



PENTAGRAM RESEARCH CENTRE PRIVATE LIMITED

Mission: ...In the service of the Nation

Major Activities

The Scientists and Scholars working in Pentagram Research Centre (P) Limited, Hyderabad are constantly involved in research, development and training activities. Some of their major activities are presented here.

A. Developmental activities

Cellular Logic Array Processing (CLAP) version 1.0, IBM PC compatible software package for image processing, pattern recognition and array manipulation, developed in Turbo C.

Cellular Logic Array Processing (CLAP) version 2.0, IBM PC compatible software package for image processing, pattern recognition and array processing, developed for Transputer T800 system in Logical Systems C.

Logical Pattern Generating System (LPGS) version 1.0, IBM PC compatible software package for generating patterns, developed in Visual C++.

Logical Image Processing System (LIPS) version 1.0, 2.0 and 3.0, IBM PC compatible software package developed in Visual C++.

Logical Pattern Recognition System (LPRS) version 1.0, IBM compatible software package for pattern recognition, developed in Visual C++.

Logical Geographic Information System (LGIS) version 1.0, IBM compatible package for use in Geographic Information Systems and Remote Sensing Applications, developed in Visual C++.

Logical Collision Avoidance System (LCAS) version 1.0, IBM compatible software package meant for space applications, especially for target seeking and collision avoidance purposes. This was developed in Visual C++.

Knowledge Based Medical Imaging System (MEDIMAGE) version 1.0, IBM compatible software package meant for medical image understanding and diagnostic purposes, developed in Visual C++.

Digital Watermarking System (RTSTEGO) version 1.0, IBM compatible software package- meant for hiding text and patterns in digital images.

Personal Health Record System (PHR-2003), IBM compatible software package meant for doctors and patients. This has been developed in Visual C++.

Genomic Signal Processing System (GSP) version 1.0, IBM compatible software package - meant for Bioinformatics applications. This has been developed in Visual C++.



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B. Invited presentations and open invitations

IIT Kanpur; IIT Madras; National Remote Sensing Agency, Hyderabad; RCI/DRDL, Hyderabad; University of Hyderabad; University of Maryland @ College Park; Florida State University, Tallahassee; Georgia Institute of Technology, Atlanta; Lincoln Laboratory, MIT, Cambridge; Pennsylvania State University @ State College; Louisiana State University; University of Southwestern Louisiana; University of Techmush, Berlin, Germany; European Molecular Biological Research Laboratories, Clingxton, U.K., South African National University, Johannesburg, Pretoria, National University of Sudan, International Center for Theoretical Physics, Triesta, Italy, National University of Malaysia, Kodleg Damanasara, Penong, Malaysia, University of Telecommunications, Malaysia, University of Multimedia, Malaysia, University of Hong Kong, University of Auckland, and Purdue University, Calumet..

C. Conference activities

Our Scientists and Engineers have participated in various conferences in India and abroad. Some of their activities are outlined below:

Judge for the session on Hardware for Computer Vision during the International Conference SURGE'94 held at Annamalai University, Chidambaram, Tamil Nadu 1994.

Judge for the session on Information Technology, during the National Technical Students' Seminar organized by the ISTE at Chaitanya Bharathi Institute of Technology, Hyderabad in 1996.

Chairman for a session on Circulatory Systems during the International Conference INCONBME'96 organized by the Biomedical Society of India at Coimbatore Institute of Technology, December 1996.

Program Committee member in the SCI'97 World Conference on Systemics, Cybernetics and Informatics organized at Simon Bolivar University, Venezuela, 1997.

Chairman for a session on Medical Instrumentation during the National Conference on Advances in Biomedical Engineering organized by Biomedical Society of India and Model College of Engineering, Cochin, 1997.

Key Note Address on Rajan Transform and its use in Image Processing and Pattern Recognition and Analysis during the National Conference on Advances in Biomedical Engineering, organized by Biomedical Society of India and Model College of Engineering, Cochin, 1997.

Chairman for a session on Medical Instrumentation and Measurements during the National Conference on Biomedical Engineering, organized by the Biomedical Society of India and Manipal Institute of Technology, 1998



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Judge for the Graduate Students' M. A. Pai Memorial Paper Competition during the National Conference on Biomedical Engineering, organized by the Biomedical Society of India and Manipal Institute of Technology, 1998

Chairman for a session on Sensors and Control during the 14th International Conference on CAD/CAM, Robotics & Factories of the Future, organized by the ISPE, U.S.A. and the P.S.G. College of Technology, Coimbatore 1998.

D Exhibition activities

1. **Booth A3, Pentagram Research, Exhibition Hall, MacKenzie Room, Waterfront Centre Hotel, Vancouver, British Columbia, Canada**, organised by Max Q.H. Meng, Exhibits Chair, 1995 IEEE International Conference on Systems, Man and Cybernetics, October 22 – 25, 1995.
2. **9/20, Indian Stall, Pentagram Research Centre Private Limited, Milan, Italy**, International Trade Fair SMAU'99, organised by the Italian Chamber of Commerce, September 30 – October 4, 1999.
3. **New Product Forum and New Product Theater**, ISPC / GSP Expo., Dallas, Texas, U.S.A., March 31 – April 3, 2003.

