

PANKAJ AGARWAL

Designation: Creative leader
Organization: Samsung Electronics
Innovation: A button-type device that connects to toys and a mobile app to enable intuitive interactions for kids
Education: BTech in electrical engineering from IIT Kanpur; MS from Seoul National University; MBA from Harvard Business School

Whenever Pankaj Agarwal saw his son Anant play alone with his toy blocks, a question often nagged him: "Why does he have to play alone? Is there something I can do to make play at home social and interactive for him?" He was also inspired to change the status quo when he looked at the many expensive toys gathering dust around his house. Agarwal thought of the millions of middle-class homes that just couldn't afford all those high-tech toys with pricey tags.

So he added a simple and interactive, yet relatively inexpensive, tag of his own: TagPlus. The innovation comprises a button-type smart tag, a smart app for phones/tablets, and, above all, content created and shared in the cloud by kids as young as 7-year-olds. A key benefit of TagPlus is that it can increase the replay value of toys.

An important feature of the innovation, says Agarwal, is that there is no set-up required. "No device pairing, no logins, no passwords." When kids play with toys that have this smart tag, they can start playing on the TagPlus platform immediately after unwrapping it. Kids can "click", "long press", "shake" and "bump" their smart tags and the smart app will respond accordingly. A "click" on the smart tag activates the TagPlus app on a nearby digital device to show toy-related content. A "long press" action will bring on a social media interface where kids can easily upload their content and also see the creations of other kids playing with the same toy. "Think of this as a 'mini Facebook for kids'," says Agarwal. A "shake" action on the smart tag will help kids find and connect with children playing with an identical toy who could be anywhere in the world. Also, when kids "bump" two



PRADEEP GAUR/MINT

tags from two different toys, the connected app shows multiple ways in which the toys can be combined to create something entirely new. Agarwal and his other TagPlus team members at Samsung believe that this patent-pending technology platform has the potential to make kids' playing experiences more scrupulous, socially engaging and creative "by seamlessly bridging their virtual and physical play environments".

Agarwal and his colleagues did multiple pilot tests of TagPlus in South Korea and they are also in discussion with many toy makers to adopt the platform. "The response has been very positive," he says.

Agarwal plans to continue his innovative work in the creative domain and believes that "members of our society should be educated and imbibe a culture of creativity".

SUBHAM BANERJEE

Designation: Young scientist
Organization: Centre for Biodesign and Diagnostic, Translational Health Science and Technology Institute, department of Biotechnology
Innovation: Transdermal patch against neurotoxin poisoning
Education: Master of pharmacy from West Bengal University of Technology; PhD in pharmacy from Birla Institute of Technology, Mesra

Soldiers fighting in hostile territories often have to shield themselves against harmful or poisonous gases and chemical substances. One often hears of deadly strikes such as the sarin gas attack on the Tokyo subway system (1995), the nerve gas attack in Syria (2013) or the recent attack in Iraq by Islamic State militants in which they set fire to a sulphur mine, spreading sulphur dioxide plumes.

Subham Banerjee's innovation concerns protecting people against neurotoxic poisoning resulting from such attacks. "The exposure of humans to neurotoxins is a major risk factor in severe mortality in chemical or biological warfare situations, as neurotoxins are one of the most potent toxins," he says. His innovation, a transdermal patch that can provide protection against neurotoxin poisoning, comprises an inert adhesive matrix system with active pharmaceutical

ingredients. The patch can be applied to intact or even burnt or blistered skin. It works by releasing a combination drug (serine and pralidoxime chloride) through the skin in what is called a "controlled or sustained release" mechanism.

"According to Banerjee, the new patch has an excellent safety profile", can be "self-administered", and has positive environmental as well as economic impact. "Apart from conventional dosage forms, no novel sustained release prophylactic transdermal patches are currently available in the market," he says. Which is why this innovation has huge socio-economic benefits and the potential to achieve product dominance in the market.

In order to sustain this project and take it to the next level of successful commercialization, however, Banerjee says that some studies have to be carried out. For one, process parameters have to be optimized to scale up the capability of manufacturing these patches in bulk quantities. Also, a preclinical toxicity study in rodents needs to be done, followed by a full-fledged pilot for the bioavailability study in human subjects as per the guidelines of the Drug Controller General of India.

