



delnet Newsletter

Vol. 17

Nos. 1 & 2

December 2010

Robotics and Artificial Intelligence

The DELNET Annual Lecture for 2010 was delivered by Dr. S. S. Mantha, the reputed specialist and Chairman, All India Council for Technical Education on May 11, 2010 at the India International Centre. Prof. Subir Kumar Saha of the Indian Institute of Technology, Delhi presided over the lecture. Dr. H. K. Kaul, Director, DELNET gave an overview of DELNET Annual Lectures and introduced the speaker to the audience.

Professor Subir Kumar Saha observed that he wanted the students to participate in robotic competitions by

making the robots. He added that students of all three major departments - mechanical, electrical and computer science should come together, make robots and as a result would get an integrated view of the hardware and software knowledge. He said that he was going to every college and was inviting students to participate in the competition on the subject and become leaders with such engineering skills.

Dr. S. S. Mantha gave an outstanding lecture on robotics. He started by explaining that "Robota" is a Czech word and it meant 'forced labour' and that

robotics was coined initially as fiction. He explained the meaning of robos and mentioned that there were many facets of robotics. "You require a manipulator, you need some device to manipulate and you build a lot of automation into that manipulator. Automation has different levels. A manipulator would do certain specific jobs. You make it flexible by building programming and thus introduce capability into the device. So, you can programme a manipulator. A manipulator is something that manipulates objects." He added that manipulation could mean that the device picks up something from one place and places it at the designated place. "You make a device to do that and then you build drives into that manipulator and you programme it, you control those drives, those actuators, you control them through some programming and you keep changing the programme over a period of time which means you build reprogramming capability into the device. And then we are somewhere near converting a manipulator into something like a robo." Dr. Mantha maintained that a lot of reprogramming capability is built into a manipulator in order to perform a job and later alone can reprogramme it for some other activity.

Dr. Mantha also referred to the use of animation in movies like Jurassic Park and said that it was not really robotics. However, he added that there are many other things which originate from what we call animation and there are several techniques which are used there. He



Dr. S. S. Mantha delivering DELNET Annual Lecture

gave an example of an arm in which he showed devices like hand, shoulder joint, elbow joint, wrist joint, fingers, etc and said you needed a manipulator to perform. Explaining the role of a manipulator he gave the example of two pneumatic cylinders, one pushing in a horizontal direction, and another pushing in a vertical direction. The two actions result in the creation of a manipulator, which can manipulate objects.

Dr. Mantha described the parts of a robot by giving graphic examples of their movement. He said that there are simple level robots and there are automatic machines that extend human potential. They do work as humans can but are used only in difficult and hazardous jobs such as the use of radioactive substances, painting, welding, etc. He added that middle level robots are programmable, multipurpose, electro-mechanical machines. The third level robots are of a complex nature, which are reprogrammable, multifunctional manipulators. He noted that when the robots are reprogrammed they can do different jobs as described in the programme. Such robots are designed to move materials, tools and parts through programmable paths. And these paths are defined: may be a straight line path or a curved path but that is achieved by defining the control points, the curves, etc.

He affirmed that building something like a human being with two legs and making it absolutely stable is extremely difficult. The best robot, the best device which is mobile in a dynamic situation will probably have only one leg. You hop, hop, hop you don't fall but you stop, you fall with a single leg." He said, "Suppose you have a small sphere, a small ball, you put it between two fingers and you can actually rotate it about any axis. You can keep doing that in the human hand. Now suppose I were to

do that using a machine. I have to build a gripper, a machine gripper which can be programmed to do this job, to take, to hold a ball and keep rotating it about any axis. Now you know what we are talking about, and how complex the whole situation becomes. So you have hyper redundant manipulators. The human hand is most dexterous, it can do many things, it can pick up a pin, it can pick up a huge complicated device and so on. And there are several faculties working together to compute in order."

Dr. Mantha also explained the use of artificial intelligence (AI) in robotics. He said that the artificial intelligence was the science and engineering of making intelligent machines. "In order to understand what is artificial intelligence we need to really look at what is human intelligence. And what are we trying to make. So, still a question remains: what is artificial intelligence, or what is intelligence? It is the computational part of the ability to achieve goal in the world."

"Suppose we want a machine to recognise a human face. What do we do? What is the reasoning that we have to build it, build into a programme, so that a machine can recognise faces? That forms part of AI. So AI is a field that overlaps with computer science, rather than being a strict sub-field, in fact everything we are doing is electrical, computers, electronics, communication... it is an absolute inter-disciplinary, multi-disciplinary area. So you have computer science, you have

AI and different areas of AI are more closely related to the psychology, philosophy, logic, linguistics and even neuro-physiology." Various techniques evolve that can be applied to diverse AI tasks. These are concerned with how we represent, manipulate and reason with knowledge in order to solve problems. And these are knowledge representation and search. What is knowledge, how do you represent it, how do you search from that? AI programming was mainly manipulating symbols and not numbers, like I said it's the whole intelligence is discretised into symbols, so you have to work with symbols in AI and therefore you need some programming language which can allow you this interface, manipulating symbols and so on". He referred to the four fundamental faces of AI: see, look, vision; talk, speak, communicate; feel, touch, emotions; logistics and analysis. "Now these are the four fundamental faces of AI. And consider these as four faces of a pyramid. So, what is good enough for a machine, is not good enough for a human being and vice versa. What is the difference between to see and have vision, and to make sense of what you see is vision."

Dr. Mantha answered many questions on robotics and artificial intelligence. He added that to express emotions and consciousness using artificial intelligence is a long way up. ■

DELNET Database Statistics

Union Catalogue of Books	:	92,27,613
Union List of Journals	:	33,916
Union Catalogue of Journals	:	20,235
Article's Database	:	9,12,042
Union List of CDRoms	:	2281
Union List of Videorecordings	:	5000
Union List of Soundrecordings	:	748
Database of Theses and Dissertations	:	44304