BUILDING ROBOTS WITH HUMAN INTELLIGENCE

Innovator-entrepreneur Aakash Sinha foresees a disruptive future for intelligent robotics in India. His company Omnipresent Robot Tech is set to be among the first movers. BY SANGITA THAKUR VARMA

- Young Entrepreneur of the Year 2012 for Outstanding and Exemplary Achievement in Entrepreneurship, Enterprise Asia and the Organising Committee of the Asia Pacific Entrepreneurship Award, 2012
- CNN Award for Outstanding Contribution in Technology, 2012
- Gold Medal from Department of Science, Technology and Lockheed Martin India Innovation Growth Programme, 2012
- Featured among the Top 20 Business Plans at the international TiE (The Indus Entrepreneur) Conference, 2011, Mumbai
- Outstanding Contribution in Technology Award by All Journalist Association of India, 2010
- Awarded DARPA Robotics Grand Challenge, 2005, by US Department of Defense for developing a driverless car
- Outstanding Employee Rock Award at iRobot Corp
- First Prize at National Level IEEE Troika 1999 conference in Hardware Design Contest

Aakash Sinha, Robotics Scientist and Founder of Omnipresent Robot Tech, has an impressive resume. He has worked with some top US robotics companies including Lockheed-Martin. As an employee he proved his mettle, winning the outstanding employee award as the Technical Head at iRobot Corp, where his team delivered over 3,000 PackBot robots to the US Army. As an engineer-scientist too, he was making his mark with more than 15 international publications in robotics. After 10 years in the field of robotics and accolades galore, it was just about two years ago that the MS/Ph.D in Robotics from Carnegie Mellon University decided to become an entrepreneur.

Intelligent Conception

Omnipresent, the company, was initially launched in the US. "It was started by my wife Jyoti, who is the co-founder, and me on a shared vision to build truly intelligent robots for the future," says Sinha sharing the belief that is the foundation of Omnipresent. Sinha and Jyoti go back a long way together to their student days at the Delhi School of Engineering and their shared passion for robotics. Jyoti, after a degree in computer science from California, Berkley, worked with Sinha at iRobot for a while. "We realised that robotics was something we are very passionate about, especially I." Sinha was keen to build humanoid robots right from the time he was an engineering student. "It

PHOTO BY SUBHOJIT PAUL

was an inspiring dream for me to build a robot that could think and act like a human, very similar to what you see in science-fiction movies."

It was working in different robotics companies, developing cutting-edge robots for various high profile clients that sharpened Sinha's desire to launch his own robot company. "I was one of the members of the technical architect team of PackBot robots at iRobot. After this project, I worked on Robotics Grand Challenge. It was here that I got inspired to build my own robot with human intelligence. With this vision, we founded Omnipresent."

Passion & Patriotism

The move to India was motivated as much by ideals as sound business sense. "We wanted to contribute back to India and also saw the emerging market here in robotics," says a candid Sinha. The first branch of Omnipresent was set up in Delhi and its first contract was with Defence Research and Development Organisation (DRDO) to build a bomb disposal robot. "We were so excited with this prospect that we decided to move all our operations to India," says Sinha. Currently, Omnipresent is based in Delhi. The project was successfully delivered to DRDO which was earlier convinced that robots could only be built abroad, reveals Sinha.

The engineer-innovator turned businessman does not regret his decision to reverse migrate to India. With his life and business partner beside him sharing his vision, it was a mutual decision. "I am quite fortunate that we were able to do this together because both of us share these ideas. And since we have known each other for a long-long while, it definitely helps a lot," says Sinha talking about his wife and partner in all his endeavours.

It was a tough call, but despite the initial days of misgivings and struggle, Sinha does not regret giving up his nine-digit salary job. "When we were building robots for the US army, internally it was not that satisfying for me. But somehow, it is now more fulfilling to say we are building robots for India. Secondly, the Indian market has grown well and in the past several years, a lot of people who have seen this development, have come back home and built good companies here," Sinha explains.

It was not an easy ride for Sinha after returning from the US. For the first six to seven months, the company had no revenues. "Fortunately, I could convince DRDO that I had a similar background working on robotics for

the US army and we got a small prototype fund from them and a six-month deadline to deliver the project. We did it in four months." Omnipresent had convinced the first customer and had built credibility in the market. "It's very important to get that first customer and build good faith. It's difficult and in defence, more so. But if you persist, you can build your reputation with one or two customers, and move forward from there," is Sinha's advise to start-ups in the space.

Omnipresent has now diversified into some other sectors like education as well as cleaning robots. "We have also built drones that we exhibited at Aero India, one of India's largest aerospace exhibitions," informs Sinha. One of the key drones built by Omnipresent is HANSA. "It is a small plane and one of the lightest of its kind that can fly over and detect a human being from 1 km height," Sinha elaborates his innovation. "We have been fortunate to also work with ISRO," Sinha continues. Omnipresent's clientele includes Centre for Artficial Intelligence and Robotics (CAIR), Bangalore, Combat Vehicles Research and Development Estt (CVRDE), Chennai, Research and Development Establishment (R&DE), Pune, Vehicle Research and Development Establishment (VRDE), Ahmednagar and Indian Space Research Organisation (ISRO).

India on Robotics Track

Sinha sees a bright future for robotics in India. "It is one of the big disruptive technologies coming up in the next 10 years," he predicts adding, "this wave will be similar to the rapid movements witnessed in the information technology industry. Nobody could have predicted the extent to which they would revolutionise the world, as they have done today." In fact, Sinha envisages a big role for robotics in human life. "Robotics will become eubiotics (eu=good/bios=life) and omnipresent (present everywhere simultaneously), just as our company name suggests. We can see robots cleaning our homes, guarding our borders, fighting wars for us, assisting our elderly and being our companions, doing monotonous household chores and also protecting us. In domestic and civil life, robots are going to be the future of our civilisation and in 10–15 years we will realise how integral to it they have become."

