

ROBOTICS: DO YOU HAVE IT IN YOU?

The robotics industry is growing at an exponential pace in India for the last few years. Let's explore whether it could be your forte

■ SUDESHNA DAS

Remember robot Kryten in the famous British TV series *Red Dwarf*? In one of the scenes, he says: "I serve, therefore, I am." Have you ever tried to comprehend the meaning of the statement? Well, it's true. Robotics has grown far beyond the realms of imagination and science fictions. Robots and robotics are more firmly entrenched into our day-to-day life. Though remaining invisible, they serve us in innumerable ways.

If you are a budding electronics professional, ready to accept high-risk challenges, or comfortable with both mechanics and computer programming with a drive to build new things, then robotics could be your forte.

Know the field

Let us first define robotics. It is a multi-disciplinary area, which integrates intelligent control, communications, computer vision, mechatronics, sensor fusion, design and many other aspects on a single platform for better service. Robots help industries to translate their competitiveness and deliver radically enhanced levels of productivity, efficiency and profitability.

According to a CII report, from 2008 onwards the world market for industrial robots is projected to rise by an average of 4.2 per cent per annum, reaching 139,300 units in 2010. In India, the industry is expected to grow at two to two-and-a-half times the global average.

Various players are entering this space. Outsourcing to India is happening in robotics, right from research/in-

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—Raj Singh Rathee, managing director, Kuka India



tellectual property (IP) generation, to converting LISP codes to C codes for industrial robots. The Indian manufacturing arena is positioned to grow bigger in the coming decades. The mobile robotics space expected to receive increasing importance in the coming years include social/interactive, consumer and medical robots. India being an agrarian society, opportunities exist in automating agricultural-related activities.

Raj Singh Rathee, managing director, Kuka India, says: "In the last few years, the automotive original equipment manufacture (OEM) sales have been growing at a good pace. More and more OEMs have started their manufacturing in India. India is now emerging as the new manufacturing hub of the world and one of the top markets for robots."

Where can you be placed?

There are two major spaces in robotics—industrial and mobile service. The industrial robotics is a well-established field where robots are widely used in the manufacturing industry. But the mobile or service robot segment is at the infancy level.

Major robot manufacturing players like ABB, Panasonic, Kuka, Precision Automation and Robotics India

(PARI), Motoman Motherson Robotics, Hi-Tech Robotics Systemz and Fanuc have their presence in India. And startups like Gridbot and Robohatah are also gradually making their presence felt in the country. Besides, several small and medium enterprises are also planning to invest in India to enhance their global competitiveness.

"Among the robotics applicants in India, till date, automotive industry is the major player with around 70 per cent stake. Companies like Tata Motors, Hyundai Motors, Mahindra & Mahindra, Ashok Leyland, etc, have dedicated departments for robotics. However, other industries like foundry, plastics, food and beverages, logistics, FMCG, solar, medical and entertainment have also started using robots in a big way," says Rathee.

Service robots may play a crucial role in some industries of the SME sector like forging and diamond, which need precision workmanship.

Robots are also used in the fields of defence, nuclear science, sea exploration, servicing of transmission electric signals, designing of bio-medical equipment, etc.

The day is not too far when robots will find applications in almost every field. From managing commerce to household chores, to security and res-

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cue operations, robots will touch our lives in several ways.

Further applying artificial intelligence and robotics, one can create unmanned aerial vehicles for weather prediction, androids for assistance and mentoring, thinking machines and smart munitions for defence applications.

“One can explore career opportunities in diversified sectors ranging from defence research to pure manufacturing. The exponential growth of robotics in India is fueling the demand for skilled workforce that can design, build, operate and repair robots and robotic machines,” says Anuj Kapuria, CEO, Hi Tech Robotic Systemz.

Find your role

I believe, up to this point, you have grabbed enough information about the opportunities-to-be in the robotics field. As electronics professional, you may find placement in the design section of a robot manufacturing firm. “Fresh electronics graduates can definitely play important roles in some of the positions, especially in the creative designing and problem-solving sections. They may have to work on electronic designs and embedded programs for robotic assemblies like actuators, sensors and interface circuitries and develop innovative GUI interfaces and control mechanisms for the robots,” opined Pulakit Gaur, CEO and co-founder of Gridbots.

In the manufacturing section, the applicants may play important roles in maintenance and operation. Microchip manufacturers, like Intel, recruit robotics and artificial intelligence specialists. Employment opportunities also exist in education and research domains.

Electronics departments in most of the IITs and CSIR labs offer research fellowships in robotics and artificial intelligence.

As a robotics engineer, you may even grab employment opportunities abroad in robot programming, troubleshooting and maintenance. Fellowships are also available in research institutes, emphasising on humanoid robotics and computational neuroscience. Prestigious research organisations like NASA may be your ultimate destination.

