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"Today the biggest challenge in super computing is coming from biology"

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Prof V. Kamakoti, Director of the Indian Institute of Technology Madras (IIT-M), is a well renowned expert in artificial intelligence (AI) and led a task force on AI for the Commerce Ministry. Also, he is a member of the National Security Advisory Board and was involved in the National Mission on Inter-disciplinary Cyber-physical Systems. Excerpts from his recent conversation on the occasion of Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) convocation 2022 recently-

Bridging the gap between academia and industry is one among the strong focus area of IIT Madras. IIT Madras Research Park has become a role model in India. Can you share your views on this ecosystem of translational research and deep tech startups?

For last 21 years, my predecessors Professor Bhaskar, Professor Ananth and myself have been focusing on translational research. We kept saying that if you have an idea, see how do you convert this idea into a product of societal importance or a state of art technology. In order to achieve this, we have enabled a vibrant patenting process which will immediately file provisional patent within 48 hrs and later file the complete patent specification. Also, we enabled AI based tools to analyse

the novelty of the idea, details of the competing ideas, market potential etc. These processes are done with the help of an indigenous software designed by XLPAT labs, Chandigarh. So, we provide a quick mechanism for everyone to understand the novelty in their idea and see if there is a total addressable market size. So IIT-M takes a quick action in deciding the importance of their concepts. Apparently, the patent will convert to a product and probably a start-up. This has been the focus of IIT-M.

IIT-M also set up a very nice process with the help of our alumnus wherein, systematically an idea can be converted into a start-p. There is an organization named NIRMAN which helps inventors to take their idea and convert it to a design. Then there is a centre for innovation (CFI) that actually allows this design concept to become a prototype. Then, IIT-M also has five incubators one each for health technology, rural technology, cyber-physical system, bio-incubator and general incubation cell. Once they enter in to the incubation process, then they have access to IIT resources and IIT faculty. In addition, they have access to investor ecosystem. Finally, there is a Gopalakrishnan Deshpande Center for Innovation & Entrepreneurship that guides or mentors these incubates to become successful startups.

Students are encouraged to get involved in the startup ecosystem with the help of their respective faculties. From my lab at IIT-M, five startups were incubated and none of the startups I was involved in admin or any other activities. Instead, I guide or mentor the students to build a platform and allow the students to grow through the projects and also to consolidate their ideas. IIT Madras faculties are the “Margadharshies” for the students. Some faculty are founders and they have some stake, while many of them only guide. The students run the show and hold the majority stakes. These are all the successful models of IIT-M.

Your interest in cyber security is well known. Cybersecurity issues in implanted medical devices is becoming an area of concern. Can you share your view on this, and what can be done to mitigate this?

Cyber security is becoming an issue in everything. Anywhere you are connected to the Internet you are part of the issue. The only solution for this is that the hardware and software source code should be open, and it should be available for scrutiny. Hardware design model, which is converted to chip, should be available for scurtiny. I strongly believe that the business in hardware and software, from a security angle, should follow the LINUX model. The LINUX is an open-source operating system. Today RedHat, SUSE etc are basically making money by taking to open source, customize the same and providing the same to customers. That is the way we are building the family of processors called Shakti Microprocessor.

All the active implantable devices have a microprocessor which is the brain for everything the device does. If anything happens to this microprocessor or software, it will in turn affect the working of the implants. So, that’s why we are building a family of microprocessors, which will give these implants a stable core. Then we know what is inside rather than buying something from outside. Note that we can afford to have bugs but we cannot have a malicious microprocessor. We are writing our own software for operating these microprocessors. This must explain why India has come out with a semiconductor mission to make its own software and hardware.

Could you please give an outline of the programmes you have in your mind in MedTech cyber security for indigenous medical devices, or any initiatives at IIT Madras in the area of cyber security?

Whatever we do, unless we understand what is inside that black box, we are not ultimately sure whether we have the malice or not. I repeat, the only solution to this problem is Aatmanirbhar Bharat. We need to make our own chips and we need to write our own codes. If somebody says Ganges is 108 feet deep, you put your own thread with a stone attached and measure. In other words, you have to confirm yourself.

We will have courses that will teach you how to build secure hardware, and how to write secure software. And that is what we need to do. But learning that courses alone is not going to give us security. We need to build our own chips.

Can you share your views on VR and AR for Healthcare, and India’s future prospects in this?

In medical field, already there are lot of training devices for eg, how to take intravenal injection etc in one form or other. But what augmented reality and virtual reality will give you is a sort of almost a digital twin of a patient, at least from the procedure point of view.

For example, we did a project on breast cancer where we made an artificial breast. And the cancer cell will start emitting temperature. We put thermal elements inside and heated it up, this type of model we can create. And people can start experimenting.