Banerjee believes that this innovation has the potential to make an "extra value-addition" to the existing measures for biological warfare protection available with India's Armed Forces.



PRADEEP GAUR/MINT



HEMANT MISHRA/MINT

PRADEEP GAUR/MINT

PRADEEP GAUR/MINT
Designation: Scientist
Organization: TCS Research and Innovation, Tata Consultancy Services Ltd
Innovation: Auditory sensing for micro unmanned aerial vehicles
Education: PhD in computer science and engineering from the University of New South Wales, Sydney; postdoctoral fellowship from the Swedish Institute of Computer Science, Stockholm

Prasant Misra has been focusing his research efforts around building "spatially intelligent systems". His current work pertains to the auditory sensing technology for micro unmanned

aerial vehicles (MAUVs, more popularly known as drones). It's like "growing the cars" for intelligent things, as he puts it. "It is part of a grand vision to equip this category of flying robots with a sensory gamut that is on par with humans," he says. This will not only enable such "things" to derive better spatial intelligence, but also drive cognition to a better level of autonomy by combining auditory sensing with vision.

There are, however, fundamental challenges in developing such robust auditory capabilities, especially in capturing the spatial dimensions of a sound scene and analysing its acoustic signature. "The signal-to-interference-plus-noise ratio is extremely low due to the presence of (near-field)

wideband acoustic interference (i.e., self-noise) from the MAUVs' spinning rotors and motors, which is both strong and non-stationary," he explains. Theoretically speaking, building an acoustic array with a large number of acoustic elements can overcome such high levels of noise, but the space, payload and energy limitations of an MAUV come in the way of meeting such exhaustive system requirements and computational needs.

Misra is now investigating both lightweight acoustic sensing system design, and low-power (but efficient) computation paradigms to overcome this challenge. The initial results, he says, are quite promising.

The impact of the work Misra is doing is far-reaching. It will not only force us to rethink the current model of aerial sensing (which is primarily vision dominated), but will also open up newer applications and usage scenarios for the betterment of society.

It is now quite common to talk of aerial drones, especially tiny ones with multiple rotors that can hover mid-air, in applications ranging from commerce deliveries and inspection of industrial machinery to wildlife monitoring and search-and-rescue operations.

Nevertheless, their sensing technology is predominantly vision-centric. "While the advantages are clearly obvious in visual inspection and monitoring applications, on the flipside, they become unusable in camera-obstructed or low-light conditions, or in scenarios that offer non-visual cues such as those based on sound. In fact, these conditions are a norm in high-stress environments (dense canopy or fog, structures on fire, underground mines, etc.)," he says.

Misra is working towards taking the MAUV technology from its existing level to "cognitive autonomous systems". He believes that as spatial intelligence and cognitive technology mature, the lines between machines and humans would blur, enabling both to live together in the same society as companions. In the future, cognitive aerial drones will take up roles such as aerial cars and taxis, pick up and escort agents, search and rescue bots, and cars and eyes for the disabled. In short: anything you want them to be.

SANDEEP SENAN

Designation: Founder and director
Organization: Evolvi Automations Pvt. Ltd (Bibox Labs)
Innovation: A toolkit-based approach to learning so that kids can learn through experiments making things like a robotic toy or a fire alarm
Education: BE in computer science from Vissveerava Technological University, Karnataka; MBA in international business from Edith Cowan University, Australia

When it comes to innovation and creativity, Sandeep Senan is as excited as the young kids he wants to empower with the innovative tools at his disposal. His innovation,

Bibox (short for Brain-in-a-box), is like an "electronic brain which can be instructed by a kid using a graphical software, which can run on a tablet or smartphone or PC or even with cards", he says. Senan is of the view that the realm of innovation must be extended to children rather than remain mostly confined to the adult world. There's a need for a huge change in the way children are taught and allowed to be creative, he feels.