The next question should be how to get an entry ticket? The answer is: Only a decent technical degree (diploma or graduation) is not enough to get you a job in robotics. You need to have a knack for the field—be it in the form of a project or training. Recruiters also look for specialised skills in research and development areas in a postgraduate or doctorate applicant. Most of the employers take interns and train them directly in various areas in robotics.

Thankfully, recruiters in this sector believe in talent building. For example, Kapuria takes talent building as part of his social responsibility. He enthusiastically talks about the involvement of interns in live projects who were later absorbed by the company.

There are opportunities for diploma holders as well, but the situation is a little bit daunting. Initially, they may have to be restricted within the fields of PCB and mechanical designing, hardware integration and soldering.

Money matters

Let’s check whether the robotics field supports the feeling that being fairly rewarded for your work is a substantial part of career satisfaction.

Students who have completed

their postgraduation and doctorate are absorbed at Rs 450,000 to 950,000 per annum. Those who are graduating may get offers ranging from Rs 350,000 to 650,000 per annum.

“A robotics engineer could be offered a minimum of Rs 350,000 per annum. The growth rate, however, is quite steep as the industry offers lots of prospects,” says Kapuria. He also adds that it is not the experience but the actual expertise like problem-solving skills specific to robotics domains which determine the career growth.

The field also offers a decent starting salary in the range of Rs 10,000 to Rs 15,000 per month to diploma holders, although the scope of work is somewhat restricted for them.

How to begin?

Possibly, you will never come across any dedicated session on robotics throughout your curriculum. Don’t get disappointed. Let us take the experts’ help. Experts like Dr Prahlad Vadakkepat, director, Robhatah Robotic Solutions and a faculty member of National University of Singapore, say that the basic knowhow of electronics as well as other allied fields like electrical engineering and mechanical engineering are quite important. But it is no longer enough to know only your fundamentals. The experts also specifically explain that the professionals work in a cut-throat environment and they should know survival tactics in order to compete in the field.

There are opportunities in the industrial robotics space focusing on developments specific to Indian requirements or expansions along manufacturing. The mobile robotics space is relatively new, and may offer higher potential growth in the coming decades, where a variety of applications from consumer products to medical robotics are expected to offer growth opportunities.

From an industrial robotics perspective, higher education in specialised areas like kinematics, statics, dynamics, path planning, control,

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—Dr Prahlad Vadakkepat, director, Robhatah Robotic Solutions and a faculty member of National University of Singapore



design, sensor data processing, code optimisation, communication, etc, are essential.

The mobile robots have to operate in dynamic environments, and intelligent and interactive modes of operations are crucial. Expertise in mechanical and electronic designs, sensor data processing/fusion, control, intelligent operation-related skill sets are important in this field. The operational environments and application domains of the mobile robots bring in challenges related to obstacle avoidance, real-time path planning and interacting with objects.

Vadakkepat says, “Presently, India has a pool of trained manpower in the robotics segment. So, proper training along with professional degree would be a turnkey for a fresher. The training should be totally industry focused. I feel an effective collaboration between industry and academia may be fruitful for both. The existing industry-institute partnership models of some reputed foreign universities are ideal to follow.” Let’s collate their suggestions to dig the field in a comprehensive manner.

Training and workshop

The training should be balanced enough to deal with both theoretical and practical aspects of robotics. Being an inter-disciplinary course, students from electronics engineering background opting for a career in robotics need to have a sound knowledge of mechanical, electrical, instrumentation and computer engineering. As

Vadakkepat says, “The knowledge of mechanical and electronic design is essential. Though it is hard to master both the areas, it is possible to join hands with the counterparts (in mechanical and electronics streams) to position better.”

“Taking up college projects in robotics will help students to determine their true motivation and prepare them early. A number of technical festivals across India with robotics as the central theme provide avenues for aspirants to develop their skill sets. There are players extending embedded systems and robotics-related training. Internet is a good source for various tools and technical papers. Attending technical meetings/conferences and seminars will assist in expanding the domain knowledge.”

Keep in mind that robotics is a completely new package to improve services. That is why at times you are required to use all your skills to come up with a solution that is trivial and requires an insight into various concepts. Introduction to the mechanical parts of robots is a must.

“If someone wants to be a good robot developer then he has to possess a good understanding of various mechanical aspects and fabrication tech-

niques, which involve working with sheet metals, die castings, CNC lathes, milling machines and moulding engineering,” says Gaur. Even exposure to soldering on PCBs may be useful.

Try to get some idea about different types of actuators used in robotics, with focus on servo motor and stepper motor. Moreover, working knowledge of different sensors used in robotics may provide an extra advantage. Especially, detailed knowhow of IR sensors, proximity sensors, LDR, temperature sensors, motion detectors and acceleration detectors is quite pertinent.