Sinha sees this change happening all over the world. But in the Indian context, he says that the changes are already underway especially in the defence sector where the demand for robotics is high. He predicts the trend infiltrating the civil and the domestic space, with robotic domestic help replacing humans in the next five years. "Cleaning robots already exist and we are also developing one," informs Sinha. If not in the next 10, then certainly in the next 15 years, domestic chores like mopping, vacuuming, cleaning and home surveillance will be done by robots, Sinha is confident.

ROBOTICS LAND

Innovations from Omnipresent

Omni 3D is a perception system that can generate three dimensional mapping using simultaneous localisation and mapping (SLAM) with advanced autonomous obstacle detection & obstacle avoidance system. It also performs object recognition for detecting various types of obstacles and their location and terrain recognition to determine the drivability of the terrain and can build a model of the entire world around the robot using a stereo camera/laser sensors or even a single camera to provide greater situational awareness.

RoboSim is a highly sophisticated kinematic simulator for ground robots which can take in vehicle/surface parameters and motion parameters of the system and generate a realistic model of the vehicle and analyse the kinematic behaviour and limitations in an accurate simulation.

Ro-Boat river cleaning robot is an innovation designed for continuous automated cleaning of great Indian rivers like Yamuna and Ganga. The product is a small unmanned boat which can navigate through a river with the help of GPS and sensors. It has cameras and video analysis capability to detect pollutants like plastics, chemicals and heavy metals. It also has the ability to clean the river water of the pollutants by sucking in the water and filtering out the pollutants.

Sinha allays prohibitive cost fears saying: "Costs of robotics have been coming down substantially because of the improvements in hardware technology." He compares robotics to computers, pointing out how technology improvements have made laptops more affordable. "Take for example cleaning robots, one of the very popular ones in the world called ROOMBA, cost around ₹10,000 (US$ 200). It has recently come within an affordable range," informs Sinha.

Commercialisation will also bring down prices in the civil robotics area, the innovator is confident, given the market dynamics. However, defence robotics will remain at a premium as they "come with their specific requirements", he adds. Sinha talks of bionic or robotic legs and micro robots or nano robots or nanobots, which are the size of molecules and are set to revolutionise the medical world and robotics surgery.

In the next 10 years "we will have at least 100 robotic companies in India," says Sinha. To encourage robotics among the youth, Omnipresent has a free mentoring programme for students. "We have students from Delhi College of Engineering, IIT Ropar and IIT Guwahati coming over for the course," informs Sinha.

A Crusader-Innovator

The innovator says his current approach is need-based innovation rather than client-based because as a startup he can afford to innovate for mass requirements. "We do look for a client and then innovate for their specific needs, as for ISRO and DRDO. The revenues thereof fund our vision to solve the bigger social problems through robotics. However, our vision is to look at what's the big problem and once we identify it, we can then find out if we can produce a solution and, if we do, what impact it will have." Sinha gives the example of his river cleaning robot, as a product of this approach.

Delhi boy Sinha though equally fond of all his inventions, singles out Ro-Boat, the river cleaning robot, as his favourite when asked to name one. The robot is essentially a boat that can sail using GPS and has robotic arms and cameras. It is designed to submerge under water, somewhat like a mini submarine. It clears plastics and sludge. "Omnipresent has been shortlisted by USAID Millennium Alliance to fund this project. We are very excited at the changes that we can bring to our rivers," Sinha discloses the possibilities of this dream project.

Sinha is currently looking for a partner with experience in the consumer robotics market to expand his civil/domestic robotics business vertical. "Currently we get defence funding and utilise a part of the revenue thereof to develop home robots. But what we really need here is a good partner," says Sinha. Defence is Omnipresent's forte, and Sinha is upfront when he admits, "We don't think we can really do this by ourselves. It's a consumer market, a different domain, different marketing force." So the company has been in talks with Wipro, Reliance, Google India and others to rope in a partner and take their dream journey forward.

Omnipresent does not believe in secrecy of mission, for its innovations are guided by the greater public good. "Our approach is to find out what the biggest problems in society are and then try to see if we can build a solution that the robots can do," says Sinha; this is the reason why he does not blink in revealing the two important innovations that Omnipresent is working on at the moment. "We are building robots that can optimise the process of agriculture and improve production by 30 to 40 per cent. The second innovation is medical robots that can transform the lives of patients and the physically challenged."

Robotics may well see many more innovations that address larger issues and bring about lasting social transformations. ■

Home Robot:
Cleaning Robot, ROBOBAI is an automated vacuum cleaner + mopper+ home surveillance device all in one product targeting home customers. It automatically vacuums/mops the home and then goes back to charge.

Educational Robots:
Robot Education Kit, ROBOED is a creative tool kit to teach school/college children and hobbyists robot building and concepts of robotics. Using the kit children can easily make dozens of robots in a short time.

Humanoid Robots:
Gatik, the Progressive, is an indigenous and dynamically developed humanoid robot. It is a semi-autonomous robot, 60 cm high and weighs around 2 kg. It can be both controlled wireless, or programmed to perform various functions.

Healthcare:
NADI-N is an intelligent electronic device that reads electronic pulse data form a patient's hand and then applies principals of Ayurveda and modern algorithms to diagnose diseases. The device has the potential to diagnose diseases like diabetes, heart problems and cancer at an early stage without using any invasive procedures. Carnegie Mellon University and Swami Vivekananda Ayurveda University are partnering in prototype development.

Industry Robots:
Automated cleaning robots for Industry, warehouse, etc.,; prototype under development.

Material transport robots for transporting material from one place to another in a factory setting; prototype under development.