"The task of making adults creative is a humongous task, but if we think about kids, they are naturally curious and thus it's easy to instill an innovative thinking process in them," says Senan. So when he discovered that there was a lack of tools and curricula designed for instilling the habit of innovation in kids, he decided to do something

about it.

"The innovation Bibox was originated out of that need to give kids the tools to change the world and thus the confidence to keep innovating and make it a habit so that when they become adults, they can go out and make large-scale impact because the thinking is ingrained into their minds," he says.

Bibox doesn't have a definite shape or size but is basically a set of tools—processors, switches, sensors, battery and software, among others—using which children in different age groups carry their hand innovation. This "brain", says Senan, can be connected to a variety of accessories, including lights, LEDs and TV sets, and children can come up with soft-like walking robotic dogs, automatic TV and even connected health products using the Internet of Things.

"Because Bibox responds to kids' logic in the physical world, they can see what the logic means and correct themselves when required—making the learning experience truly experiential," he says. Besides providing them such toolkits, Senan's organization also provides them some structured mentoring to enable them to use their creative freedom and confidence to innovate more and more in any field they choose to be in. "We are just getting the process started a little early," he says. Through Bibox Labs, he has enrolled more than 25,000 students in over 100 schools in India.

To take his innovative ways to a much larger base of students, Senan and his team are digitizing the process of mentoring the kids to be innovators. Once this is in place, he says, any student anywhere in the world would be able to go through the same process that Bibox Labs follows in its affiliate schools. They also plan to partner with private firms, non-governmental organizations and various government bodies to scale up the programme.

VINAY KUMAR

Designation: Co-founder, director and CEO
Organization: PathShodh Healthcare Pvt. Ltd
Innovation: A single device that can diagnose multiple parameters related to diabetes management
Education: MTech in microelectronics and VLSI design and MSc in electronic science from Kurukshetra University; PhD from Centre for Nano Science and Engineering, Indian Institute of Science Bangalore

At age 14, when Vinay Kumar was diagnosed with juvenile diabetes, his doctor told him he would have to take insulin injections. The look of disappointment on his face prompted the physician to tell that it was only for 10 days that injections were needed. Later on, when Kumar realized that he was stuck with the needle for a lifetime, he became determined to put the hurt and discomfort behind and do something about it. Over the years, diabetes took a bigger and bigger toll on his body, with episodes of hypoglycemia (abnormally low level of sugar in the blood) and even fainting—but all this only strengthened his resolve.

In addition to struggling with a debilitating condition like millions in the world do, Kumar constantly thought about how a diabetic can manage his condition better and, at the same time, persisted with his studies. "These two aspects of my life merged when I decided to pursue a PhD at the Indian Institute of Science (IISc Bangalore)," he says. Besides working on novel ways to diagnose diseases and acquiring multiple patents, he also co-founded along with Navak-

anta Bhat and Gautam Sharma) PathShodh Healthcare Pvt. Ltd, a start-up incubated at IISc that is focused on medical device research and development.

Kumar's innovation is a hand-held point-of-care device which, as a single unit, can measure eight different parameters related to diabetes management and early detection of its complications. "With a tiny drop of finger-pricked blood samples, patients can test HbA1c (which gives 90 days blood glucose control profile), glycated albumin (which gives 15-day blood glucose control profile) and instant blood glucose as well," he says. The device can detect very early damage in the kidney by measuring the microalbuminuria, creatinine and ACR (albumin to creatinine ratio) in the urine samples. Apart from these, he adds, it can measure the haemoglobin level for anaemia and chronic kidney disease. "The device can measure serum albumin, an important blood marker for kidney and liver. So the single device can take care of full diabetes glycaemic management and early detection of complications such as diabetic nephropathy," explains Kumar.

The road ahead for PathShodh is well-defined. "The device is ready and rigorous clinical validation for most of the tests has been completed on real patient samples in collaboration with major pathology labs and hospitals in Bangalore. We also have the manufacturing line set up at IISc to manufacture the disposable test strips for these different tests," says Kumar. The commercial launch of the device can happen any time now. That would certainly move the needle in a positive direction for PathShodh's mission of making healthcare diagnostics affordable and available to all.



PRADEEP GAUR/MINT



HEMANT MISHRA/MINT