To control your robot, you need to know about microcontrollers. Try to put emphasis on the interfacing action of microcontrollers with sensors and actuators using programming languages like MPLAB.

Another suggestion is that, irrespective of the stream of engineering you are pursuing, be bold to explore multidisciplinary areas—mechanical design, electronics, microcontroller programming, wireless control and sensors. The first and foremost step is to learn how to control a motor, may be directly from a PC. Microcontroller programming comes next. Identify peers with similar interests, and form a team for group learning and sharing the workload. Pass on the expertise to your juniors. Assembly level to higher level programming, soldering and mechanical design skills should be picked up. Internet is a powerful medium to keep abreast with the latest in robotics and idea exchange.

From classroom to industry

Perhaps, your awareness of robotics and artificial intelligence are from a notional perspective only. This is a

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significant drawback of our educational system. According to Kapuria, project-driven learning, supported by a steady exposure to seminars on contemporary topics and interaction with the industry people, gives aspirants an edge. "A robotics-based project in the areas of different assistive systems may be a turnkey to enter a good organisation. Any parallel course on robotics may also be helpful. But nearly all our institutes, barring a handful, are woefully inept in providing students with such opportunities," he adds.

Major recruiters, however, often complain that they spend their quality time and resources in preparing freshers for specific job needs. This 'gap' between industry and institutes can be filled by taking up industry-oriented projects and strategically chosen courses run by various educational/technical centres.

Such training can go a long way in providing an edge over your competitors. So, concentrate on your project work and try to identify a course. These steps can increase your chances to be picked up. The recruiters need something extra, and the hands-on experience is indispensable.

You can get the overview of 'chip to ship' of robotics only after completing a project. Instead of depending only on your institutional projects, try for an industrial project or internship. Various private and public sector organisations accommodate final year and pre-final year students in their live projects.

We have already discussed the

Institute watch

Universities

- IIT, Kanpur
- University of Hyderabad
- Jadavpur University, Kolkata
- BITS, Pilani

Industrial Centres

- Kuka Training Center, Pune
- HiTech Robotics Training Centre, Gurgaon

Training Centres

- EFY Tech Center
- Emtech
- Thinklabs

Start-up speak

Job at first and then entrepreneurship, for a simple reason that hands-on experience is very important in this field. If a software engineer makes a mistake it could result in an error pop-up but if an electronics engineer makes a mistake it could lead to losses in terms of money and even physical injuries.

Not only R&D experience is necessary but also an exposure to technical marketing and procurement process can be helpful if you plan to start your own company. Contacts and business relations made once always pay back. Procurement of electronic/mechanical components is a very tricky job. As for the same functionality there are numerous alternatives, different manufactures and quality grades, it requires subjective awareness and experience.

After 1.5 years of service as R&D engineer, I founded TECHNIDO (Technology Nest in Italian) to work in industrial/educational robotics and technical training domains that was my childhood dream.



Siddharth Dev, chief technical officer & founder, Technido

relevant primary to-do steps. Besides these, you may try to understand project requirements in a better way with respect to design and documentation, development of prototype modules, coding and unit testing.

So be a go-getter, dig all the possibilities to get a practical exposure. Industry is ready to help you out. "I have delivered technical talks and demonstrated legged and wheeled mobile robots in various technical festivals and institutions. These activities have provided a way to students/aspirants to look beyond their normal curriculum and improve their approach towards robotics. We have handpicked the employees through personal interactions over the last four to five years. I am in touch with a number of students/researchers through various social networking forums and email," informs Vadakkepat.

At the same time, keep yourself updated about the latest technological trends. Newspapers, technical magazines, various technical seminars and last but not the least—trade fairs—may provide you with an opportunity to get an edge over your competitors.

Touch up jobs

You may find various training institutes mushrooming all around. But before you join any course, be sure to compare the course curriculum with the skill sets discussed so far. Besides, you can always rely on vocational

courses offered by the institutes of repute (see Institute Watch).

Till now, we had enough chin wagging with robotics. According to my perception, now you are ready to explore the field. So pull up your socks! Plan your schedule for the final year project in this field and find a suitable industry to pursue it.

I know, the next possible question is: 'How?' Search the website of the organisations, send requests for project work and put in honest efforts to grab every possible opportunity.

Dr Vadakkepat has a tip for you. "Competitions have played an important role in pushing technologies, leading to a number of technology startups. The FIRA Robot World Cup and Congress Bangalore 2010 is expected to act as a catalyst in these directions where the advancements in robotics will be showcased. FIRA India aims to propagate and popularise robotics and international level robotic competitions across India," he says.

Taking part in such events (competitions, conferences) paves the way for improving various skills. For an example, taking up a joint/collaborative project can enhance your networking, communication and management skills. Perhaps, it will be your first interaction with robotics industry, but believe me it will be a fruitful one. ●

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