E Conference organization

1. International Conference on **Systemics, Cybernetics and Informatics SCI-2000** organized by Pentagram Research Centre Private Limited, Hyderabad, India, 17th December 17, 2000, Venue: Indian Institute of Information Technology, Gacchi Bowli, Hyderabad, India.
2. International Conference on **Systemics, Cybernetics and Informatics ICSCI-2004** organized by Pentagram Research Centre Private Limited, Hyderabad, India, February 12 - 15, 2004, Venue: Dr. MCR HRD Institute of A.P., Hyderabad, India.
3. International Conference on **Systemics, Cybernetics and Informatics ICSCI-2005** to be organized by Pentagram Research Centre Private Limited, Hyderabad, India, January 06 - 09, 2005, Venue: Dr. MCR HRD Institute of A.P., Hyderabad, India.

F Training activities

Academic Projects (UG level)

Cellular Logic Techniques for Character Recognition
Digital Filters and Filter Automata
Morphological Image Processing in Hexagonal Digital Grid
Lindenmayer Systems and their use in parallel Processing of Signals
Precision Tracking and Control of Autonomous Homing Systems



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Symbolic Processing of Signals
Neural Automata Based Object Recognition
Two Dimensional Digital Filters- Analysis and Design
Speech Digitization using Adaptive Delta Modulation
GIS- an Integration of GRASS 4.1 (U.S.Army Product) with CLAP
Signal Processing using Rewriting Cyclic Normal Automata
Character Recognition using Generalised Rapid Transform
Study of Algebraic Properties of Rajan Transform
BRAHMASTRA - Target Seeking / Target Avoiding System Model.
VC++ Based Software for Collision Avoidance Systems.
Sub Band Coding of Speech signals in Windows Environment.
Watermarking of Digital Images using Rajan Transform
Neighborhood Processing of Digital Images
Cellular Logic Based Collision Avoidance System
Flank Wear Measurement using Machine Vision Techniques
Fingerprinting of DNA sequences by processing 2-D GEL Analysis Image Data
Study of Geometric Filters over rectangular and hexagonal grids of pixels

Academic Projects (PG level)

M.S. Theses:

Object Identification and Tracking in a Multiple Target Environment
M.E. thesis submitted to Osmania University by Mr. K. Jayasankar 1994.

Skeletonization of Graphic Images using Cellular Logic Array Processing techniques
MCA thesis submitted to Osmania University by Mukaramuddin 1995.

Generalised Rapid Transformation and its use in Data Encryption,
M.Tech thesis submitted to Regional Engineering College, Warangal by N. Srinivasa Rao, 1996.

Representation and Processing of Digital Images on Hexagonal Grid
M.Tech thesis submitted to Department of Electronics, Government of India, by R. Subhani 1997

Cellular Automata Modeling of Unidirectional Fluid Flow
M.E. thesis submitted to Jawaharlal Nehru Technological University, Hyderabad by G. S. S. Prasada Rao 1997.

Modeling and Simulation of Solidification and Aggregation using Lattice Gas Automata
M.E. thesis submitted to Jawaharlal Nehru Technological University, Hyderabad by V.S. Ravi Prasad 1997.

Machine Vision Aided Component Sorting in a Robot Based Industry using Generalised Rapid Transform
M.E. thesis submitted to Jawaharlal Nehru Technological University, by S. Venugopal, 1997.

Modeling of Obstacle Avoidance in the framework of Cellular Logic Array Processing
M.E. thesis submitted to Jawaharlal Nehru Technological University, by V. V. Sai Reddy, 1997.

Generalised Rapid Transform and its Applications to Pattern Recognition and Image Processing
M.E. thesis submitted to Gulbarga University by Moyeed Sultana, 1998.

Constructive Genetic Algorithms in the Framework of Markov's Associative Calculus
M.Tech thesis submitted to Osmania University by Mrs. Nuzhat Sultana, 1998

A Constructive Logical Approach to Intelligent Control of Autonomous Systems
M.E. thesis submitted to Osmania University by Ms. Mohsina Afroz, 1998.



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FLEXINET – An Intelligent Networking System

M.Tech thesis submitted to Visveswaraiah Technological University, Karnataka, by Mrs. Parveen Tabassum, 1999

Cellular Automata Realization of Digital Filter

M.Tech thesis submitted to Visveswaraiah Technological University, Karnataka, by Mrs. Shabana Naaz, 1999

Spatial and Spectral Domain approach to watermarking of digital images

M.E. thesis submitted to Visveswaraiah Technological University, Karnataka, by Mr. Fakaruddin Chisty, 2000.