Augmented reality (AR) and virtual reality (VR) essentially become extremely crucial where you create a virtual patient and train the physicians, the future physicians, and the surgeons on it.

During the past three decades, SCTIMST has successfully developed many medical devices like artificial heart valve, hydrocepalus shunt, vascular graft, bioceramic implants etc. Do you have any new SCTIMST-IIT Madras collaboration interest in pipeline for medical device development?

There is a joint PhD programme (Biomedical Devices and Technology) between SCTIMST, CMC and IIT Madras. This is a very very strong relationship, we believe.

Some IITs and other premier institutes likely to roll out theirs MBBS programme. Could you give your perspective of bringing engineering and medical academic programmes together in same campus?

Medicine and technology have to come together. Lot of great things in medicine has happened because of intervention of technologies. And lot of improvement in technology has happened because of intervention of medicine. Today the biggest challenge in super computing is coming from biology. I see so many of my doctor friends actually talking about technology in a very big way. Probably more tools they have used than what I have used. On the other hand, very few people talk about medicine in a technology school. But every doctor I meet, almost 99% are talking about technology.

Today there is a great dependency on foreign imports for medical devices. If we look at the bill of quantities (BOQ) of these devices it is very less. We almost pay 25-30 times to get those devices. So, we need to make these devices in India. We need to customize these devices to Indian needs. For example. American Vaccine worked at specific temperatures suitable for them. They did not try customizing the vaccine for India. So, we need to become Aatmanirbhar.

Technology readiness level (TRL), Product market fit, Valley of death, lab to market transition, lean start up frame work etc are becoming buzzwords among current generation of students at IITM. Could you share your perspective of this trend?

As I mentioned; there are four different layers in IIT-M to encourage a startup ecosystem.

NIRMAN assess the Technology readiness level and helps in patenting. If the TRL is not up to the mark, the Centre for innovation ensures to reach necessary technology readiness level, and enable them to convert to a startup. Till that level there will be some sort of funding support including CSR. Other sources will be arranged through this center if the technology is found good. When the idea reached a promising TRL, many enthusiasts will come and support with funding. For example recently our railway ministry supported a start-up working in Hyperloop-technology for transportation which is in early stage of TRL.

Product-market fit is ensured, beginning with, an AI-based intervention which tells you totally addressable market. Even before this product comes from the seed, we will get an idea would be there when it comes. Also, it helps to understand the market requirements now, thereby customizing the product development.

Valley of death is also addressed to help the startups in lab to market transitions. Unless the idea reaches the relevant TRL level we will not take it to this next level. Failures can also be published as papers in academia as it will be useful for others. There are also expert committees that look into intrinsic value, market analysis, etc. There is some enough amount of checks and balances for helping ideas and start-ups to jump through the valley of death.

Lean startup framework is facilitated by Gopalakrishnan Deshpande Center for Innovation & Entrepreneurship (GDC). At beginning the startups may not be having sufficient money, so we give a frame work where the startup can run. Administration support, handholding and mentorship is given by GDC and incubation cell, to make presentations, connect with investors and bringing investment.

So the well-established process and centres is the reason for the success in translation.

IIT-M is home to several successful enterprises and more than 200 deep technology startups have been incubated here. What are those factors which motivate faculties to take up the additional role of entrepreneurs?

Faculty as entrepreneurs actually comes out of passion. Some faculty may really want to become multi-millionaire, and also, they may also have a passion to do something to the nation and primarily involve themselves. But if they want to become successful as entrepreneurs, they need very good manpower. Getting good manpower is like getting good family. Faculty alone cannot succeed; they need a dedicated group.

Is funding a challenge for translational or product-oriented research in India? Other than traditional Government/Extramural funds, what are the other areas to focus in future?

It is very sad to say that, in our country, we don't have confidence on our own people; but we don't know how to break that cycle.

For example, when we started the SHAKTHI project, I was told that if this processor is made, and if it works, I can retire. Actually, we made the chip, and it worked. On that day I contacted the same person and said "hi, the chip is working and I am not retiring".

Similarly, when the Indian semiconductor mission came, I did make a statement saying within next 2-3 years, in every mobile phone at least one chip from India should be there. After that I came across comments such as "he is too optimistic", "he is day dreaming". At least I am day dreaming. So these kind of negative attitude needs to change.

As a country, we lack confidence on our youngsters. That is what we need to build and invest. This cautious friendship is contradictory in terms, and that's why funding is limited.

Government can support by some funding, but they cannot put everything. For example, Government shows you a path, puts a road, but you have to drive your car. The industry should come forward, and encourage these youngsters (start-ups and researchers).

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