

The Knowledge-Based Computer System Development Program of India: A Review

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- This article summarizes the efforts of the knowledge-based computer system (KBCS) development program of India. A five-year project, it is aimed at promoting cooperation among research centers, developing state-of-the-art training and teaching programs, and demonstrating KBCS solutions to selected socioeconomic problems.

The Department of Electronics, Government of India, with the assistance of the United Nations Development Program (UNDP) decided in 1986 to support a five-year project on knowledge-based computer systems (KBCSs). Seven major research and teaching centers and a number of associated institutions are involved in the project.

The nodal centers in this project are the Center for the Development of Advanced Computing (Pune), the Department of Electronics (New Delhi), The Indian Institute of Science (Bangalore), The Indian Institute of Technology (Madras), the Indian Statistical Institute (Calcutta), the National Center for Software Technology (Bombay), and the Tata Institute of Fundamental Research (Bombay).

The objectives are multiple but among them are to build an institutional infrastructure and promote cooperation among research centers in India; develop state-of-the-art training and teaching programs; and demonstrate specific KBCS solutions to selected socioeconomic problems encountered, in particular, in India.

This program also has social objectives, such as improving the quality of teaching in schools, improving medical care in rural areas, and enhancing industrial productivity and management.

The KBCS project has a strong and well-defined organizational structure. At the highest level is a program policy committee, followed by a program coordinating unit that works in conjunction with a technical coordination committee. Projects are regularly reviewed by international experts nominated by the United

Nations Development Program. Nodes are equipped in a homogeneous way and permit scientists to develop research and teaching in a good environment. Each node has between 20 and 35 full-time researchers (not including students) involved in from 5 to 8 major projects that might have several applications developed under contract with Indian companies.

The major areas of research are parallel processing, including parallel processing machines, logic programming environments, and the engineering of parallel AI workstations; KBCS applications, including expert systems for government administration, expert systems for engineering and medical applications, intelligent tutoring-authoring systems, computer vision system applications, and KBCS applications in and for ancient Indian sciences; and language-processing technologies, including natural language processing (access to databases and large corpora of texts), machine translation, speech-vision processing systems, and Indian language-processing environments.

Each of the areas supports two to five projects developed in a node or in cooperation between nodes. For example, the expert systems for government administration include the following projects: income tax assessment, central civil service rules, import-export trade legislation, and crime-related expert systems. Each project develops fundamental, as well as practical, research at various levels. Further information can be obtained from the national project coordinator, Dr. Krishnan Kutty, KBCS Project, A Block, CGO Complex, Lodi Road, New Delhi, 110003, India. *Vivek*, a quarterly publication on AI (published by NCST Bombay), gives more information on AI work in India. For details, write to Editor, *Vivek*, Gulmohar Cross Road No. 9, Juhu, Bombay 400049 India. E-mail: vivek@ncst.ernet.in.

Since 1988, the KBCS program has also conducted an annual international conference. Proceedings are pub-

lished by Narosa Publishers for India and in the AI lecture note series by Springer-Verlag. The KBCS '89 conference was organized by the National Center for Software Technology. It was held 10–13 December in Bombay (Proceeding Lecture Notes in AI, number 444). The conference started with a one-day tutorial session on various aspects of AI: task-specific architectures for the construction of knowledge-based systems (B. Chandrasekaran), knowledge engineering (J. Arvind), logic programming systems (D. Warren), language processing (A. Joshi), and computational vision (S. Zucher). During the conference, 41 papers (carefully selected from over 140 submitted) and 6 invited lectures were given. Papers were presented by researchers from a large number of countries, including the United Kingdom, France, Germany, Japan, the United States, Canada, and Australia.

The main topics addressed were expert systems and knowledge representation, logic programming (which seems to be well developed in India), and reasoning. The proceedings also contains the presentations of the KBCS projects. The level of most presentations was good and of an international flavor. The audience was unusually active, initiating discussions and friendly controversies. Interesting demonstrations on image processing, parallel processing, language processing, and Indian script processing were presented. The conference, including its cultural and social program, was also professionally organized and well coordinated. The 1990 conference, with a special emphasis on language processing, took place in Pune.

To conclude, I feel the KBCS program will be a major international research and development effort that will have a role to play in AI research strategies comparable to that of the Japanese Fifth Generation Project. It constitutes the emergence of a new research potential with its own peculiarities and objectives.

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