Information Coding Techniques for Error Detection and Correction

M.Tech thesis submitted to Jawaharlal Nehru Technological University, by G. Krishna Reddy, 2000

Multi-Sensor Fusion of Scanned images

M.Tech thesis submitted to Visveswaraiah Technological University, Karnataka, by Abdul Samad Khan, 2002

Three Dimensional Digital Morphology – Theory and Applications

M.Tech thesis submitted to Visveswaraiah Technological University, Karnataka, by Jayalaxmi, 2002

Pattern Recognition and Object Identification Using Artificial Neural Networks

M.Tech thesis submitted to Visveswaraiah Technological University, Karnataka, by Sameena, 2003

Linear Block Coding – A Novel Approach to Enumerate Generator Matrices

M.Tech thesis submitted to Visveswaraiah Technological University, Karnataka, by Aruna, 2003

Travelling Salesman Problem – Genetic Algorithmic and DNA based Approach

M.Tech thesis submitted to Visveswaraiah Technological University, by Asma, 2003

Data Encryption Using Rajan Transform

M.Tech thesis submitted to Visveswaraiah Technological University, Karnataka, by Ruksar Fatima, 2003.

Ph.D Theses:

Intelligent Control using Constructive Logical Methods

Ph.D thesis by Mr. E. Nagabhooshanam, Assistant Professor, CBIT, Hyderabad, submitted to Jawaharlal Nehru Technological University, Hyderabad.

Fault Diagnosis Using Cellular Automata

Ph.D thesis by Mrs. Asha Rani, Assistant Professor, Dept. of Electronics & Communication Engineering, J.N.T.U. Kukatpally, to be submitted to Jawaharlal Nehru Technological University, Hyderabad.

Study of Discrete Geometry Models for Shape Representation and Understanding

Ph.D thesis by Mrs. Jyothi Patil, Assistant Professor, Department of Computer Science & Engineering, PDA College of Engineering, Gulbarga University, Gulbarga, to be submitted to the University of Mysore.

DNA Computing in the Framework of Markov's Constructive Mathematical Logic, thesis by Mr. B. Rajasekhara Reddy Asst. Professor, Department of Electronics & Communication Engineering, Vasavi College of Engineering, Hyderabad, to be submitted to the University of Mysore.

Spectral Domain Object Recognition Using Rapid Transform and Its Variants, thesis by Mr. Ekambaram Naidu, Principal, S.V.P. College of Engineering and Technology, Puttur, Chittoor Dt., to be submitted to the University of Mysore.



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Flexinet - DNA search in a networking system, thesis by Yousuf Mulge, Professor, Dept. of Computer Science, Rural College of Engineering, Bhalki, to be submitted to University of Mysore.

Thinning Approach to Human Visual Perception of Noisy Digital Patterns, thesis by Sanjeeva Rayudu, Lecturer, GPW, Nandigama, to be submitted to Jawaharlal Nehru Technological University, Hyderabad.

Transform Domain Enhancement of Crack Resistance in Secured Communication, thesis by N. Renuka Chari, Associate Professor, Dept. of ECE, JBIET, Hyderabad, to be submitted to Jawaharlal Nehru Technological University, Hyderabad.

Multi valued Logic and Its Application to Genomic Signal Processing, thesis by D.Venkat Reddy, Associate Professor, MGIT, Hyderabad, to be submitted to Jawaharlal Nehru Technological University, Hyderabad.

Hilbert Space Formulation of Signal Spaces in Quantum Signal Processing, thesis by Sheik Meeravali, Assistant Professor, Dept. of ECE, DVR College of Engineering and Technology, Medak, to be submitted to Jawaharlal Nehru Technological University, Hyderabad.

Molecular Computing Using Rewriting Cyclic Normal Automata, thesis by M. Pavan Kumar, Senior Research Engineer, Pentagram Research Centre (P) Limited, Hyderabad, to be submitted to Jawaharlal Nehru Technological University, Hyderabad.

G SPONSORED RESEARCH AND DEVELOPMENT PROJECTS

COMPLETED PROJECTS AND CONSULTANCY WORK

1. *High-Throughput Cellular Logic Array Processing Structures for Image Understanding*, A research and development project sponsored by the All India Council for Technical Education, Govt. of India. Project Cost: Rs. 5,00,000/-. (Project completed.)
2. *Computer Vision Laboratory*, A project sponsored by All India Council for Technical Education, Government of India. Project Cost: Rs. 6,00,000/-. (Project completed.)
3. *Genomic Signal Processing in the Framework of Markov's Constructive Mathematical Logic*, A research and development project sponsored by the All India Council for Technical Education, Govt. of India. Project Cost: Rs. 5,00,000/-. (Project in progress.)
4. *Genuine Currency Verification System*, A research and development project sponsored by Tyche Peripheral Systems, Hyderabad, A.P. India. Project Cost: Rs. 25,00,000/-. (Project completed)

Summary of research projects and consultancy

Total cost of R&D projects:	Rs. 16,00,000
Funding Agency:	Ministry of Human Resources AICTE, Government of India
Cost of a development project:	Rs. 25,00,000
Funding Agency:	Tyche Peripheral Systems, Hyderabad, A.P. India

PROJECT UNDER CONSIDERATION

1. *Solar Cooling Systems*, A development project from University of Gelsenkirchen, Germany. Project cost: Rs. 3.0 Crores.