support from the government and extraordinary assistance from implementation partners such as Mr Praveen Poddar of Mahavir Pumps Pvt Ltd, the technology is now serving 700+ locations across the country.